UVR 61-3

Version 9.5 EN

Three circuit universal controller

Operation
Installation instructions

en

TECHNISCHE ALTERNATIVE

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

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

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

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

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

Deze handleiding is in het Nederlands te downloaden via www.ta.co.at.

Tento návod k obsluze naleznete na internetu i v jiných jazycích na adrese www.ta.co.at.

Ove upute za rukovanje možete naći na internetu i u drugim jezicima na adresi www.ta.co.at.

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 a 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 ENTER	
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**
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 describe these outputs, can be logically linked (AND, OR) in menu "**Par**" with other outputs or used as time switch output.

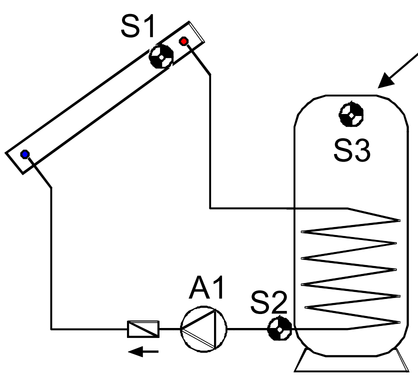
- ♦ In diagrams with a holding circuit (= burner requirement with a sensor, shut-down function with another one), the shut-down transducer is "dominant". In other words, if improper parameters or sensor installation leads to the fulfillment of both the shut-on and shut-off conditions, the shut-off condition has priority.

- ♦ **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 cylinder 1**. If **max1** is exceeded on the sensor 2 (filling cylinder 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 cylinders** during filling.
  - **PSC** (for standard pumps only): The speed control **only** operates when **filling cylinder 1**.

Program 0 - Single solar power system = factory settings



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

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.

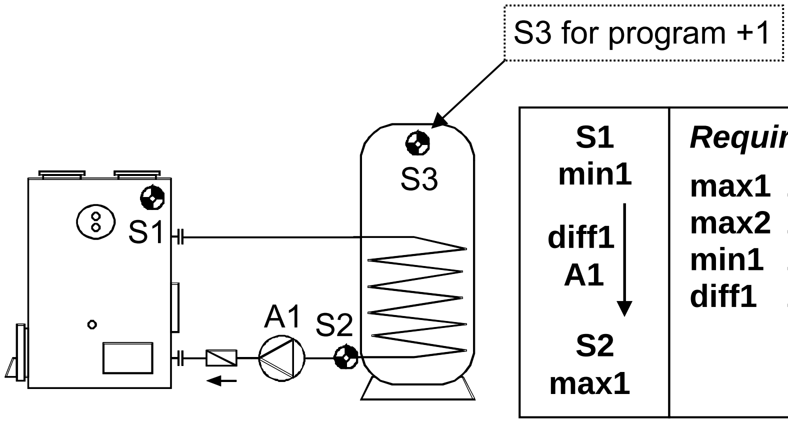
Program 4 – Simple drain-back - solar thermal system with valve

This program can only be selected with activated drain-back function (menu Enter/MEN - DRAINB) selected.
The basic settings are made as in program 0:

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

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) of if low water protection is activated and the set volume flow is not reached after the filling time.

Program 16 - Loading the cylinder from the boiler



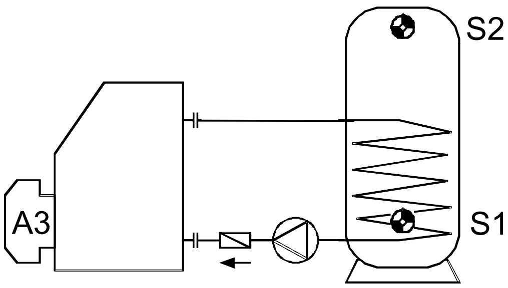
S1 min1 diff1 A1 S2 max1	***Required settings:***
	max1 … limit CYL **S2** → **A1**
	max2 … see all programs +1
	min1 … switch-on temp. boiler **S1** → **A1**
	diff1 … burner **S1** – CYL **S2** → **A1**

