

UVR 63

Version 2.6 EN

Triple-loop universal controller



Operation
Installation instructions

en

 TECHNISCHE
ALTERNATIVE

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Niniejsza instrukcja dostępna jest również w innych językach na stronie internetowej www.ta.co.at.

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Safety requirements



These instructions are intended exclusively for authorised professionals. All installation and wiring work on the controller must only be carried out in a zero-volts state.

The opening, connection and commissioning of the device may only be carried out by competent personnel. In so doing, all local security requirements must be adhered to.

The device corresponds to the latest state of the art and fulfils all necessary safety conditions. It may only be used or deployed in accordance with the technical data and the safety conditions and rules listed below. When using the device, the legal and safety regulations apposite to the particular use are also to be observed. Incorrect use will result in the negation of any liability claims.

- ▶ The device must only be installed in a dry interior room.
- ▶ It must be possible to isolate the controller from the mains using an all-pole isolating device (plug/socket or double pole isolator).
- ▶ Before starting installation or wiring work, the controller must be completely isolated from the mains voltage and protected against being switched back on. Never interchange the safety extra-low voltage connections (sensor connections) with the 230V connections. Destructive 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. Take care when fitting temperature sensors!
- ▶ For safety reasons, the system 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 a lengthy period of time under unsuitable conditions. If this is the case, place the controller and equipment out of service and secure against unintentional use.

Maintenance

The system does not require maintenance if handled and used properly. Use a cloth moistened with soft alcohol (such as spirit) to clean. Do not use cleansers and/or solvents such as trichlorethene.

As none of the components relevant to accuracy are under loads when used properly, they have a long service life without much drift. The unit thus does not have any adjustment options. No adjustments are needed.

The design characteristics of the unit must not be changed during repairs. Spare parts must correspond to the original spare parts and be as good as new.

Generally applicable rules for the proper use of this unit

The manufacturer's warranty does not cover any indirect damage to the unit if the mechanic installing the unit does not equip it with any additional electromagnetic devices (thermostat, possibly in combination with a one-way valve) to protect the unit from damage from malfunction under the following conditions:

- ◆ **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 current less). The controller's pump output can provide this as well. Hence, all heat-sensitive parts would be protected from overheating if the system were not running, even if steam were created in the unit 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 freezing because the controller fails, the heat exchanger and other components may be damaged due to freezing. In this case, a thermostat must be installed on the supply line of the secondary side after the heat exchanger to stop the primary pump automatically when the temperature falls below 5°C, regardless of the output of the controller.
- ◆ **When used for floor and wall heaters:** here, a safety thermostat must be used just as with conventional heater controllers. It has to switch off the heating loop pump if there is overheating regardless of the output from the controller to prevent indirect damage from excess temperatures.

Solar power systems - tips on system standstill (stagnation):

Generally, stagnation is not a problem and cannot be ruled out if there is a power outage, for instance. In the summer, 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 (antifreeze) is under less stress during stagnation than when it is just below the steam phase.

All of the data sheets of the collector manufacturers list standstill temperatures above 200°C. However, these temperatures generally only occur during operation with dry steam, i.e. when the heat exchange medium has completely turned to steam in the collector or 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.

Setting for "Step by step" control

Even if you receive an instruction to set the control here, you must read the operating manual - in particular the chapters „Program selection" and "Set values".

	Menu	
1		Selection of the hydraulic diagram based on the system diagram. Observe the arrow diagrams and "formulae", as well as the program expansions "+1", "+2", "+4" and "+8", insofar as they are specified in the diagram.
2		Program number selection. In some cases it also makes sense to select one or more options "+1", "+2", "+4" or "+8", to achieve optimum control.
3		Connection of the sensors to the inputs and the pumps, valves etc. to the outputs exactly according to the selected diagram; if used: connection of the data link (DL-bus) and the control outputs
4	PAR	Access to the parameter menu, input of code number 32 and input of the program number PR , restart with loading of factory setting
5	PAR	Consideration of whether an output should be crossed out, sub-menu input " LO ". As only one output 1 can be speed-regulated, crossing-out may sometimes be necessary in order to control the speed of a specific pump.
6	PAR	Selection of the priority allocation in the sub-menu " PA ", if required
7	PAR	Entry of the necessary setting values max , min , diff corresponding to the list for the selected diagram or program
8	PAR	Setting of time and date
9	PAR	If necessary, input of time windows TIME W or activation of the timer
10	PAR	By selecting O ON or O OFF you can permanently switch the outputs on or off and check whether the connections are correct. After this check, all outputs must again be set to O AUTO .
11	PAR	By selecting C ON or C OFF you can permanently switch the control outputs between 10V and 0 V and thus check the operation of the control outputs (if in use). After this check, all control outputs must again be set to C AUTO .
12	MEN	If standard sensors PT1000 are not being used, the sensor settings must be changed in the menu " SENSOR " (e.g. if KTY sensors are being used).
13	MEN	If necessary, activate additional functions (e.g. start function, cooling function, speed control, heat quantity counter, etc.)
14		Check all displayed sensor values for plausibility. Any disconnected or incorrectly parameterized sensors display 999°C.

Hydraulic diagrams

The hydraulic schemas in this booklet are representative diagrams that illustrate the principles involved. They are for the purpose of correct choice of program but do not in any way replace the specialized planning of a system, which is why copying them does not guarantee that they will function.

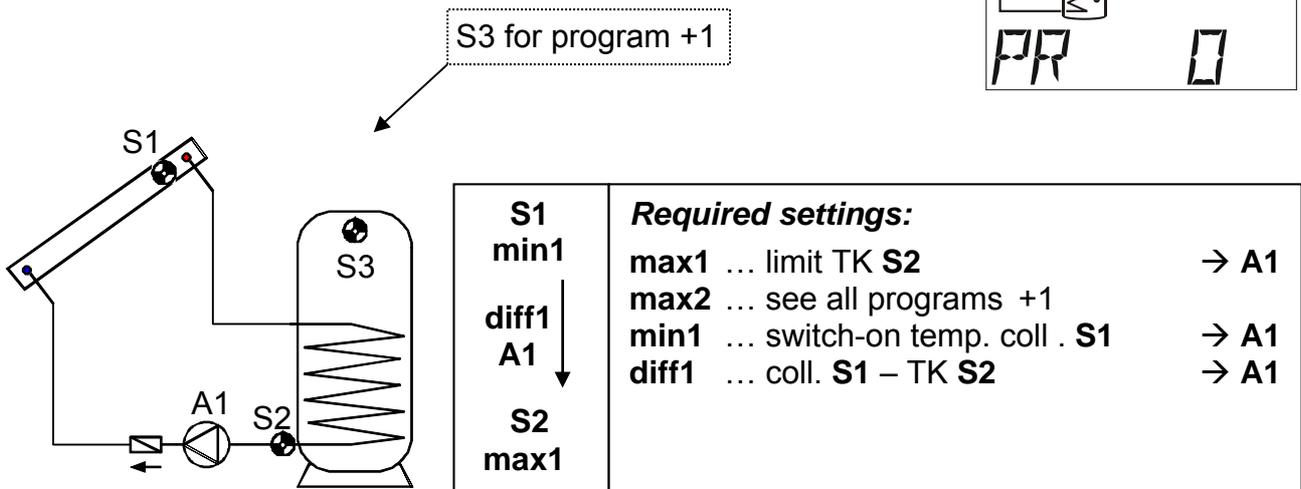
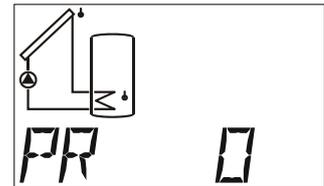
Warning: Before using the hydraulic schemas it is absolutely necessary to read the operating instructions and in particular the chapters "Choice of Program" and "Set values".

- ◆ The following functions can be used additionally with **every** program diagram:
Pump after-running time, Pump speed control, 0 – 10V or PWM output, System function control, Heat counter, Legionella protection function, Anti-blocking protection
- ◆ The following functions only make sense together with solar systems:
Collector excess temperature delimiter, frost protection function, Start function, Solar priority, Collector re-cooling function, Drain-back function (only for drain-back systems)
- ◆ The outputs **A2** and/or **A3** from diagrams which do not use these outputs, can be logically linked (AND, OR) in the menu "**Par**" with other outputs or used as a time switch output.
- ◆ In diagrams with a holding circuit (= burner requirement with a sensor, shut-down function with another one), the shut-down transducer is "dominant". In other words, if improper parameters or sensor installation leads to the fulfillment of both the shut-on and shut-off conditions, the shut-off condition has priority.
- ◆ The factory setting for the adjustment values (max, min, diff) is appropriately matched to the diagrams, but must however be checked prior to commissioning and matched to the individual requirements. The specific adjustment values are only loaded, if after setting the program number, the factory setting is reloaded (press the bottom key (entry) while plugging in). Only then should the controller be parameterised.
- ◆ For programs, for which it is not possible to display a diagram in the display, the upper area remains empty. For some programs, the display was only approximately matched to the actual diagram, individual symbols may be missing.
- ◆ **Pump valve system** of the programs 49, 177, 193, 209, 225, 226, 227, 417, 625:
Speed control (if activated):
 - **Control output COP 1:** The speed control only operates when **filling tank 1**. If **max1** is exceeded on the sensor 2 (filling tank 2 or 3), the pump is operated on the highest speed.
Depending on the output mode, the highest speed complies with analogue stage 100 (**modes 0-100**, MAX = 100) or analogue stage 0 (**modes 100-0**, MAX = 100).
 - **Control output COP 2:** The speed control affects **all tanks** during filling.
 - **PSC** (for standard pumps only): The speed control **only** operates when **filling tank 1**.

Programs with displayed diagrams

0	1			4											
16	17														
32	33														
48	49	50	51	52	53	54	55								
64	65	66	67	68	69	70	71								
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97	98	99												
112															
128	129	130	131												
144	145														
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199								
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
240	241														
256	257	258	259												
272	273	274	275												
288	289	290	291	292	293	294	295								
304	305	306	307												
320	321							328	329						
336		338		340		342									
352	353			356	357			360	361			364	365		
368	369														
384	385														
400	401	402	403												
416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431
432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447
448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463
464	465	466	467	468	469	470	471								
480	481														
496															
512	513														
528	529														
544															
560	561														
576	577														
592	593														
608	609	610	611	612	613			616	617	618	619	620	621		
624	625	626	627	628	629	630	631								
640	641			644											
656	657	658	659												
672	673	674	675												

Program 0 - Single solar power system = factory settings



Program 0: Pump **A1** runs when:

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

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

All programs +1:

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

Program 4 – Simple drain-back - solar thermal system with valve

This program can only be selected with activated drain-back function (menu **MEN - DRAINB**) selected.

The basic settings are made as in program 0:

S1	Required settings:	
min1	max1 ... limit TK S2	→ A1
diff1	max2 ... see all programs +1	
A1	min1 ... switch-on temp. coll. S1	→ A1
	diff1 ... coll. S1 – TK S2	→ A1
S2		
max1		

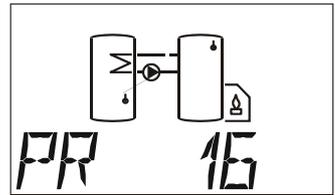
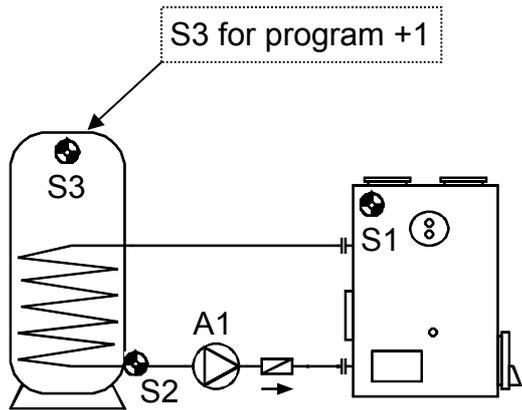
During the day, a valve on output **A3** prevents the flowing away of the heat transfer medium out of the collector.

Once the filling time has elapsed, output **A3** for the valve is **on**.

If pump **A1** is shut-off due to the **temperature difference** valve **A3** remains open for a further **2 hours**.

However the valve is **immediately** closed if the collector temperature protection or frost protection function becomes active, the radiation value falls below 50W/m² with the pump shut down (only if a radiation sensor is being used) or if low water protection is activated and the set volume flow is not reached after the filling time.

Program 16 - Loading the tank from the boiler



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p>	<p>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... see all programs +1</p> <p>min1 ... switch-on temp. boiler S1 → A1</p> <p>diff1 ... burner S1 – TK S2 → A1</p>
---	---

Program 16: Pump **A1** runs when:

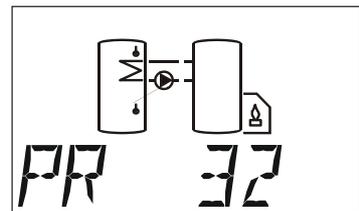
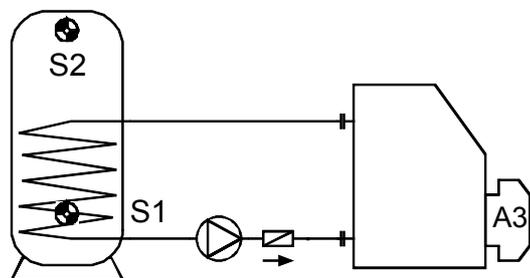
- ♦ **S1** is greater than the threshold **min1** ♦ and **S1** is greater than **S2** by the difference **diff1**
- ♦ and **S2** has not exceeded the threshold **max1**.

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

All programs +1:

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

Program 32 - Burner requirement via tank sensors



<p>Burner A3</p> <p>S2 min3</p> <p>S1 max3</p>	<p>Required settings:</p> <p>max3 ... burner req. off SP S1 → A3</p> <p>min3 ... burner req. on SP S2 → A3</p>
--	---

Program 32:

The output **A3** switches on if **S2** falls below the threshold **min3**.

The output **A3** switches off (dominant) if **S1** exceeds the threshold **max3**.

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

All programs +1:

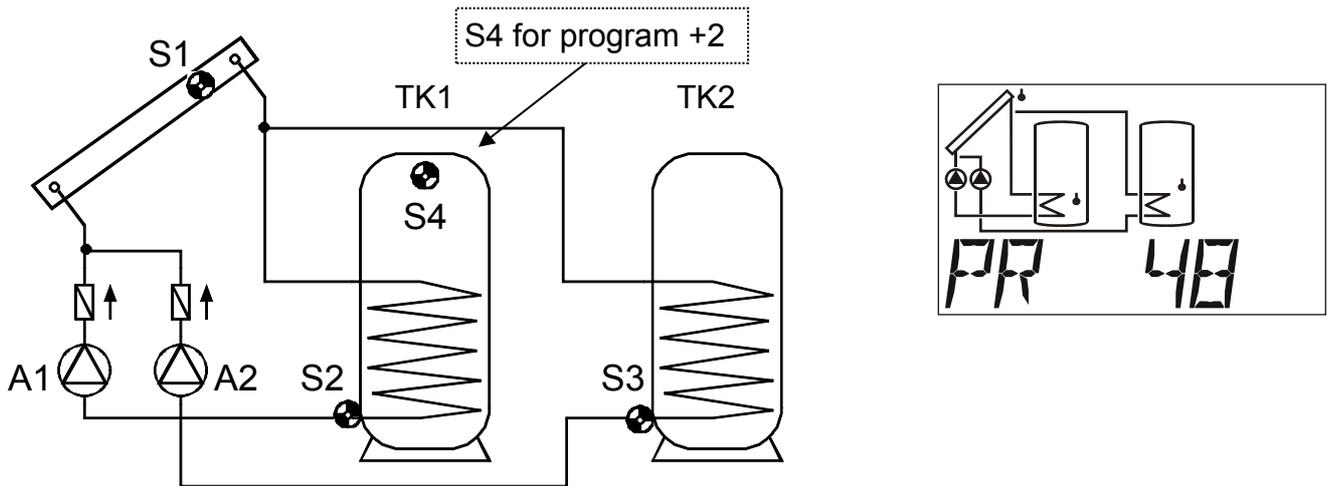
The burner request (**A3**) is only made via **S2**.

The output **A3** switches on if **S2** falls below the threshold **min3**.

The output **A3** switches off (dominant) 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



<p>S1 min1</p> <p>diff1 diff2 A1 A2</p> <p>S2 S3 max1 max2</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... see all programs +2</p> <p>min1 ... switch-on temp. coll. S1 → A1, A2</p> <p>min2 ... see all programs +4</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... coll. S1 – TK2 S3 → A2</p>
--	---

Program 48: Pump **A1** runs when:

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

Pump **A2** runs when:

- ♦ **S1** is greater than 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 the two pumps, one pump and a three-way valve are used (pump-valve system).

Speed control: Observe the comments on page 9!

Without a priority allocation, tank 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

All programs +2:

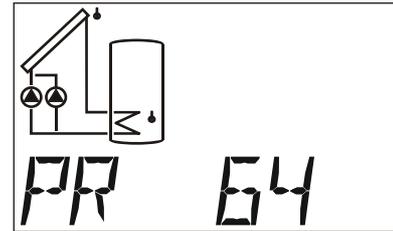
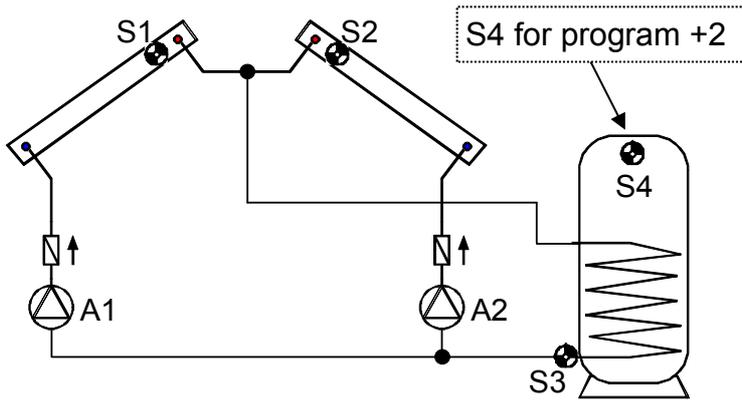
In addition, if **S4** exceeds the threshold **max3**, pump **A1** is switched off.

All programs +4: Both solar loops have separate switch-on thresholds at **S1**:

output **A1** retains **min1**, and **A2** switches at **min2**.

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see “solar priorities” for more details).

Program 64 - Solar power system with 2 collector panels



Only one collector field portrayable

<p>S1 min1</p> <p>S2 min2</p> <p>diff1 A1</p> <p>diff1 A2</p> <p>S3 max1</p>	<p>Required settings:</p> <p>max1 ... limit TK S3 → A1, A2</p> <p>max2 ... see all programs +2</p> <p>min1 ... switch-on temp. coll.1 S1 → A1</p> <p>min2 ... switch-on temp. coll.2 S2 → A2</p> <p>diff1 ... coll.1 S1 – TK S3 → A1</p> <p>... coll.2 S2 – TK S3 → A2</p> <p>diff3 ... see all programs +1</p>
---	---

Program 64: Pump **A1** runs when:

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

Pump **A2** runs when:

- ♦ **S2** is greater than 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 collector sensors **S1** and **S2** exceeds the difference **diff3**, the colder collector is switched off. This prevents heat from being lost in the colder collector when temperatures are mixed.

All programs +2:

In addition, if **S4** exceeds the threshold **max2**, pumps **A1** and **A2** are switched off.

All programs +4:

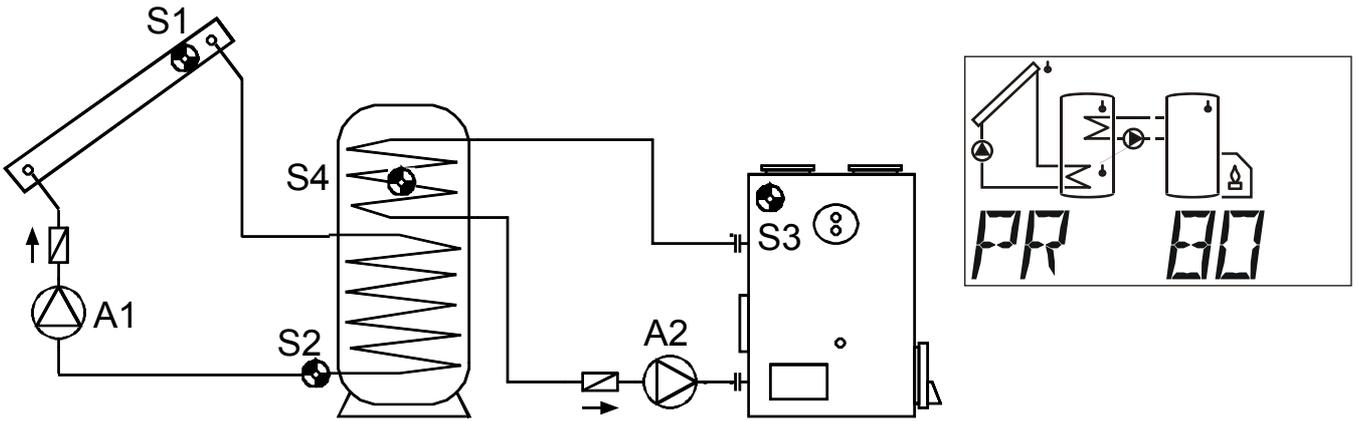
Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

WARNING: This program is not intended for systems with two collector fields, since through a three-way valve one collector field is always operated at standstill.

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

A1 ... common pump **A2** ... valve

Program 80 - Single solar power system and tank load from 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>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... limit TK S4 → A2</p> <p>max3 ... see all programs +4</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. boiler S3 → A2</p> <p>diff1 ... coll. S1 – TK S2 → A1</p> <p>diff2 ... boiler S3 – TK S4 → A2</p>
---	---	---

Program 80: Pump **A1** runs when:

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

The feed pump **A2** runs when:

- ♦ **S3** is greater than 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 81 (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>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... limit TK S2 → A2</p> <p>max3 ... see all programs +4</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. boiler S3 → A2</p> <p>diff1 ... coll. S1 – TK S2 → A1</p> <p>diff2 ... boiler S3 – TK S2 → A2</p>
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Pump **A1** runs when:

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

The feed pump **A2** runs when:

- ♦ **S3** is greater than 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:

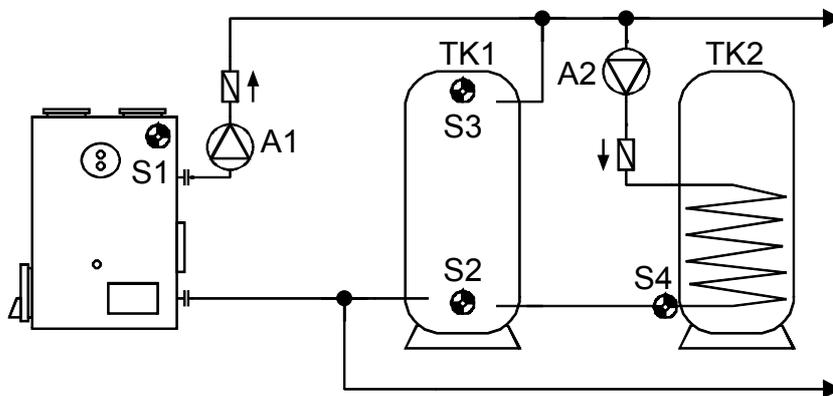
If sensor **S2** has reached **max1** (or if **S4** has reached threshold **max3** along with all programs +4), pump **A2** is switched on, and pump **A1** keeps running. This provides a cooling function for the boiler / heater without causing standstill temperatures in the collector.

All programs +4:

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

All programs +8: With re-cooling activated (all programs +2) **A3** runs concurrently.

Program 96 - Buffer and hot water tank load via boiler fired with solid fuel



<p>S1 min1</p> <p>↓ diff1</p> <p>A1</p> <p>↓</p> <p>S2 max1</p>	<p>S3 min2</p> <p>↓ diff2</p> <p>A2</p> <p>↓</p> <p>S4 max2</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S4 → A2</p> <p>max3 ... see all programs +2</p> <p>min1 ... switch-on temp. boiler S1 → A1</p> <p>min2 ... switch-on temp TK1. S3 → A2</p> <p>min3 ... see all programs +2</p> <p>diff1 ... boiler S1 – TK1 S2 → A1</p> <p>diff2 ... TK1 S3 – TK2 S4 → A2</p> <p>diff3 ... see all programs +1, +2</p>
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Program 96: Pump **A1** runs when:

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

Feed pump **A2** runs when:

- ♦ **S3** is greater than 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: In additional, hot water tank load pump A2 also switches on via the heater boiler temperature S1.

Pump **A2** runs when:

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

$$A2 = (S1 > (S4 + diff3) \& S1 > min1 \& S4 < max2)$$

or

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

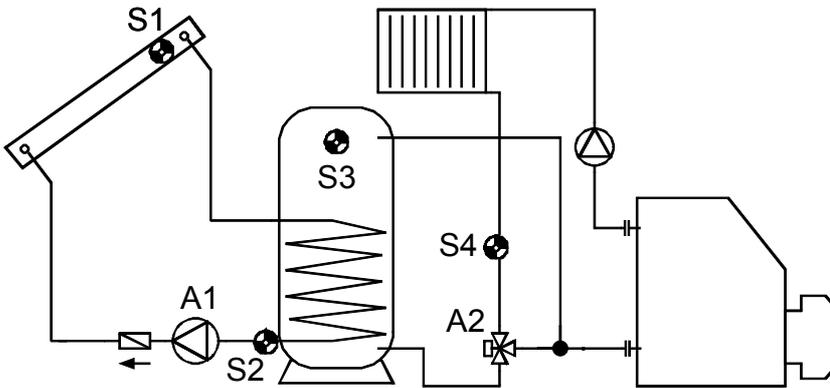
All programs+2: The pump **A3** runs if:

- ♦ **S5** is greater than threshold **min3** ♦ and **S5** is higher than **S6** by the difference **diff3**
- ♦ and **S6** has not exceeded threshold **max3**

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

Program 112 - 2 independent differential loops

Example: Solar thermal system with return flow booster



<p>S1 min1</p> <p style="text-align: center;">↓ diff1</p> <p style="text-align: center;">A1</p> <p style="text-align: center;">↓</p> <p style="text-align: center;">S2 max1</p>	<p>S3 min2</p> <p style="text-align: center;">↓ diff2</p> <p style="text-align: center;">A2</p> <p style="text-align: center;">↓</p> <p style="text-align: center;">S4 max2</p>	<p>required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... return limit S4 → A2</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. TK top S3 → A2</p> <p>diff1 ... coll. S1 – TK S2 → A1</p> <p>diff2 ... TK S3 – return S4 → A2</p>
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Program 112: 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 the threshold **max1**.

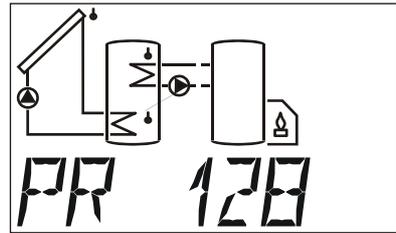
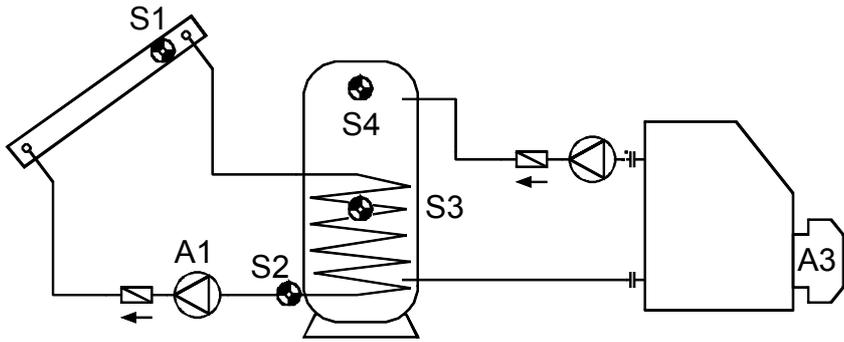
The output **A2** switches on, if:

- ♦ **S3** is greater than 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 requirement and solar power system (or feed pump)



S1 min1 diff1 A1 ↓ S2 max1	Burner A3 S4 min3 S3 max3	Required settings: max1 ... limit TK S2 → A1 max3 ... burner req. off SP S3 → A3 min1 ... switch-on temp. coll. S1 → A1 min2 ... see all programs +2 min3 ... burner req. on TK S4 → A3 diff1 ... collector S1 – TK S2 → A1 diff2 ... see all programs +2
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Program 128: Pump **A1** runs when:

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

Output **A3** switches on when **S4** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S3** exceeds **max3**.

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

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

All programs +1:

The burner requirement (**A3**) only occurs via sensor **S4**.

Output **A3** switches on when **S4** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S4** exceeds **max3**.

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

All programs +2:

In addition, pump **A1** switches between sensors **S4** and **S2** (such as oil boiler - buffer - tank system) when difference **diff2** is reached.

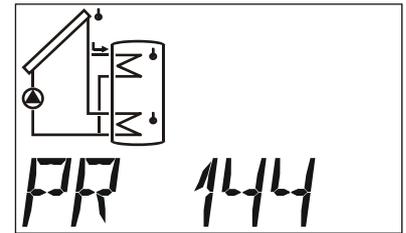
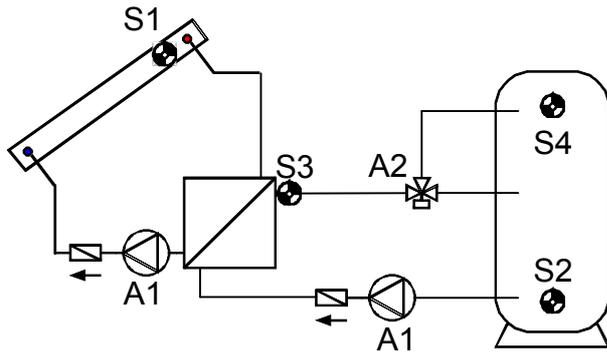
Pump **A1** runs when:

- ♦ **S1** is greater than the threshold **min1** ♦ and **S1** is greater than **S2** by the difference **diff1**
- ♦ and **S2** has not exceeded the threshold **max1**,
- ♦ or **S4** is greater than threshold **min2** ♦ and **S4** is greater than **S2** by the difference **diff2**
- ♦ and **S2** has not exceeded **max2**.

$$A1 = (S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1) \\ \text{or} \qquad (S4 > (S2 + diff2) \ \& \ S4 > min2 \ \& \ S2 < max1)$$

Program 144 - Solar power system with layered storage tank loading

A layered system only makes sense if the speed control is activated!
 (Absolute value control system: AC N1)



No symbol for S3 and heat exchanger

S1 min1 ↓ diff1 A1 ↓ S2 max1	S3 <min2 ↓ diff2 A2 ↓ S4 max2	S3 >min2 ↓ A2 ↓ S4 max2	Required settings: max1 ... limit TK S2 → A1 max2 ... limit TK S4 → A2 min1 ... switch-on temp. coll. S1 → A1 min2 ... switch-on temp. supply l. S3 → A2 diff1 ... collector S1 – TK S2 → A1 diff2 ... supply line S3 – TK S4 → A2
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Program 144: Solar pumps A1 run when:

- ♦ S1 is greater than 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 up when:

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

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

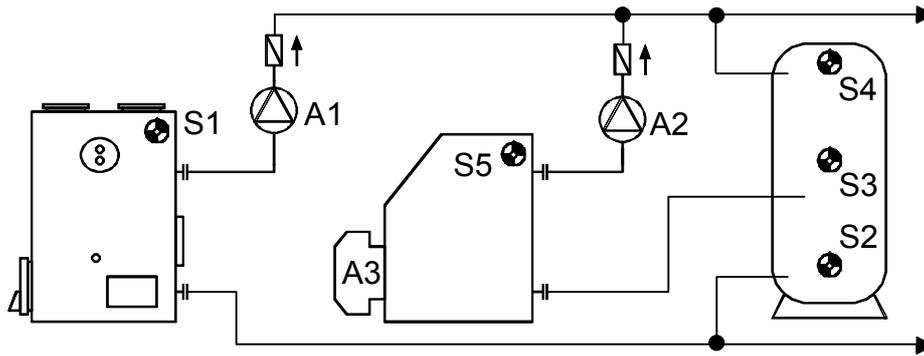
$$A2 = (S3 > min2 \text{ or } S3 > (S4 + diff2)) \& S4 < max2$$

Program 145:

If S4 has reached **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.

If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum speed is output. Control output 2 is not changed and continues control.

Program 160 - Inserting two boilers into the heating system



<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>S4 min3 S3 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... limit TK S3 → A2</p> <p>max3 ... burner req. off TK S3 → A3</p> <p>min1 ... switch-on temp. boiler S1 → A1</p> <p>min2 ... switch-on temp. boiler S5 → A2</p> <p>min3 ... burner req. on TK S4 → A3</p> <p>diff1 ... boiler S1 – TK S2 → A1</p> <p>diff2 ... boiler S5 – TK S3 → A2</p>
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Program 160: Feed pump **A1** runs when:

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

Feed pump **A2** runs when:

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

Output **A3** switches on when **S4** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S3** exceeds **max3**.

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

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

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

All programs +1: The burner requirement (**A3**) only occurs via sensor **S4**.

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

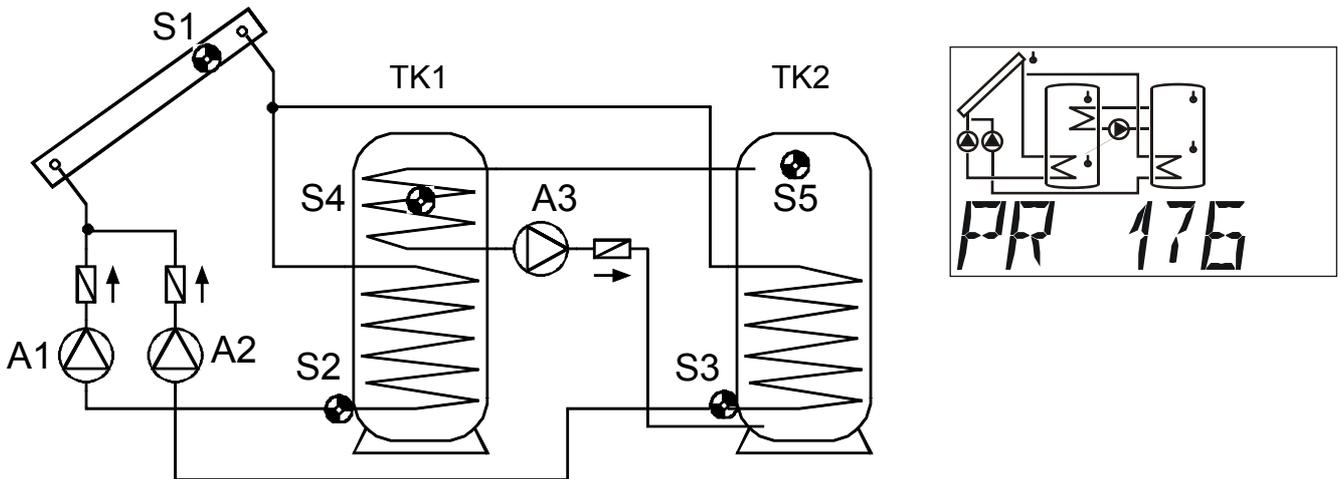
All programs +2: The burner requirement (**A3**) is only admissible if pump **A1** is switched off.

All programs +4 (only makes sense together with “all programs+2”): Feed pump **A2** runs when:

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

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

Program 176 - Solar power system with 2 consumers and feed pump function



<p>S1 min1</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>S2 max1</p> <p>S3 max2</p>	<p>S5 min2</p> <p>diff3 A3</p> <p>S4 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... limit TK1 S4 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1, A2</p> <p>min2 ... switch-on temp. TK2 S5 → A3</p> <p>min3 ... see all programs +4</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... coll. S1 – TK2 S3 → A2</p> <p>diff3 ... TK2 S5 – TK1 S4 → A3</p>
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Program 176: Pump **A1** runs when:

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

Pump **A2** runs when:

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

The feed pump **A3** runs when:

- ♦ **S5** is greater than 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 both pumps **A1** and **A2** one pump **A1** and a three-way valve **A2** are deployed. **Speed control: Observe the comments on page 9!**

Without a priority allocation, tank 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

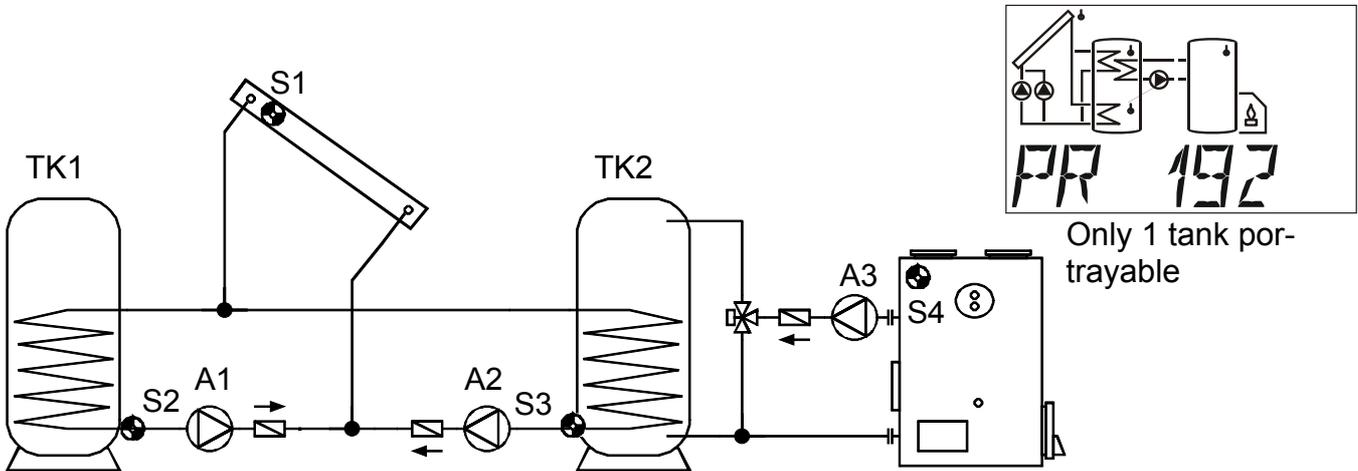
All programs +2: If both tanks have reached their maximum temperature due to the solar power system, pumps **A1** and **A3** are switched on (reverse cooling function).