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 cylinder sensors



Burner A3 S2 min3 S1 max3	***Required settings:***
	max3 … burner req. off SP **S1** →**A3**
	min3 … burner req. on SP **S2** → **A3**

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.***

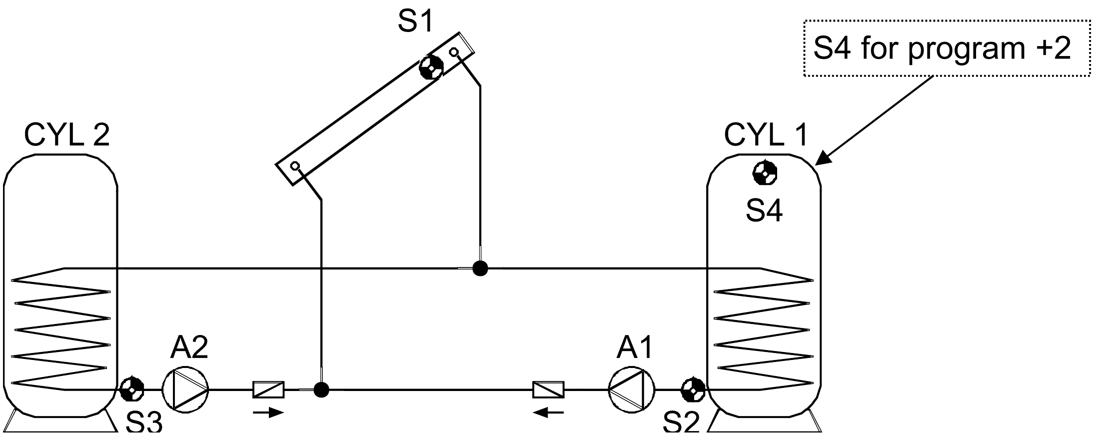
A3 (on) = S2 < min3 ***A3 (off) = S1 > max3***

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 (on) = S2 < min3 ***A3 (off) = S2 > max3***

Program 48 - Solar power system with 2 consumers



S1 min1 diff1 A1 ↙ ↘ diff2 A2 S2 max1 / S3 max2	***Required settings:***	
	max1 … limit CYL 1 **S2**	→ **A1**
	max2 … limit CYL 2 **S3**	→ **A2**
	max3 … see all programs +2	
	min1 … switch-on temp. coll. **S1**	→ **A1, A2**
	min2 … see all programs +4	
	diff1 … coll. **S1** – CYL 1 **S2**	→ **A1**
	diff2 … coll. **S1** – CYL 2 **S3**	→ **A2**
	CET 1 ... OP 1 → OP 12	

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, cylinder 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

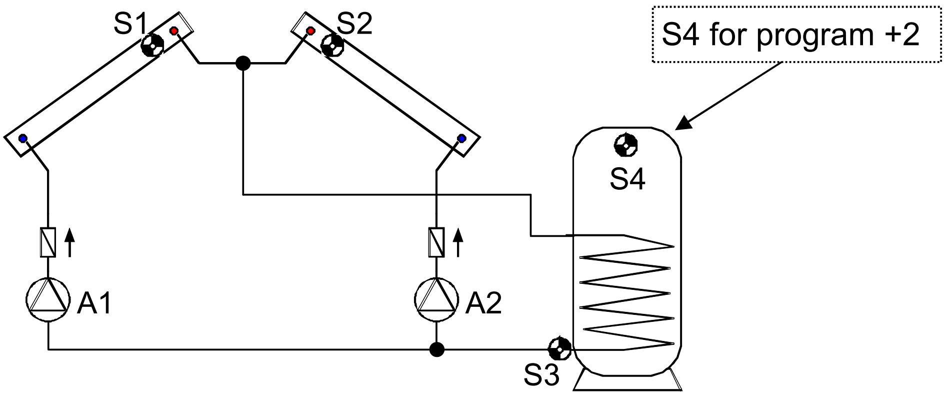
All programs +2:

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 **CYL 1** and **CYL 2** 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



S1 min1 S2 min2 diff1 A1 diff1 A2 S3 max1	***Required settings:***	
	max1 … limit CYL **S3**	→ **A1, A2**
	max2 … see all programs +2	
	min1 … switch-on temp. coll.1 **S1**	→ **A1**
	min2 … switch-on temp. coll.2 **S2**	→ **A2**
	diff1 … coll.1 **S1** – CYL **S3**	→ **A1**
	… coll.2 **S2** – CYL **S3**	→ **A2**
	diff3 … see all programs +1	
	CET 2 ... → **ON**	

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:

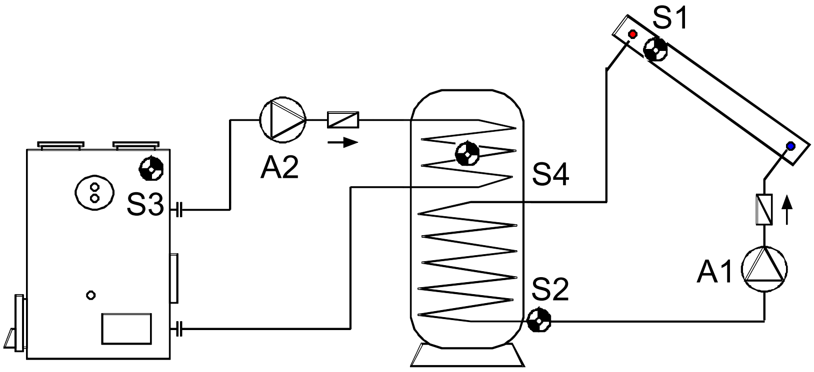
Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

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 cylinder load from boiler



S1 min1 → (diff1, A1) → S2 max1

S3 min2 → (diff2, A2) → S4 max2

Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S4**	→ **A2**
max3	… see all programs +4	
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp. boiler **S3**	→ **A2**
diff1	… coll. **S1** – CYL **S2**	→ **A1**
diff2	… boiler **S3** – CYL **S4**	→ **A2**

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):

S1 min1 → (diff1, A1) → S2 max1 max2

S3 min2 → (diff2, A2) → S2 max1 max2

Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S2**	→ **A2**
max3	… see all programs +4	
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp. boiler **S3**	→ **A2**
diff1	… coll. **S1** – CYL **S2**	→ **A1**
diff2	… boiler **S3** – CYL **S2**	→ **A2**

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:

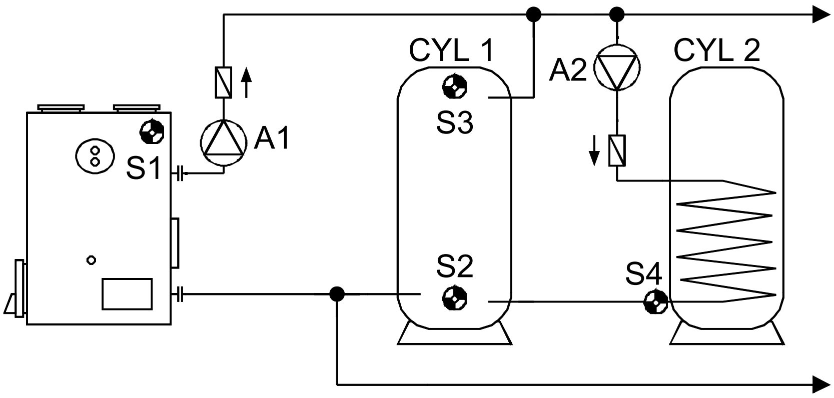
If sensor **S2** has reached ***max1*** (or if **S4** has reached threshold ***max3*** along with all programs +4), pump **A2** is switched on, and pump **A1** keeps running. This provides a cooling function for the boiler / heater without causing standstill temperatures in the collector.