All programs +4: Both solar loops have separate switch-on thresholds at **S1**:
Output **A1** retains **min1**, and **A2** switches at **min3**.

All programs +8: The limiting of tank TK1 is made via the independent sensor **S6** and the maximum threshold **max1** (no maximum threshold on **S2!**)

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities more details).

Program 192 - Solar power system with 2 consumers and feed pump (heating boiler)



	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1 max2 ... limit TK2 S3 → A2 max3 ... limit TK2 S3 → A3 min1 ... switch-on temp. Coll. S1 → A1, A2 min2 ... switch-on temp. boiler S4 → A3 min3 ... see all programs +4 diff1 ... coll. S1 – TK1 S2 → A1 diff2 ... coll. S1 – TK2 S3 → A2 diff3 ... boiler S4 – TK2 S3 → A3</p>
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Program 192: Pump **A1** runs when:

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

Pump **A2** runs when:

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

The feed pump **A3** runs when:

- ♦ **S4** is greater than 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 both pumps **A1** and **A2** one pump **A1** and a three-way valve **A2** are deployed. **Speed control: Observe the comments on page 9!**

Without a priority allocation, tank 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

All programs +2: If both tanks have reached their maximum temperature due to the solar power system, pumps **A2** and **A3** are switched on (reverse cooling function)

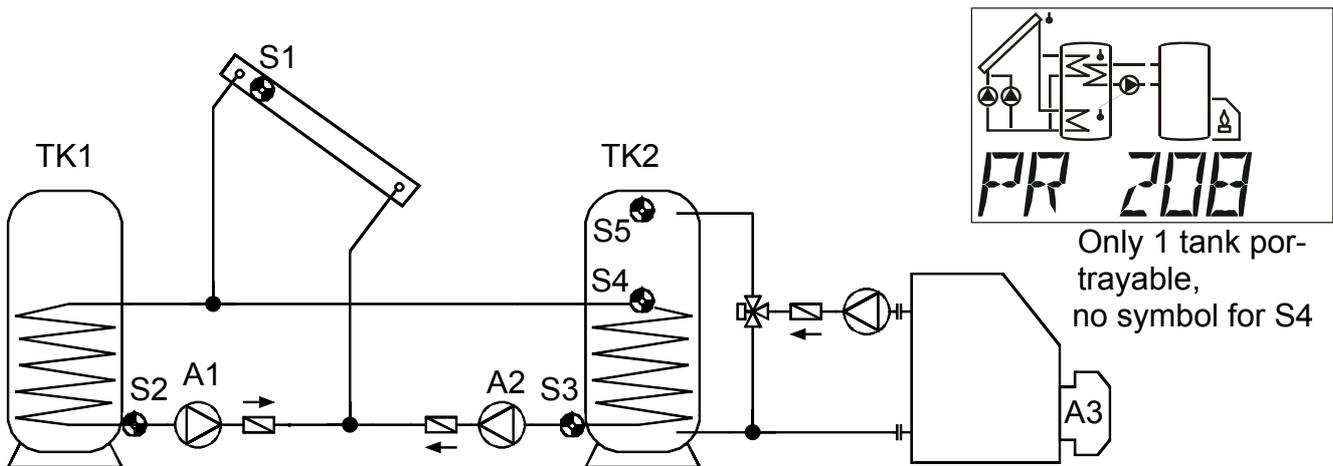
All programs +4:

Both solar loops have separate switch-on thresholds at **S1**:

Output **A1** retains *min1*, and **A2** switches at *min3*.

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities for more details).

Program 208 - Solar power system with 2 consumers and burner requirement



<p>S1 <i>min1</i></p> <p>diff1 A1</p> <p>diff2 A2</p> <p>S2 <i>max1</i></p> <p>S3 <i>max2</i></p>	<p>Burner A3</p> <p>S5 <i>min3</i> S4 <i>max3</i></p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... burner req. off TK2 S4 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1, A2</p> <p>min2 ... see all programs +4</p> <p>min3 ... burner req. on TK2 S5 → A3</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... coll. S1 – TK2 S3 → A2</p>
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Program 208: Pump **A1** runs when:

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

Pump **A2** runs when:

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

Output **A3** switches on when **S5** falls below threshold *min3*.

Output **A3** switches off (dominant) when **S4** exceeds *max3*.

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

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

$$A3 \ (on) = S5 < min3$$

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

All programs +1: Instead of both pumps **A1** and **A2** one pump **A1** and a three-way valve **A2** are deployed. **Speed control: Observe the comments on page 9!**

Without a priority allocation, tank 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

All programs +2: The burner requirement (**A3**) only occurs via sensor **S5**.

$$A3 \text{ (on)} = S5 < \text{min}3 \qquad A3 \text{ (off)} = S5 > \text{max}3 \text{ (dominant)}$$

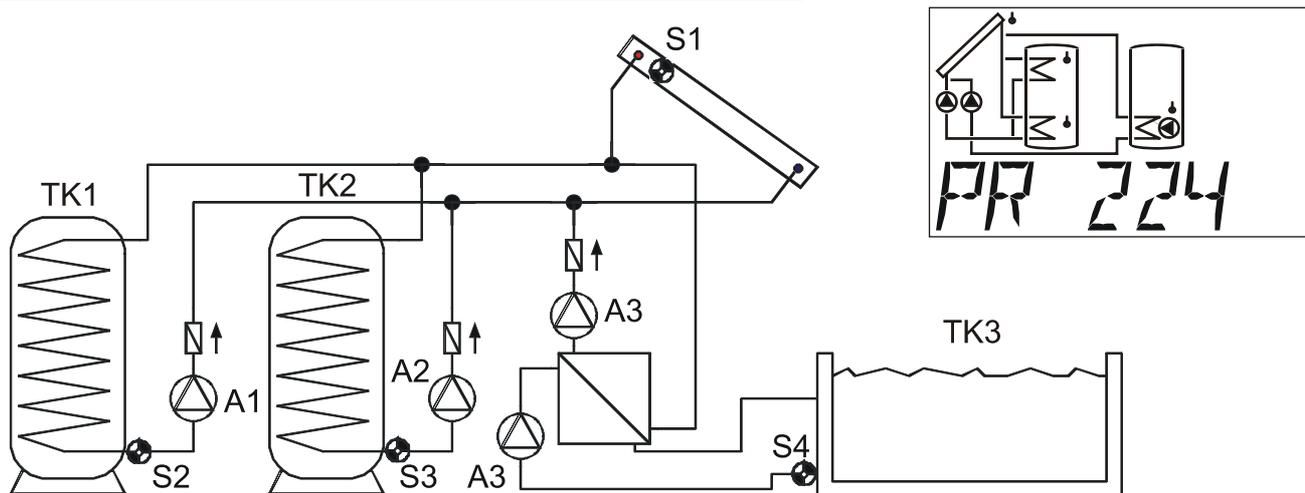
All programs +4: Both solar loops have separate switch-on thresholds at **S1**:

Output **A1** retains *min1*, and **A2** switches at *min2*.

All programs +8: If one of the two solar circuits is active the burner requirement will be blocked. If both solar circuits switch off the burner requirement is released again with a switch delay of 5 minutes.

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities for more details).

Program 224 - Solar power system with 3 consumers



<p>S1 min1</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>diff3 A3</p> <p>S2 max1</p> <p>S3 max2</p> <p>S4 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... limit TK3 S4 → A3</p> <p>min1 ... switch-on 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 – TK1 S2 → A1</p> <p>diff2 ... coll. S1 – TK2 S3 → A2</p> <p>diff3 ... coll. S1 – TK3 S4 → A3</p>
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Program 224: Pump **A1** runs when:

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

Pump **A2** runs when:

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

Pump **A3** runs when:

- ♦ **S1** is greater than 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 both pumps **A1** and **A2** one pump **A1** and a three-way valve **A2** are deployed. (pump - valve system between TK1 and TK2). **Speed control: Observe the comments on page 9!**

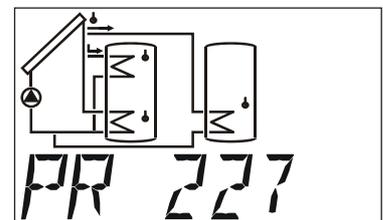
A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

Program 226: Instead of both pumps **A1** and **A3** one pump **A1** and a three-way valve **A3** are deployed. (pump - valve system between TK1 and TK3). **Speed control: Observe the comments on page 9!**

A1 ... common pump **A3** ... Valve (A3/S receives power when filling tank TK3)

Program 227:

All three tanks are fed via one pump (**A1**) and two serially connected three-way valves (**A2** and **A3**). When both valves have no power, TK1 is fed. **Speed control: Observe the comments on page 9!**



A1 ... common pump

A2 ... valve (A2/S receives power when filling tank TK2)

A3 ... valve (A3/S receives power when filling tank TK3)

If there is an active priority allocation in menu **PA**, then the two valves **A2** and **A3** are never switched on simultaneously: when filling into tank 2, only pump **A1** and valve **A2** are switched on, when filling into tank 3, only pump **A1** and valve **A3** are switched on.

All programs +4:

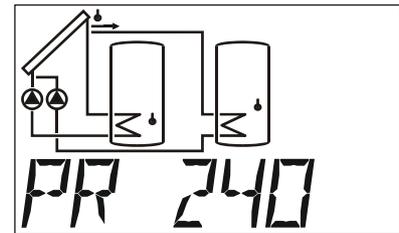
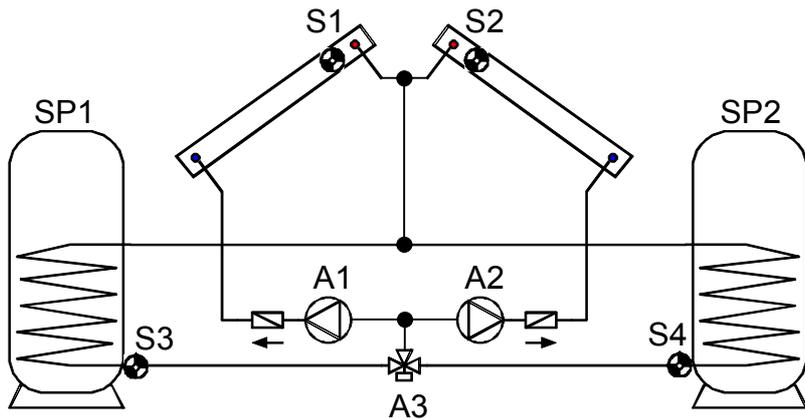
If all of the tanks have reached their maximum temperature, loading to TK2 continues regardless of **max2**.

All programs +8: All solar circuits have separate switch-on thresholds at **S1**:

Output **A1** retains **min1**, but **A2** switches at **min2** and **A3** at **min3**.

The **priorities** for **TK1**, **TK2** and **TK3** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities for more details).

Program 240 - Solar power system with 2 collector panels and 2 consumers



Only one collector field portrayable

A1, A2... pumps A3..... switch-over valve (A3/S has power when loading TK2)

<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>Required settings:</p> <p>max1 ... limit TK1 S3 → A1, A2</p> <p>max2 ... limit TK2 S4 → A1, A2, A3</p> <p>min1 ... switch-on temp. coll.1 S1 → A1</p> <p>min2 ... switch-on temp. coll.2 S2 → A2</p> <p>diff1 ... coll.1 S1 – TK1 S3 → A1</p> <p>... coll.2 S2 – TK1 S3 → A2</p> <p>diff2 ... coll.1 S1 – TK2 S4 → A1, A3</p> <p>... coll.2 S2 – TK2 S4 → A2, A3</p> <p>diff3 ... see all programs +1</p>
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Program 240: Pump **A1** runs when:

- ♦ **S1** is greater than the threshold **min1** ♦ and **S1** is greater than **S3** by the difference **diff1**
 - ♦ and **S3** has not exceeded **max1** ♦ and valve **A3** is switched off
- or
- ♦ **S1** is greater than the threshold **min1** ♦ and **S1** is greater than **S4** by the difference **diff2**
 - ♦ and **S4** has not exceeded **max2** ♦ and valve **A3** is switched on.

Pump **A2** runs when:

- ♦ **S2** is greater than the threshold **min2** ♦ and **S2** is greater than **S3** by the difference **diff1**
 - ♦ and **S3** has not exceeded **max1** ♦ and valve **A3** is switched off
- or
- ♦ **S2** is greater than the threshold **min2** ♦ and **S2** is greater than **S4** by the difference **diff2**
 - ♦ and **S4** has not exceeded **max2** ♦ and valve **A3** is switched on.

Valve **A3** switches relative to the set priority (solar priority)

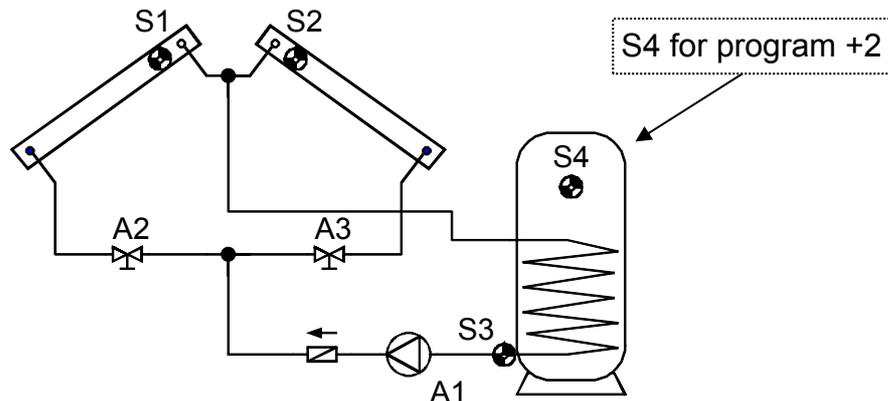
- A1** = **S1** > (**S3** + **diff1**) & **S1** > **min1** & **S3** < **max1** & (**A3** = off)
- or **S1** > (**S4** + **diff2**) & **S1** > **min1** & **S4** < **max2** & (**A3** = on)
- A2** = **S2** > (**S3** + **diff1**) & **S2** > **min2** & **S3** < **max1** & (**A3** = off)
- or **S2** > (**S4** + **diff2**) & **S2** > **min2** & **S4** < **max2** & (**A3** = on)
- A3** = dependent on preset priority

All programs +1:

If the difference between collector sensors **S1** and **S2** exceeds the difference **diff3**, the colder collector is switched off. This prevents heat from being lost in the colder collector when temperatures are mixed.

Warning: In this diagram, priority does not refer to the pumps, but rather to the tanks. The **priorities** for **TK1**, **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities for more details).

Program 256 - Solar power system with 2 collector panels (1 pump, 2 stop valves)



<p>S1 min1</p> <p>diff1 A1, A2</p>	<p>S2 min2</p> <p>diff2 A1, A3</p>	<p>Required settings:</p> <p>max1 ... limit TK S3 → A1, A2, A3</p> <p>max2 ... see all programs +2</p> <p>min1 ... switch-on temp. coll.1 S1 → A1, A2</p> <p>min2 ... switch-on temp. coll.2 S2 → A1, A3</p> <p>diff1 ... coll.1 S1 – TK S3 → A1, A2</p> <p>diff2 ... coll.2 S2 – TK S3 → A1, A3</p> <p>diff3 ... see all programs +1</p>
<p>S3 max1</p>		

Program 256: Pump **A1** runs when:

- ♦ Valve **A2** is switched on ♦ or valve **A3** is switched on.

Valve **A2** switches on when:

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

Valve **A3** switches on when:

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

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

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

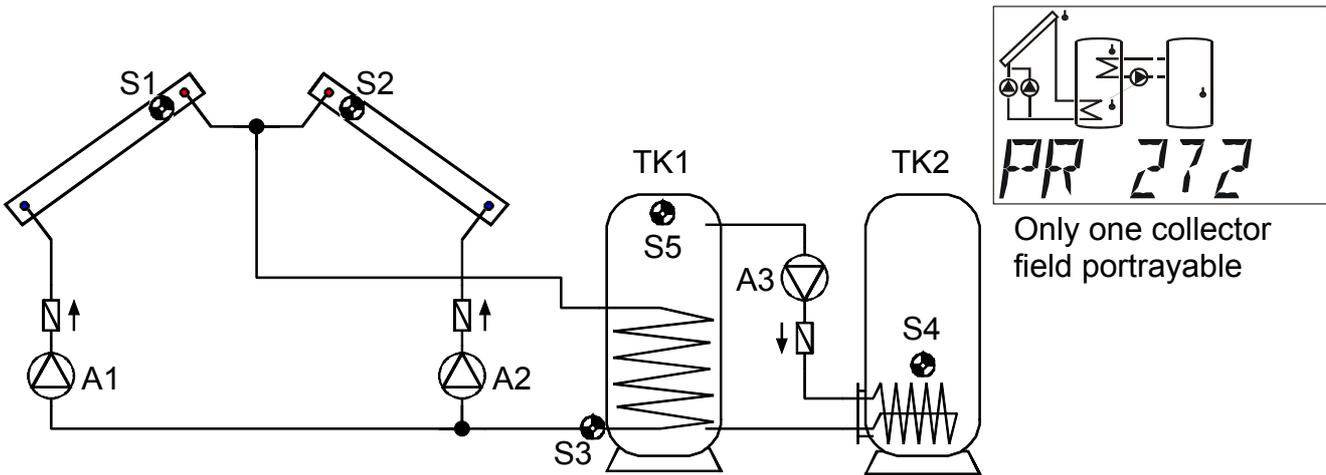
$$A3 = S2 > (S3 + diff2) \ \& \ S2 > min2 \ \& \ S3 < max1$$

All programs +1: If the difference between collector sensors **S1** and **S2** exceeds the difference **diff3**, the colder collector is switched off. This prevents heat from being lost in the colder collector when temperatures are mixed.

All programs +2:

In addition: if **S4** exceeds the threshold **max2** the outputs **A1**, **A2** and **A3** are switched off.

Program 272 - Solar power system with 2 collector panels and feed 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>Required settings:</p> <p>max1 ... limit TK1 S3 → A1, A2</p> <p>max2 ... limit TK2 S4 → A3</p> <p>min1 ... switch-on temp. coll.1 S1 → A1</p> <p>min2 ... switch-on temp. coll.2 S2 → A2</p> <p>min3 ... switch-on temp. TK1 S5 → A3</p> <p>diff1 ... coll.1 S1 – TK1 S3 → A1</p> <p>... coll.2 S2 – TK1 S3 → A2</p> <p>diff2 ... TK1 S5 – TK2 S4 → A3</p> <p>diff3 ... see all programs +1</p>
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Program 272: Pump **A1** runs when:

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

Pump **A2** runs when:

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

The feed pump **A3** runs when:

- ♦ **S5** is greater than 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 collector sensors **S1** and **S2** exceeds the difference **diff3**, the colder collector is switched off. This prevents heat from being lost in the colder collector when temperatures are mixed.

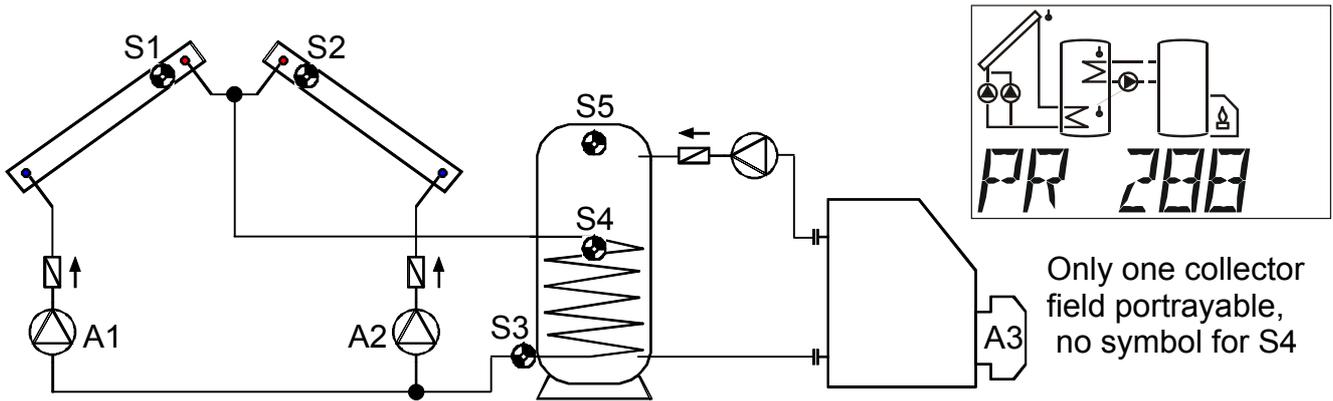
All programs +2:

Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

WARNING: This program is not intended for systems with two collector fields, since through a three-way valve one collector field is always operated at standstill.

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

Program 288 - Solar power system with 2 collector panels and burner requirement



S1 min1 diff1 A1 S3 max1 diff1 A2	S2 min2 diff1 A2 S3 max1	Burner A3 S5 min3 S4 max3	Required settings: max1 ... limit TK S3 → A1, A2 max3 ... burner req. off TK S4 → A3 min1 ... switch-on temp. coll.1 S1 → A1 min2 ... switch-on temp. coll.2 S2 → A2 min3 ... burner req. on TK S5 → A3 diff1 ... coll.1 S1 – TK S3 → A1 ... coll.2 S2 – TK S3 → A2 diff3 ... see all programs +1
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Program 288: Pump **A1** runs when:

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

Pump **A2** runs when:

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

Output **A3** switches on when: **S5** falls short of threshold **min3**.

Output **A3** switches off (dominant) when **S4** exceeds **max3**.

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

All programs +1:

If the difference between collector sensors **S1** and **S2** exceeds the difference **diff3**, the colder collector is switched off. This prevents heat from being lost in the colder collector when temperatures are mixed.

All programs +2:

The burner requirement (**A3**) only occurs via sensor **S5**

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

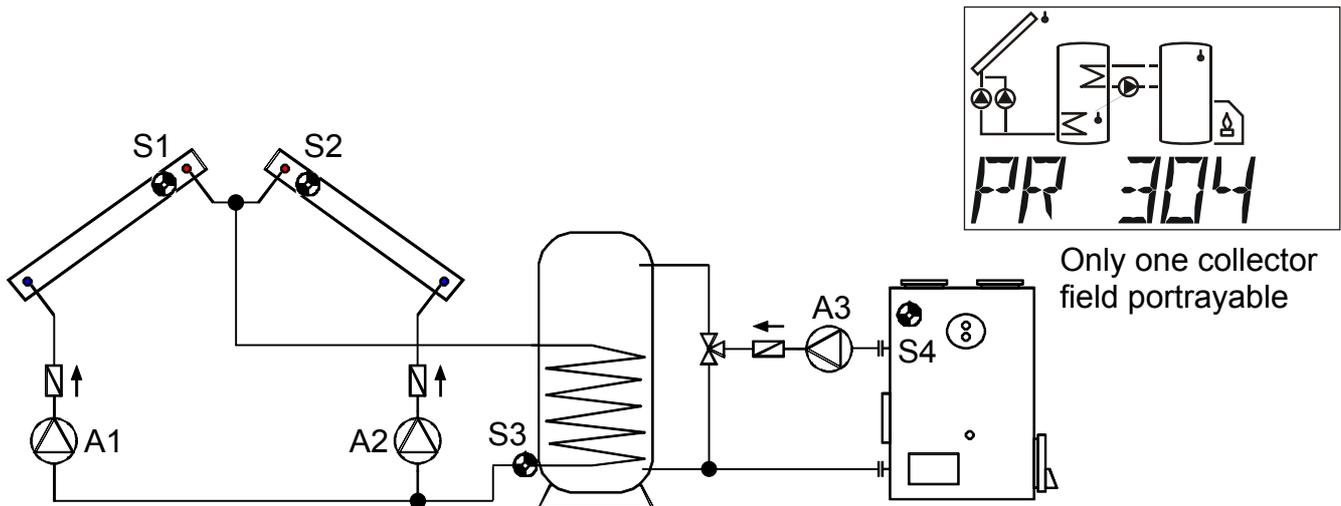
All programs +4:

Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

WARNING: This program is not intended for systems with two collector fields, since through a three-way valve one collector field is always operated at standstill.

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

Program 304 - Solar power system with 2 collector panels + feed 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>Required settings:</p> <p>max1 ... limit TK S3 → A1, A2</p> <p>max2 ... limit TK S3 → A3</p> <p>min1 ... switch-on temp. coll.1 S1 → A1</p> <p>min2 ... switch-on temp. coll.2 S2 → A2</p> <p>min3 ... switch-on temp. boiler S4 → A3</p> <p>diff1 ... coll.1 S1 – TK S3 → A1</p> <p>... coll.2 S2 – TK S3 → A2</p> <p>diff2 ... boiler S4 – TK S3 → A3</p> <p>diff3 ... see all programs +1</p>
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Program 304: Pump **A1** runs when:

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

Pump **A2** runs when:

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

The feed pump **A3** runs when:

- ♦ **S4** is greater than 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 collector sensors **S1** and **S2** exceeds the difference **diff3**, the colder collector is switched off. This prevents heat from being lost in the colder collector when temperatures are mixed.

All programs +2: (Warning: not allowed with two collector fields)

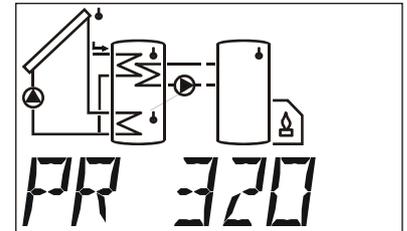
Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

WARNING: This program is not intended for systems with two collector fields, since through a three-way valve one collector field is always operated at standstill.

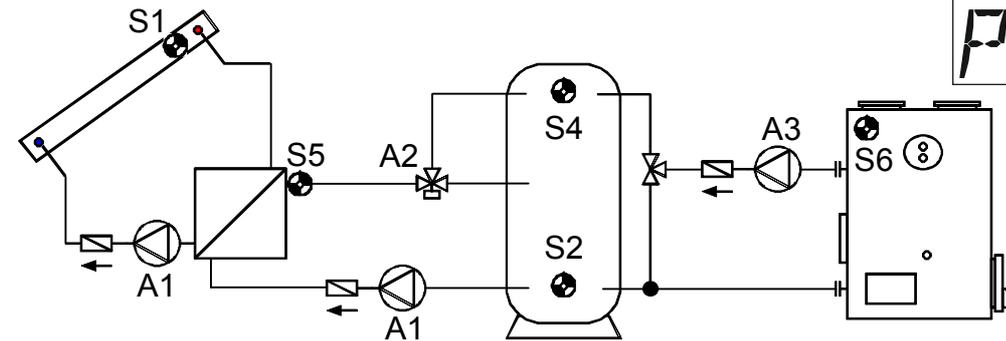
Note: The additional application of the priority circuit "All programs +1" is recommended.

Program 320 - layered tank and load pump

Layered system only effective with speed control activated.
(Absolute value control system: AC N1)



No symbol for S5
and heat exchanger



<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>S5 >min2</p> <p>diff2 A2</p> <p>A2</p> <p>S4 max2</p> <p>S4 max2</p>	<p>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... limit TK S4 → A2</p> <p>max3 ... limit TK S2 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. ssl. S5 → A2</p> <p>min3 ... switch-on temp. boiler S6 → A3</p> <p>diff1 ... coll. S1 – TK S2 → A1</p> <p>diff2 ... supply l. S5 – TK S4 → A2</p> <p>diff3 ... boiler S6 – TK S2 → A3</p>
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Program 320: Solar pumps **A1** run when:

- ◆ **S1** is greater than 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 **to up** when:

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

The feed pump **A3** runs when:

- ◆ **S6** is greater than 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 **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.

If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum speed is output. Control output 2 is not changed and continues control.

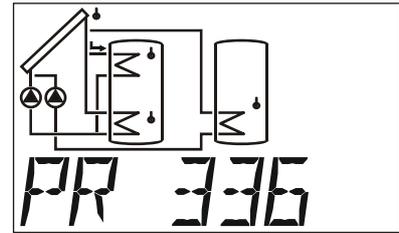
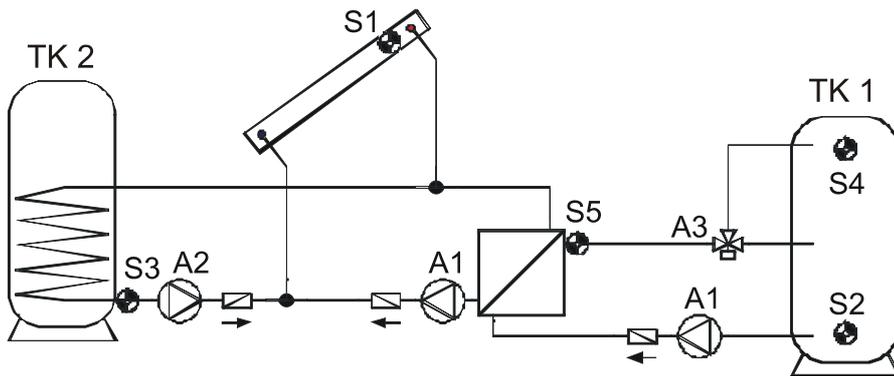
All programs +8 (independent load pump **A3**): the pump **A3** runs when:

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

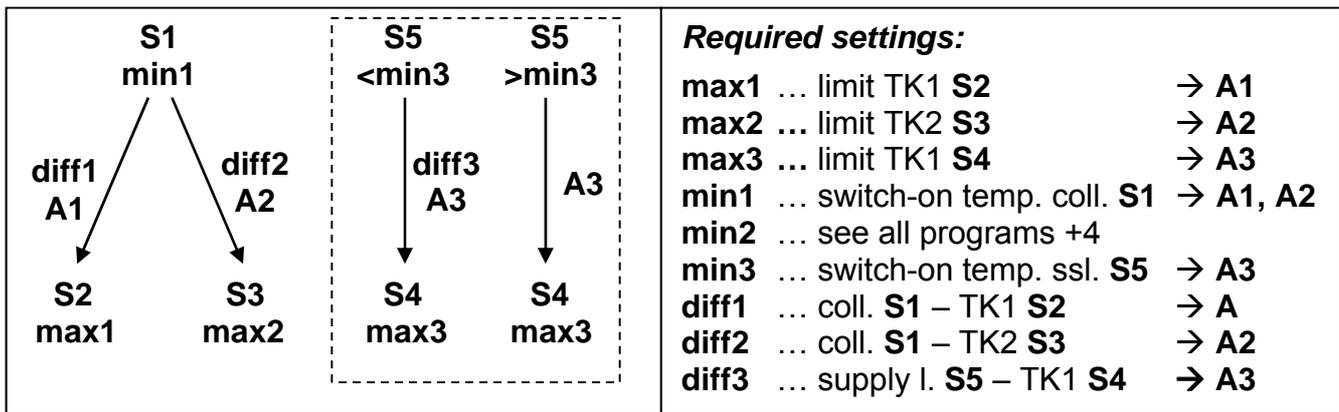
$$A3 = S6 > (S3 + diff3) \& S6 > min3 \& S3 < max3$$

Program 336 - Solar system with 2 consumers and layered tank charging

Layered system only effective with speed control activated.
(Absolute value control system: AC N1)



No symbol for S5 and heat exchanger



Program 336: Solar pumps **A1** run when:

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

The three-way valve **A3** switches to up if:

- ♦ **S5** is greater than the threshold **min3** ♦ or **S5** is greater than **S4** by the difference **diff3**
- ♦ and **S4** has not exceeded 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: When **S4** has reached threshold **max3** the quick warm-up phase is completed and consequently the speed control blocked ⇒ optimum efficiency.

If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum speed is output. Control output 2 is not changed and continues control.

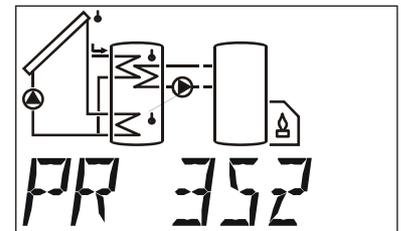
All programs +4: Both solar circuits have separate switch on thresholds on **S1**:

The output **A1** continues to retain **min1** and **A2** switches with **min2**.

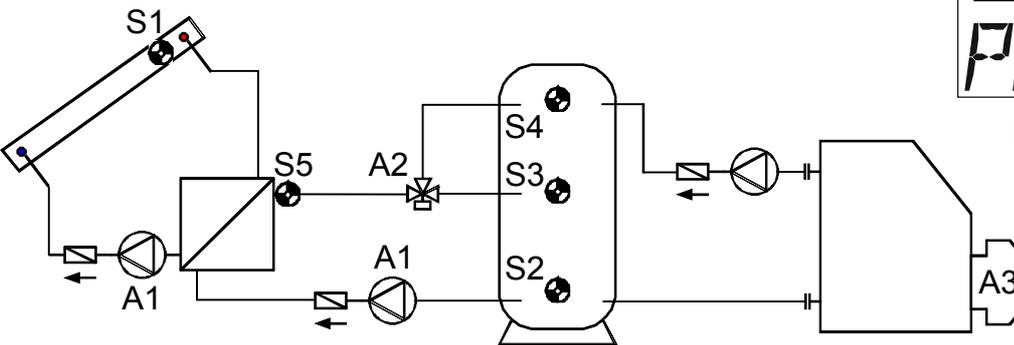
The priorities for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see “solar priorities” for more details).

Program 352 - Layered tank and burner requirement

Layered system only effective with speed control activated.
(Absolute value control system: AC N1)



No symbol for S3, S5 and heat exchanger



S1 min1 ↓ diff1 A1 ↓ S2 max1	S5 <min2 ↓ diff2 A2 ↓ S4 max2	S5 >min2 ↓ A2 ↓ S4 max2	Burner A3 S4 min3 S3 max3	Required settings: max1 ... limit TK S2 → A1 max2 ... limit TK S4 → A2 max3 ... burner req. off TK S3 → A3 min1 ... switch-on temp. coll. S1 → A1 min2 ... switch-on temp. ssl. S5 → A2 min3 ... burner req. on TK S4 → A3 diff1 ... coll. S1 – TK S2 → A1 diff2 ... supply l. S5 – TK S4 → A2
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Program 352: Solar pumps A1 run when:

- ♦ S1 is greater than 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 to up when:

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

Output A3 switches on when S4 falls below **min3**.

Output A3 switches off (dominant) when S3 exceeds **max3**.

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

Program 353: If S4 has reached **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.

If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum speed is output. Control output 2 is not changed and continues control.

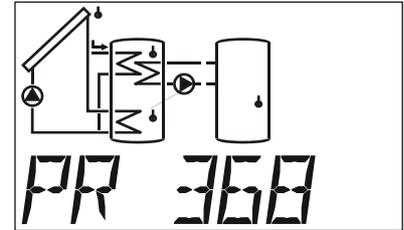
All programs +4: The burner requirement (A3) only occurs via sensor S4.

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

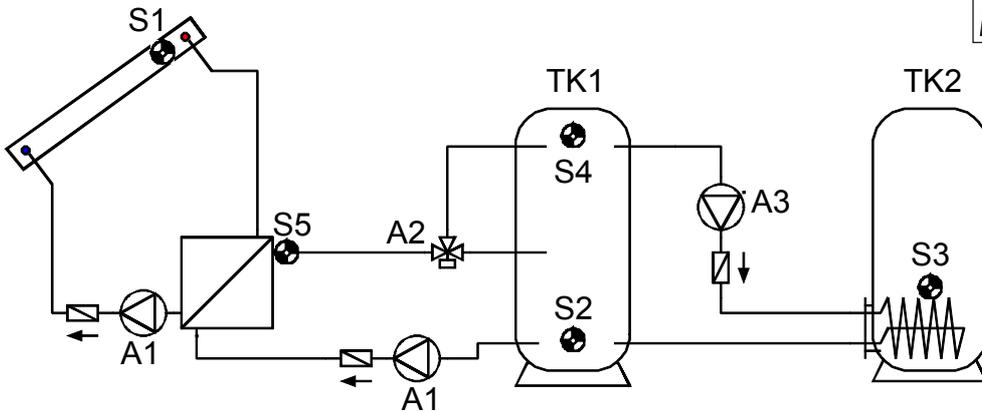
All programs +8: If one of the two solar circuits is active the burner requirement will be blocked. If the solar circuit switch off the burner requirement is released again with a switch delay of 5 minutes.

Program 368 - Layered tank and feed pump function

Layered system only effective with speed control activated.
 (Absolute value control system: AC N1)



No symbol for S5 and heat exchanger



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</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>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK1 S4 → A2</p> <p>max3 ... limit TK2 S3 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. ssl. S5 → A2</p> <p>min3 ... switch-on temp. TK1 S4 → A3</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... supply l. S5 – TK1 S4 → A2</p> <p>diff3 ... TK1 S4 – TK2 S3 → A3</p>
	<p>min3</p> <p>diff3 A3</p> <p>S3 max3</p>		

Program 368: Solar pumps **A1** run when:

- ♦ **S1** is greater than 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 to up when:

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

The feed pump **A3** runs when:

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

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

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

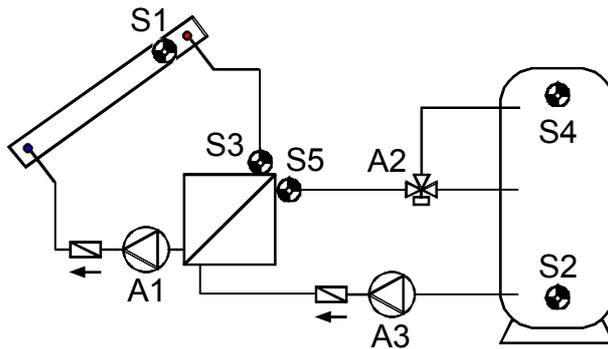
$$A3 = S4 > (S3 + diff3) \ \& \ S4 > min3 \ \& \ S3 < max3$$

Program 369: If **S4** has reached **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.

If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum speed is output. Control output 2 is not changed and continues control.