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 cylinder load via boiler fired with solid fuel



S1 min1 → diff1 A1 → S2 max1 ; S3 min2 → diff2 A2 → S4 max2	***Required settings:***	
	max1 … limit CYL 1 **S2**	→ **A1**
	max2 … limit CYL 2 **S4**	→ **A2**
	max3 … see all programs +2	
	min1 … switch-on temp. boiler **S1**	→ **A1**
	min2 … switch-on temp CYL 1. **S3**	→ **A2**
	min3 … see all programs +2	
	diff1 … boiler **S1** – CYL 1 **S2**	→ **A1**
	diff2 … CYL 1 **S3** – CYL 2 **S4**	→ **A2**
	diff3 … see all programs +1, +2	

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 cylinder 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

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

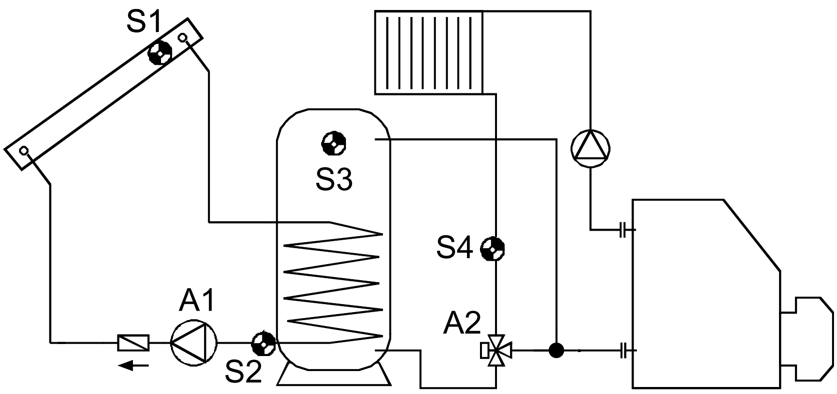
All programs+2: The pump **A3** runs if:

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

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

<u>Program 112 - 2 independent differential loops</u>

Example: Solar thermal system with return flow booster



S1 min1 → S2 max1	S3 min2 → S4 max2	***Required settings:***		
diff1 A1	diff2 A2	**max1**	… limit CYL **S2**	→ **A1**
		max2	… limit return **S4**	→ **A2**
		min1	… switch-on temp. coll. **S1**	→ **A1**
		min2	… switch-on temp. CYL top **S3**	→ **A2**
		diff1	… coll. **S1** – CYL **S2**	→ **A1**
		diff2	… CYL **S3** – return **S4**	→ **A2**

Program 112: Pump **A1** runs, if:

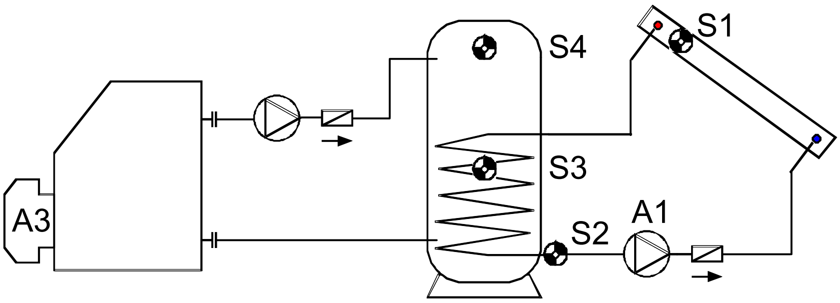
- **S1** is greater than threshold ***min1*** ◆ and **S1** is greater than **S2** by the difference ***diff1***
- and **S2** has not exceeded the threshold ***max1***.

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

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 ***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 ***A3 (off) = S4 > max3***

All programs +2:
In addition, pump **A1** switches between sensors **S4** and **S2** (such as oil boiler - buffer - cylinder system) when difference ***diff2*** is reached.

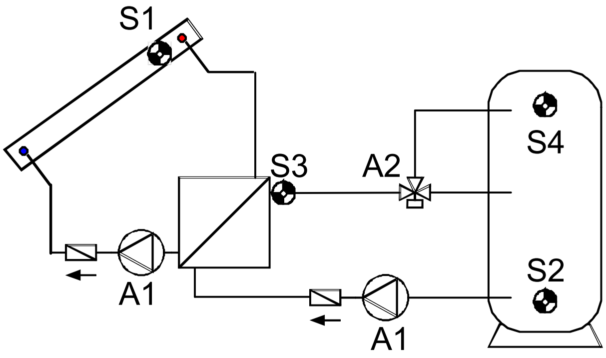
Pump **A1** runs when:

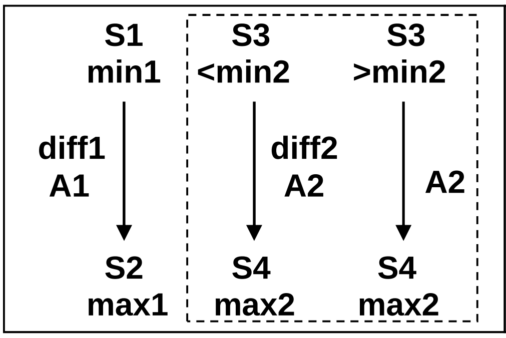
- **S1** is greater than the threshold ***min1*** ◆ and **S1** is greater than **S2** by the difference ***diff1***
- and **S2** has not exceeded the threshold ***max1***,
- or **S4** is greater than threshold ***min2*** ◆ and **S4** is greater than **S2** by the difference ***diff2***
- and **S2** has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

A1 = (S1 > (S2 + diff1) & S1 > min1 & S2 < max1)
or (S4 > (S2 + diff2) & S4 > min2 & S2 < max1)

Program 144 - Solar power system with layered storage cylinder loading

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





Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S4**	→ **A2**
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp. supply l. **S3**	→ **A2**
diff1	… collector **S1** – CYL **S2**	→ **A1**
diff2	… supply line **S3** – CYL **S4**	→ **A2**

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***.

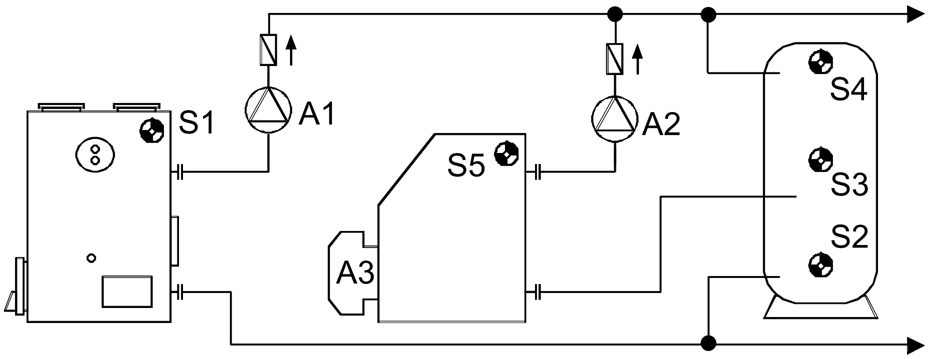
A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = (S3 > min2 or S3 > (S4 + diff2)) & S4 < max2

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



S1 **min1** **diff1** **A1** ↓ **S2** **max1** **S5** **min2** **diff2** **A2** ↓ **S3** **max2**	**Burner** **A3** **S4 min3** **S3 max3**	***Required settings:*** **max1** … limit CYL **S2** → **A1** **max2** … limit CYL **S3** → **A2** **max3** … burner req. off CYL **S3** → **A3** **min1** … switch-on temp. boiler **S1** → **A1** **min2** … switch-on temp. boiler **S5** → **A2** **min3** … burner req. on CYL **S4** → **A3** **diff1** … boiler **S1** – CYL **S2** → **A1** **diff2** … boiler **S5** – CYL **S3** → **A2**

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 ***A3 (off) = S3 > max3***

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

A3 (on) = S4 < min3 ***A3 (off) = S4 > max3*** (dominant)