Program 384 - Layered storage with bypass function

Layered system only effective with speed control activated.
(Absolute value control system: AC N1)



<p>S1 min1</p> <p>diff1 A1</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>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... limit TK S4 → A2</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp.ssl. 1 S5 → A2</p> <p>diff1 ... coll. S1 – TK S2 → A1</p> <p>diff2 ... supply l.1 S5 – TK S4 → A2</p> <p>diff3 ... supply l.2 S3 – TK S2 → A3</p>
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Program 384: Pump A1 runs when:

- ♦ S1 is greater than 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 **to up** when:

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

The feed pump A3 runs when:

- ♦ S3 is greater than S2 by **diff3** ♦ and pump A1 is running.

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

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

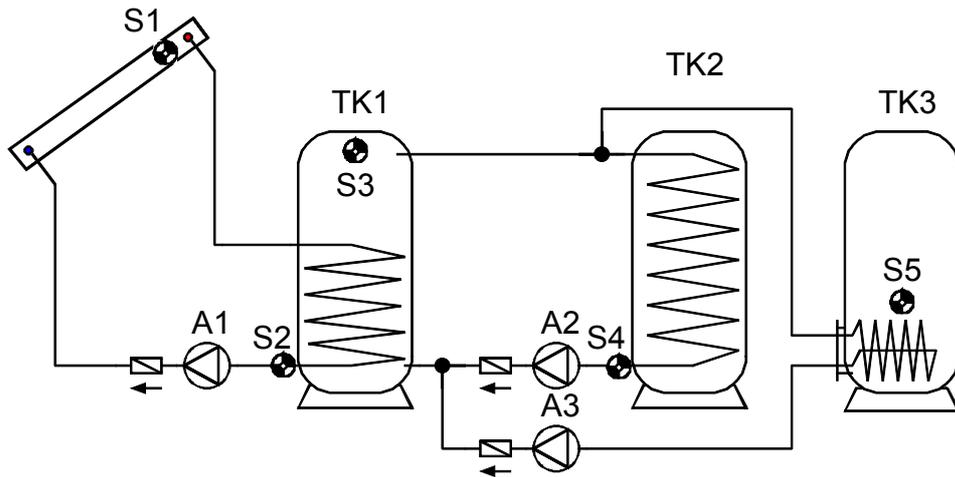
$$A3 = S3 > (S2 + diff3) \& (A1 = on)$$

Program 385: If S4 has reached **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.

If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum speed is output. Control output 2 is not changed and continues control.

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

Program 400 - Solar power system with 1 consumer and 2 feed 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>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S4 → A2</p> <p>max3 ... limit TK3 S5 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. TK1 S3 → A2, A3</p> <p>min3 ... see all programs +2</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... TK1 S3 – TK2 S4 → A2</p> <p>diff3 ... TK1 S3 – TK3 S5 → A3</p>
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Program 400: Pump **A1** runs when:

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

The feed pump **A2** runs when:

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

The feed pump **A3** runs when:

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

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

All programs +1: Instead of both pumps **A2** and **A3** one pump **A2** and a three-way valve **A3** are deployed. Without a priority allocation, tank 3 is filled by priority.

A2 ... common pump **A3** ... Valve (A3/S receives power when filling tank TK3)

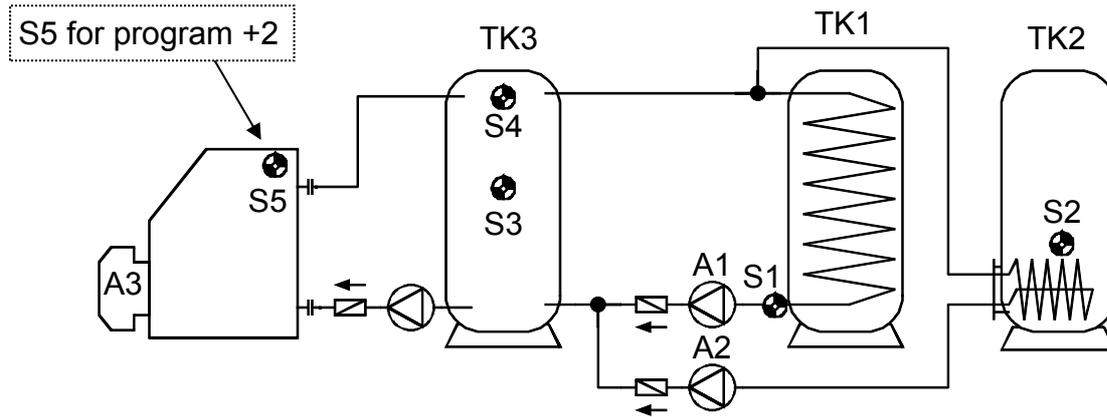
All programs +2: Separate switch-on thresholds on the load pump circuits.

The output **A2** continues to retain **min2** and **A3** switches with **min3**.

The **priorities** for **TK2** and **TK3** can be set in the parameter menu under **PA**.

Program 416 - 1 consumer, 2 feed pump functions, and burner requirement

Priority assignment between TK1 and TK2 possible



<p>S4 min1</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>S1 max1</p> <p>S2 max2</p>	<p>Burner A3</p> <p>S4 min3 S3 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S1 → A1</p> <p>max2 ... limit TK2 S2 → A2</p> <p>max3 ... burner req. off TK3 S3 → A3</p> <p>min1 ... switch-on temp. TK3. S4 → A1, A2</p> <p>min2 ... see all programs +2</p> <p>min3 ... burner req. on TK3 S4 → A3</p> <p>diff1 ... TK3 S4 – TK1 S1 → A1</p> <p>diff2 ... TK3 S4 – TK2 S2 → A2</p> <p>diff3 ... see all programs +2</p>
--	---	--

Program 416: Feed pump **A1** runs when:

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

The feed pump **A2** runs when:

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

Output **A3** switches on when **S4** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S3** exceeds **max3**.

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

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

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

$$A3 \ (off) = S3 > max3$$

All programs +1: Instead of both pumps **A1** and **A2** one pump **A1** and a three-way valve **A2** are deployed. **Speed control: Observe the comments on page 9!** Without a priority allocation, tank 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

All programs +2:

In addition, the feed pump **A1** switches on when the temperature of the tank **S1** (TK1) varies by **diff3** from the boiler pre-run temperature.

In addition, the feed pump **A2** switches on when the temperature of the tank **S2** (TK2) varies by **diff3** from the boiler pre-run temperature.

Pump **A1** runs when:

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

or

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

Feed pump **A2** runs when:

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

or

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

$$\begin{aligned}
 & \text{or} \quad A1 = (S4 > (S1 + \text{diff1}) \ \& \ S4 > \text{min1} \ \& \ S1 < \text{max1}) \\
 & \quad \quad \quad (S5 > (S1 + \text{diff3}) \ \& \ S5 > \text{min2} \ \& \ S1 < \text{max1}) \\
 & \quad \quad \quad A2 = (S4 > (S2 + \text{diff2}) \ \& \ S4 > \text{min1} \ \& \ S2 < \text{max2}) \\
 & \quad \quad \quad \text{or} \quad \quad \quad (S5 > (S2 + \text{diff3}) \ \& \ S5 > \text{min2} \ \& \ S2 < \text{max2})
 \end{aligned}$$

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

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

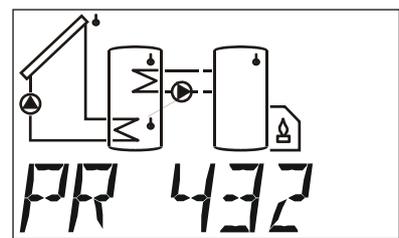
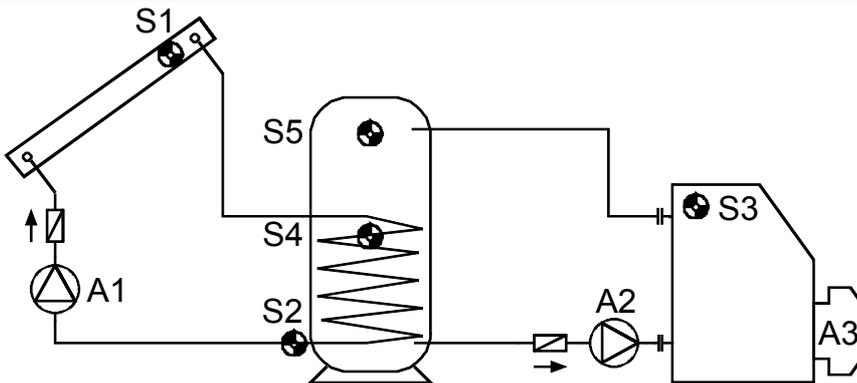
All programs +8: (Cannot be used with +2!)

Both feed pump loops have separate switch-on thresholds at **S4**:

Output **A1** retains **min1**, and **A2** switches at **min2**.

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**.

Program 432 - Solar power system, burner requirement, and one feed pump



No symbol for S4

S1 min1 ↓ diff1 A1 ↓ S2 max1	S3 min2 ↓ diff2 A2 ↓ S4 max2	Burner A3 S5 min3 S4 max3	Required settings: max1 ... limit TK S2 → A1 max2 ... limit TK S4 → A2 max3 ... burner req. off TK S4 → A3 min1 ... switch-on temp. coll. S1 → A1 min2 ... switch-on temp. boiler S3 → A2 min3 ... burner req. on TK S5 → A3 diff1 ... coll. S1 – TK S2 → A1 diff2 ... boiler S3 – TK S4 → A2
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Program 432: Pump **A1** runs when:

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

The feed pump **A2** runs when:

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

Output **A3** switches on when **S5** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S4** exceeds **max3**.

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

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

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

Program 433:

	Burner A3 S5 min3 S4 max3	Required settings: max1 ... limit TK S2 → A1 max2 ... limit TK S2 → A2 max3 ... burner req. off TK S4 → A3 min1 ... switch-on temp. coll.1 S1 → A1 min2 ... switch-on temp. boiler 2 S3 → A2 min3 ... burner req. on TK S5 → A3 diff1 ... coll. S1 – TK S2 → A1 diff2 ... boiler S3 – TK S2 → A2
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Pump **A1** runs when:

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

The feed pump **A2** runs when:

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

Output **A3** switches on when **S5** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S4** exceeds **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:

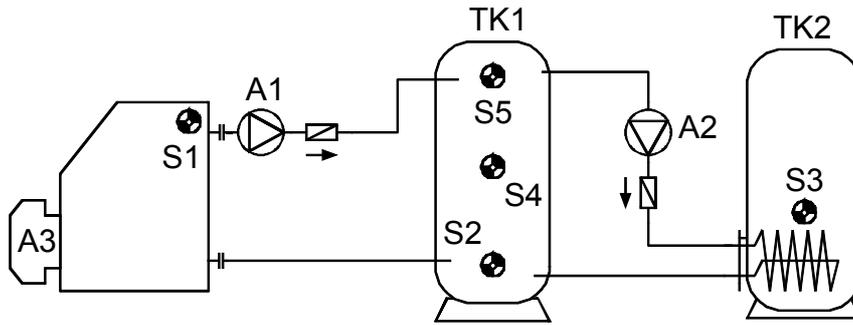
The burner requirement (**A3**) only occurs via sensor **S5**.

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

All programs+4: if sensor **S2** has reached the threshold **max1** pump **A2** is activated and pump **A1** continues running. A "cooling function" to the boiler or the heating is thereby achieved without the occurrence of standstill temperatures at the collector.

All programs +8: An active solar circuit blocks the burner requirement. After switching off the solar circuit the release of the requirement occurs with a delay of 5 minutes.

Program 448 - Burner requirement and 2 feed pump functions



<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>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... burner req. off TK1 S4 → A3</p> <p>min1 ... switch-on temp. boiler S1 → A1</p> <p>min2 ... switch-on temp. TK1 S5 → A2</p> <p>min3 ... burner req. on TK1 S5 → A3</p> <p>diff1 ... boiler S1 – TK1 S2 → A1</p> <p>diff2 ... TK1 S5 – TK2 S3 → A2</p> <p>diff3 ... see all programs +2</p>
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Program 448: Feed pump **A1** runs when:

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

The feed pump **A2** runs when:

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

Output **A3** switches on when **S5** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S4** exceeds **max3**.

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

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

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

Program 449:

<p>S1 min1</p> <p>↓ diff1</p> <p>A1</p> <p>↓</p> <p>S4 max1</p>	<p>S5 min2</p> <p>↓ diff2</p> <p>A2</p> <p>↓</p> <p>S3 max2</p>	<p>Burner A3</p> <p>S5 min3 S4 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S4 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... burner req. off TK1 S4 → A3</p> <p>min1 ... switch-on temp. boiler S1 → A1</p> <p>min2 ... switch-on temp. TK1 S5 → A2</p> <p>min3 ... burner req. on TK1 S5 → A3</p> <p>diff1 ... boiler S1 – TK1 S4 → A1</p> <p>diff2 ... TK1 S5 – TK2 S3 → A2</p> <p>diff3 ... see all programs +2</p>
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Feed pump **A1** runs when:

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

Feed pump **A2** runs when:

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

Output **A3** switches on when **S5** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S4** exceeds **max3**.

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

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

$$A3 \ (on) = S5 < min3$$

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

All programs +2: In addition, the feed pump **A2** switches on when the temperature of the tank **S3** (TK2) varies by **diff3** from the temperature of the burner.

Feed pump **A2** runs when:

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

or

- ♦ **S1** is greater than 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 requirement (**A3**) only occurs via sensor **S5**.

$$A3 \ (on) = S5 < min3$$

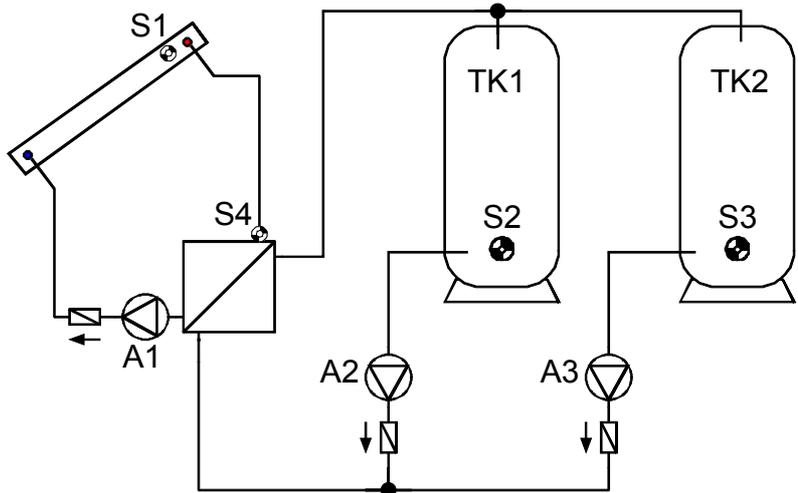
$$A3 \ (off) = S5 > max3 \ (dominant)$$

All programs +8: The burner requirement (**A3**) only occurs via sensor **S4**.

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

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

Program 464 - Solar power system with 2 consumers and bypass function



<p>S1 min1</p> <p>S4 min2</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>diff1 A1</p> <p>diff3 A3</p> <p>S2 max1</p> <p>S3 max2</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1, A2</p> <p>max2 ... limit TK2 S3 → A1, A3</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. ssl. S4 → A2, A3</p> <p>min3 ... see all programs +2</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p> ... coll. S1 – TK2 S3 → A1</p> <p>diff2 ... supply l. S4 – TK1 S2 → A2</p> <p>diff3 ... supply l. S4 – TK2 S3 → A3</p>
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Program 464: Pump **A1** runs when:

- ♦ **S1** is greater than the threshold **min1** ♦ and **S1** is greater than **S2** by the difference **diff1**
- ♦ or **S1** is greater than **S3** by **diff1**
- ♦ both temperature delimiters (**S2** > **max1** and **S3** > **max2**) have not been exceeded.

Feed pump **A2** runs when:

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

The feed pump **A3** runs when:

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

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

All programs+1: Instead of both pumps **A2** and **A3** one pump **A2** and a three-way valve **A3** are deployed. Valve **A3/S** receives power when filling tank **TK2**.

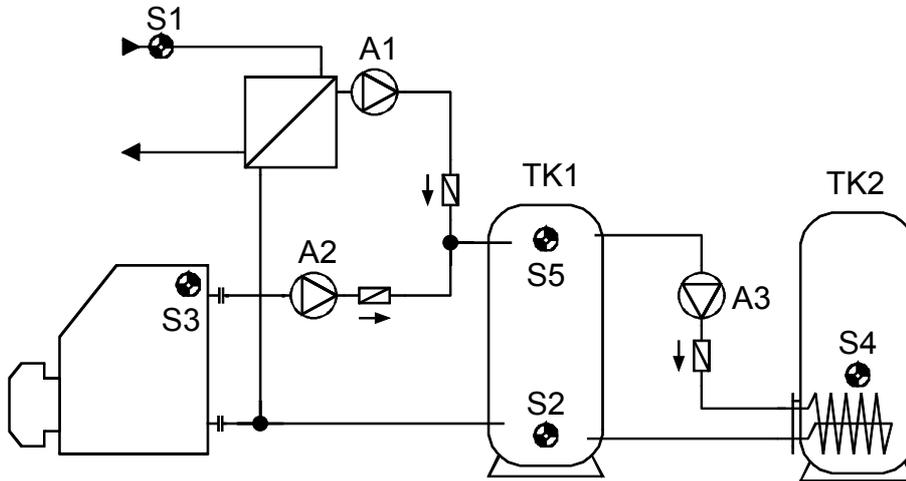
Speed control via control outputs: **COP 1** and **COP 2** are set to the highest speed as soon as value **max1** is reached. **All programs +2:** Both secondary solar loops have separate switch-on thresholds at **S4**:

Output **A2** retains **min2**, and **A3** switches at **min3**.

All programs +4: The two secondary pumps **A2** and **A3** are only released when primary pump **A1** is running in automatic mode.

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities for more details).

Program 480 - 2 consumers and 3 feed pump functions



<p>S1 min1</p> <p>S3 min2</p> <p>S5 min3</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>diff3 A3</p> <p>S2 max1 max2</p> <p>S4 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK1 S2 → A2</p> <p>max3 ... limit TK2 S4 → A3</p> <p>min1 ... switch-on t. heat source S1 → A1</p> <p>min2 ... switch-on temp. boiler S3 → A2</p> <p>min3 ... switch-on temp. TK1 S5 → A3</p> <p>diff1 ... heat source S1 – TK1 S2 → A1</p> <p>diff2 ... boiler S3 – TK1 S2 → A2</p> <p>diff3 ... TK1 S5 – TK2 S4 → A3</p>
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Program 480: Feed pump **A1** runs when:

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

The feed pump **A2** runs when:

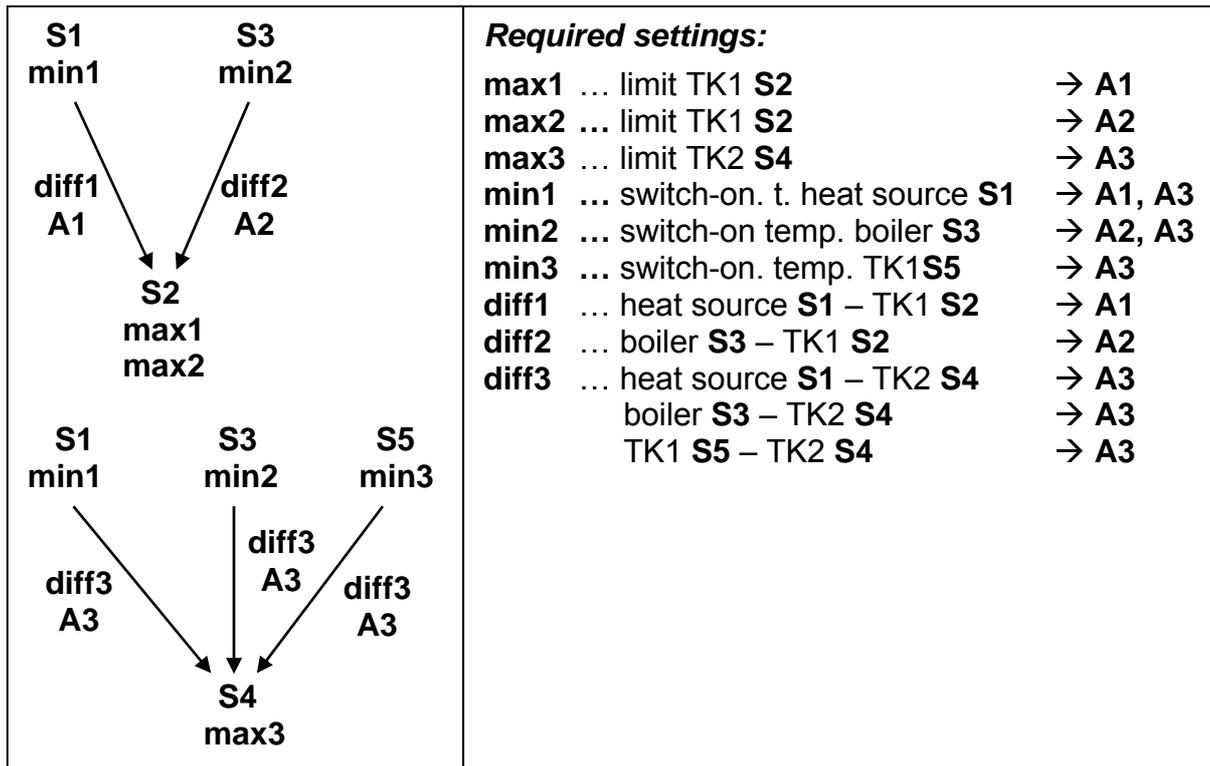
- ◆ **S3** is greater than the threshold **min2** ◆ and **S3** is greater than **S2** by the difference **diff2**
- ◆ and **S2** has not exceeded the threshold **max2**.

The feed pump **A3** runs when:

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

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

Program 481:



Feed pump **A3** runs if:

- ♦ **S1** is greater than threshold **min1** ♦ and **S1** is higher than **S4** by the difference **diff3**
- ♦ and **S4** has not exceeded threshold **max3**

or

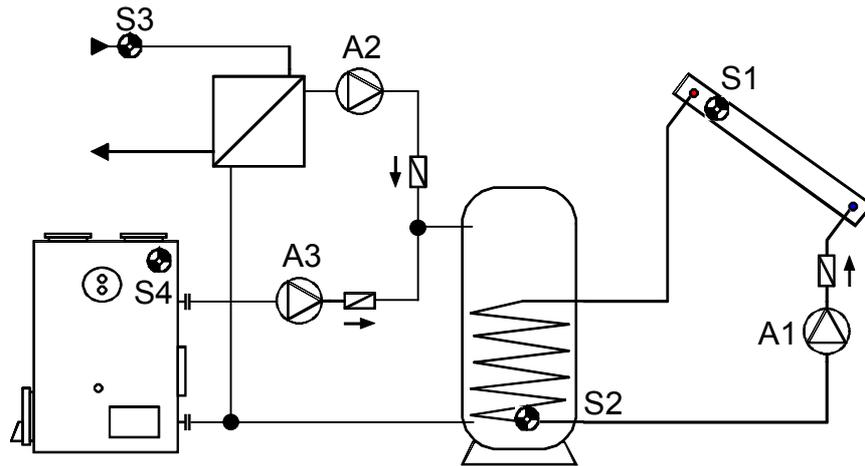
- ♦ **S3** is greater than threshold **min2** ♦ and **S3** is higher than **S4** by the difference **diff3**
- ♦ and **S4** has not exceeded threshold **max3**.

or

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

$$\begin{aligned}
 & \mathbf{A3} = (\mathbf{S1} > (\mathbf{S4} + \mathbf{diff3}) \ \& \ \mathbf{S1} > \mathbf{min} \ \& \ \mathbf{S4} < \mathbf{max3}) \\
 \text{or} & \quad (\mathbf{S3} > (\mathbf{S4} + \mathbf{diff3}) \ \& \ \mathbf{S3} > \mathbf{min2} \ \& \ \mathbf{S4} < \mathbf{max3}) \\
 \text{or} & \quad (\mathbf{S5} > (\mathbf{S4} + \mathbf{diff3}) \ \& \ \mathbf{S5} > \mathbf{min3} \ \& \ \mathbf{S4} < \mathbf{max3})
 \end{aligned}$$

Program 496 - 1 consumer and 3 feed pump functions



<p>S1 min1</p> <p>S3 min2</p> <p>S4 min3</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>diff3 A3</p> <p>S2 max1 max2 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK S2 → A1</p> <p>max2 ... limit TK S2 → A2</p> <p>max3 ... limit TK S2 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on t. heat source S3 → A2</p> <p>min3 ... switch-on temp. boiler S4 → A3</p> <p>diff1 ... coll. S1 – TK S2 → A1</p> <p>diff2 ... heat source S3 – TK S2 → A2</p> <p>diff3 ... boiler S4 – TK S2 → A3</p>
---	---

Program 496: Solar pump **A1** runs when:

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

The feed pump **A2** runs when:

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

The feed pump **A3** runs when:

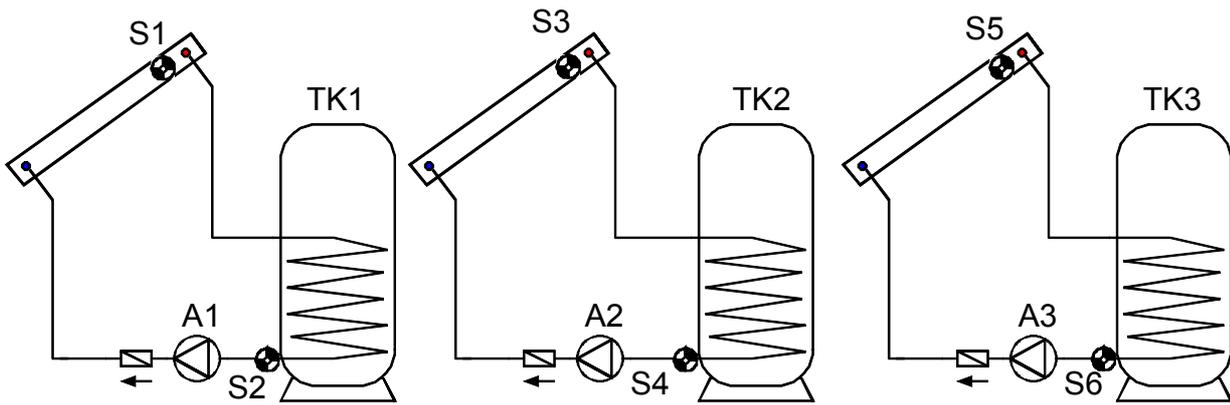
- ♦ **S4** is greater than the threshold **min3** ♦ and **S4** is greater than **S2** by the difference **diff3**
- ♦ and **S2** has not exceeded the threshold **max3**.

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

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

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

Program 512 - 3 independent differential loops



<p>S1 min1</p> <p>diff1 A1</p> <p>↓</p> <p>S2 max1</p>	<p>S3 min2</p> <p>diff2 A2</p> <p>↓</p> <p>S4 max2</p>	<p>S5 min3</p> <p>diff3 A3</p> <p>↓</p> <p>S6 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S4 → A2</p> <p>max3 ... limit TK3 S6 → A3</p> <p>min1 ... switch-on temp. coll.1 S1 → A1</p> <p>min2 ... switch-on temp. coll.2 S3 → A2</p> <p>min3 ... switch-on temp. coll.3 S5 → A3</p> <p>diff1 ... coll.1 S1 – TK1 S2 → A1</p> <p>diff2 ... coll.2 S3 – TK2 S4 → A2</p> <p>diff3 ... coll.3 S5 – TK3 S6 → A3</p>
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Program 512: Pump **A1** runs when:

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

Feed pump **A2** runs when:

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

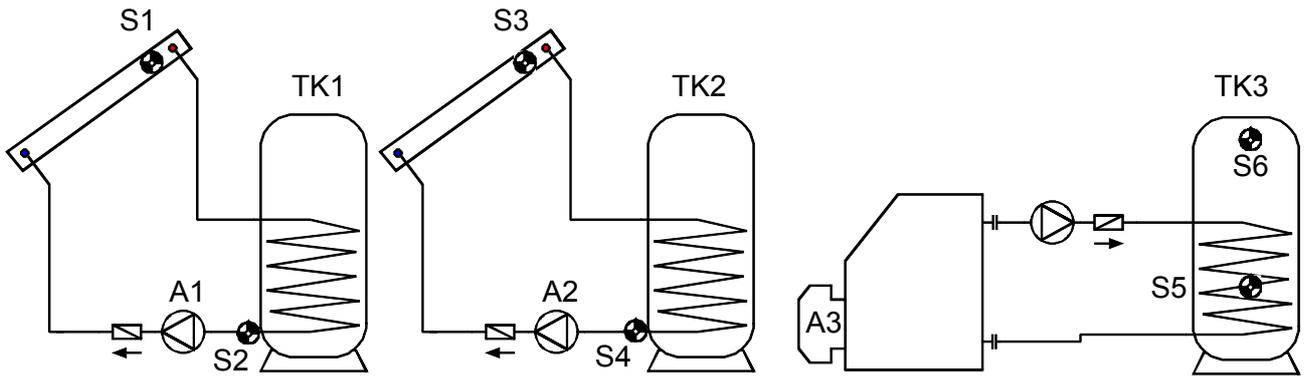
The feed pump **A3** runs when:

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

$$\begin{aligned}
 A1 &= S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1 \\
 A2 &= S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2 \\
 A3 &= S5 > (S6 + diff3) \ \& \ S5 > min3 \ \& \ S6 < max3
 \end{aligned}$$

All programs+1: if sensor **S2** has reached the threshold **max1** pump **A2** is activated and pump **A1** continues running. A "cooling function" to the boiler or the heating is thereby achieved without the occurrence of standstill temperatures at the collector.

Program 528 - 2 independent differential loops and independent burner requirement



<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>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S4 → A2</p> <p>max3 ... burner req. off TK3 S5 → A3</p> <p>min1 ... switch-on temp. coll.1 S1 → A1</p> <p>min2 ... switch-on temp. coll.2 S3 → A2</p> <p>min3 ... burner req. on TK3 S6 → A3</p> <p>diff1 ... coll.1 S1 – TK1 S2 → A1</p> <p>diff2 ... coll.2 S3 – TK2 S4 → A2</p>
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Program 528: Pump **A1** runs when:

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

Feed pump **A2** runs when:

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

Output **A3** switches on when **S6** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S5** exceeds **max3**.

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

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

$$A3 \ (on) = S6 < min3$$

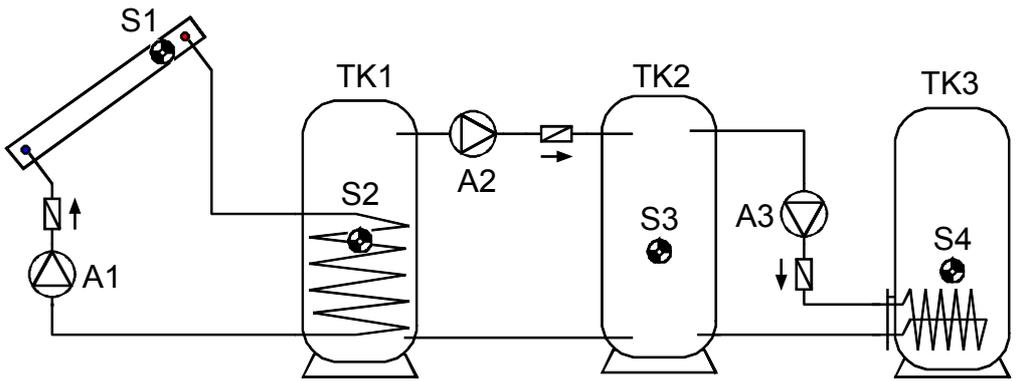
$$A3 \ (off) = S5 > max3$$

All programs +1: The burner requirement (**A3**) only occurs via sensor **S6**

$$A3 \ (on) = S6 < min3$$

$$A3 \ (off) = S6 > max3 \ (dominant)$$

Program 544 - Cascade: S1 → S2 → S3 → S4



<p>S1 min1</p> <p>diff1 ↓ A1 ↓</p> <p>max1 S2 min2</p> <p>diff2 ↓ A2 ↓</p> <p>max2 S3 min3</p> <p>diff3 ↓ A3 ↓</p> <p>S4 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S3 → A2</p> <p>max3 ... limit TK3 S4 → A3</p> <p>min1 ... switch-on temp. coll S1 → A1</p> <p>min2 ... switch-on temp. TK1 S2 → A2</p> <p>min3 ... switch-on temp. TK2 S3 → A3</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... TK1 S2 – TK2 S3 → A2</p> <p>diff3 ... TK2 S3 – TK3 S4 → A3</p>
---	--

Program 544: Solar pump **A1** runs when:

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

The feed pump **A2** runs when:

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

The feed pump **A3** runs when:

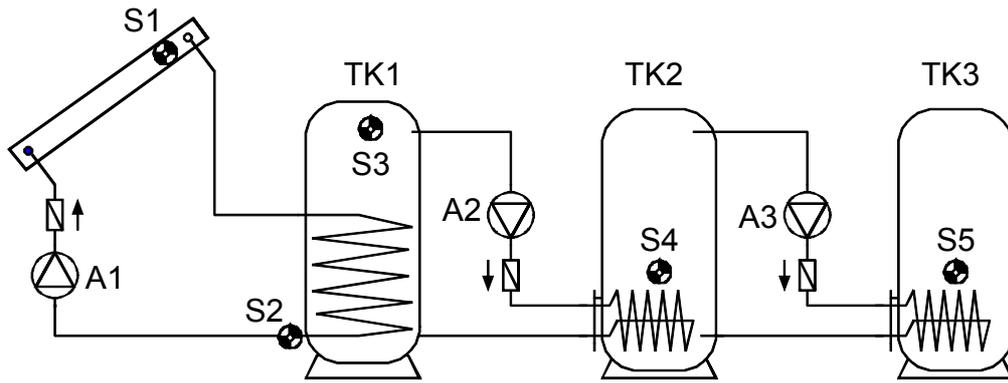
- ♦ **S3** is greater than the threshold **min3** ♦ and **S3** is greater than **S4** by the difference **diff3**
- ♦ and **S4** has not exceeded the threshold **max3**.

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

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

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

Program 560 - Cascade: S1 → S2 / S3 → S4 → S5



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p> <p>S5 max3</p> <p>← diff3 A3</p>	<p>S3 min2</p> <p>↓ diff2 A2</p> <p>S4 max2 min3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S2 → A1</p> <p>max2 ... limit TK2 S4 → A2</p> <p>max3 ... limit TK3 S5 → A3</p> <p>min1 ... switch-on temp. coll. S1 → A1</p> <p>min2 ... switch-on temp. TK1 S3 → A2</p> <p>min3 ... switch-on temp. TK2 S4 → A3</p> <p>diff1 ... coll. S1 – TK1 S2 → A1</p> <p>diff2 ... TK1 S3 – TK2 S4 → A2</p> <p>diff3 ... TK2 S4 – TK3 S5 → A3</p>
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Program 560: Pump **A1** runs when:

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

The feed pump **A2** runs when:

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

The feed pump **A3** runs when:

- ♦ **S4** is greater than 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: The pump **A3** runs if:

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

or

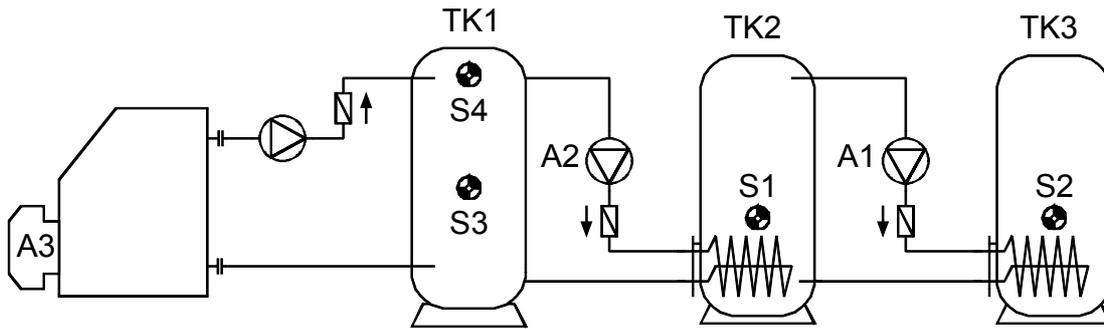
- ♦ **S4** is greater than threshold **min3** ♦ and **S4** is higher than **S5** by the difference **diff3**
- ♦ and **S5** has not exceeded threshold **max3**

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

or

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

Program 576 - Cascade: S4 → S1 → S2 + burner requirement



<p>S4 min2</p> <p>diff2 A2</p> <p>↓</p> <p>S1 max2 min1</p> <p>diff1 A1</p> <p>↓</p> <p>S2 max1</p>	<p>Burner A3</p> <p>S4 min3 S3 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK3 S2 → A1</p> <p>max2 ... limit TK2 S1 → A2</p> <p>max3 ... burner req. off TK1 S3 → A3</p> <p>min1 ... switch-on temp. TK2 S1 → A1</p> <p>min2 ... switch-on temp. TK1 S4 → A2</p> <p>min3 ... burner req. on TK1 S4 → A3</p> <p>diff1 ... TK2 S1 – TK3 S2 → A1</p> <p>diff2 ... TK1 S4 – TK2 S1 → A2</p>
--	--	---

Program 576: Feed pump **A1** runs when:

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

The feed pump **A2** runs when:

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

Output **A3** switches on when **S4** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S3** exceeds **max3**.

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

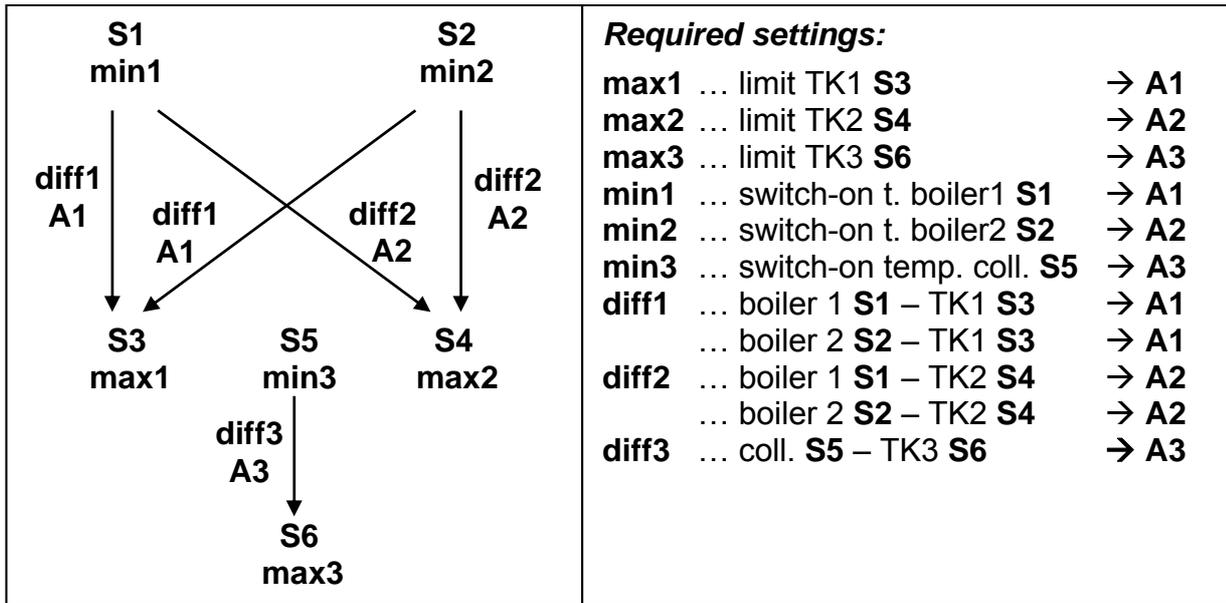
All programs +1:

The burner requirement (**A3**) only occurs via sensor **S4**.

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

Program 592 - 2 generators on 2 consumers + independent differential loop

No diagram available!



Program 592: Pump **A1** runs when:

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

or

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

Feed pump **A2** runs when:

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

or

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

The feed pump **A3** runs when:

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

or

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

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

or

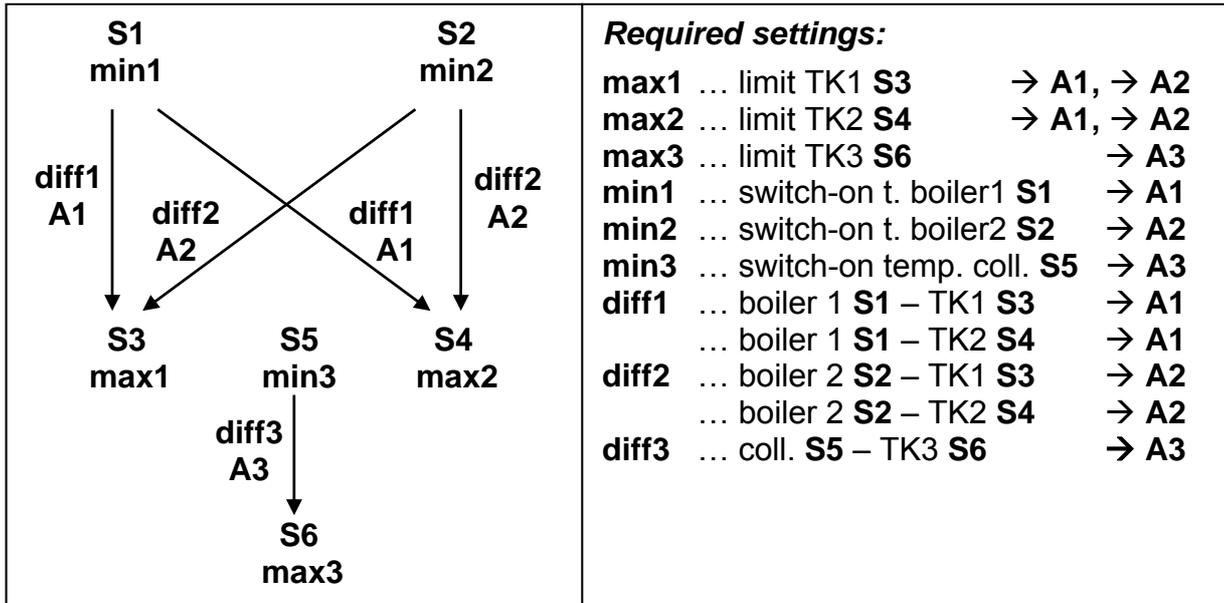
$$A2 = S1 > (S4 + diff2) \ \& \ S1 > min1 \ \& \ S4 < max2$$

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

or

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

Program 593:



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

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

or

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

The pump **A2** runs if:

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

or

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

Load pump **A3** runs if:

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

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

or **S1 > (S4 + diff1) & S1 > min1 & S4 < max2**

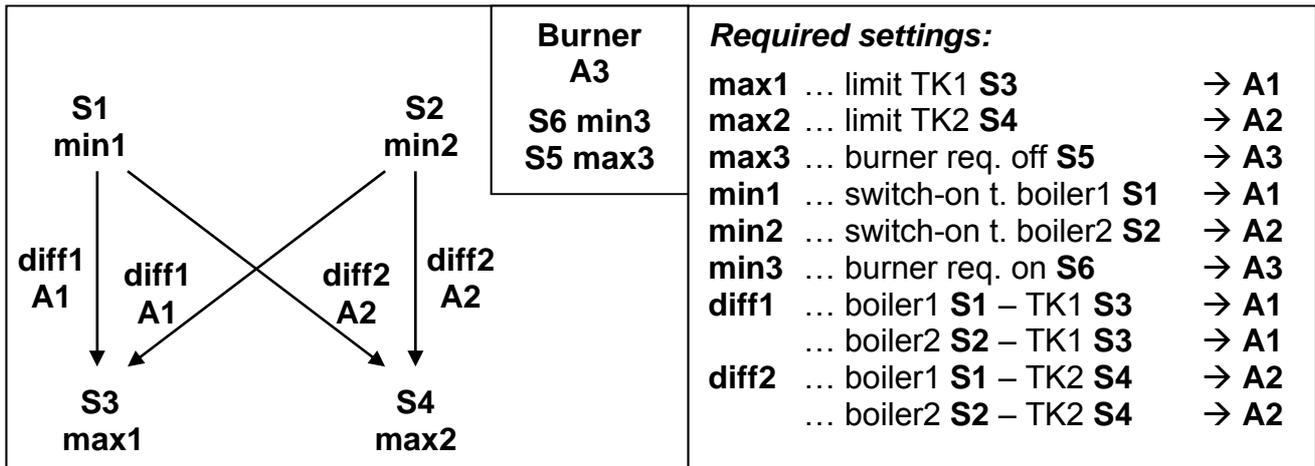
A2 = S2 > (S3 + diff2) & S2 > min2 & S3 < max1

or **S2 > (S4 + diff2) & S2 > min2 & S4 < max2**

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

Program 608 - 2 generators on 2 consumers + burner requirement

No diagram available!



Program 608: Pump A1 runs when:

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

Pump A2 runs when:

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

Output A3 switches on when S6 falls below threshold *min3*.

Output A3 switches off (dominant) when S5 exceeds *max3*.

$$\begin{aligned}
 & \text{or} \quad A1 = S1 > (S3 + \text{diff1}) \ \& \ S1 > \text{min1} \ \& \ S3 < \text{max1} \\
 & \quad \quad S2 > (S3 + \text{diff1}) \ \& \ S2 > \text{min2} \ \& \ S3 < \text{max1} \\
 & \text{or} \quad A2 = S1 > (S4 + \text{diff2}) \ \& \ S1 > \text{min1} \ \& \ S4 < \text{max2} \\
 & \quad \quad S2 > (S4 + \text{diff2}) \ \& \ S2 > \text{min2} \ \& \ S4 < \text{max2} \\
 & \quad \quad A3 \text{ (on)} = S6 < \text{min3} \quad \quad A3 \text{ (off)} = S5 > \text{max3}
 \end{aligned}$$

Program 609: The burner requirement (A3) only occurs via sensor S6.

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

Program 610: As with program 608, but the burner requirement (A3) comes from S2 and S5

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

Program 611:

As with program 608, but the burner requirement (**A3**) comes from sensor **S2**.

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

Program 612:

As with program 608, but the burner requirement (**A3**) comes from **S4** and **S5**.

$$A3 \text{ (on)} = S4 < min3 \qquad A3 \text{ (off)} = S5 > max3 \text{ (dominant)}$$

Program 613:

As with program 608, but the burner requirement (**A3**) comes from sensor **S4**.

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

All programs +8:

	<p>Burner A3 S6 min3 S5 max3</p>	<p>Required settings:</p> <p>max1 ... limit TK1 S3 → A1, → A2 max2 ... limit TK2 S4 → A1, → A2 max3 ... burner req. off S5 → A3 min1 ... switch-on t. boiler1 S1 → A1 min2 ... switch-on t. boiler2 S2 → A2 min3 ... burner req. on S6 → A3 diff1 ... boiler1 S1 – TK1 S3 → A1 ... boiler1 S1 – TK2 S4 → A1 diff2 ... boiler2 S2 – TK1 S3 → A2 ... boiler2 S2 – TK2 S4 → A2</p>
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The pump **A1** runs if:

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

or

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

The pump **A2** runs if:

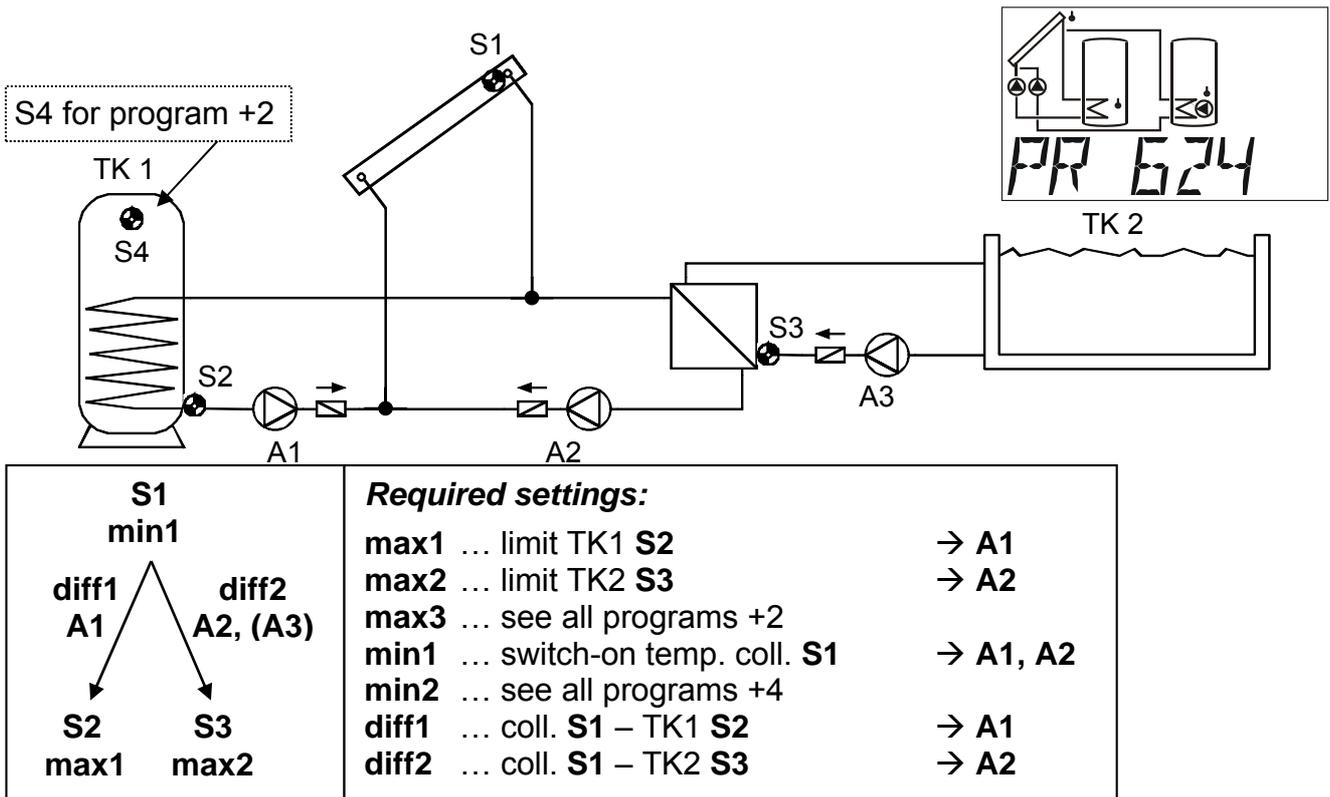
- ♦ **S2** is greater than threshold **min2** ♦ and **S2** is higher than **S3** by the difference **diff2**
- ♦ and **S3** has not exceeded threshold **max1**.

or

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

$$\begin{aligned}
 & \text{or} \qquad A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1 \\
 & \qquad \qquad S1 > (S4 + diff1) \ \& \ S1 > min1 \ \& \ S4 < max2 \\
 & \qquad \qquad A2 = S2 > (S3 + diff2) \ \& \ S2 > min2 \ \& \ S3 < max1 \\
 & \text{or} \qquad \qquad S2 > (S4 + diff2) \ \& \ S2 > min2 \ \& \ S4 < max2
 \end{aligned}$$

Program 624 - Solar power system with one consumer and swimming pool



Program 624: Solar pump **A1** runs when:

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

Solar pump **A2** runs when:

- ♦ **S1** is greater than 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 when:

- ♦ **A3** is enabled via an **OR** time window (setting: OPO3)
- or ♦ pump **A2** is running on automatic mode.

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

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

$$A3 = (A3 = time\ window\ on) \underline{or} (A2 = automatic\ mode)$$

All programs +1: Instead of both pumps **A1** and **A2** one pump **A1** and a three-way valve **A2** are deployed. **Speed control: Observe the comments on page 9!**

Without a priority allocation, tank 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling tank TK2)

All programs +2: In addition, if **S4** exceeds the threshold **max3**, pump **A1** is switched off.

All programs +4: Both solar loops have separate switch-on thresholds at **S1**.

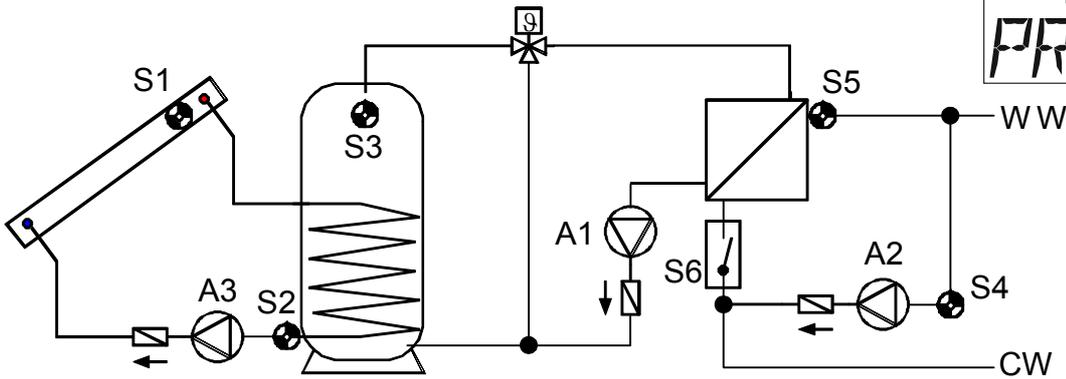
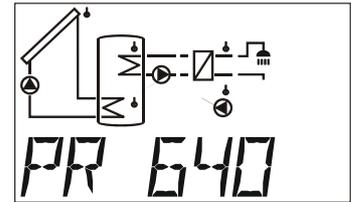
Output **A1** retains **min1**, and **A2** switches at **min2**.

The **priorities** for **TK1** and **TK2** can be set in the parameter menu under **PA**. In addition, a solar priority function can be set for this diagram in the menu **PRIOR** (see solar priorities for more details).

Program 640 - Preparation of hot water including circulation and solar power system

Only makes sense if the speed control is activated!

(Absolute value control system: AC I5, Differential control DC N35)



WARNING: Collector excess temperature limitation on output **A1** is activated ex works. This must be changed to **A3** or deactivated.

<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>Required settings:</p> <p>max1 ... limit TK S2 → A3</p> <p>max2 ... limit circ. return S4 → A2</p> <p>min1 ... switch-on temp. coll. S1 → A3</p> <p>min2 ... switch-on temp TK S3 → A2</p> <p>diff1 ... coll. S1 – TK S2 → A3</p> <p>diff2 ... TK S3 – circ. return S4 → A2</p>
<p>A1 = FS (S6) = ON</p>		

Program 640: Pump **A1** runs when:

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

The circulation pump **A2** runs when:

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

Solar pump **A3** runs when:

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

$$\begin{aligned}
 A1 &= \text{flow switch } S6 = ON \\
 A2 &= S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2 \\
 A3 &= S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1
 \end{aligned}$$

All programs +1: Circulation pump **A2** is only switched on when in addition to the basic function the volume flow switch (**FS**) **S5** is on (**A1** = ON).

All programs +4: Pump **A1** runs when:

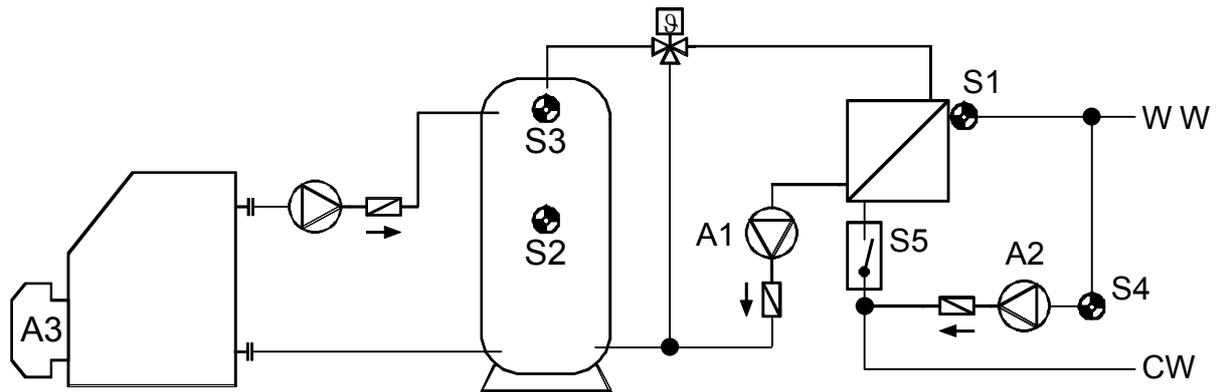
- ♦ the flow switch (**FS**) **S6** detects flow or pump **A2** is switched on.

$$A1 = A2 \text{ or flow switch } (S6) = ON$$

Program 656 - Preparation of hot water including circulation and burner requirement

Only makes sense if the speed control is activated!

(Absolute value control system: AC I1, Differential control DC N31)



<p>S3 min1</p> <p>diff1 A2</p> <p>↓</p> <p>S4 max1</p> <p>A1 = FS (S5) = ON</p>	<p>Burner A3</p> <p>S3 min3 S2 max3</p>	<p>Required settings:</p> <p>max1 ... limit circulation return S2 → A2</p> <p>max3 ... burner req. off TK S2 → A3</p> <p>min1 ... switch-on temp. TK S3 → A3</p> <p>min3 ... burner req. on TK S3 → A3</p> <p>diff1 ... TK S3 – circulation return S4 → A2</p>
--	---	---

Program 656: Pump **A1** runs when:

- ◆ the flow switch (**FS**) **S5** detects flow. The nominal value DVA for the PSC speed control (absolute value control) of pump **A1** is specified for sensor **S1**.

The circulation pump **A2** runs when:

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

Output **A3** switches on when **S3** falls below threshold **min3**.

Output **A3** switches off (dominant) when **S2** exceeds **max3**.

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

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

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

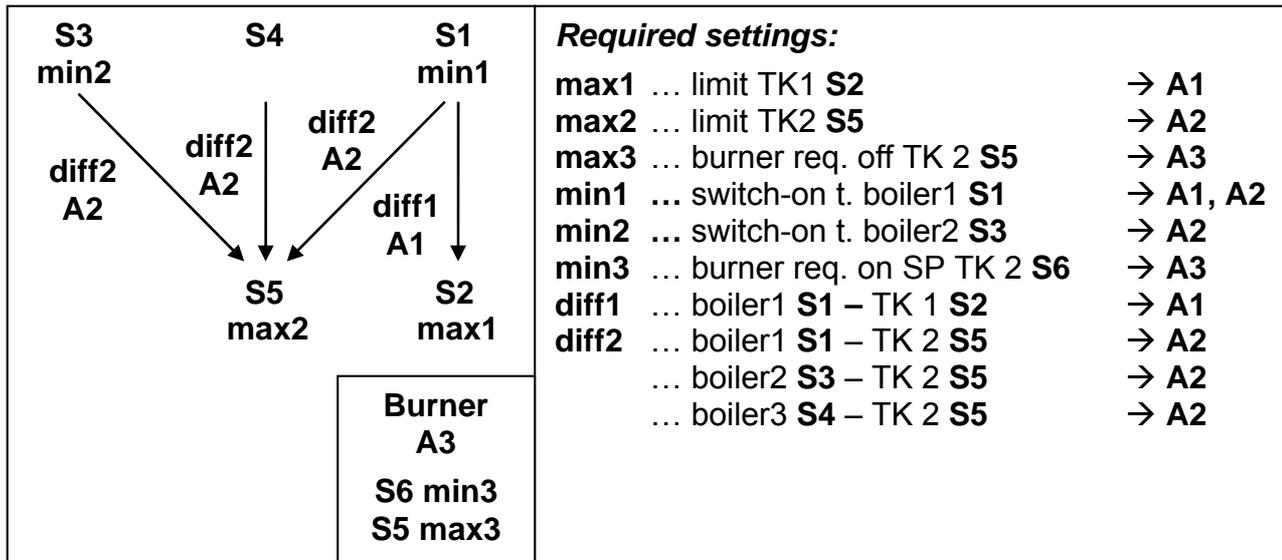
All programs +1: Circulation pump **A2** is only switched on when in addition to the basic function the volume flow switch (**FS**) **S5** is on (**A1** = ON).

All programs +2: The burner requirement (**A3**) only occurs via sensor **S3**.

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

Program 672 - 3 generators to 1 consumer + difference circuit + burner requirement

No diagram available



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

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

The pump **A2** runs if:

- ♦ **S1** is greater than threshold **min1** ♦ and **S1** is higher than **S5** by the difference **diff2**.
- ♦ and **S5** has not exceeded threshold **max2**.

or

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

or

- ♦ **S4** is higher than **S5** by the difference **diff2**
- ♦ and **S5** has not exceeded threshold **max2**.

The output **A3** switches on if **S6** falls below the threshold **min3**.

The output **A3** switches off (dominant) if **S5** exceeds the threshold **max3**.

$$\begin{aligned}
 &A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1 \\
 &A2 = S1 > (S5 + diff2) \ \& \ S1 > min1 \ \& \ S5 < max2 \\
 \text{or} &S3 > (S5 + diff2) \ \& \ S3 > min2 \ \& \ S5 < max2 \\
 \text{or} &S4 > (S5 + diff2) \ \& \ S5 < max2 \\
 &A3 \ (on) = S6 < min3 \qquad \qquad A3 \ (off) = S5 > max3
 \end{aligned}$$

All programs +1: The burner requirement (**A3**) is only made via sensor **S6**.

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

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

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

Installation instructions

Installing the sensors

The sensors must be arranged and installed properly for the system to function correctly. To this end, make sure that they are completely inserted in the immersion sleeves. The threaded cable connections provided can be used to provide strain relief. The clip-on sensors must be insulated to protect them from being influenced by the ambient temperature. Water must be kept out of the immersion sleeves when used outdoors (**damage from freezing**).

In general, the sensors may not be exposed to moisture (such as condensation water), which might enter the cast resin and damage the sensor. If this happens, heating the sensor to 90°C for an hour might help. When using immersion sleeves in NIRO tanks (inoxidable) or pools, pay attention to their **non-corrosion properties**.

● **Collector sensor (red or gray cable with connection box):** Insert either in the tube directly soldered or riveted to the absorber and sticking out of the collector's frame or in a T-shaped connector on the outer collector's supply line collector tube. Screw an immersion sleeve with an MS (brass) threaded cable connection (= to protect from moisture) into this T-shaped connector and insert the sensor. To protect from lightening, the connection box has parallel overvoltage protection between the sensor and the extension cable.

● **Boiler sensor (boiler supply line):** This sensor is either screwed into the boiler with an immersion sleeve or attached to the boiler's supply line at a slight distance.

● **Tank sensor:** The sensor that the solar power system needs should be used with an immersion sleeve for fin coil heat exchangers just above the exchanger or, if integrated bare-tube heat exchangers are used, on the lower third of the exchanger or the exchanger's return line so that the immersion sleeve is inside the exchanger's tube. The sensor that monitors the heating of the tank from the boiler is installed at the level of the desired amount of hot water during the heating season. The plastic threaded cable connections provided can be used to provide strain relief. They must not be installed below the register / exchanger.

● **Buffer sensor:** The sensor that the solar power system needs is installed on the bottom of the tank just below the solar heat exchanger using the immersion sleeve provided. The plastic threaded cable connections provided can be used to provide strain relief. It is recommended that the sensor be used between the middle and the upper third of the buffer tank using the immersion sleeve as a reference sensor for the heater's hydraulics or - flush with the tank's wall - under the insulation.

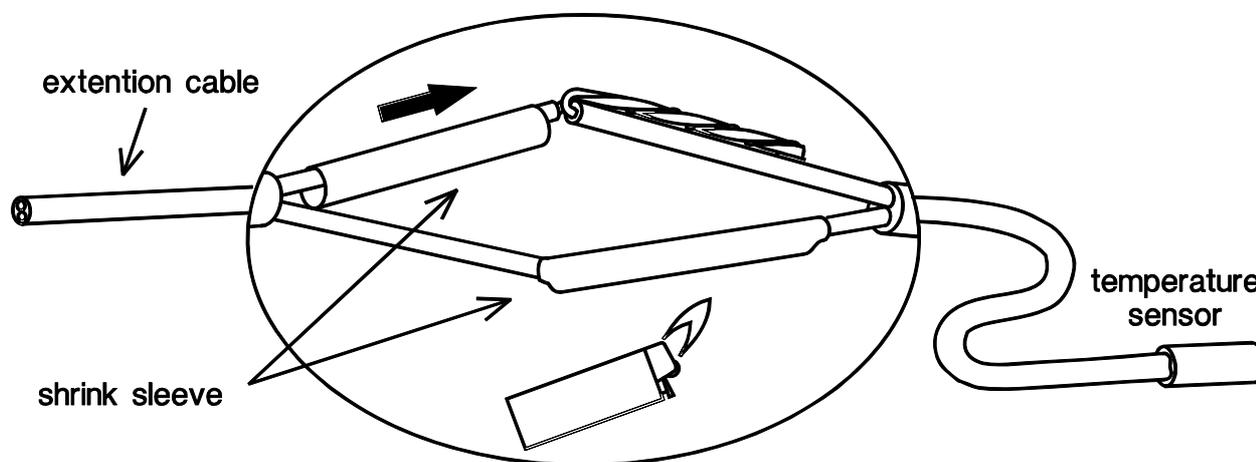
● **Pool sensor (swimming pool):** Put a T-shaped connector on the suction line immediately on the line leading from the pool and screw the sensor in with an immersion sleeve. In the process, make sure that the material used is non-corroding. Another option is to put the sensor on the same spot using hose clamps or adhesive tape and to provide thermal insulation for ambient influences.

● **Clip-on sensor:** Optimally secured using roll springs, pipe clamps or hose band clips to the corresponding line. Make sure that suitable material is used (corrosion and temperature resistance, etc.). Then, the sensor has to be well insulated so that the tube temperature can be taken exactly and influences from the ambient temperature can be ruled out.

- **Hot water sensor:** When the control system is used in hot water systems with an external heat exchanger and variable-speed pump, changes in the amount of temperature have to be **reacted to quickly**. Hence, the hot water sensor has to be put directly on the heat exchanger's outlet. A t-shaped connector should be used to insert the ultrafast sensor (special accessory) in the outlet using an O-ring along the NIRO tube (inoxidable). The heat exchanger has to be installed upright with the hot water outlet on top.
- **Radiant heat sensor:** To get a measurement according to the collector's position, it should be parallel to the collector. It should thus be screwed onto the metal sheet or next to the collector along an extension of the assembly rail. To this end, the sensor case has a blind hole that can be opened at any time.
- **Space sensor:** This sensor is intended for installation in floor space (as a reference space). The space sensor should not be near a source of heat or near a window.
- **Outdoor temperature sensor:** This sensor is installed on the coldest wall side (usually the north) some two meters above ground. Avoid temperature influences from nearby air shafts, open windows, etc.

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. The sensor and the probe can be connected by putting the heat-shrinkable sleeve truncated to 4 cm over a wire and twisting the bare ends. If one of the wire ends is tinned then the connection must be made through soldering. Then the heat-shrinkable sleeve is put over the bare, twisted ends and carefully heated (such as with a lighter) until it has wrapped the connection tightly.



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.

Installing the unit

CAUTION! Always pull the mains plug before opening the case!

Only work on the control system when it is dead.

Unscrew the screw on the top of the case and take off the lid. The control electronics is in the lid. Contact pins are used to restore the connection to the clamps in the lower part of the case when it is put back on. The basin of the case can be screwed on through the two holes to the wall using the fastening screws provided (**with the cable bushings downwards**).

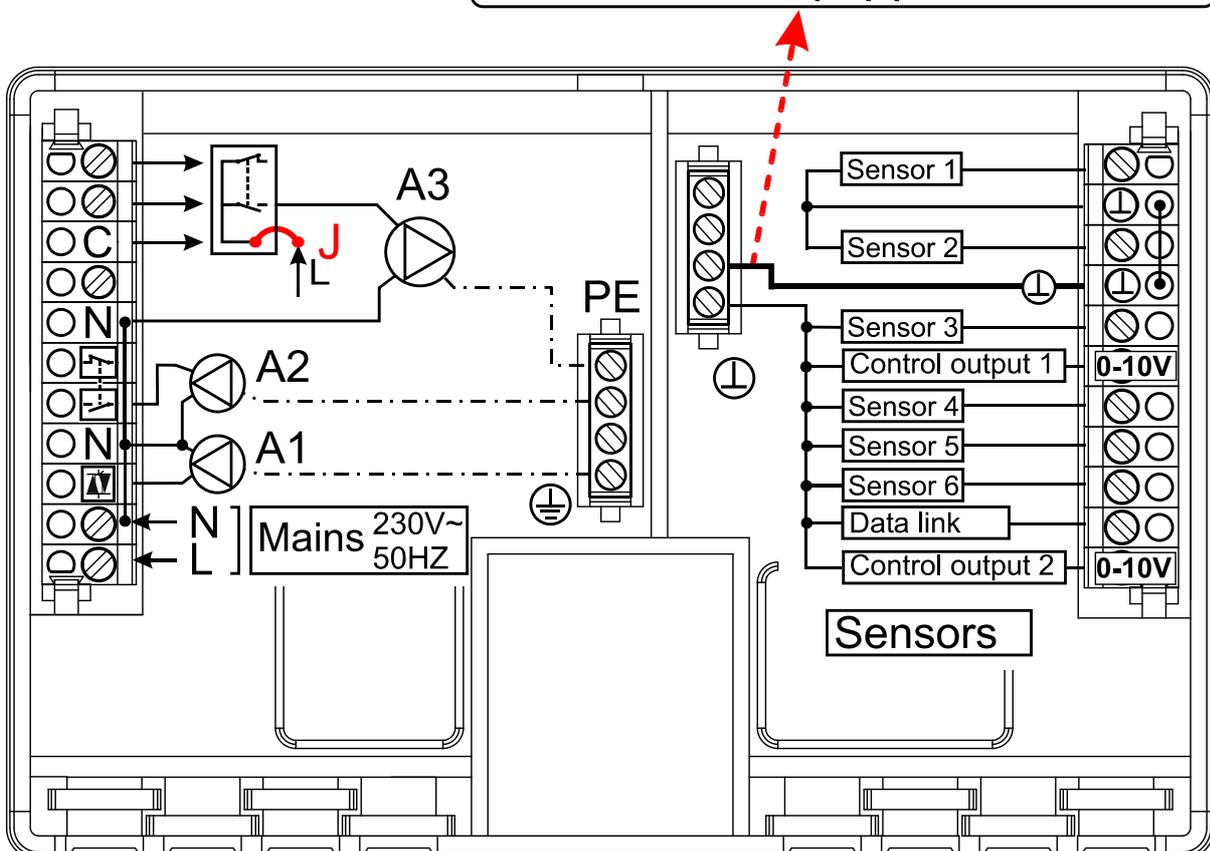
Electrical connection

Warning: The electrical connection should only be made by a professional electrician in accordance with the relevant local guidelines. The sensor lines may not be fed through the same cable channel as the supply voltage. The maximum load of output A1 equals 1.5A while that of outputs A2 and A3 each 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 need be.

WARNING! This connecting link must still be equipped!



Special connections

Control output (0 – 10V / PWM)

These outputs are intended for the speed control of electronic pumps, for control of burner performance (0 - 10V or PWM) or for switching the auxiliary relay HIREL-STAG. They can be operated via respective menu functions parallel to the other outputs A1 to A3.

Sensor input S6

As transducer in the menu SENSOR, all of the six input can work as digital inputs. Unlike the other inputs, input S6 has the special ability of being able to detect quick signal changes, such as those from volume flow encoders (type VSG...).

The data link (DL-Bus)

The bi-directional data link (DL-Bus) was developed for the ESR/UVR 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) having a max. length of 30 m. For longer cables, we recommend the use of shielded cable. If screened cables are used, the screen must be connected to the sensor earth.

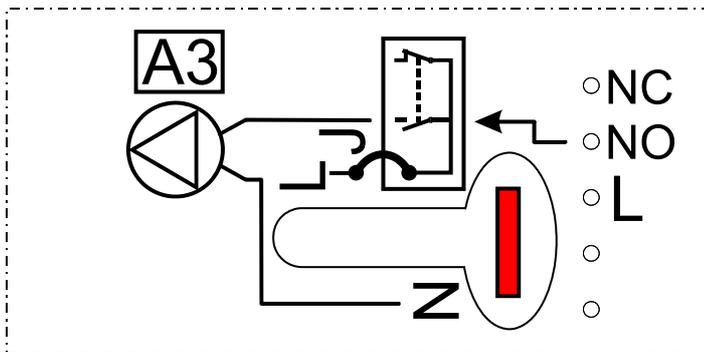
Interface to PC: The data is cached via the data converter **D-LOGG**, Bootloader **BL-NET** or **C.M.I.** interface and transferred to the PC on request. **BL-NET** and **C.M.I.** require a separate 12V power unit for power supply.

External sensors: Reading the values from external sensors with DL connector.

Switch output 3 to potential-free

By removing the jumper **J** the relay output A3 can be made potential-free.

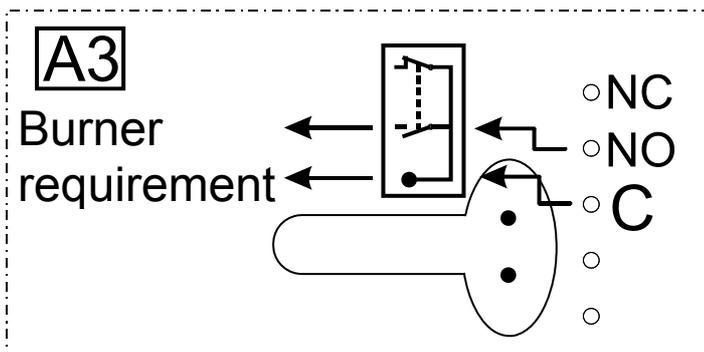
With the jumper **J** in place, output 3 is **not** potential-free.



Example: Connection of a pump

L ... Phase conductor (line)
 NO Closer (make contact)
 NC Opener (break contact)

If the jumper is removed, then output 3 is potential-free.

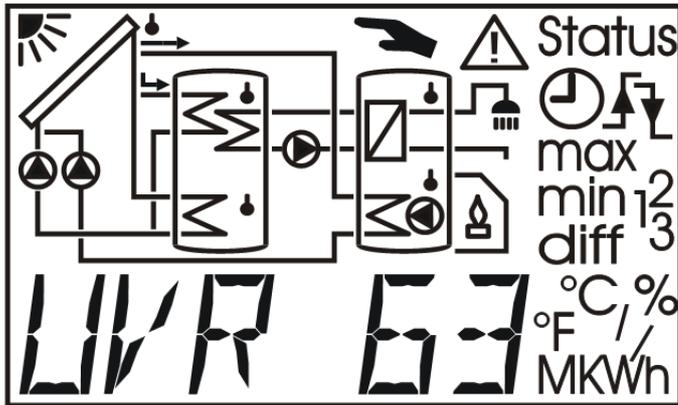


Example: burner requirement

C Root
 NO Closer (make contact)
 NC Opener (break contact)

Operation

The large majority contains all of the icons needed for all of the important information as well as a plain text field. Navigation with the co-ordination keys has been adapted to the display arrangement.



↔ = Navigation keys to select the display and change parameters.

↓ = Entry in a menu, release of a value to modify with the navigation keys (enter key).

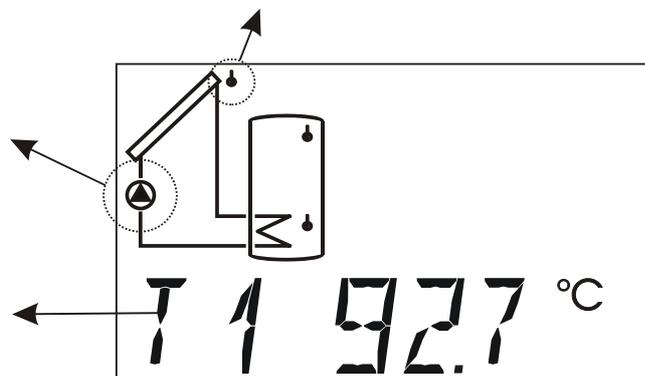
↑ = Return to the last menu level selected, exit the parameter level for a value (return key).

In the main level, the left/right arrows ↔ are the navigation keys to select the desired display, such as collector or storage tank temperature. A different sensor symbol flashes for each pressure and the corresponding temperature is displayed.