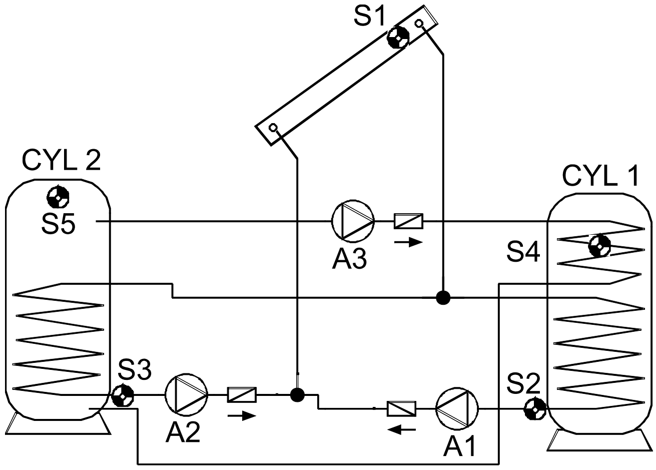
All programs +2: The burner requirement (**A3**) is only admissible if pump **A1** is switched off.

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



S1 min1 → diff1 A1 → S2 max1; S1 min1 → diff2 A2 → S3 max2; S5 min2 → diff3 A3 → S4 max3	***Required settings:***		
	max1	… limit CYL 1 **S2**	→ **A1**
	max2	… limit CYL 2 **S3**	→ **A2**
	max3	… limit CYL 1 **S4**	→ **A3**
	min1	… switch-on temp. coll. **S1**	→ **A1, A2**
	min2	… switch-on temp. CYL 2 **S5**	→ **A3**
	min3	… see all programs +4	
	diff1	… coll. **S1** – CYL 1 **S2**	→ **A1**
	diff2	… coll. **S1** – CYL 2 **S3**	→ **A2**
	diff3	… CYL 2 **S5** – CYL 1 **S4**	→ **A3**
	CET 1 ... OP 1 → OP 12		

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, cylinder 2 is filled by priority.
A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

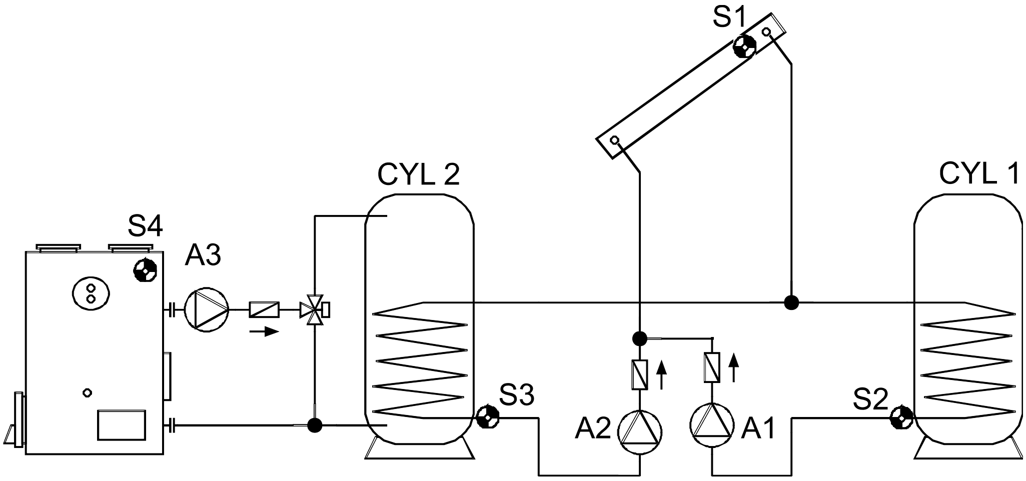
All programs +2: If both cylinders have reached their maximum temperature due to the solar power system, pumps **A1** and **A3** are switched on (reverse cooling function).