Sensor symbol flashes: the temperature for this sensor is displayed

Pump symbol flashes:
The output is active
(Pump is running)

Current temperature of
sensor 1

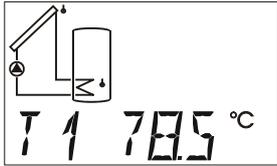


For programs, for which it is not possible to display a diagram in the display, the upper area remains empty. For some programs, the display was only approximately matched to the actual diagram, individual symbols may be missing.

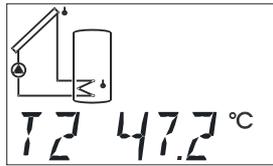
To the side of the display, the currently active outputs are identifiable on the green illuminated figures 1 - 3. If the speed control is active, the output 1 display flashes according to the speed stage.

3
2
1

The main level

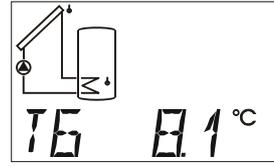


Temperature Sensor 1

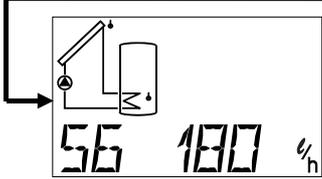


Temperature Sensor 2

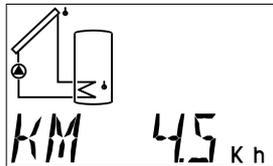
...



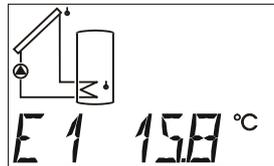
Temperature Sensor 6



Volume flow
Only displayed if S6 = VSG

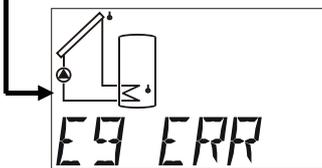


Wind velocity
Only displayed if S6 = WS

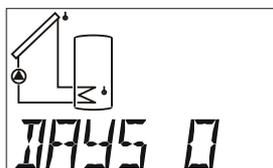


External value 1
Only displayed if external DL is activated

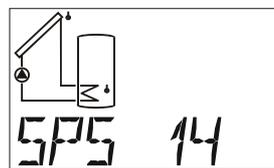
...



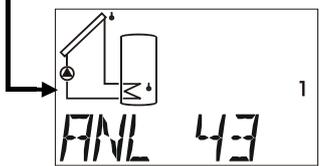
External value 9
Only displayed if external DL is activated



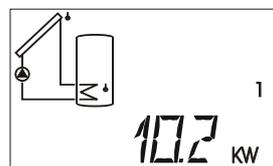
Legionella function
Only displayed if legionella function is activated



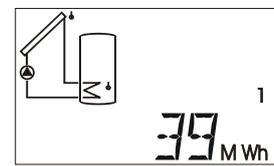
Speed stage
only displayed if speed control is activated



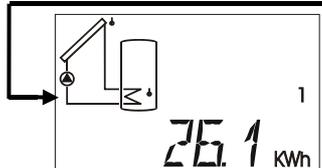
Analogue level
only displayed if analogue output is activated



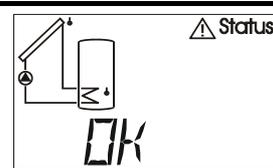
Current power
only displayed if heat counter is activated



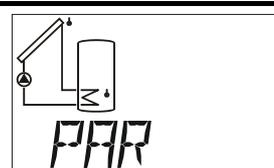
MWh only displayed if heat counter is activated



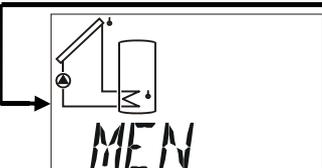
kWh only displayed if heat counter is activated



Status display
"OK" only displayed if active function control



Parameter menu **PAR**

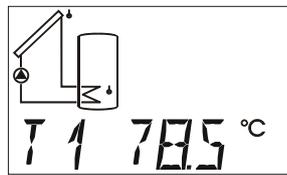


Menu **MEN**

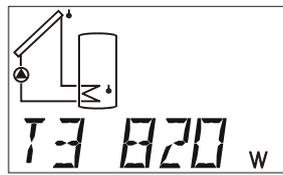
...

T1 to T6 Displays the value measured at the sensor (S1 - T1, S2 - T2, etc.). The display (unit) depends on the settings of the sensor type.

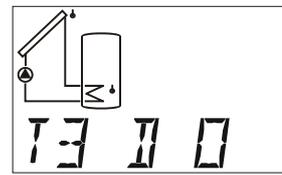
Display types:



Temperature in °C



Radiation in W/m²
(radiation sensor)



Digital status 1 =
ON (digital input)

If in the **SENSOR** menu (main menu **MEN**) one sensor is set to **OFF**, then the value display of this sensor is displayed in the main level.

S6 Volume flow, shows the flow rate of the volume flow encoder in litres per hour

KM Wind velocity in km/h, if S6 is a wind sensor WIS01.

E1 to E9 Displays the values from external sensors which are read via the data link. Only activated inputs are displayed.

ERR means that no valid value has been read. In this case the external value is set to 0.

DAYS Legionella function: number of days, in which the required minimum temperature was not attained in the tank. This menu item is only displayed, if the legionella function is active.

SPS Speed stage, indicates the current speed stage. This menu item is only displayed if the speed control is activated.

Display range: 0 = output is off
 30 = speed control is running at the highest stage

ANL Analogue level, indicates the current analogue level of the 0-10V output. This menu item is only displayed if a control output has been activated.

Display range: 0 = output voltage = 0V or 0% (PWM)
 100 = output voltage = 10V or 100% (PWM)

kW The current output of the heat counter indicated in kW.

MWh Megawatt hours, indicates the megawatt hours of the heat counter.

kWh Kilowatt-hours, indicates the kilowatt-hours of the heat counter. When 1000 kWh has been reached the counter restarts at 0 and the MWh are increased by 1.

Menu items **kW**, **MWh**, **kWh** are only displayed if the heat quantity counter has been activated.

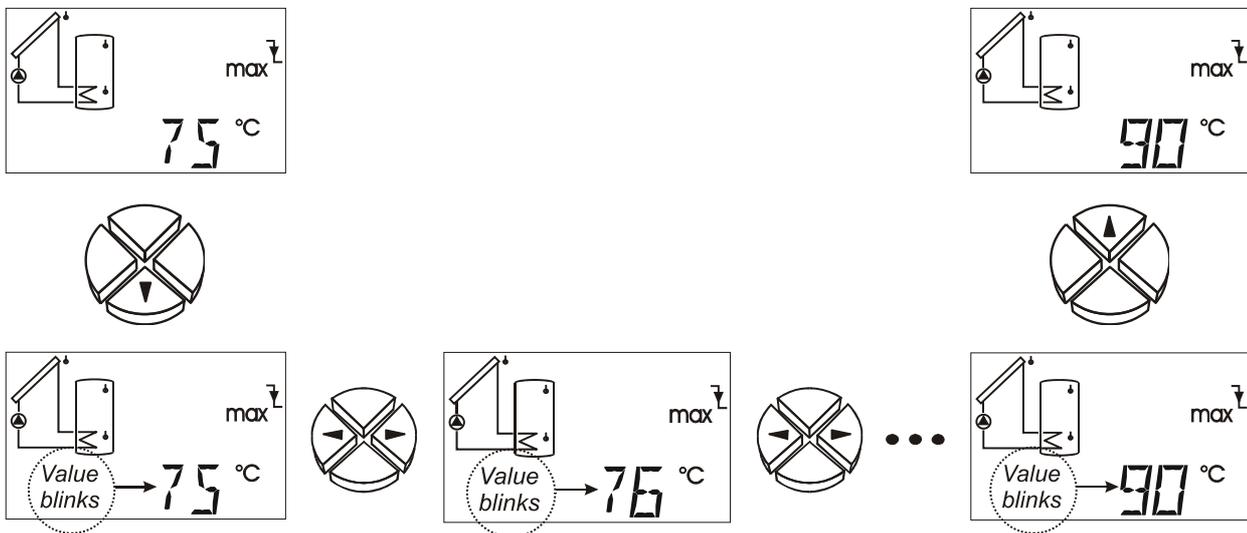
△Status: Display of the system's status. Depending on the program selected, various system statuses are monitored. If any problems have occurred, this menu contains all of the information.

PAR: In the parameterisation level the navigation keys (←, →) are used to select the program, the adjustment values and the manual/automatic switchover. The parameter selected can now be released for selection with the down key ↓ (enter). The parameter blinks to indicate release. Press one of the navigation keys (←, →) to change the value by one increment. Keep the key pressed to keep the value running. The changed value is adopted when the UP key ↑ (return) is pressed. To prevent unintended changes in parameters, entry in **PAR** is only possible using the **code 32**.

MEN: The menu contains basic settings to determine additional functions such as the sensor type, language, the system protection functions, etc. Use the keys for navigation and to make changes as usual. As the settings in the menu change the basic features of the control unit, entry is only possible with a code that only the technician knows.

The settings of the parameters and menu functions ex works can be restored at any time using the down key (entry) when plugging the unit in. If this occurs, **WELOAD** will appear in the display for three seconds. In doing so the program number with the specific parameters of the factory setting remains saved.

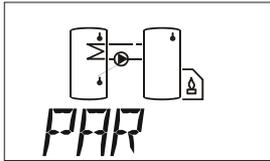
Changing a value (parameter)



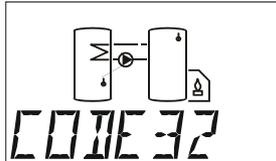
If a value is to be changed, press the arrow key. This value will then blink and can be set to the desired value with the navigation keys.

Use the arrow key up to save the value.

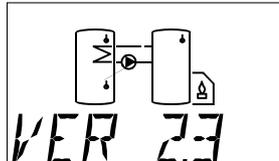
The parameter menu *PAR*



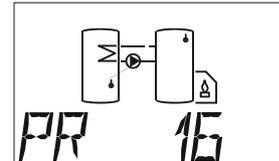
In the following example the *PAR* menu has been selected for program 16 so that all setting parameters (max, min, diff) can be displayed.



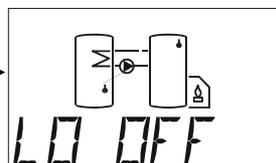
Code to enter menu



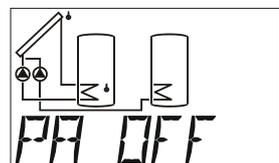
Version number



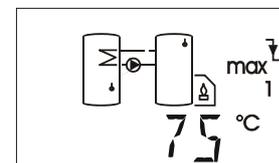
Program number



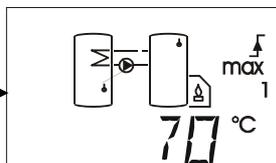
Linking of output



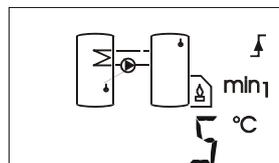
Priority assignment
(only for programs with priority)



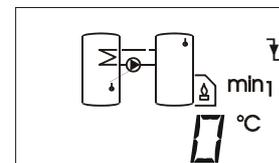
Max limit switch-off threshold (3 times)



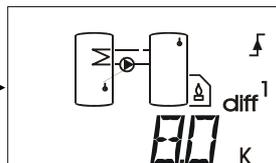
Max limit switch-on only displayed (3 times)



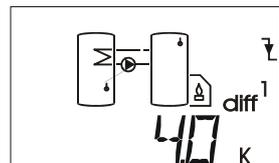
Min limit switch-on threshold (3 times)



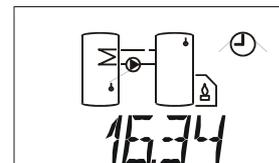
Min limit switch-off only displayed (3 times)



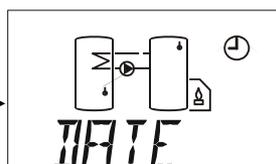
Difference switch-on thresh (3 times)



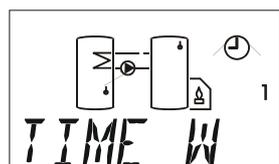
Difference switch-off thresh (3 times)



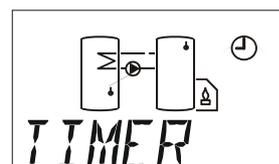
Time



Date, automatic summer / winter time adjustment

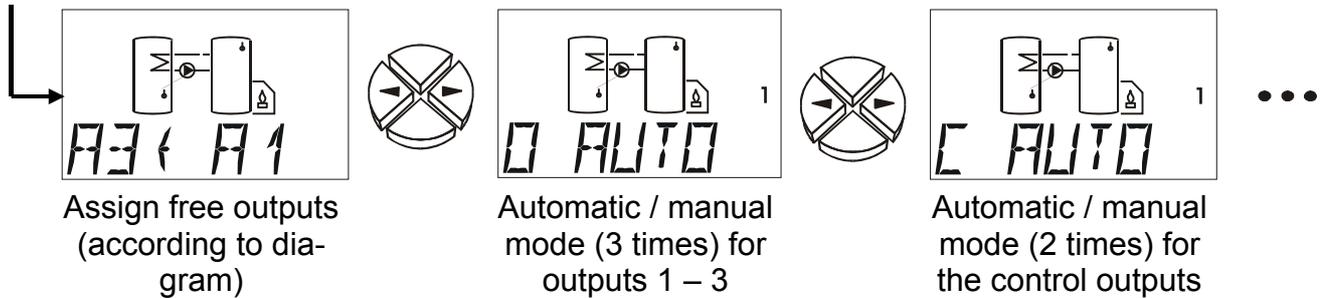


Time window (3 times)



Timer function





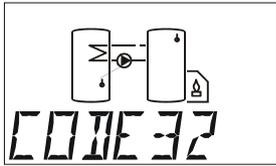
Brief description:

- CODE** Code to enter the menu. The other menu items are only displayed once the correct code has been entered
- VER** Version number
- PR** Selection of the **program** number
- LO** Linking of **outputs** (A1 with A2, A1 with A3 or A2 with A3). The speed control (only output 1) can be assigned within the program diagram in any way desired by this means.
- PA** Priority assignment (this menu item is only displayed for program diagrams with priority)
- max↓** Maximum limit - switch-off threshold (3 times)
- max↑** Maximum limit - switch-on threshold (3 times)
- min↑** Minimum limit - switch-on threshold (3 times)
- min↓** Minimum limit - switch-off threshold (3 times)
- diff↑** Difference - switch-on threshold (3 times)
- diff↓** Difference - switch-off threshold (3 times)

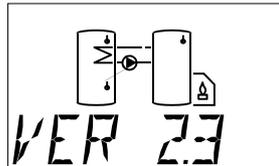
The number of minimum thresholds, maximum thresholds, and differences is displayed according to the program selected.

E.g. **16.34** Time

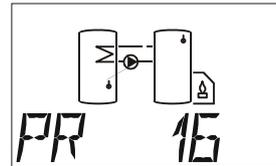
- DATE** Sets the date (timestamps for data lines) and automatic / manual settings between summer and normal time.
- TIME W** Time window (available 3 times)
- TIMER** Timer function
- A3↔ A1** Assignment of unused outputs
- O AUTO** Output in **automatic** or manual mode (**ON/OFF**). This menu is available for every output.
- C AUTO** Control output in automatic or manual mode. In manual mode the controller is switched from 10V to 0V (**ON/OFF**). This menu is available for every control output.



Code to enter menu



Version number



Program number



Code number **CODE**

The other menu items of the parameter menu are only displayed after input of the correct code number (code number 32).

Software version **VER**

Display of the software version. It cannot be changed as it indicates the intelligence of the device and must be provided if there are any queries.

Program number **PR**

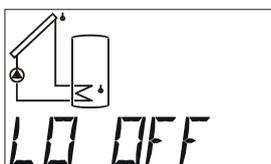
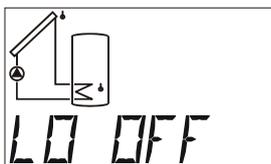
Program selection according to the selected hydraulic diagram (WE = 0)

Further functions can be added to the described programs. The described functions apply together. "All programs +1 (+2, +4, +8)" indicates that the selected program number can be increased by the sum total of these numbers.

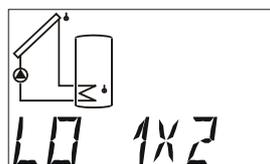
Example: Program 48 +1 + 2 = Program number 51 = solar thermal system with 2 consumers, with pump-valve system and additional sensor S4 for the upper limit.

Linking of outputs **LO**

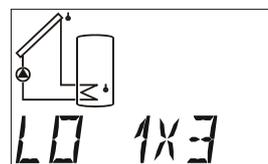
Possibility to cancel out the numbered outputs listed in the program diagram against each other (A1 with A2, A1 with A3 or A2 with A3). By this means it is possible to assign the speed output at will. (ex works = OFF)



Link OFF



Link A1 and A2



Link A1 and A3

...

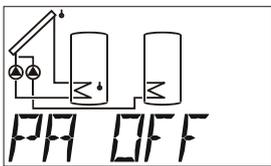
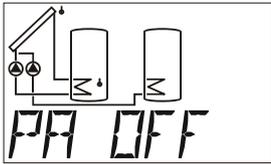
IMPORTANT: All outputs set in menu functions relate directly to the terminal outputs and not to the program diagram. This means that if an output is transposed, it must be taken into account for parameterization of the functions and priority allocations.

Priority assignment PA

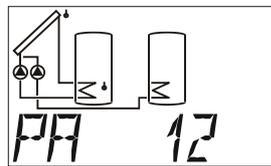
Priorities can be set for program diagrams with multiple consumers on one heat generator.

This menu item is only displayed for program diagrams with priority. The priority assignment (output assignment) is adapted to the specific program diagram. The priority assignment always refers to the pumps. **For pump/valve systems, the priority is always set according to the basic diagram.** (ex works = OFF)

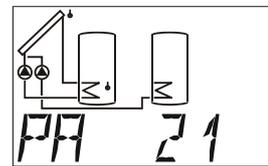
Settings: OFF, 123 to 321, or only 2 outputs (such as 12, 21,...)



Priority OFF



Priority
A1 before A2



Priority
A2 before A1

...

Set values (max, min, diff)

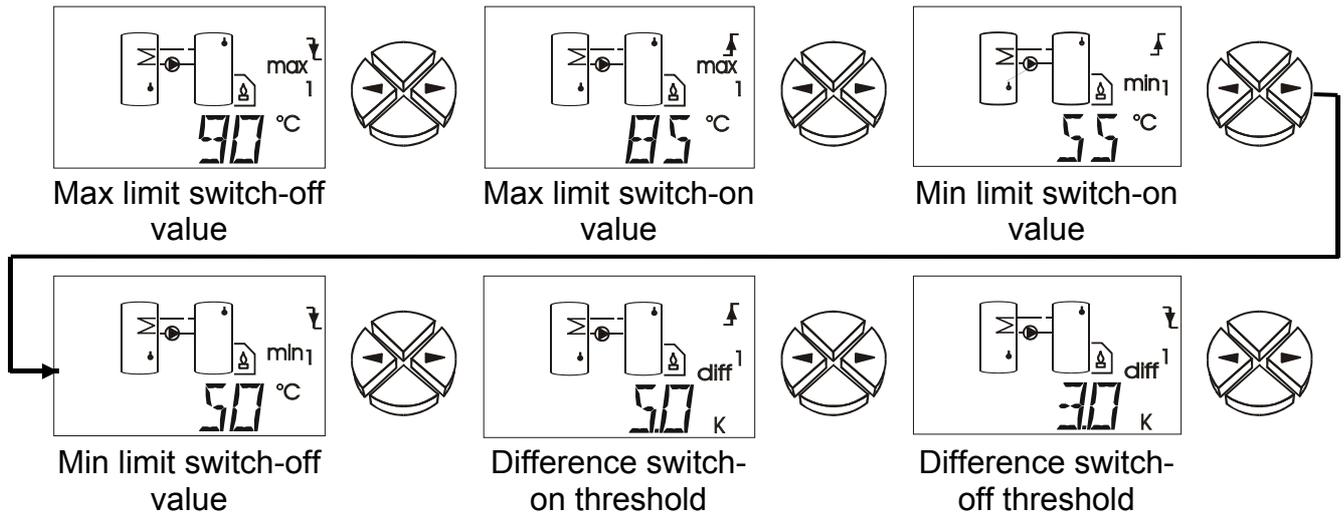
The number of maximum thresholds, minimum thresholds, and differences is displayed according to the set program number. The differentiation between similar thresholds (e.g. max1, max2, max3) is displayed on the side by the index 1, 2 or 3). Each threshold comprises two values. I.e. all switching thresholds are divided into on and off thresholds!

CAUTION: When setting the parameter, the computer always limits the threshold value (such as **max on**↑) when it approaches a certain temperature of the second threshold (such as **max off**↓) to prevent negative hysteresis. If a threshold cannot be changed any longer, the second threshold has to be changed first.

All thresholds (**min**, **diff**, **max**) can be disabled individually. The respective threshold is shut-down when the highest possible setting value is exceeded. For **min** and **max**, that is 149°C and for **diff** 98K. In this case, the display just has a line (-) where the number would be, and the partial function is considered not available.

The factory setting for the adjustment values (max, min, diff) is appropriately matched to the diagrams, but must however be checked prior to commissioning and matched to the individual requirements. The specific adjustment values are only loaded, if after setting the program number, the factory setting is reloaded (press the bottom key (entry) while plugging in). Only then should the controller be parameterised.

Example: Program number 16



max ↓ When a sensor reaches this temperature, the output is blocked.

max ↑ The output previously blocked when **max ↓** is reached is released when this temperature is fallen short of. **max** generally limits storage. Recommendation: the switch-off point for storage should be 3-5K higher (1-2K higher for pools) than the switch-on point. The software does not allow for differences less than 1K. Setting range: -30 to 149°C in increments of 1°C (for both thresholds, but **max ↓** has to be at least 1K greater than **max ↑**)

min ↑ Above this temperature, the output is released.

min ↓ The output previously released via **min ↑** is blocked at this temperature. **min** generally prevents boilers from being clogged with soot. Recommendation: the switch-on point should be 3-5K higher than the switch-off point. The software does not allow for a difference less than 1K.

Setting range: -30 to 149°C in increments of 1°C (for both thresholds, but **min ↑** has to be at least 1K greater than **min ↓**)

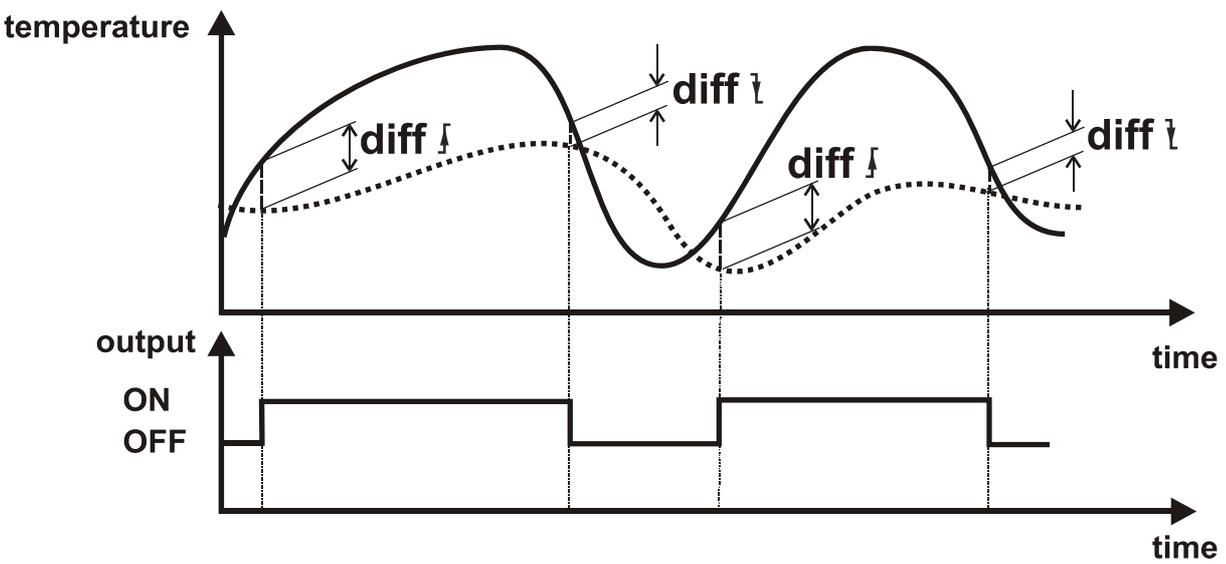
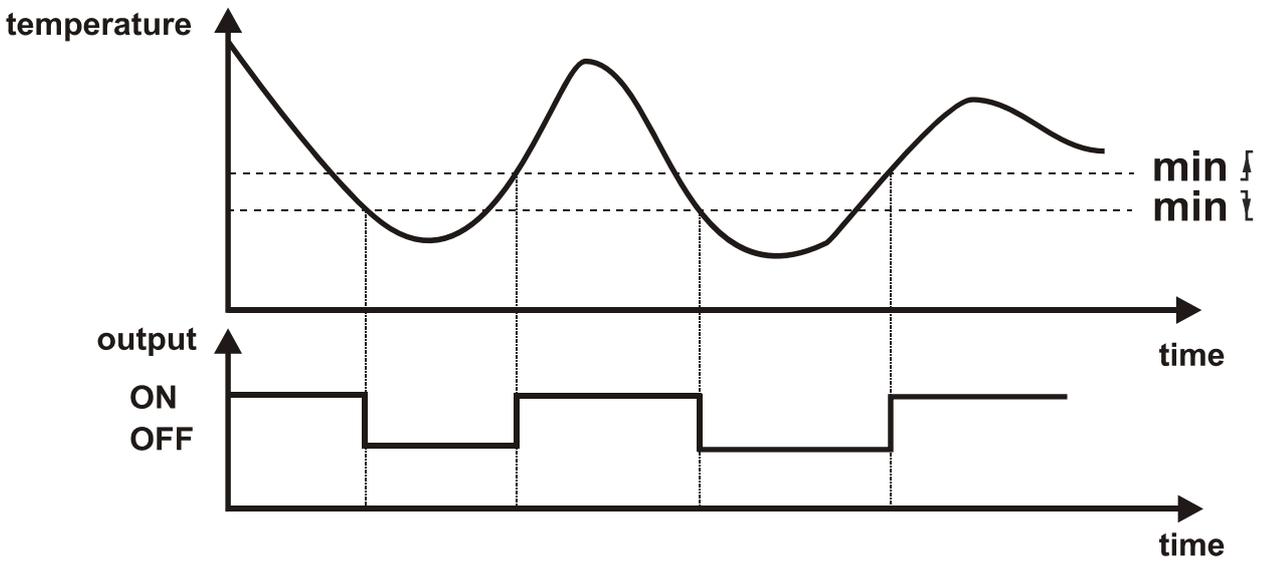
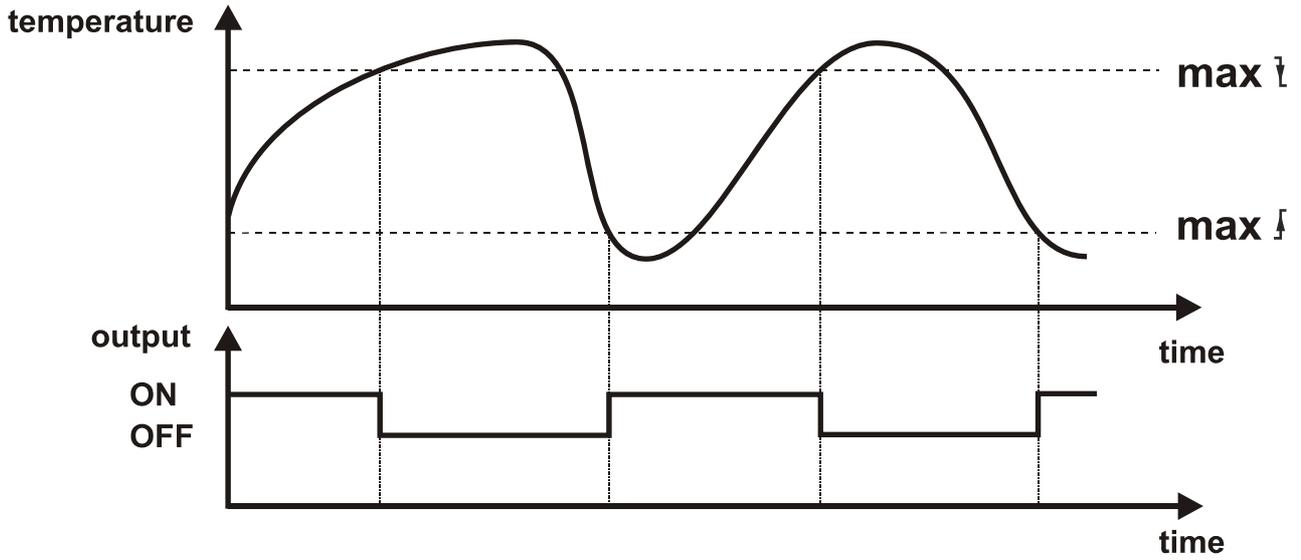
diff ↑ When the temperature difference between the two set sensors exceeds this value, this output is released. **diff** is the basic function (differential control) of this unit for most programs. Recommendation: In solar applications, **diff ↑** should be set to 7 - 10K. Somewhat lower values suffice for the feed pump program.

diff ↓ The output released previously when **diff ↑** was reached is blocked again when this temperature difference is reached. Recommendation: **diff ↓** should be set at around 3 - 5K. Although the software allows for a minimum difference of 0.1K between the switch-on / off difference, no value below 2K should be entered due to transducer and measurement tolerances.

Setting range: 0.0 to 9.9K in increments of 0.1K

10 to 98K in increments of 1K (for both thresholds, but **diff ↑** has to be at least 0.1K / 1K greater than **diff ↓**)

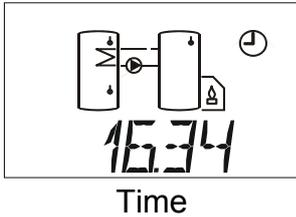
Schematic representation of setting values



Time

Example: **16.34** = Display of time.

The time is set by pressing enter ↵ and the navigation keys ⇐⇒. Press the key again to switch between minutes and hours.

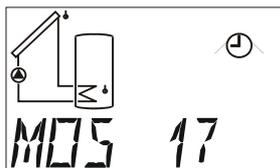
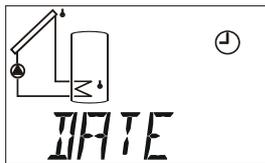


NOTICE: The correct setting of date and time can be useful even if the time windows are not used. If a data recording is performed using the data logger (*D-LOGG*_{USB} or *BL-NET*), an allocation of time-related data is only possible with the correct date and time.

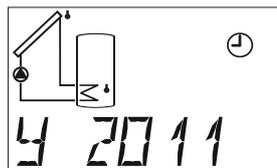
Power reserve in the event of a power failure: at least 1 day, typically 3 days

DATE

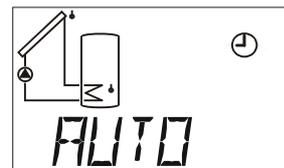
In this menu, you can set and read the day, months, and year. You can also switch between summer and winter time manually or automatically.



Month and day



Year



Summer / winter
time adjustment



M05 17 **Month** (Example: 17th May): If the month is reset backwards and the set day is greater than 30 the day is reset to 1 to avoid the occurrence of an invalid date.
Day: The days are set according to the months and year (leap year).

Y 2011 **Year**

AUTO **Automatic** switch between summer / normal time (ex works = AUTO)
Setting possibilities: **AUTO** switch is automatic depending on Date and time
NORMally there is no deference to summer time

NOTICE: The date and time have to be set correctly for the automatic switch from normal and summer time to work properly.

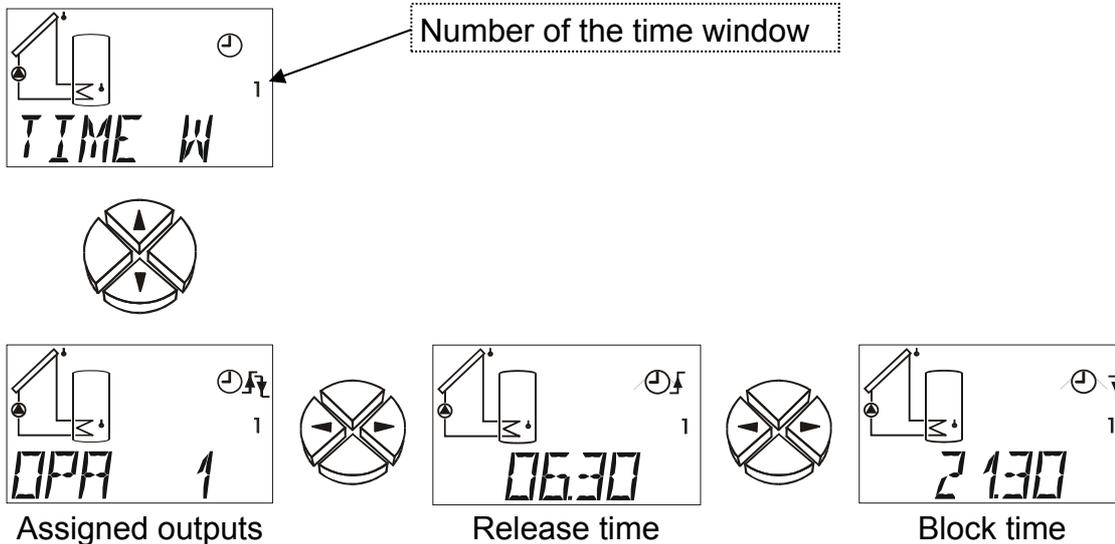
Time window *TIME W* (3 times)

Setting of 3 time windows

A total of 3 time windows are available.

For each time window, the outputs that affect the window can be freely set.

Each output can have up to 3 time windows assigned to it. If an output is released in a time window (between the switch-on / off times), the remaining time windows do not affect this output any longer.



In the example, output 1 has been assigned to time window 1 (index). This output can be switched between 06:30 AM and 09:30 PM.

The following outputs are assigned to the time window. (ex works = --)

OPA A (AND) In the time window the respective program determines the status of the selected outputs. Outside the time window they are switched off.

OPO O (OR) The selected outputs are switched on in the time window. Outside the time window the respective program determines the output status.

Setting range: Combination of all outputs (e.g. OP 1, OP 23, OP 123)

OPA 1 to OPA 123 and OPO 1 to OPO 123

OP -- = no output (time window disabled)

↑ The time at which the set outputs are allowed (ex works = 00:00 AM)

Setting range: 12:00 AM to 11:50 PM in increments of 10 min

↓ The time at which the set outputs are blocked (ex works = 00:00 AM)

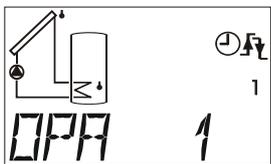
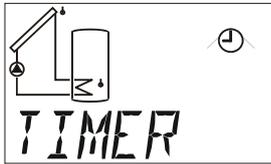
Setting range: 12:00 AM to 11:50 PM in increments of 10 min

Timer function *TIMER*

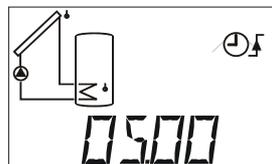
Setting the **Timer** function

The timer function can be assigned to any output.

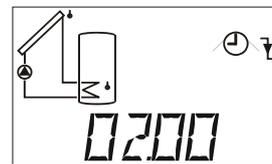
It is possible to specify a release time (during this time the output is released) and a block time (during this time the output is blocked). **Release time and block time are active alternately.**



Assigned
outputs



Release time



Block time

In the example the timer function is assigned to output 1. The output is released for 5 hours and blocked for 2.

To the timer function are assigned the following **outputs**. (ex works = --)

OPA **A (AND)** During the release time the respective program determines the status of the selected outputs. During the block time they remain deactivated.

OPO **O (OR)** The selected outputs are released during the release time. During the block time the respective program determines the output status.

Setting range: Combination of all outputs (e.g. OP1, OP 23, OP 123)

OPA 1 to OPA123 and OPO 1 to OPO 123

OP -- = no output (timer function deactivated)

↑ Period for which the set outputs are enabled (ex works = 00.00)

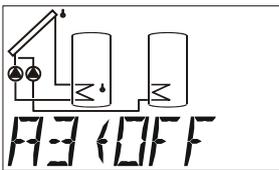
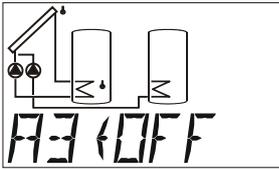
Setting range: 00.00 to 23.50 in 10 min increments

↓ Period for which the set outputs are blocked (ex works = 00.00)

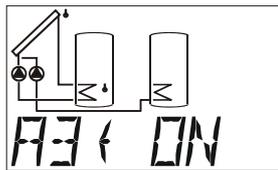
Setting range: 00.00 to 23.50 in 10 min increments

Assignment of free outputs **A2/A3** \Leftarrow **OFF**

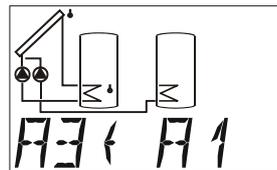
Outputs which do not have a fixed assignment in the diagram (diagram 0 to 159) can be linked to other outputs.



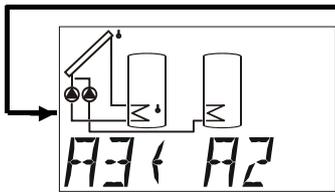
A3 deactivated



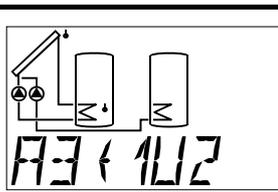
A3 activated (as time switch output)



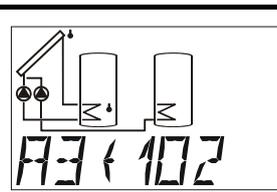
A3 switches with A1



A3 switches with A2



A3 switches when A1 and A2 are ON



A3 switches when A1 or A2 are ON

A3 \Leftarrow **OFF** Output A3 has no function

A3 \Leftarrow **ON** Output A3 is released and available as e.g. time switch output

A3 \Leftarrow **A1** Output A3 switches together with output A1

A3 \Leftarrow **A2** Output A3 switches together with output A2

A3 \Leftarrow **1U2** Output A3 switches if output A1 and output A2 have activated.

A3 = A1 & A2

A3 \Leftarrow **1O2** Output A3 switches if output A1 or output A2 have activated.

A3 = A1 or A2

WARNING: The switch function does not relate directly to the allocated output, rather only to its function in the **Basic program** diagram, in which respect a possible priority allocation is **not** considered. If this is necessary, program diagram 624 can be used. If the output is to be affected by special functions (e.g. time window, collector excess temperature limitation etc.) so that this is to be especially allowed for when assigning outputs.

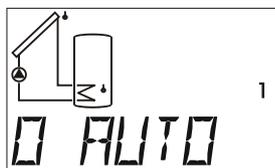
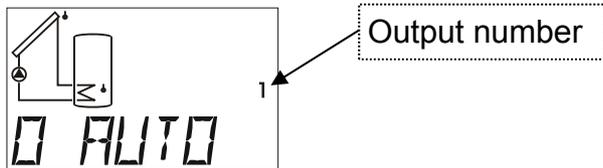
Automatic / manual mode

O AUTO The three outputs are set to automatic mode and can be set to manual mode for test purposes (**O ON**, **O OFF**). **To indicate manual mode a flashing hand symbol appears.** An active output (pump is running) is indicated when a number (LED) appears next to the display. (ex works = AUTO)

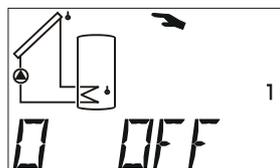
Settings: **AUTO** the output switches according to the program diagram

OFF the output switches off

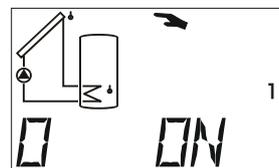
ON the output switches on



Automatic mode



Manual OFF



Manual ON

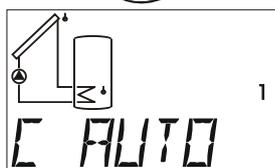
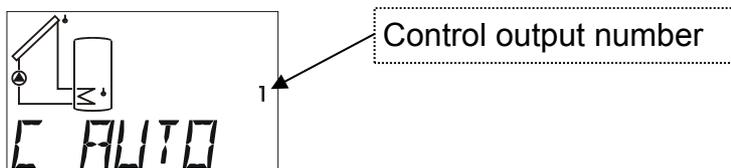
IMPORTANT: If the output is switched manually to ON or OFF this program diagram or these functions (e.g. anti-freeze, start function etc.) no longer have any effect on the output.

C AUTO The 2 control outputs are set to automatic mode and can be changed over to manual mode (**C ON**, **C OFF**) for test purposes. **To indicate manual mode a flashing hand symbol appears.** (ex works = AUTO)

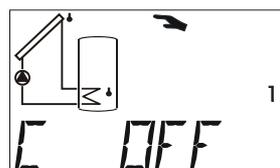
Settings: **AUTO** the control output delivers a control voltage between 0 and 10 volts dependent on the settings in the **COP** menu.

OFF the control voltage is always 0 volts

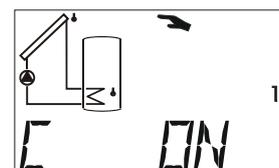
ON the control voltage is always 10 volts



Automatic operation

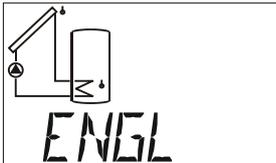
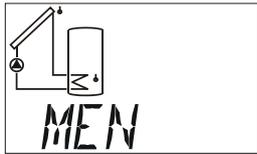


Manual 0 volts

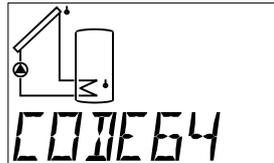


Manual 10 volts

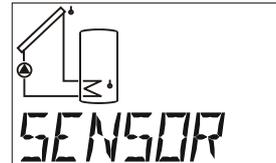
The menu *MEN*



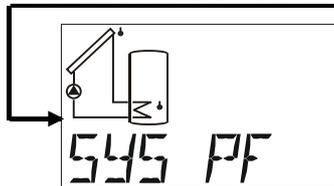
Language



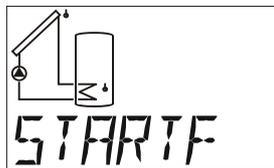
Code to enter the menu



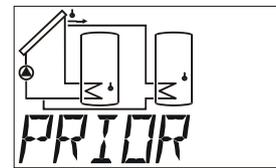
Sensor menu



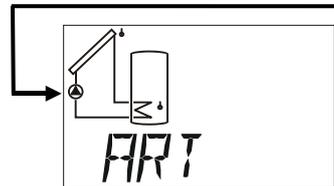
System protection function



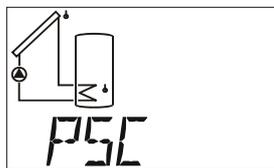
Start function



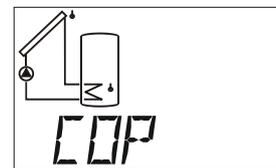
Solar priority only displayed for progr. with priority



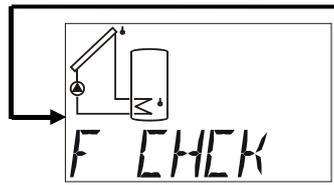
After-running time of outputs



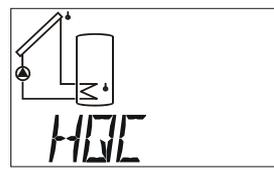
Pump speed control



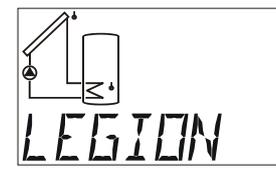
Control outputs



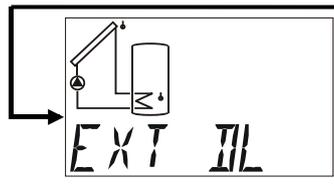
Function check



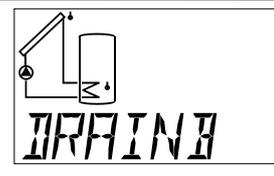
Heat quantity counter



Legionella-function



External sensors via data link



Drain-back function

Brief description

The menu contains basic settings to determine additional functions such as the sensor type, the system protection functions, etc. Navigation and changes are done as usual with the keys ⇒↑↓⇐, while the dialogue is only set up in the text line.

As the settings in the menu can change the basic features of the control unit, only a technician who has the code can open this level.

ENGL	Actually chosen menu language = English . Factory settings are made in DEUT (German).
CODE	Code to enter the menu. The other menu items are only displayed once the correct code has been entered.
SENSOR	Sensor settings: selection of sensor type, mean value of sensor values and assignment of icons for sensors.
SYS PF	System protection function : collector overheating limiter (2 times) and frost protection function (2 times) Collector cooling function Anti-blocking protection
STARTF	Start function (2 times): start aid for solar power systems
PRIOR	Solar priority : only for program diagrams with more than one solar circle
ART	After-running time : can be set for each output.
PSC	Pump speed control : constant temperature thanks this feature.
COP	Control output (0-10V / PWM) available twice As analogue output (0-10 V): output of a voltage between 0 and 10 V. As a fixed value of 5V As PWM (pulse width modulation): output of a frequency. The duty cycle (ON / OFF) conforms to the control signal. Error message (switchover from 0V to 10V or inversely from 10V to 0V)
F CHCK	Function check : monitoring of sensor malfunctions, short circuits and circulation checks
HQC	Heat quantity counter : operation with the volume flow encoder or operation with fixed volume flow
LEGION	Legionella protection function
EXT DL	External sensor values from the data link
DRAINB	Function for drain-back systems

Language *DEUT, ENGL, INTER*

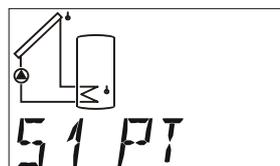
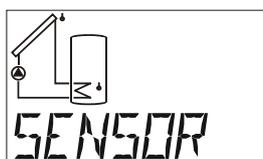
Language selection: The entire menu can be switched to the desired user language even before the code is provided. The following languages are available: German (*DEUT*), English (*ENGL*) and international (*INT*) for French, Italian and Spanish.

Factory settings are made in German (*DEUT*).

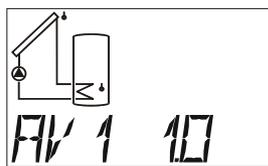
Code number *CODE*

The additional menu items are only displayed after the correct **code** number (**code number 64**) has been entered.

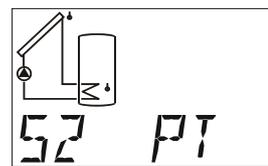
Sensor menu *SENSOR*



Sensor 1



Average determination



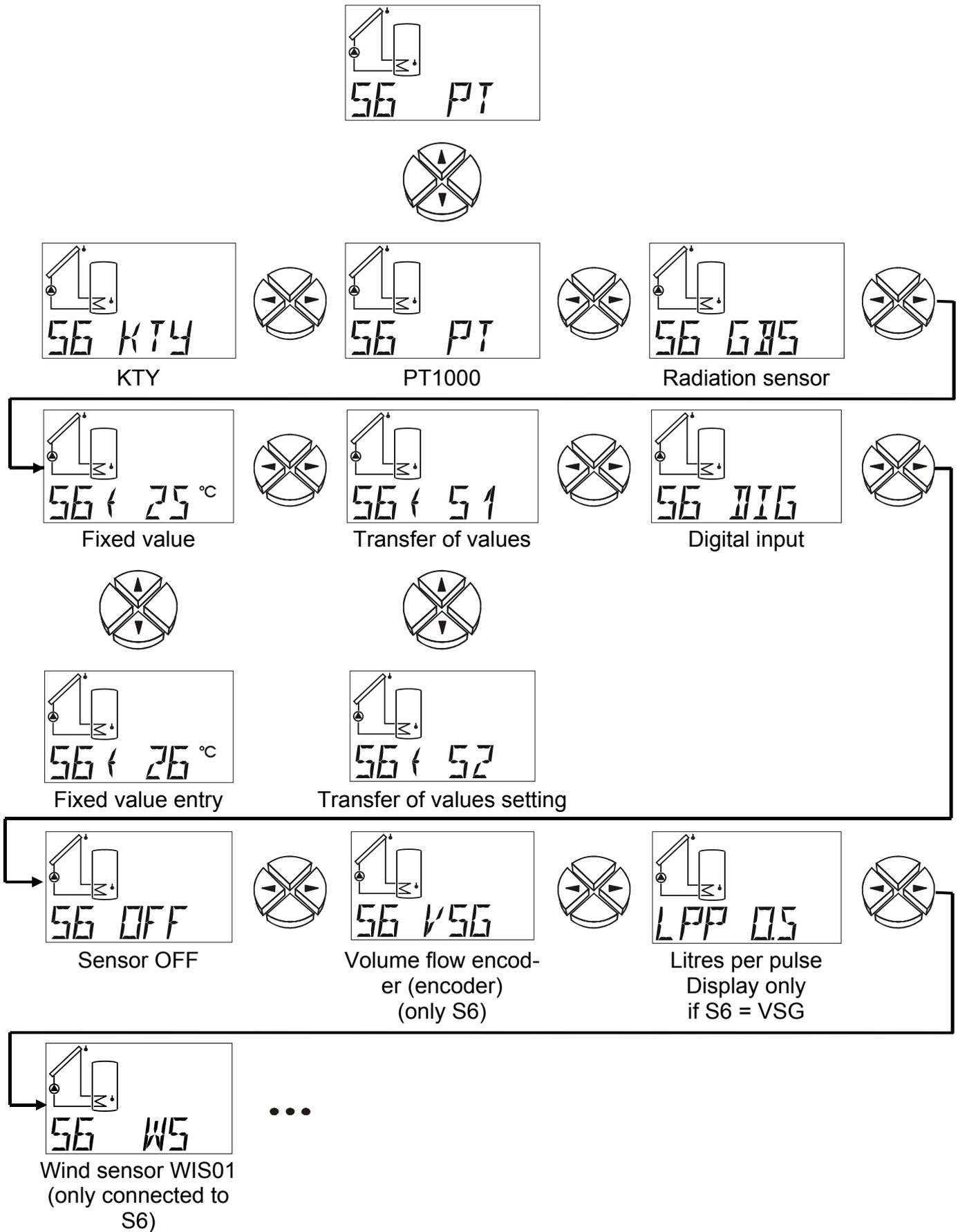
Sensor 2

...

These 2 menu items (sensor type, determination of average) are available for each sensor.

Sensor settings

Sensor S6 has been taken in this example as it has the most setting possibilities.



Sensor type

Solar collectors reach standstill temperatures of 200 to 300°C. No value above 200°C is expected due to the sensor installation point and physical properties (dry steam does not conduct heat well, for instance). The standard PT1000 series sensors can be permanently exposed to 240°C and briefly to 260°C. KTY10 sensors are designed for brief use at 180°C. The **SENSOR** menu enables changing over of the individual sensor inputs between PT1000 and KTY types.

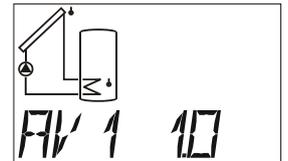
As default factory setting all inputs are set to PT1000 type.

PT, KTY	Temperature sensors
GBS	Radiant sensor (can be used for the start function and solar priority function)
S6↔ 25	Fixed value: e.g. 25°C (using this settable value instead of measured temperature) Setting range: -20 to 149°C in increments of 1°C
S6↔ S1	(Transfer of values) Example: Instead of a measured value the input S6 receives its (temperature) information from input S1 . A mutual allocation (in this example also: S1 ↔S6) in order to link information is not admissible. In addition it is possible to assign values from external sensors (E1 to E9).
DIG	Digital input: such as when a volume flow switch is used. Input short-circuited (ON): Display: D1 Input interrupted (OFF): Display: D0
OFF	The sensor is not displayed on the main level. The sensor value is set to 0°C.
VSG	Volume flow encoder: Only sensor S6 to read-in the signals from a volume flow encoder
LPP	Litres per pulse = the volume flow encoder's pulse rate, only if sensor type S6 = VSG. (ex works = 0.5) Setting range: 0.0 to 10.0 litres/pulse in increments of 0.1 litre/pulse
WS	Wind sensor: Only connected to input S6 , to read in the pulses of the wind sensor WIS01 from Technische Alternative (1Hz per 20km/h).

Creating a mean (average) AV

Setting of the time in seconds over which an averaging of the measured value should be carried out (ex works = 1.0s).

Example: AV1 1.0 Create an average of sensor S1 for 1.0 seconds



For simple measurements, 1.0-2.0 should be selected. A large average slows everything down and is only recommended for the sensors for the heat counter.

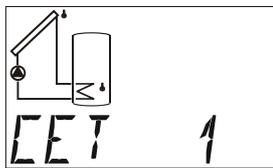
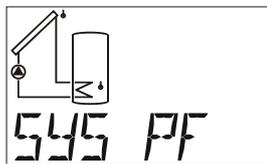
The measurement of the ultra-fast sensor for the preparation of hot water also requires a fast evaluation of the signal. Hence, the creation of the average of the sensor should be reduced to 0.3 to 0.5 although fluctuations will then occur in the display.

No averaging is possible for the volume flow encoder VSG and the wind sensor WIS01.

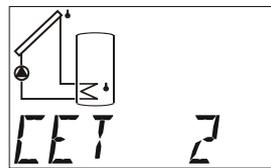
Setting range: 0.0 to 6.0 seconds in increments of 0.1 seconds

0.0 no average

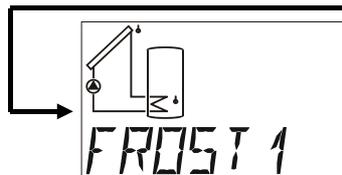
System protection function SYS PF



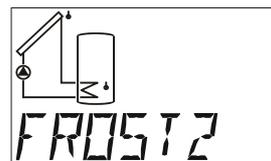
Collector excess temperature limit 1



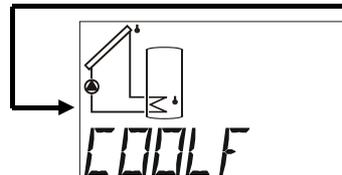
Collector excess temperature limit 2



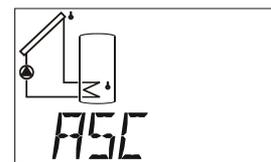
Frost protection function 1



Frost protection function 2



Collector cooling function



Anti-blocking protection

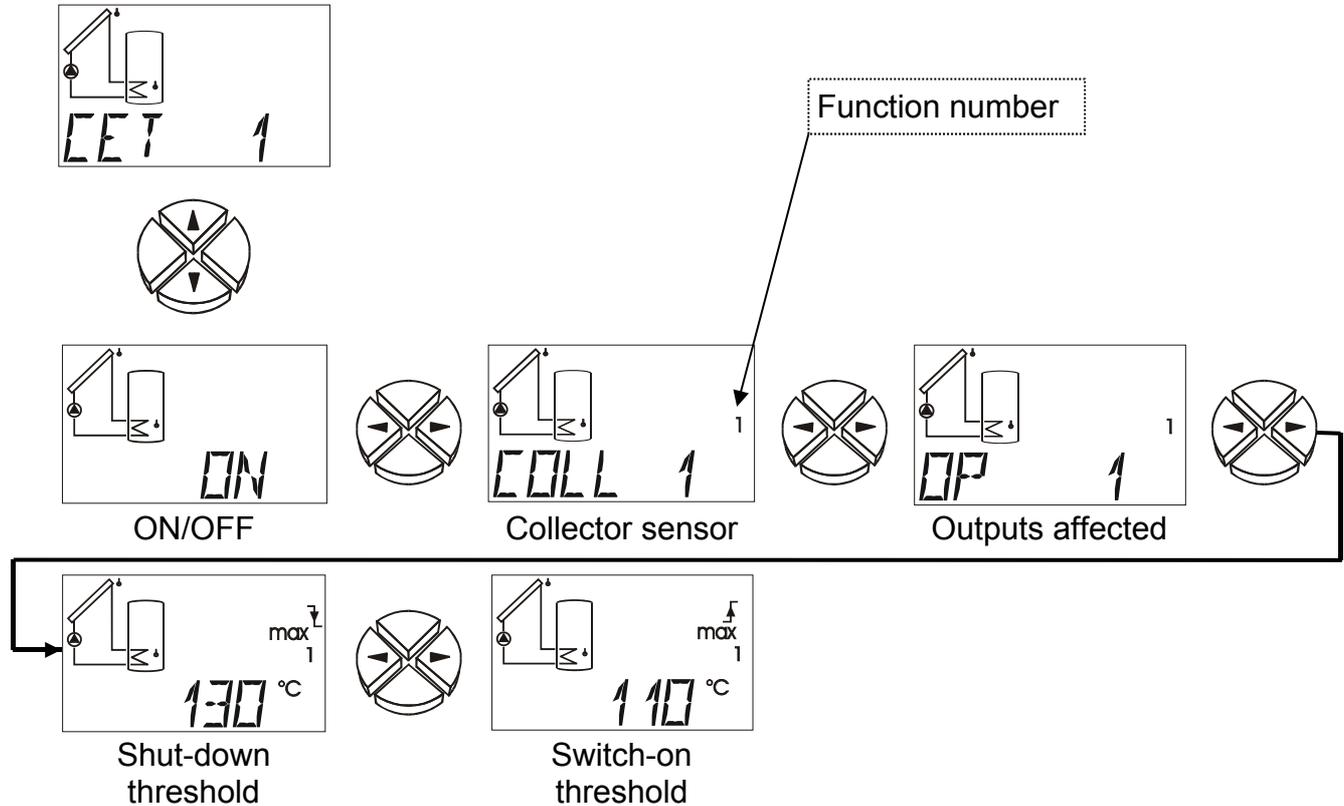
Two collector excess temperature limiter functions and two frost protection functions are available. These functions can be set completely independently of the program diagram selected.

The first limit function **CET1** is activated ex works; all other functions are disabled.

Collector excess temperature limit *CET*

Steam builds up when the system is not circulating. When it automatically switches on again, the pump does not have the pressure to lift the fluid level above the highest point in the system (collector feed line). If there is no circulation, the load on the pump is enormous. This function allows the pump to be blocked above a set collector temperature threshold (**max ↓**) until a second set threshold (**max ↑**) is fallen short of.

If a control output is allocated to the output, the analogue level for pump standstill is issued at the control output if collector excess temperature shutdown is active.



ON / OFF Collector excess temperature limit ON/OFF

(ex works₁ = ON, ex works₂ = OFF)

COLL Setting of the **collector sensor** (S1 to S6) to be monitored.

(ex works₁ = S1, ex works₂ = S2)

Setting range: S1 to S6

OP Setting of the **outputs** to be blocked when the switch-off threshold is exceeded.

(ex works₁ = OP1, ex works₂ = OP2)

For programs with pump-valve systems (e.g. program 176+1=177), all the outputs concerned (e.g. OP 12) must be set, as this function always relates to the control circuit.

Setting range: combination of all outputs (such as OP1, OP23, OP123)

max ↓ Temperature above which the outputs set are to be blocked

(ex works₁ = ex works₂ = 130°C)

Setting range: 0°C to 200°C in increments of 1°C

max ↑ Temperature above which the outputs set are to be released.

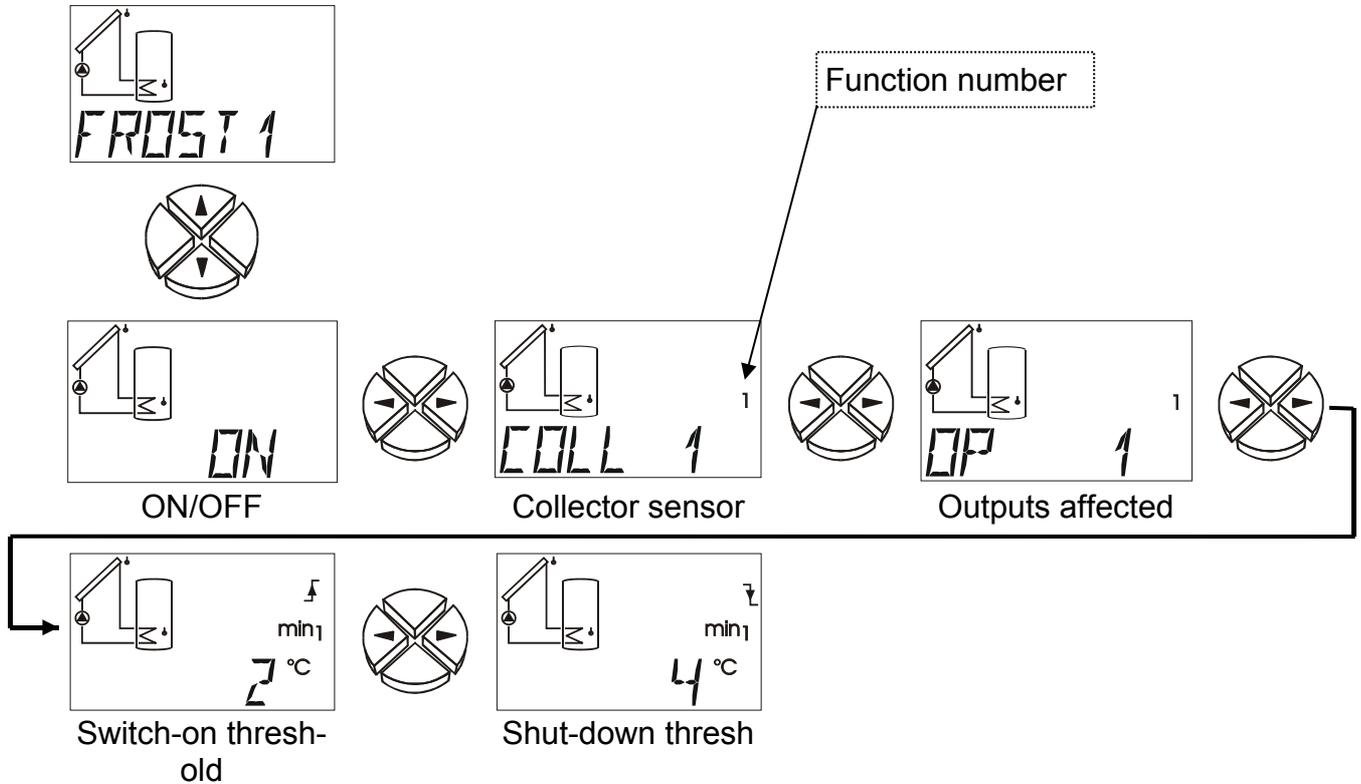
(ex works₁ = ex works₂ = 110°C)

Setting range: 0°C to 199°C in increments of 1°C

The function of the collector excess temperature limit is available twice and is differentiated by the index (1 or 2) in the right display area.

Collector frost protection **FROST**

This function is disabled ex works and is only necessary for solar power systems that run without antifreeze: In the south, the energy from the solar tank suffices to keep the collector at a minimum temperature for the few hours below freezing. At **min** \uparrow of 2°C on the collector sensor, the settings in the chart release the solar pump and block it again at **min** \downarrow of 4°C.



ON / OFF Frost-protection function ON/OFF (ex works₁ = ex works₂ = OFF)

COLL Setting of the **collector** sensor (S1 to S6) to be monitored
(ex works₁ = S1, ex works₂ = S2)
Setting range: S1 to S6

OP Setting of the **outputs** to be blocked when the switch-on threshold is fallen short of. If a control output is allocated to the output, the analogue level for the maximum speed is additionally issued at the control output. (ex works₁ = OP1, ex works₂ = OP2)

Setting range: combination of all outputs (such as OP1, OP23, OP123)

min \uparrow Temperature above which the outputs set are to be switched on
(ex works₁ = ex works₂ = 2°C)

Setting range: -30°C to 119°C in increments of 1°C

min \downarrow Temperature above which the outputs set are to be switched off
(ex works₁ = ex works₂ = 4°C)

Setting range: -29°C to 120°C in increments of 1°C

NOTICE: If the frost protection function is activated and an error occurs at the set collector sensor (short circuit, interruption), the set output is switched on at the top of every hour for 2 minutes.

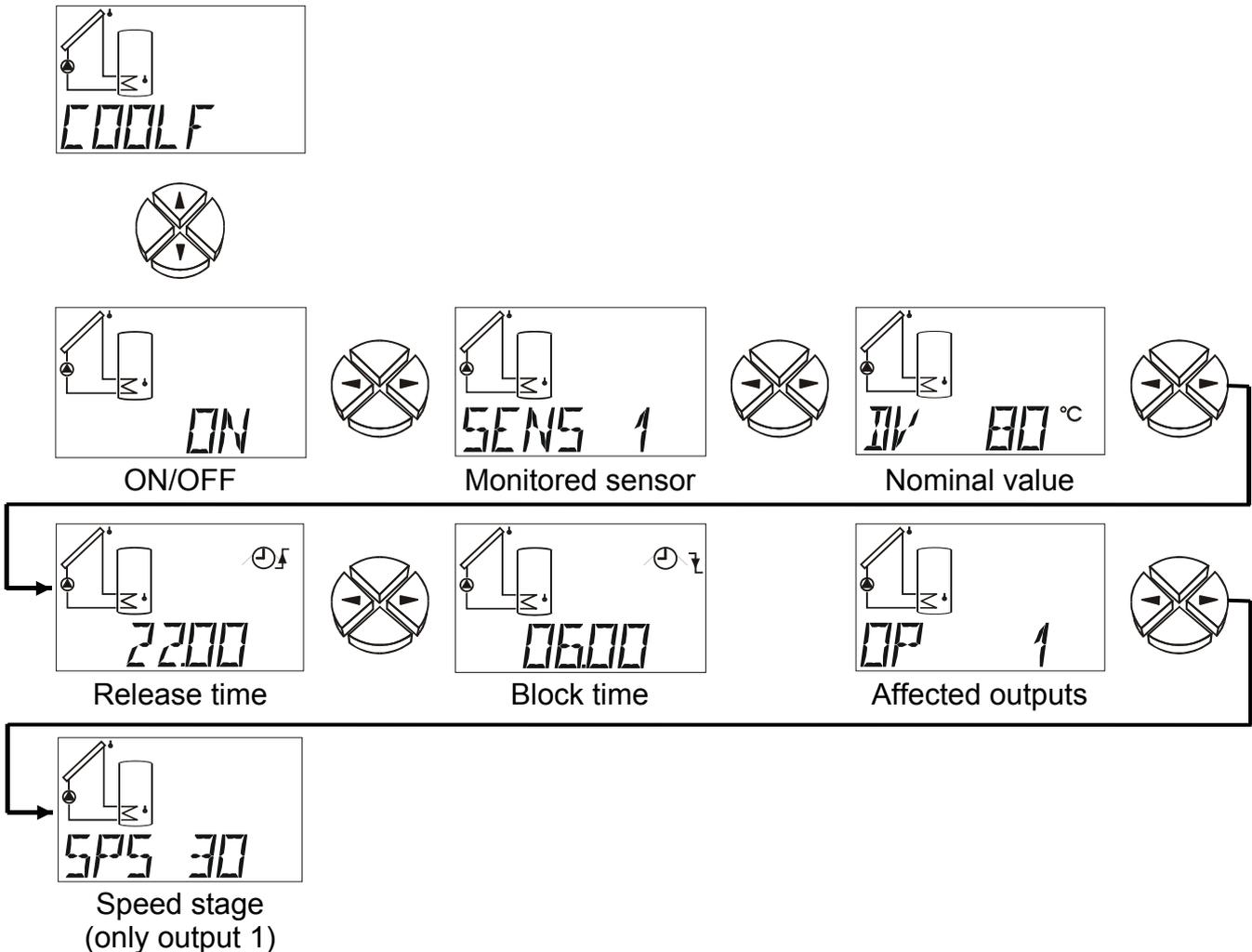
The frost protection function is available twice and is differentiated by the index (1 or 2) in the right display area.

If the drain-back function is activated the frost protection function is blocked (with the exception of program 4).

Collector cooling function **COOLF**

With the aid of this function the tank is allowed to cool overnight so that the following day heat can be taken in again.

If the selected sensor (tank temperature) has exceeded the set threshold temperature the selected output remains switched on during the specified period for so long until it is under-run again. Since even with reduced speed sufficient cooling is achieved excessive power consumption can be avoided by specifying a speed stage at output A1.



ON / OFF Collector cooling function ON /OFF (ex works = OFF)

SENS Monitored (tank) **sensor**
Setting range: S1 to S6 (ex works = S1)

DV This nominal value must be exceeded by the set sensor.
Setting range: 0 to 150°C in 1°C increments (ex works = 80°C)

↑ Time from which the set outputs are enabled (ex works = 22.00)
Setting range: 00.00 to 23.50 in 10 min increments

↓ Time from which the set outputs are disabled (ex works = 06.00)
Setting range: 00.00 to 23.50 in 10 min increments

OP This output switches itself on as soon as the selected sensor exceeds the temperature threshold in the set time period. If a control output is allocated to the output, the analogue level for the maximum speed is additionally issued at the control output.

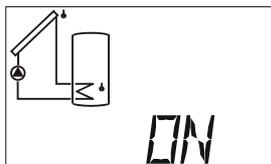
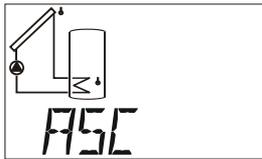
Setting range: Combinations of all outputs (ex works = OP1)

SPS Speed stage with which the pump is to run (only output A1, ex works =30)

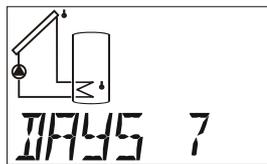
Anti-blocking protection ASC

Circulating pumps which do not run for longer periods (e.g. heating circuit pump during the summer) often encounter start-up problems as a result of corrosion. Solution: Periodically (e.g. every 7 days) set the pump in motion for several seconds (PRT).

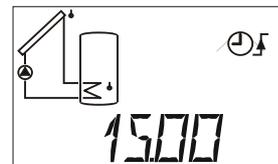
Warning! For heat exchanger programs (e.g. program 384), both the primary and secondary pumps must always be switched on due to the risk of freezing.



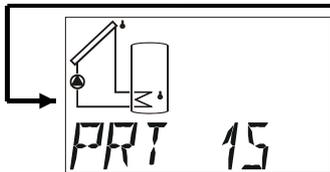
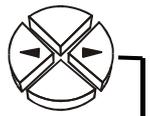
ON/OFF



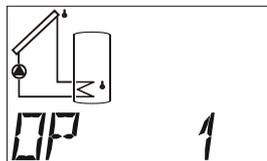
Interval time



Starting time



Pump run time



Affected outputs

ON / OFF Anti blocking protection ON/OFF (ex works = OFF)

DAYS Time lapse in days. If the selected output has not run during this time it is switched on for the pump run time set.

Setting range: 1 to 7 days (ex works = 7 days)

↑ Time by which the set outputs are switched on (ex works = 15.00)

Setting range: 00.00 to 23.50 in 10 min increments

PRT Pump run time in seconds. The selected outputs are switched on for this set time. (ex works = 15s)

Setting range: 0 to 99 seconds in increments of 1 second

OP Setting the **outputs** which are to be switched on by the anti-blocking protection. If a control output is allocated to the output, the analogue level for the maximum speed is additionally issued at the control output. Setting range: combinations of all outputs (ex works = OP1)

Start function *STARTF* (ideal for tube collectors)

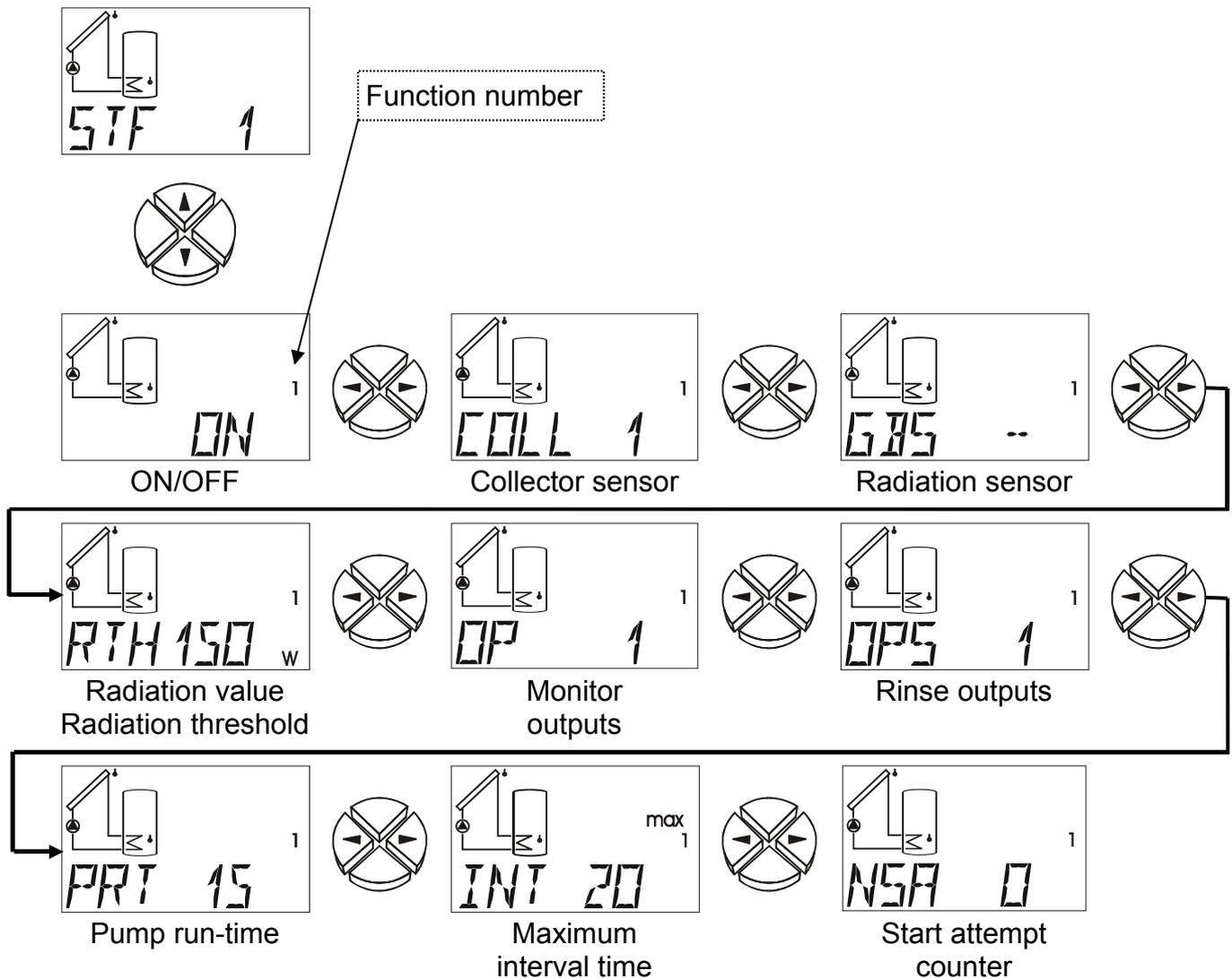
In the morning, solar power systems sometimes do not “start” quickly enough because the warm heat transfer medium does not reach the collector sensor. Flat collector panels and **forced-circulation vacuum tubes** generally lack sufficient gravitational force.

The start function tries to release a rising interval while the collector temperature is constantly monitored. The computer first determines the weather conditions based on the constant measurements of the collector temperatures. It thus determines the right time for a short rinsing interval to maintain the actual temperature for normal operation.

When the radiation sensor is used, the solar radiation is used for the calculation of the start function (radiation sensor **GBS 01** - non-standard accessory).

The start function may not be activated in conjunction with the drain-back function.

Since the device also supports twin collector field systems this function is available **twice**. The start functions are deactivated ex works and only make sense together with a solar system. In activated condition the following sequential diagram for STF 1 results (STF 2 is identical):



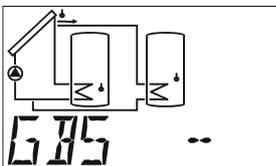
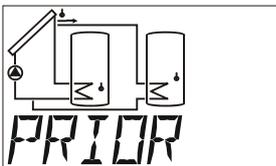
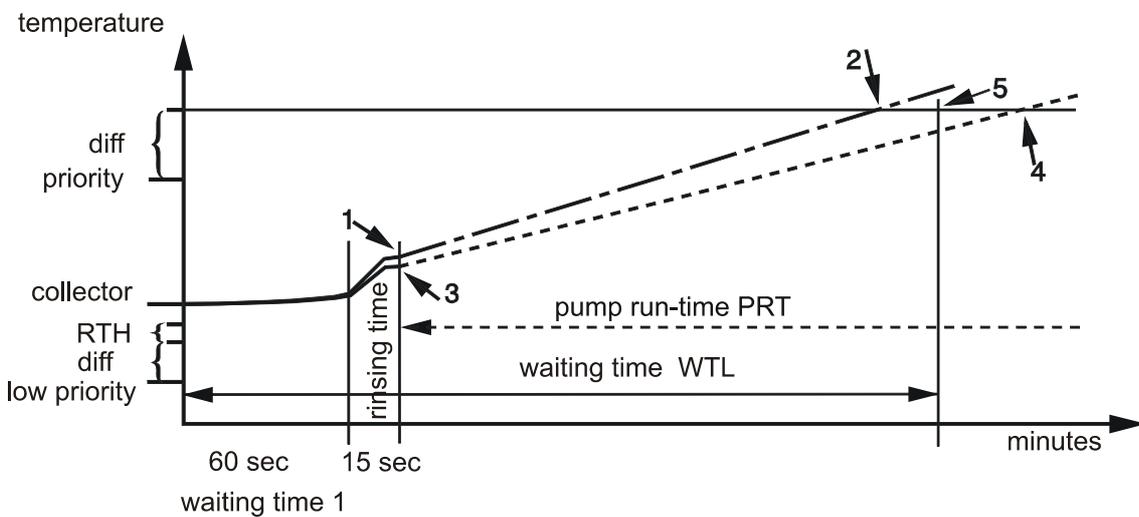
ON / OFF	Start function ON/OFF (ex works ₁ = ex works ₂ = OFF)
COLL	Setting of collector sensor (ex works ₁ = S1, ex works ₂ = S2). Setting range: S1 to S6
GBS	Radiation sensor GBS 01 - non-standard accessory: Indicates a sensor input if a radiation sensor is used. If no radiation sensor is used, the average temperature (long-term mean regardless of the weather) is calculated. (ex works ₁ = ex works ₂ = --) Setting range: S1 to S6 Input of radiation sensor E1 to E9 Value of the external sensor GBS -- = no radiation sensor
RTH	Radiation value (radiation threshold) in W/m ² above which rinsing is allowed. Without a radiation sensor, the computer calculates the necessary temperature increase for the long-term mean that launches rinsing from this value. (ex works ₁ = ex works ₂ = 150W/m ²) Setting range: 0 to 990W/m ² in increments of 10W/m ²
OP	Outputs to be monitored. If one of the outputs set is running, no start function needs to be executed. (ex works ₁ = OP1, ex works ₂ = OP2) Setting range: combination of all outputs (such as OP1, OP23, OP123)
OPS	Outputs used for rinsing. If a control output is allocated to the output, the analogue level for the maximum speed is additionally issued at the control output. (ex works ₁ = OPS1, ex works ₂ = OPS2) Setting range: combination of all outputs (such as OPS1, OPS23, OPS123)
PRT	Pump run-time (rinsing time) in seconds. During this time, the pump(s) should have pumped roughly half of the content of the collector's heat transfer medium past the collector sensor. (ex works ₁ = ex works ₂ = 15s) Setting range: 0 to 240 seconds in increments of 1 sec
INT(max)	Maximum allowable interval between two rinses. This time is automatically reduced according to the temperature increase after rinsing. (ex works ₁ = ex works ₂ = 20min) Setting range: 0 to 99 minutes in increments of 1 min
NSA	Number of start attempts (= counter). The system is automatically reset for a start attempt if the last start attempt was more than four hours ago.

Priority *PRIOR*

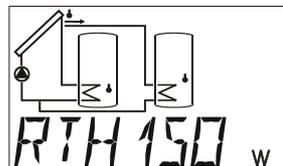
This menu item is only displayed for program diagrams with priority.

When the consumers with **lower priority** are being filled, the unit monitors the irradiation at the radiation sensor or the collector temperature. If a radiation threshold is reached or the collector temperature is exceeded by a value calculated from the threshold for the low-priority consumer, the priority timer is activated. The pump then switches off for a set waiting time of 60 sec.

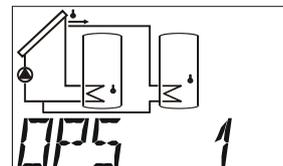
After the rinsing time (1, 3), the computer calculates the increase in collector temperature. It detects whether the set waiting time WTL has been reached to heat the collector to the priority temperature. In the second case, the unit waits until the priority has been reached to switch. If the computer detects that the increase will not suffice within the WTL time (4, 5), it discontinues the process and reactivates the time again after PRT. **At PRT=0, the low-priority is only allowed when the maximum threshold for the priority is reached (= absolute priority).**



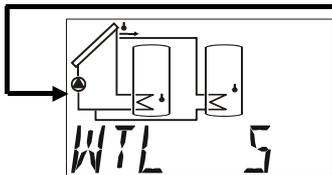
Radiation sensor



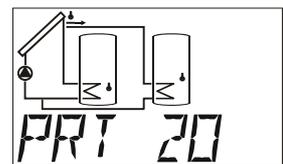
Radiation threshold



Rinse outputs



Waiting time

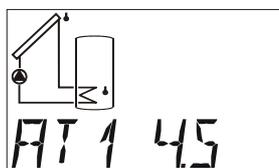
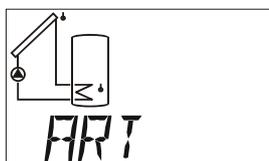


Pump run-time of low-priority

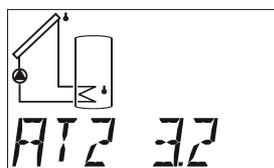
- GBS** Radiation sensor **GBS 01** - non-standard accessory: Indicates a sensor input if a radiation sensor is used. If the radiation sensor exceeds the radiation threshold (RTH), the priority timer is launched.
Without the radiation sensor, the launch is based on the collector temperature. (ex works = --)
Setting range: S1 to S6 Input of radiation sensor
 E1 to E9 Value of the external sensor
 GBS -- no radiation sensor
- RTH** Radiation value (radiation **threshold**) in W/m^2 above which rinsing is allowed. Without a radiation sensor, the computer calculates the necessary temperature increase for the long-term mean that launches rinsing from this value. (ex works = $150W/m^2$)
Setting range: 0 to $990W/m^2$ in increments of $10W/m^2$
- OPS** **Outputs** used for rinsing. If a control output is allocated to the output, the analogue level for the maximum speed is additionally issued at the control output. (ex works = OPS1)
Setting range: combination of all outputs (such as OPS1, OPS23, OPS13...)
- WTL** **Waiting time** of low priority. This is the time in which the collector should reach the temperature necessary for priority operation. If the waiting time is set to 0 the solar priority timer is deactivated. (ex works = 5 min)
Setting range: 0 to 99 minutes in increments of 1 min
- PRT** **Pump run-time** of low-priority. If the solar radiation to switch to priority is not sufficient, the low priority is allowed again for this time.
If the pump run-time PRT is set to 0, the low priority is only allowed when the maximum threshold for priority is reached (= absolute priority).
(ex works = 20 min)
Setting range: 0 to 99 minutes in increments of 1 min

After-running time *ART*

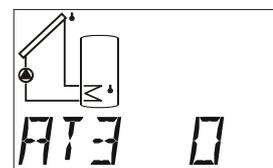
During the start phase, the pumps may repeatedly switch on and off for a long time, especially with solar and heating systems with long hydraulic system lines. That is detrimental especially for high efficiency pumps. This response can be reduced by using a speed control or increasing the pump after-run time.



After-running time
output 1



After-running time
output 2



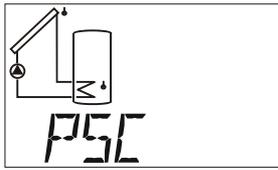
After-running time
output 3

AT1 After-running time output 1 (ex works = 0)
Setting range: 0 (no after-running time) to 9 minutes in increments of 10 secs

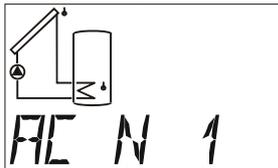
AT2, AT3 After-running time for outputs 2 and 3 (ex works = 0)

Pump speed control PSC

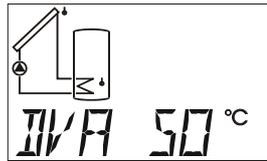
Pump speed control PSC is not suitable for electronic or high efficiency pumps.



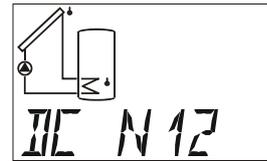
Warning! The values in the following description are by way of example only; they must, in all cases, be matched to the system!



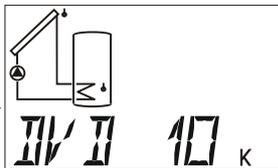
Absolute value control system



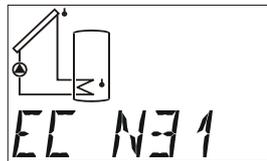
Desired value for absolute value control



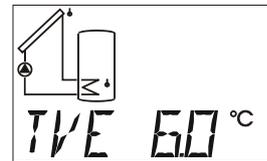
Differential control system



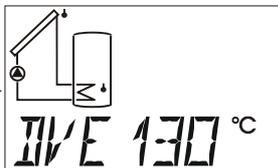
Desired value for differential control



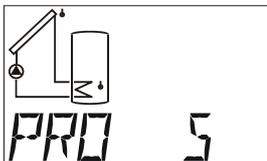
Event control system



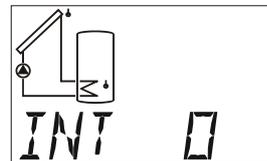
Desired value of the event



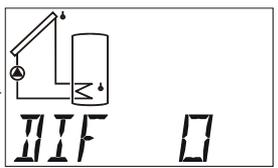
Desired value of the control system



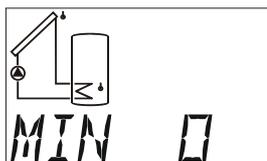
Proportional part



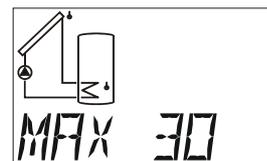
Integral part



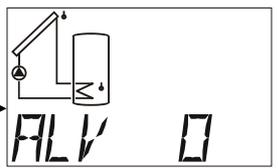
Differential part



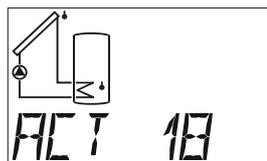
Minimum Speed stage



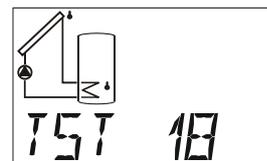
Maximum Speed stage



Delay time



Current speed



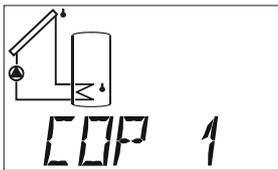
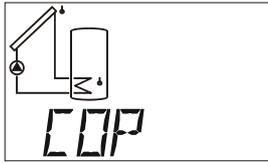
Setting of test speed



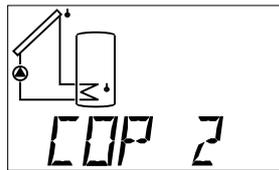
The behaviour of the control circuit is equal to that of the control outputs (COP); however, instead of 100 (COP) a maximum of 30 increments is available.

The description of the parameter values follows in the menu "COP".

Control output COP 0-10 V / PWM (twice)

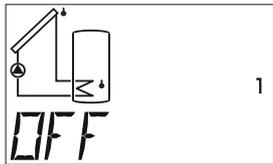


Control output 1



Control output 2

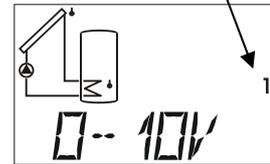
Different functions of the control output



Control output deactivated



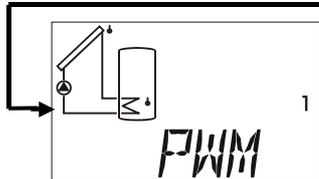
5V power supply



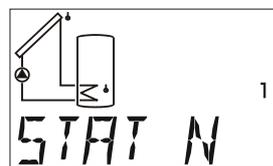
0 - 10V output



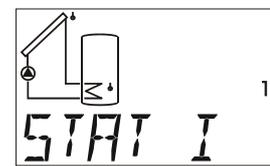
Control output number



PWM output



Error message
(upon error 0 to
10V switchover)



Error message
(upon error in-
verse switchover
from 10 to 0V)



OFF Control output deactivated; output = 0V

5V Power supply; output = 5V

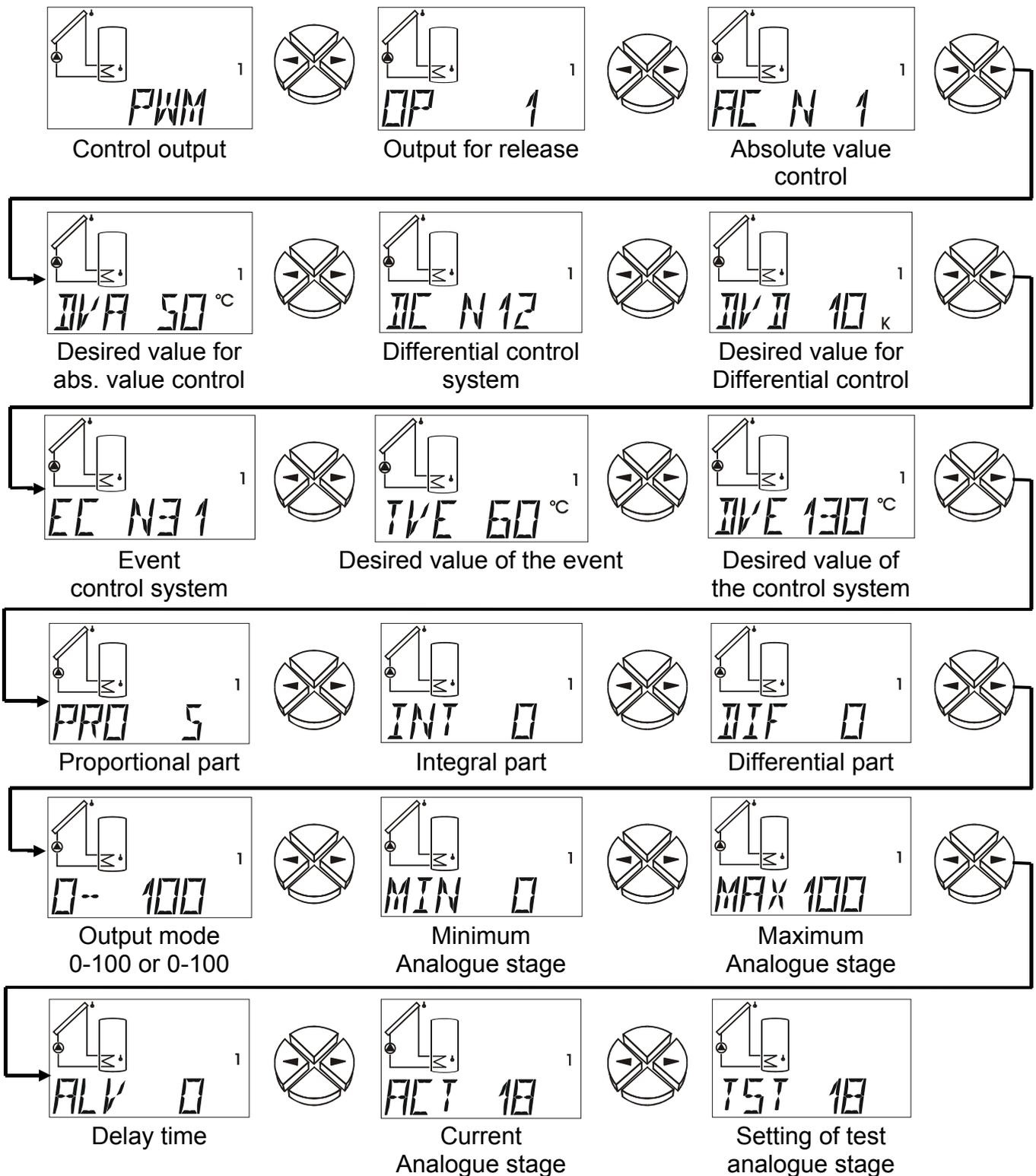
0-10V PID – controller; output= 0-10V in 0.1V increments

PWM PID – controller; output = duty cycle 0-100% in 1% increments

STAT N / STAT I If function control is activated and an error message is displayed in the status display Δ **Status** (sensor open circuit **IR**, -short circuit **SC** or circulation error **CIRC.ER**) the output with the setting **STAT N** is switched over from 0 to 10 V (for **STAT I**: inversely from 10V to 0V). Upon collector excess temperature switch-off **CET**, the control output does not switchover. Subsequently, an auxiliary relay can be connected to the control output, which forwards the error message to a signalling device (e.g. warning lamp or audible alarm).

The following settings are only possible in **0-10V** and **PWM** modes.

Warning! The values in the following description are by way of example only; they must, in all cases, be matched to the system!



In this menu the parameters for the control output are specified.

As analogue output it can put out a voltage of 0 to 10V in 0.1V increments.

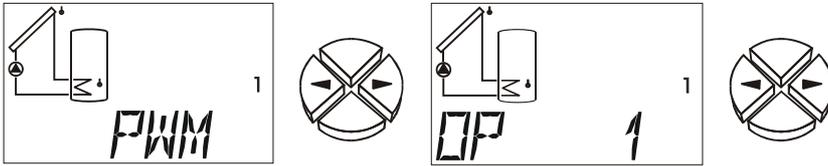
As PWM a digital signal with a frequency of 500 Hz (level approx. 10 V) and a variable duty cycle from 0 to 100% is created.

In the active state, they can be enabled by an assigned output, i.e. by an output specified by the schematic and the program number.

The control output 1 is factory set to PWM and linked to output 1.

If a control output (0-10 V or PWM) is activated and speed control is set, the analogue level is displayed in the basic menu after the measured values under "ANL 1" or "ANL 2".

The instructions on **page 9** should be observed for the speed control in **pump valve systems**.



OP Setting the outputs to enable the control output.

There are 4 programming options:

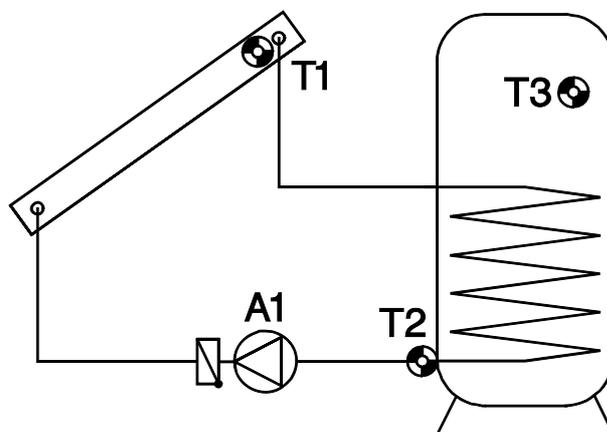
1. If the control output is set to **0-10 V** or **PWM**, **no** output is selected **and no** absolute value control, differential control or event control is activated, a **constant** voltage of 10 V (=100 % PWM) is emitted (mode 0-100).
2. If **no** output is selected **and** absolute value control, differential control or event control is activated, the control output is **always** enabled and a correcting variable that corresponds to the control parameters is issued.
3. If an output is selected **and no** absolute value control, differential control or event control is activated, 10 V (mode 0-100) is emitted at the control output if this output is activated through the program (= factory setting).
4. If an output is selected **and** absolute value control, differential control or event control is activated, the analogue output is enabled and a correcting variable that corresponds to the control parameters is issued if the output is activated through the program.

Setting range: combination of all outputs (such as OP1, OP23, OP123)

OP -- = The analogue output is not assigned to any output; rather, it runs independently.

The pump speed control can be used to change the delivered quantity – i.e. the volume flow – via one of the control outputs. This provides constant levels of (differential) temperatures in the system.

A simple solar diagram is used to illustrate the possibilities of this process:

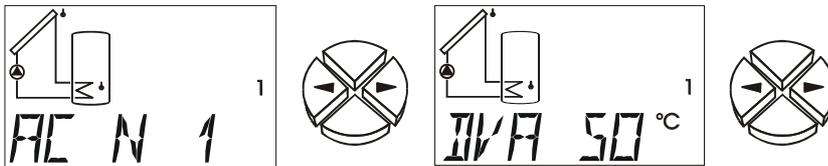


Absolute value control = maintaining a sensor

S1 can be kept at one temperature (such as 50°C) very well by using the speed control. If the solar radiation is reduced, S1 becomes colder. The control unit then lowers the speed and hence the flow rate. However, that 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 tank. 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 control is set via two parameter windows. The **example** has typical settings for the hydraulics:



AC N 1 Absolute value control in normal operation, with sensor S1 being kept constant.

Normal operation **N** means that the speed increases as temperatures do and is valid for all applications to keep a “feed sensor” constant (collector, boiler, etc.)

Inverse operation **I** means that the speed decreases as temperatures drop and is necessary to maintain a return or control the temperature of a heat exchange outlet via a primary circulating pump (such as hygienic hot water). If the temperature at the heat exchanger’s outlet is too high, too much energy yield enters the heat exchanger, thus reducing the speed and hence the input. (ex works = --)

Setting range: AC N 1 to AC N6, AC I 1 to AC I 6
AC -- = absolute value control is disabled.

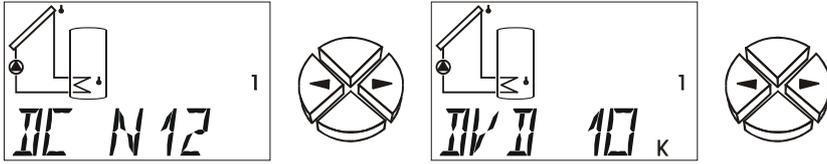
DVA 50 The desired value for absolute value control is 50°C. In the example, S1 is thus kept at 50°C. (ex works = 50°C)

Setting range: 0 to 99°C in increments of 1°C

Differential control = keeps the temperature constant between two sensors.

Keeping the temperature difference constant between S1 and S2, for instance, allow for “shifting” operation of the collector. If S1 drops due to lower irradiation, the difference between S1 and S2 thus drops. The control unit then lowers the speed, which increases the dwell time of the medium in the collector and hence the difference between S1 and S2.

Example:



DC N12 Differential control in normal operation between sensors S1 and S2.

(ex works = --)

Setting range: DC N12 to DC N65, DC I12 to DC I65)

DC -- = differential control is disabled.

DVD 10 The desired value for differential control is **10K**. In the example, the temperature difference between S1 and S2 is maintained at 10K.

Warning: DVD always has to be greater than the switch-off difference of the basic function. If the DVD is lower, the basic function of pump release blocks before the speed control has reached the desired value. (ex works = 10K)

Setting range: 0.0 to 9.9K in increments of 0.1K,

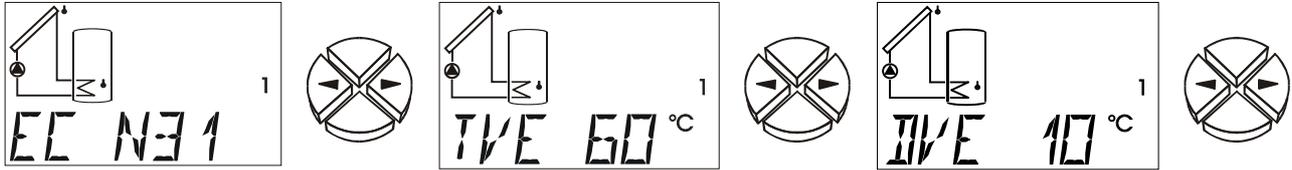
10 to 99K in increments of 1K

If the absolute value control (maintaining a sensor) and the differential control (maintaining the difference between two sensors) are both active, the slower of the two speeds “wins out”.

Event control = If a set temperature event occurs, the speed control starts, thus keeping a sensor constant.

If, for instance, S3 reaches 60°C (activation threshold), the collector should be kept at a certain temperature. Maintaining a sensor then works as with absolute value control.

Example:



EC N31 Event control in normal operation, an event at sensor S3 leads to a constant level at sensor S1. (ex works = --)

Setting range: EC N12 to EC N65, EC I12 to EC I65)

EC -- = event control is disabled.

TVE 60 The threshold value for event control is 60°C. At a temperature of 60°C at S3, the speed control is activated. (ex works = 60°C)

Setting range: 0 to 99°C in increments of 1°C

DVE 10 The desired value for event control is 10°C. As soon as the event has occurred, S1 is kept at 10°C. (ex works = 130°C)

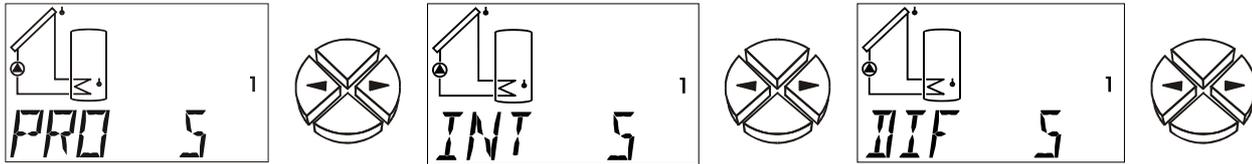
Setting range: 0 to 199°C in increments of 1°C

The event control “overwrites” the speed results from other control methods. A set event can thus block the control of absolute values or differences.

Example: keeping the collector temperature at 50°C with the absolute value control is blocked when the tank has already reached 60°C at the top = the fast provision of hot water is complete and is now to be continued with full volume flow (and hence a lower temperature but slightly better efficiency). To do so, a value that value automatically requires full speed (such as S1 = 10°C) has to be entered as the new desired temperature in the event control.

Stability problems

The speed control has a PID controller. It ensures an exact and fast adjustment of the actual value to the set point. **In applications such as solar power systems or feed pumps, the following parameters should be left in factory settings.** With a few exceptions, the system will run stably. These two values have to be balanced, however, especially for hygienic hot water from the external heat exchanger. In addition, in this case the use of an ultrafast sensor (non-standard accessory) is recommended at the hot water outlet.



Set value = desired value

Actual value = temperature measured

- PRO 5** **Proportional part of the PID controller 5.** It represents the reinforcement of the deviation between the desired and the actual value. The speed is changed by one increment for each 0.5K of deviation from the desired value. A large number leads to a more stable system but also to more deviation from the predefined temperature. (ex works = 5) Setting range: 0 to 100
- INT 5** **Integral part of the PID controller 5.** It 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 5 seconds. A large number provides a more stable system, but it then takes longer to reach the desired value. (ex works = 0) Setting range: 0 to 100
- DIF 5** **Differential part of the PID controller 5.** The faster a deviation occurs between the desired and the current value, the greater the short-term overreaction will be to provide the fastest compensation possible. If the desired value deviates at a rate of 0.5K per second, the speed is changed by one increment. Large numbers provide a more stable system, but it then takes longer to reach the desired value. (ex works = 0) Setting range: 0 to 100

The parameters PRO, INT, and DIF can also be determined in a test: Assume that the pump is running in automatic mode in a unit that is ready for operation with appropriate temperatures. With INT and DIF set to zero (= switched off), PRO is reduced every 30 seconds starting at 10 until the system is unstable. In other words, the pump speed changes rhythmically and can be read in the menu with the command ACT. Every proportional part that becomes unstable is noted as P_{krit} just as the duration of the oscillation (= time between the two highest speeds) is noted as t_{krit} . The following formulas can be used to determine the correct parameters.

$$PRO = 1,6 \times P_{krit}$$

$$INT = \frac{PRO \times t_{krit}}{20}$$

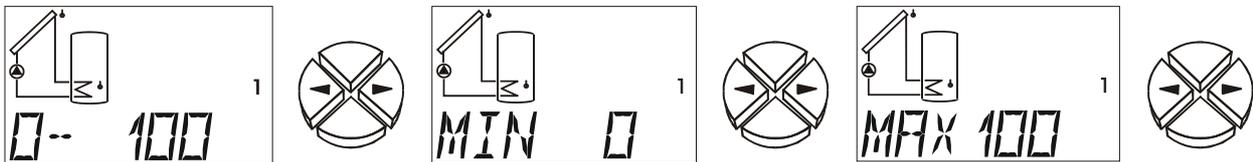
$$DIF = \frac{PRO \times 8}{t_{krit}}$$

A typical result of **hygienic domestic hot water service** with the ultrafast sensor is PRO = 8, INT = 9, DIF = 3. For reasons not entirely understood, the setting PRO = 3, INT = 1, DIF = 4 has proven practical. Probably, the control unit is so unstable that it oscillates very quickly and appears to be balanced due to the system's and the fluid's inertia.

Output mode, output limits

Depending on the pump version, the control mode of the pump can be normal (0 – 100 “solar mode”) or inverse (100 – 0, “heating mode”). There can 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:

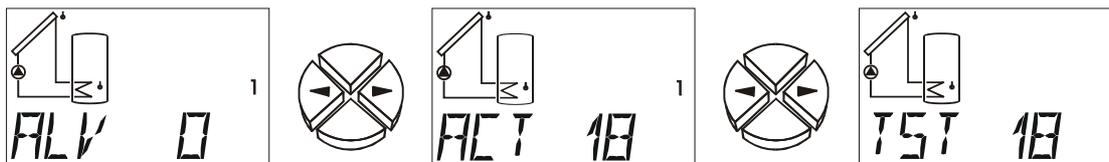


0-100 Output mode setting: 0-100 corresponds to 0->10V or 0->100% PWM, 100-0 corresponds to 10->0V or 100->0% PWM. (WE = 0-100)

MIN Lower speed limit (ex works = 0)

MAX Upper speed limit (ex works = 100)

Delay time, Control commands



ALV If the control output is activated by an assigned output, then the speed control is deactivated for the specified period and the value for the maximum speed is output. The control output is only controlled after this time has elapsed.

Setting range: 0 to 9 minutes in 10-second increments (ex works = 0)

The following commands provide a test of the system and allow you to monitor the current speed:

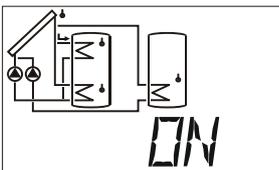
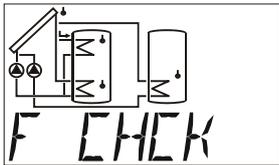
ACT 19 The pump is currently running at stage **18** (actual value).

TST 14 The speed stage **18** is currently being **tested**. Calling TST automatically switches to manual mode. As soon as the value blinks via the key ↓ (= entry), the pump runs at the speed displayed.

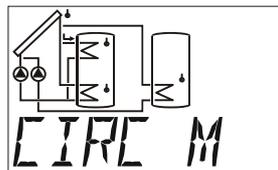
Setting range: 0 to 100

Function check *F CHCK*

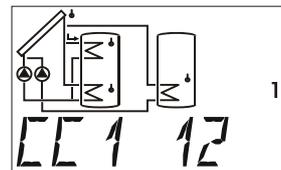
Some countries only grant support for the installation of solar power systems if the control unit monitors the system, especially to detect a lack of circulation. The function check is disabled ex works.



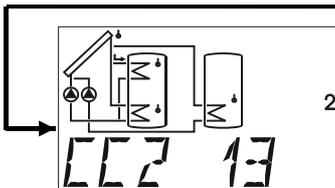
ON/OFF



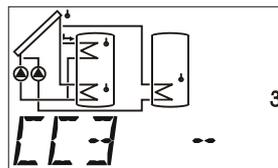
Circulation OFF/
AUTO/MANUAL



Circulation check
for output 1



Circulation check
for output 2



Circulation check
for output 3
(not active)



ON / OFF Select/disable the function check. (ex works = OFF)

The function check mainly makes sense for the monitoring of solar power systems. The following system statuses and sensors are monitored:

An interruption / short circuit of the sensors.

CIRC Release of circulation check (ex works = --)

Circulation problems - if the output is active and the temperature difference between two the sensors is greater than 60K for at least 30 minutes, an error message is output. (if activated)

Setting possibilities: CIRC -- = circulation check is disabled

CIRC A = circulation checks are performed according to the diagram (only the solar circuits in the diagrams shown)

CIRC M = circulation checks can be set manually for each output.

The following menu items are only displayed if the circulation checks have been set to "manual".

CC1 Manual circulation check for output 1.

Example: CC1 12 = if output 1 is active, and sensor S1 has been 60K greater than sensor S2 for at least 30 minutes, a circulation error is displayed.

(ex works = --)

Setting range: CC1 12 to CC 1 65

CC1 -- = manual circulation check for output 1 is disabled.

CC2 Manual circulation check for output 2.

CC3 Manual circulation check for output 3.

The error messages are entered in the menu **△Status**. If **△Status** is blinking, an error or special system status has been detected (see "status display **△Status**").

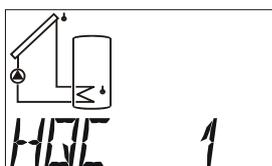
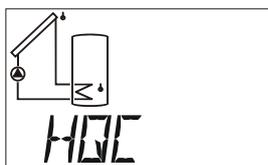
If one of the two control outputs is set to "STAT N" or "STAT I" and the function control is activated, then if an error occurs, the control output is switched over. Subsequently an auxiliary relay can be used to forward this error message to a signalling device.

Heat quantity counter **HQC** (3 times)

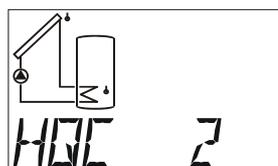
The device also has a function for determining the heat quantity. It is deactivated ex works. A heat quantity meter fundamentally requires three specifics. These are:

pre-run temperature, return temperature, flow rate (volume flow)

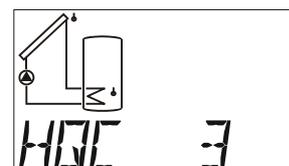
In solar systems a correct installation of sensor (see sensor installation - collector sensor on pre-run collection tube, tank sensor on return outlet) leads automatically to correct recording of the specified temperatures. However, the heat quantity figures will be affected by losses in the pre-run line. In order to increase accuracy even more it is necessary to specify the anti-freeze share in the heat transfer medium since the anti-freeze reduces its heat-transporting capacity. The flow rate can be made as a direct entry or via an additional sensor.



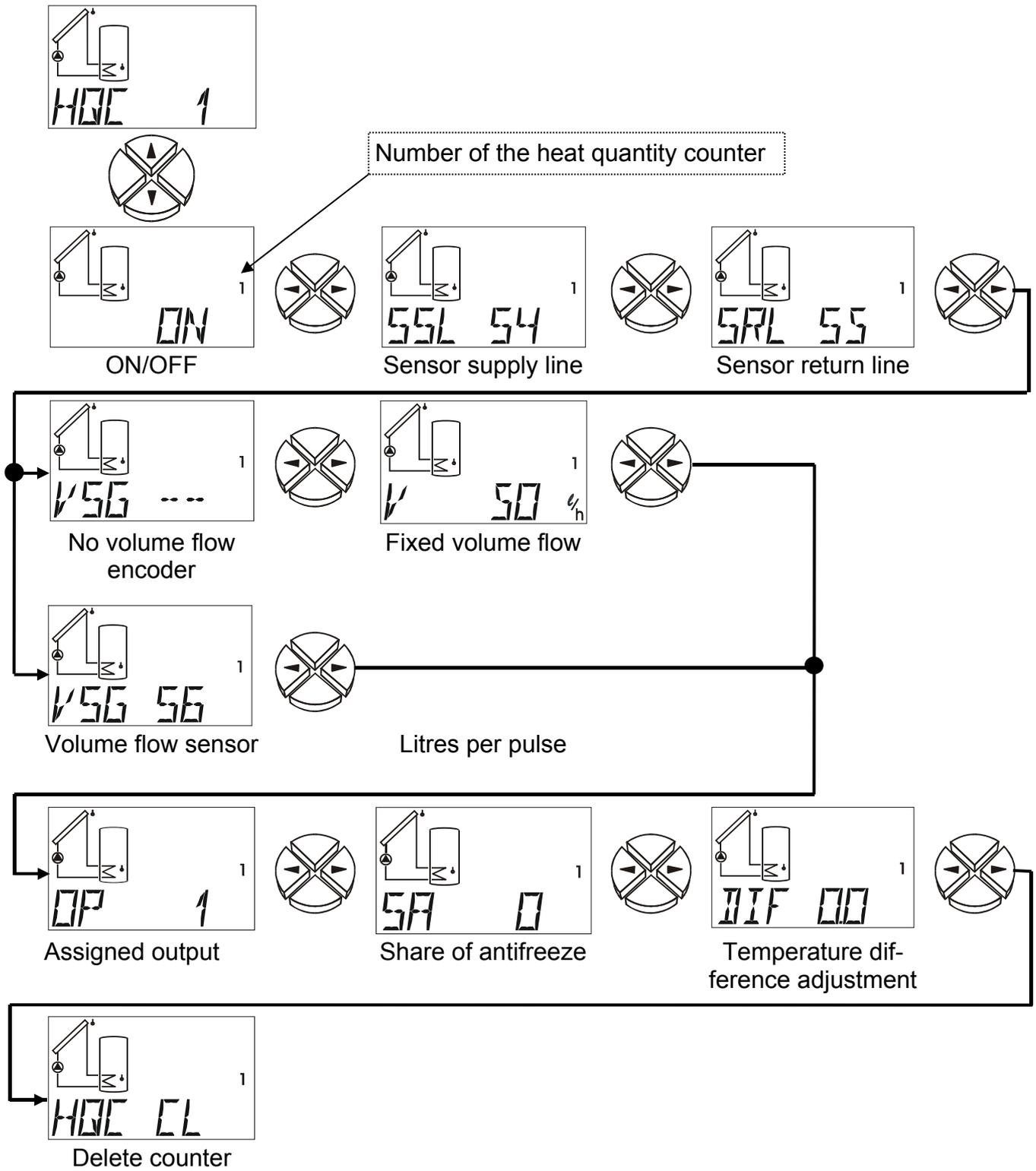
Heat quantity counter 1



Heat quantity counter 2



Heat quantity counter 3



When using Vortex sensors without DL connection the supply can be made from one of the control outputs. For this purpose the appropriate control output must be set to 5 V.

ON/OFF select / disable heat counter (ex works = OFF)

SSL Sensor input for supply line temperature (ex works = S4)
Setting range: S1 to S6 Input of the pre-run sensor
E1 to E9 Value from external sensor via DL

SRL Sensor input for return line temperature (ex works = S5)
Setting range: S1 to S6 Input of the return sensor
E1 to E9 Value from external sensor via DL

VSG Sensor input for volume flow encoder (ex works = --)
The pulse encoder **VSG** can only be connected to input S6. For this purpose the following settings must be made in the **SENSOR** menu without fail:
S6 VSG volume flow sensor with pulse encoder
LPI Litres per pulse
Setting range: VSG S6 = volume flow encoder **VSG** at input 6.
VSG E1 to E9 = Value from external sensor via DL
VSG -- = no volume flow encoder → fixed volume flow. For the calculation of the heat amount, the set volume flow is only used if the set output is active

V Volume flow in litres per hour. If no volume flow encoder has been set, a fixed volume flow can be preset in this menu. If a set output is not active, the volume flow is assumed to be 0 litres/hour.
As activated speed control can produce constant changes in volume flow, this method is not suited to use with speed control. (ex works = 50 l/h)
Setting range: 0 to 20000 litres/hour in increments of 10 litre/hour

OP Assigned outputs. The set/measured volume flow is only used to calculate the heat quantity if the output specified here is active (or at least one of several outputs). (ex works = --)
With pump-valve systems, the allocated outputs must be adjusted according to the basic diagram (e.g. with program 49: OP 12)
Setting range: OP = -- heat quantity is calculated without any consideration to the outputs.
Combinations of all outputs (e.g. OP 1, OP 23, OP 123)

SA Share of antifreeze in the heat transfer medium. An average has been calculated from the product specifications of all of the major manufacturers; this average is used in the table of mixing ratios. This method generally produces an additional maximum error of one percent. (ex works = 0%)
Setting range: 0 to 100% in increments of 1%

DIF Temporary temperature **difference** between the flow and return line sensor (Maximum display ± 8.5 K, above an arrow is displayed). If both sensors are immersed in one bath for test reasons (with both thus measuring the same temperatures), the device should display “**DIF 0**”. Sensor and measurement equipment tolerance may, however, lead to a displayed difference under **DIF**. If this display is set to zero, the computer saves the difference as a correction factor and then calculates the heat amount adjusted by the natural measurement error. **This menu item thus provides a way to calibrate to system. The display may only be set to zero (i.e. changed) if both sensors have the same measurement conditions (same bath).** In addition, the temperature of the test medium should be around 50-60°C.

HQC CL Clear heat quantity counter. The cumulative amount of heat can be reset with the ↵ key (=enter).

If the amount of heat is zero, **CLEAR** is displayed in this menu item.

If the heat counter has been activated, the following are displayed in the basic menu:

the current output in kW

the amount of heat in MWh and kWh

of the volume flow in litres/hour

NOTICE: If an error (short circuit, interruption) occurs at one of the two set sensors (supply sensor, return sensor) for the heat counter, the current output is set at 0, i.e. no heat is counted.

NOTICE: As the internal storage (EEPROM) has only a limited number of write cycles, the totalled heat quantity is saved only once per hour. For this reason, it is possible that a power failure can result in loss of the heat-quantity data for one hour.

Tips on accuracy:

A heat counter can only be as exact as its sensors and equipment. In the range from 10°C to 90°C the standard solar control sensors (PT1000) have an accuracy of approximately ± 0.5 K. For KTY sensors the equivalent figure is ± 1 K. The unit's measurement equipment is accurate down to ± 0.5 K according to laboratory measurements. PT1000 sensors may be more accurate, but they have a weaker signal that increases the error. In addition, the proper installation of the sensors is crucial and can increase error considerably if installed improperly.

If all of the tolerances cumulate in a worst-case scenario, the error would be 40% (KTY) at a typical temperature difference of 10 K! However, normally the error should be below 10% as the equipment error affects all of the input channels the same and the sensors are from the same production batch. The tolerances thus cancel each other out somewhat. In general: the greater the differential temperature, the smaller the error. The measurement results should always be seen just as guide values in all respects. The adjustment due to measurement differences (see **DIF**;) leads to a measurement error in standard applications of around 5%.

"Step by step" setting of the heat quantity counter

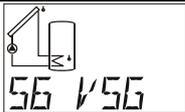
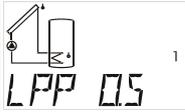
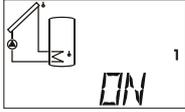
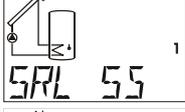
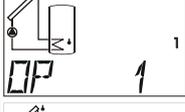
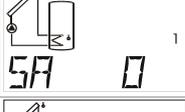
You have the option of using 2 different volume flow encoders:

- ◆ the pulse encoder VSG and
- ◆ the FTS....DL, which is connected to the data link.

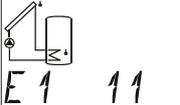
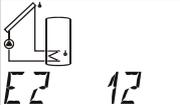
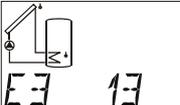
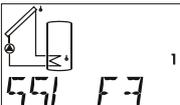
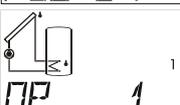
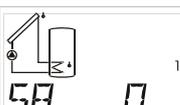
If you do not use a volume flow encoder, then you can only set a fixed volume flow.

In the following, the necessary settings are displayed "step by step".

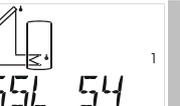
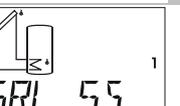
VSG (pulse encoder)

1		The VSG (pulse encoder) must only be connected to input 6, hence: menu "SENSOR", sensor setting S6 to "S6 VSG"
2		Checking and possible alteration of the LPP value (litre per impulse)
3		Access to menu "HQC", selection of heat quantity counter 1 - 3, setting to "ON"
4		Setting of the pre-run sensor in the SSL display, in the example shown, sensor S4
5		Setting of the return sensor in the SRL display, in the example shown, sensor S5
6		Entry of "S6" in the VSG display as the VSG is the sensor S6
7		Specification of the allocated outputs OP, dependent on the selected program. With pump-valve systems, the allocated outputs must be adjusted according to the basic diagram (e.g. with program 49: AG 12).
8		Indication of the antifreeze fraction SA in %
9		Possible sensor compensation as per the operating manual

FTS...DL (Example: Fitting in the return, only 1 FTS4-50DL in use, use of an external sensor for the pre-run which is connected to the FTS4-50DL)

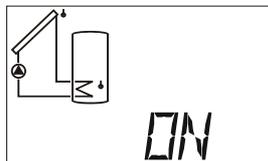
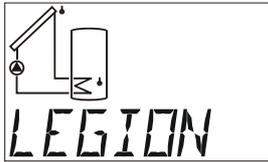
1		The FTS4-50DL is connected to the data link (external sensor), hence: menu "EXT DL", setting of the volume flow encoder in the display of the external sensor "E1": 11 (address 1, index 1)
2		Setting the sensor temperature of the FTS4-50DL: Menu "EXT DL", in the display "E2": 12 (address 1, index 2)
3		If an external temperature sensor is connected for the pre-run on the FTS4-50DL: menu "EXT DL", in the display "E3": 13, Pt1000 sensor (address 1, index 3) is used
4		Access to menu "HQC", selection of heat quantity counter 1 - 3, setting to "ON"
5		Setting of the pre-run sensor in the "SSL" display, if, as shown in the example, external sensor: E3 (see point 3), otherwise specification of the corresponding pre-run sensor S1 - S6
6		Setting of the return sensor in the SRL display, by using the temperature sensor on the FTS4-50DL: E2 (see point 2)
7		Display VSG: entry VSG E1, i.e. the volume flow encoder is external sensor E1 (see point 1)
8	  	Specification of the allocated outputs OP, dependent on the selected program, specification of the antifreeze fraction and sensor compensation

No volume flow encoder:

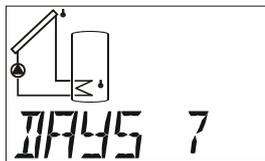
1		Access to menu "HQC", selection of heat quantity counter 1 - 3, setting to "ON"
2		Setting of the pre-run sensor in the SSL display, in the example shown, sensor S4
3		Setting of the return sensor in the SRL display, in the example shown, sensor S5
4		Entry of "--" in the VSG display, as no volume flow encoder is being used
5		Entry of the fixed volume flow in litres/hour of the allocated output (it makes sense to only allocate one output)
6	  	Specification of the allocated output OP, dependent on the selected program, specification of the antifreeze fraction and sensor compensation

Legionella function **LEGION**

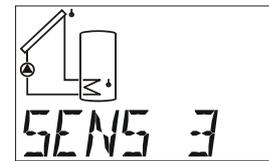
Protective function against the formation of legionella. If the specified tank temperature **DV** is not reached at the monitored sensor within the time interval for the duration of the runtime **RT**, then an output (e.g. **electric heating element**) is switched on for the duration of the runtime **RT** and maintained via the temperature threshold **DV**. If the temperature threshold is exceeded during the time interval for the duration of the runtime **RT** (e.g. by the solar system) the time interval is reset to zero. The time remaining is shown in the main level after the temperature. If the function is active then "**LEGION**" appears in the menu **△Status**.



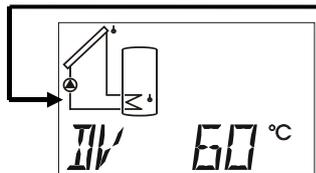
ON/OFF



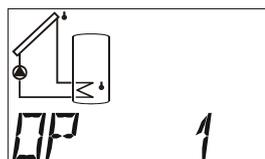
Interval time



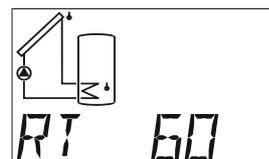
Monitored sensor



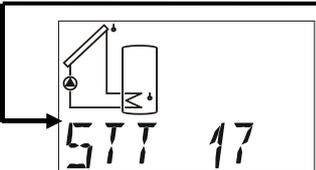
Temperature threshold



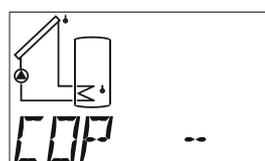
Affected outputs



Runtime



Starting time



Control output

ON / OFF Legionella function ON/OFF (ex works = OFF)

DAYS Time lapse in **days**. If the temperature at the specified sensor does not exceed the specified temperature threshold **DV** within the time period **RT**, the selected output is switched on.

Adjustment range: 1 to 7 days (ex works = 7 days)

SENS Specifies which **sensor** is to be monitored.

Adjustment range: S1 to S6 (ex works = S3)

DV Nominal value. This temperature must be exceeded by the set sensor during the interval time for the duration of the running period **RT**. The selected output is switched on upon activation of the function for the duration of the runtime **RT** and the sensor is maintained above the nominal value **DV** (hysteresis ON = 5K, hysteresis OFF = 3K). Adjustment range: 0 to 99°C in 1°C steps (ex works = 60°C)

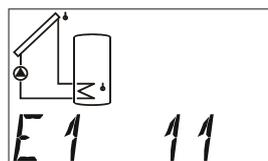
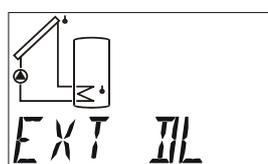
OP This output is switched on if the selected sensor does not exceed the temperature threshold within the specified time interval **RT**.

Adjustment range: Combination of all outputs (e.g. OP 1, OP 23, OP 123).

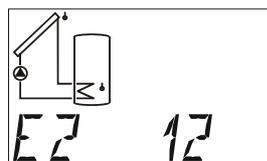
(ex works = OP1)

- RT** Minimum runtime. If the specified tank temperature **DV** is not reached at the monitored sensor within the time interval for the duration of the runtime **RT**, then an output is switched on for the duration of the runtime **RT** and maintained via the temperature threshold **DV**.
Setting range: 0 – 90 min in 1min steps (ex works = 60min)
- STT** Starting time. The output is enabled from this time for an active function.
Adjustment range: 0 – 23 hour (ex works = 17 hour)
- COP** Control output. The selected control output 1 or 2 is switched on simultaneously with the selected output with step 100. This makes it possible to use the auxiliary relay HIREL-STAG (special accessory) for a burner requirement request.
Important: The corresponding control output must be activated in the COP menu.
Adjustment range: Combinations of all control outputs (ex works = --)

External sensors *EXT DL*

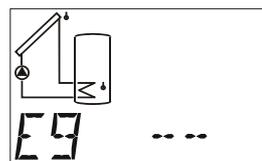


Address for
External value 1



Address for
External value 2

...



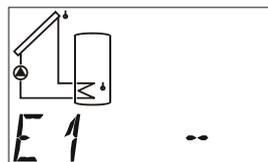
Address for
External value 9

Electronic sensors for temperature, pressure, humidity, differential pressure, etc. are also available in the **DL** version. In this case, the supply and signal transmission takes place via the **DL bus**.

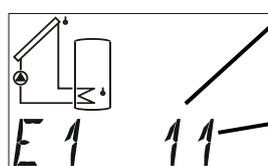
Up to 9 values from external sensors can be read via the DL bus.

The values of the electronic sensors can be taken from sensor inputs for further control tasks (adjustment in the SENSOR menu, transfer of values).

Examples:



The external value 1 is deactivated and faded out in the main level.



The **front** number indicates the main address of the external sensor. This can be set to between 1 and 8 on the sensor according to its operating instructions.

The **rear** number indicates the index of the sensor value. Since external sensors can transmit numerous values the value required from the sensor is defined via the index.

The setting of the address and index can be taken from the respective data sheets.

Due to the relatively high power requirement, the "**bus load**" must be considered: The controller UVR 63 delivers the maximum bus load, 100%. For example, the electronic sensor FTS4-50DL has a bus load of 25%, therefore up to a max. 4 FTS4-50DL can be connected to the DL bus. The bus loads of the electronic sensors are listed in the technical data of the respective sensors.

Simultaneous power supply to a boot loader and external sensors is not possible. In this case, the boot loader must be supplied via a power pack (CAN-NT).

Drain-Back Function *DRAINB*

This additional function may only be activated with programs for a collector field with a consumer (e.g. program 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 tank, which when the pump is stationary receives all the heat transfer medium above the tank.

System start up is triggered either by a **radiation sensor** or by the exceeding of the temperature difference **diff ↑** between the **collector-** and **tank 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 ↓**. In the following **stabilisation time** the pump continues to run irrespective of the temperature difference **diff ↓** at the **calculated speed**.

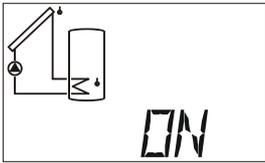
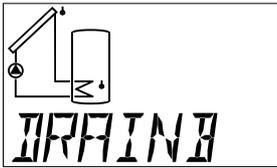
If the pump is switched off during normal operation (e.g. as a result of undershooting of the temperature difference **diff ↓** or collector overtemperature switch-off), then the heat transfer medium runs out of the collector field back to the expansion tank.

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 filling time**, the solar pump is switched off and the error message **DB ERR** appears in the status menu. The system can only restart after resetting of the controller by switching it on and off.

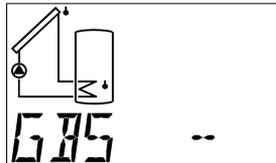
For the speed control of pump 1 the pump speed control **PSC** (for standard pumps) or the control output **COP 1** (for electronic pumps with 0-10V or PWM input) must be activated (see the corresponding chapter). It makes sense to define a minimum speed **MIN** for the stabilisation time, that safeguards the circulation.

If an **electronic pump with a 0-10V or PWM input** is used as a booster pump during the filling time, the control output **COP 2** must be activated and linked to the input of the booster pump. During the filling time, the maximum stage is output.

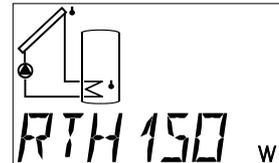
The start function **STARTF** may **not** be activated in conjunction with the drain-back function. If the drain-back function is activated the frost protection function is blocked (with the exception of program 4).



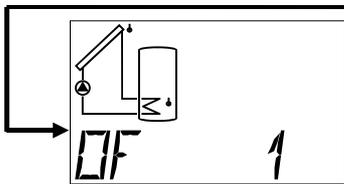
ON/OFF



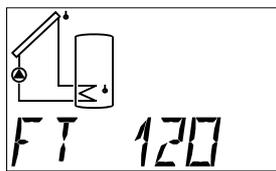
Radiation sensor



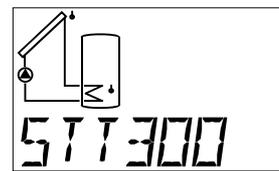
Radiation value
Radiation threshold



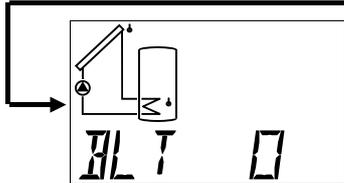
Outputs filling



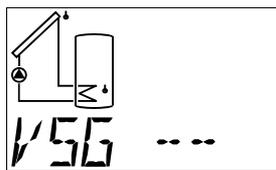
Filling time



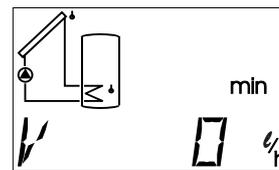
Stabilisation time



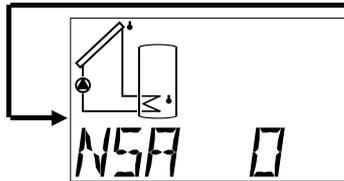
Blocking time



Volume flow sensor
Low water



Minimum flow low
water



Start attempts
counter

ON / OFF Drain-back function ON /OFF (ex works = OFF)

GBS Specification of a sensor input if a Global radiation sensor is used. If no temperature sensor is available, then only the collector sensor temperature is referenced for starting of the drain-back function. (ex works = --)

Adjustment range:	S1 to S6	Radiation sensor input
	E1 to E9	External sensor value
	GBS --	= No radiation sensor

- RTH** Radiation value (radiation threshold) in W/m^2 , above which filling is permitted when using a radiation sensor. (ex works = $150W/m^2$)
Adjustment range: 0 to $990W/m^2$ in $10W/m^2$ steps
- OF** Outputs, that are responsible for filling. It is also possible to use a "booster pump". The output for the 2nd pump must be a free output, that is not already being used for other purposes. (ex works = OF 1)
Adjustment range: Combination of all outputs (e.g. OF 1, OF 23, OF 123).
- FT** Filling time. After system start-up, due to the radiation value or the temperature difference between the collector sensor and tank sensor, the outputs for filling of the system run at full speed.
(ex works = 120 sec)
Adjustment range: 0 – 990 seconds in 10 second steps
- STt** Stabilisation time. After filling of the system, the solar pump participating in the start runs during the stabilisation time in order to heat up the collector, even if the set difference **diff** ↓ is undershot. If speed control is activated, the pump runs at the speed calculated by the functions **PSC** or **COP** (minimum speed stage **MIN**).
(ex works = 300 sec)
Adjustment range: 0 – 990 seconds in 10 second steps
- BLT** Blocking time between two filling processes. (ex works = 0 min)
Adjustment range: 0 to 99 minutes in 1 minute steps
- VSG** Volume flow sensor setting for low water protection. (ex works = --)
Adjustment range: S1 to S6 Volume flow sensor input
E1 to E9 External sensor value
VSG -- = No volume flow sensor
- V min** Minimum volume flow **after the filling time**. If the value is not reached, the participating solar outputs are switched off. The system can only restart after resetting of the controller by switching it off and on.
(ex works = 0 l/h)
Adjustment range: 0 to 990 l/h in 10 l/h steps
- NSA** Number of Start attempts (= counter). Resetting takes place automatically upon a start attempt, if the last attempt was more than four hours ago.

Status display **Status**

The status display offers information in special system situations and when problems occur. It is primarily intended for use with solar power systems but can also be useful with other diagrams. The status display can, however, then only be set off due to an active function check or defective sensors S1 to S6. In solar applications, there are three status ranges:

- ◆ **Function check and collector excess temperature not active** = no system response is analyzed. Only a bar appears in the display under  **Status**.
- ◆ **Collector excess temperature is active** = the excess temperature that occurs at the collector during system standstill only displays **CETOFF** (collector excess temperature cut-off active) under  **Status** during this time. The display  **Status** does not flash.
- ◆ **Function check is active** = monitoring for interruptions (**IR**) / short circuits (**SC**) of sensors and circulation problems (if also activated). If the output is active and the differential temperature between the sensors is greater than 60K for more than 30 minutes, the error message **CIRC.ER** (circulation error) is issued. The index in the lower display line shows the output where a circulation error has occurred. The index in the side display area indicates the output, at which the circulation error occurred.
- ◆ Legionella protection function is active = During the runtime **RT LEGION** is displayed under  **Status**.
- ◆ Drain-back function with low water protection is active = in the event of low water **Stat DB ERR** is displayed and the solar pump switched off. A reset is only possible if the controller is switched off and on.

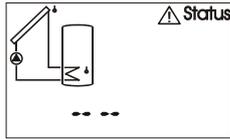
Error messages remain displayed (and  **Status** blinks) even after the error has disappeared; they have to be deleted in the status menu via the command **CLEAR**.

OK appears under  **Status** if the monitoring functions are activated and the system is running well. If anything special happens,  **Status** blinks regardless of the display position.

You can only enter the status menu if there has been an error. Then, **ENTER** is displayed instead of **OK** or **CETOFF** in  **Status**.

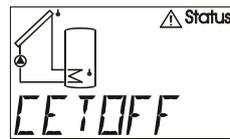
If one of the two control outputs is set to "**STAT N**" or "**STAT I**" and the function control is activated, then if any of the errors "sensor open circuit, sensor short-circuit or circulation error" occur, the control output is switched over. Subsequently an auxiliary relay can be used to forward this error message to a signalling device. Upon collector excess temperature switch-off **CETOFF**, the control output does not switchover.

Function check disabled



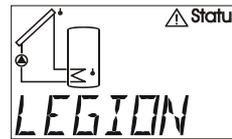
Function check disabled

or:



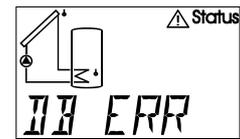
Collector - excess temperature - cut-off is active

or:



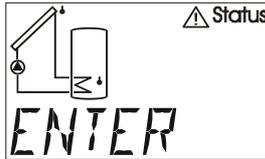
Legionella function is active

or:



Drain-back low water

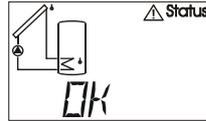
Function check activated



Function check activated → error occurred

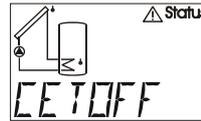


or:



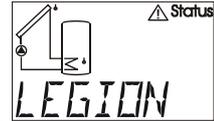
Function check activated → no error

or:



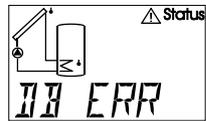
Collector – over temperature legionella function switch-off active (no error occurred)

or:

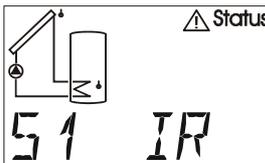


legionella function active

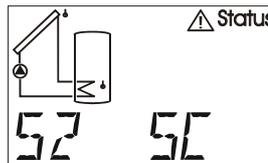
or:



Drain-back low water

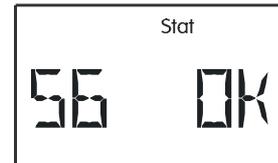


Error sensor 1 (interruption)

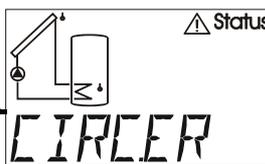


Error sensor 2 (short circuit)

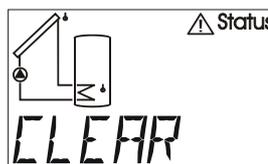
...



Sensor 6 no error

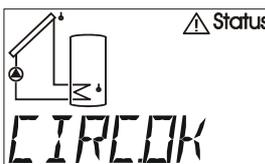


Circulation error only displayed when activated

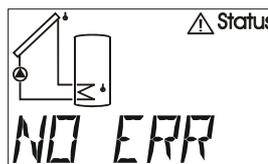


Delete errors (only possible, if all errors have been cleared)

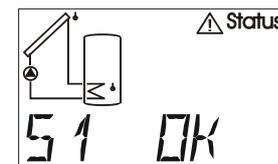
...



No circulation error existing



No error existing



Sensor 1 no error

Troubleshooting

In general, all of the settings in the menus **PAR** and **MEN** and the terminals should be checked if there is an error.

Malfunction, but “realistic” temperatures:

Check the program number.

- ◆ Check the thresholds for on/off and the set differential temperatures. Have the thermostat and differential thresholds been reached?
- ◆ Were the settings in the submenus (**MEN**) changed?
- ◆ Can the output be switched on/off in manual mode? - If endurance runs and standstill at the output produce an appropriate reaction, the unit is definitely not broken.
- ◆ Are all of the sensors connected to the right terminals? - Heat the sensor using a lighter and check the display.

Incorrect temperature displayed:

- ◆ If a value such as -999 is displayed when a sensor short-circuits or 999 if there is an interruption, the cause may not be a material or terminal error. Are the correct sensor types (KTY or PT1000) selected under the menu **MEN / SENSOR**? The factory settings have all inputs set to **PT(1000)**.
- ◆ The sensor can also be checked without a measuring device simply by changing the part that is probably defective with one that works at the strip terminal and checking the display. The resistance measured with an ohmmeter should have the following value according to the temperature:

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 settings of the parameters and menu functions ex works can be restored at any time using the down key (entry) when plugging the unit in. If this occurs, WELOAD will appear in the display for three seconds. In doing so the program number with the specific parameters of the factory setting remains saved.

If in spite of connection to the supply voltage, the device is not working the 3.15A fast-acting fuse which protects the control and the outputs should be checked or replaced.

As the programs are constantly being revised and improved, there may be a difference in the numbering of the sensors, pumps, and programs. Only the instruction manual provided with the device delivered applies (identical serial number). The program version of the manual must correspond to the one for the device.

If the control system malfunctions despite these checks as described above, please contact your retailer or the manufacturer directly. The cause of the error can only be determined if the **table of settings has been completely filled** in along with a description of the error. If possible, also include a hydraulic diagram of the system.

Table of settings

If the control system fails unexpectedly, all of the settings should be reset for initial configuration. In this case, problems are inevitable if all of the setting values are entered in the following table. **If there are questions, this table has to be provided.** Only then is a simulation possible to reproduce the error.

EX factory settings (ex works)

CS Controller settings

	EX	CS		EX	CS
Values					
Sensor S1		°C	External value E1		
Sensor S2		°C	External value E2		
Sensor S3		°C	External value E3		
Sensor S4		°C	External value E4		
Sensor S5		°C	External value E5		
Sensor S6		°C	External value E6		
			External value E7		
Speed stage SPS			External value E8		
Analogue stage 1 ANL			External value E9		
Analogue stage 2 ANL					

Basic parameters PAR					
Equipment version			Program PR	0	
Linking of output LO	OFF		Priority assignm. PA	OFF	
max1 off ↓		°C	max1 on ↑		°C
max2 off ↓		°C	max2 on ↑		°C
max3 off ↓		°C	max3 on ↑		°C
min1 on ↑		°C	min1 off ↓		°C
min2 on ↑		°C	min2 off ↓		°C
min3 on ↑		°C	min3 off ↓		°C
diff1 on ↑		K	diff1 off ↓		K
diff2 on ↑		K	diff2 off ↓		K
diff3 on ↑		K	diff3 off ↓		K

Time window TIME W and TIMER					
Time window 1			Time window 2		
Outputs OP	--		Outputs OP	--	
Switch-on time ↑	00.00		Switch-on time ↑	00.00	
Switch-off time ↓	00.00		Switch-off time ↓	00.00	
Time window 3			Timer		
Outputs OP	--		Outputs OP	--	
Switch-on time ↑	00.00		Switch-on time ↑	00.00	
Switch-off time ↓	00.00		Switch-off time ↓	00.00	

Output assignment			Output settings		
A1 <=	OFF		Output 1	AUTO	
A2 <=	OFF		Output 2	AUTO	
A3 <=	OFF		Output 3	AUTO	

	EX	CS		EX	CS
Sensor type SENSOR					
Sensor S1	PT1000		Average determ. AV1	1,0 s	s
Sensor S2	PT1000		Average determ. AV2	1,0 s	s
Sensor S3	PT1000		Average determ. AV3	1,0 s	s
Sensor S4	PT1000		Average determ. AV4	1,0 s	s
Sensor S5	PT1000		Average determ. AV5	1,0 s	s
Sensor S6	PT1000		Average determ. AV6	1,0 s	s
S6 = VSG ⇒ Litres per pulse LPP	0,5				

System protection function SYS PF					
Collector excess temperature CET 1			Frost protection function FROST 1		
ON/OFF	ON		ON/OFF	OFF	
Collector sensor COLL	1		Collector sensor COLL	1	
Outputs OP	1		Outputs OP	1	
Switch-off temp. max↓	130°C	°C	Switch-on temp. min↑	2°C	°C
Switch-on temp. max↑	110°C	°C	Switch-off temp. min↓	4°C	°C
Collector excess temperature CET 2			Frost protection function FROST 2		
ON/OFF	OFF		ON/OFF	OFF	
Collector sensor COLL	2		Collector sensor COLL	2	
Outputs OP	2		Outputs OP	2	
Switch-off temp. max↓	130°C	°C	Switch-on temp. min↑	2°C	°C
Switch-on temp. max↑	110°C	°C	Switch-off temp. min↓	4°C	°C
Collector cooling function COOLF			Anti-blocking protection ASC		
ONN/OFF	OFF		ON/OFF	OFF	
Sensor SENS	1		Interval time DAYS	7	
Nominal value DV	80°C	°C	Starting time ↑	15.00	
Switch-on time ↑	22.00		Pump run time PRT	15s	s
Switch-off time ↓	06.00		Outputs OP	1	
Outputs OP	1				
Speed stage SPS	30				

Start function STARTF					
Start function 1 STF1			Start function 2 STF2		
ON/OFF	OFF		ON/OFF	OFF	
Collector sensor COLL	1		Collector sensor COLL	2	
Radiation sensor GBS	--		Radiation sensor GBS	--	
Radiation thresh. RTH	150 W	W	Radiation thresh. RTH	150 W	W
Outputs OP	1		Outputs OP	2	
Rinse outputs OPS	1		Rinse outputs OPS	2	
Pump run time PRT	15 s	s	Pump run time PRT	15 s	s
Interval time INT	20 min	min	Interval time INT	20 min	min

	EX	CS		EX	CS
Solar priority PRIOR					
Radiation sensor GBS	--		Radiation value RTH	150 W	W
Rinse outputs OPS	1		Waiting time WTL	5 min	min
Pump run time PRT	20 min	min			

After-running time ART					
AT 1	0 s	s	AT 2	0 s	s
AT 3	0 s	s			

Pump speed control PSC					
Abs.value control. AC	--		Desired value DVA	50°C	°C
Differential control DC	--		Desired value DVD	10 K	K
Event control EC	--		Threshold value TVE	60°C	°C
			Desired value DVE	130°C	°C
Proportional part PRO	5		Integral part INT	0	
Differential part DIF	0				
Minimum speed MIN	0		Maximum speed MAX	30	
Delay time ALV	0				

Control output 0-10V / PWM COP					
Control output COP 1					
OFF/5V/0-10V/PWM/ STAT N/STAT I	OFF		Outputs OP	--	
Abs.value control. AC	--		Desired value DVA	50°C	°C
Differential control DC	--		Desired value DVD	10 K	K
Event control EC	--		Threshold value TVE	60°C	°C
			Desired value DVE	130°C	°C
Proportional part PRO	5		Integral part INT	0	
Differential part DIF	0		Output mode	0-100	
Min. analog stage MIN	0		Max. analog stage MAX	100	
Delay time ALV	0				
Control output COP 2					
OFF/5V/0-10V/PWM/ STAT N/STAT I	OFF		Outputs OP	--	
Abs.value control. AC	--		Desired value DVA	50°C	°C
Differential control DC	--		Desired value DVD	10 K	K
Event control EC	--		Threshold value TVE	60°C	°C
			Desired value DVE	130°C	°C
Proportional part PRO	5		Integral part INT	0	
Differential part DIF	0		Output mode	0-100	
Min. analog stage MIN	0		Max. analog stage MAX	100	
Delay time ALV	0				

Function control F CHCK					
ON/OFF	OFF		Circulation control CIRC --/A/M	--	
Circulation A1 CC1	--		Circulation A2 CC2	--	
Circulation A3 CC3	--				

	EX	CS		EX	CS
Heat counter <i>HQC</i>					
Heat counter <i>HQC 1</i>					
ON/OFF	OFF				
Flow sensor SSL	S4		Return sensor SRL	S5	
Volume flow encoder VSG	--		or Volume flow V	50 l/h	l/h
Outputs OP	--				
Share of antifreeze SA	0%	%			
Heat counter <i>HQC 2</i>					
ON/OFF	OFF				
Flow sensor SSL	S4		Return sensor SRL	S5	
Volume flow encoder VSG	--		or Volume flow V	50 l/h	l/h
Outputs OP	--				
Share of antifreeze SA	0%	%			
Heat counter <i>HQC 3</i>					
ON/OFF	OFF				
Flow sensor SSL	S4		Return sensor SRL	S5	
Volume flow encoder VSG	--		or Volume flow V	50 l/h	l/h
Outputs OP	--				
Share of antifreeze SA	0%	%			
Legionella protection <i>LEGION</i>					
ON/OFF	OFF				
DAYS	7		Sensor SENS	3	
Nominal value DV	60°C	°C	Outputs OP	1	
Runtime RT	60	min	Starting time STT	17	h
Control output COP	--				
External sensors <i>EXT DL</i>					
External sensor E1	--		External sensor E2	--	
External sensor E3	--		External sensor E4	--	
External sensor E5	--		External sensor E6	--	
External sensor E7	--		External sensor E8	--	
External sensor E9	--				
Drain-Back Function <i>DRAINB</i>					
ON/OFF	OFF		Radiation sensor GBS	--	
Radiation value RTH	150 W	W	Outputs filling OF	1	
Filling time FT	120 s	s	Stabilization time STT	300 s	s
Blocking time BLT	0 min	min	Volume flow sensor VSG	--	
Min. flow V	0 l/h	l/h			

Technical data

Power supply: 210 ... 250V~ 50-60 Hz
Power input: max. 3 VA
Fuse: 3.15 A fast-acting (device + output)
Supply cable: 3x 1mm² H05VV-F conforming to EN 60730-1
Case: plastic: ABS, flame resistance: Class V0 to UL94 Norm
Protection rating: II – protective insulation 
Protection class: IP40
Dimensions (W/H/D): 152x101x48 mm
Weight: 210 g
Allowed ambient temperature: 0 to 45° C

6 inputs: 6 inputs- optional for temperature sensor (KTY (2 kΩ), PT1000),
Radiation sensor, as digital input,
or as pulse input for volume flow encoder (only input 6)

3 outputs: output A1 ... Triac output (minimum load of 20W required)
output A2 ... relay output
output A3 ... relay output

Rated current load: Output 1: max. 1.5 A ohmic inductive cos phi 0.6
Output 2 and 3: max. 2.5 A ohmic inductive cos phi 0.6

2 control outputs: 0 - 10V / 20mA individually switchable to PWM (10V / 500 Hz),
supply +5 V DC / 10 mA or connection of the auxiliary relay
HIREL-STAG

Tank sensor BF: diameter 6 mm incl. 2 m cable
BF KTY – to 90°C continuous load
BF PT1000 – to 90°C continuous load

Collector sensor KF: diameter 6 mm incl. 2 m cable with connection box &
overvoltage protection
KF KTY – to 240°C continuous load (momentary to 260°C)
KF PT1000 – to 160°C continuous load

The sensor lines on the inputs having a cross-section of 0.50 mm² can be extended to a length of 50 m.

Consumers (e.g.: pumps, valves...) having a cable cross-section of 0.75 mm² can be connected at a distance of up to 30 m.

Differential temperature: adjustable from 0 to 99°C

Minimum threshold / Maximum threshold: adjustable from -30 to +150°C

Temperature display: PT1000: -50 to 250°C , KTY: -50 to 150°C

Resolution: from -40 to 99.9°C in 0.1°C increments; from 100 to 140°C in 1°C increments

Accuracy: typical +/- 0.3%

Information on the Eco-design Directive 2009/125/EC

Product	Class ^{1,2}	Energy efficiency ³	Standby max. [W]	Typ. power consumption [W] ⁴	Max. power consumption [W] ⁴
UVR63	1	1	1.8	1.49 / 2.37	1.8 / 2.8

¹Definitions 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

Rights to make technical changes reserved

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EU Declaration of conformity

Document- Nr. / Date: TA17019 / 02/02/2017
Company / 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: UVR63
Product brand: Technische Alternative RT GmbH
Product description: Triple-loop universal controller

The object of the declaration described above is in conformity with Directives:

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/EC Eco-design directive

Employed standards:

EN 60730-1: 2011 Automatic electrical controls for household and similar use –
Part 1: General requirements
EN 61000-6-3: 2007 Electromagnetic compatibility (EMC) - Part 6-3: Generic standards -
+A1: 2011 Emission standard for residential, commercial and light-industrial envi-
+ AC2012 ronments
EN 61000-6-2: 2005 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards -
+ AC2005 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, manual and type label



Issuer: Technische Alternative RT GmbH
A- 3872 Amaliendorf, Langestraße 124

This declaration is submitted by

A handwritten signature in black ink, appearing to read 'Schneider Andreas'. The signature is written in a cursive, flowing style.

Dipl.-Ing. Andreas Schneider, General manager,
02/02/2017

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.

Guarantee conditions

Note: The following guarantee conditions do not in any way limit the legal right to a guarantee, rather expand your rights as a consumer.

1. The company Technische Alternative RT GmbH provides a two-year guarantee from the date of purchase by the end consumer 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 guarantee 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. In 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 overvoltage's or abnormal ambient conditions. Likewise, no guarantee 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 guarantee 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 guarantee result neither in an extension of the guarantee period nor in a resetting of the guarantee period. The guarantee period for fitted parts ends with the guarantee 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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