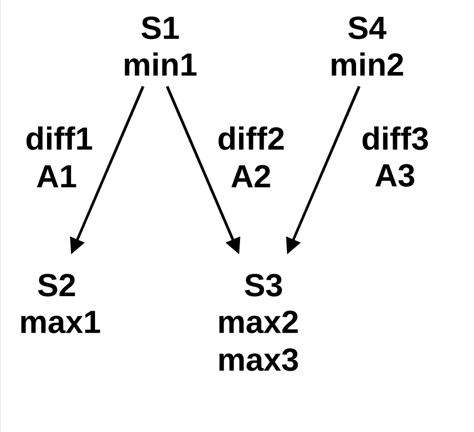
All programs +4: Both solar loops have separate switch-on thresholds at **S1:**
Output **A1** retains ***min1***, and **A2** switches at ***min3***.

All programs +8: The limiting of cylinder CYL 1 is made via the independent sensor **S6** and the maximum threshold **max1** (no maximum threshold on **S2!**)

The **priorities** for **CYL 1** and **CYL 2** 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)





Required settings:

max1	... limit CYL 1 **S2**	→ **A1**
max2	... limit CYL 2 **S3**	→ **A2**
max3	... limit CYL 2 **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** – CYL 1 **S2**	→ **A1**
diff2	... coll. **S1** – CYL 2 **S3**	→ **A2**
diff3	... boiler **S4** – CYL 2 **S3**	→ **A3**

CET 1 ... OP 1 → OP 12

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 ***min2*** - 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, cylinder 2 is filled by priority.
A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

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

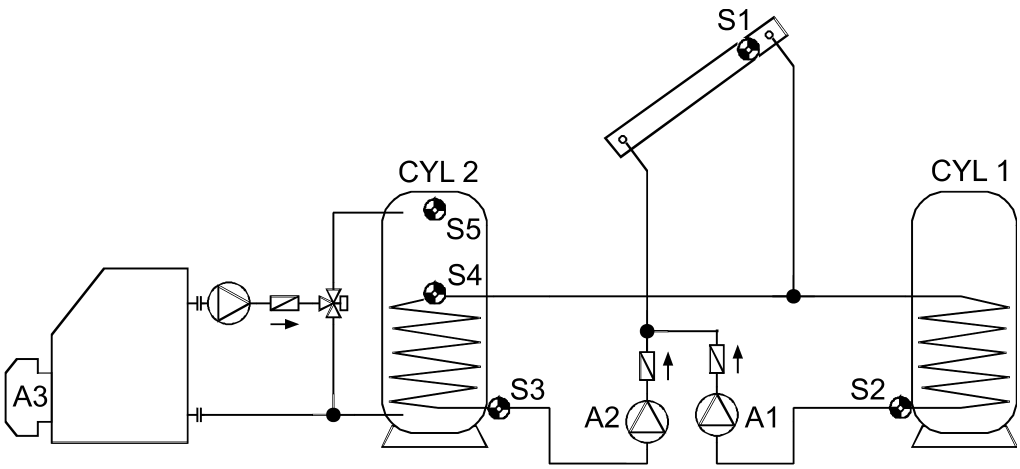
All programs +4:

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

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

The **priorities** for **CYL 1** and **CYL 2** 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



S1 **min1** **diff1 A1** ↙ ↘ **diff2 A2** **S2** **max1** / **S3** **max2**	**Burner** **A3** **S5 min3** **S4 max3**	***Required settings:*** **max1** … limit CYL 1 **S2** → **A1** **max2** … limit CYL 2 **S3** → **A2** **max3** … burner req. off CYL 2 **S4** → **A3** **min1** … switch-on temp. coll. **S1** → **A1, A2** **min2** … see all programs +4 **min3** … burner req. on CYL 2 **S5** → **A3** **diff1** … coll. **S1** – CYL 1 **S2** → **A1** **diff2** … coll. **S1** – CYL 2 **S3** → **A2** **CET 1 ... OP 1 → OP 12**

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, cylinder 2 is filled by priority.
A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

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

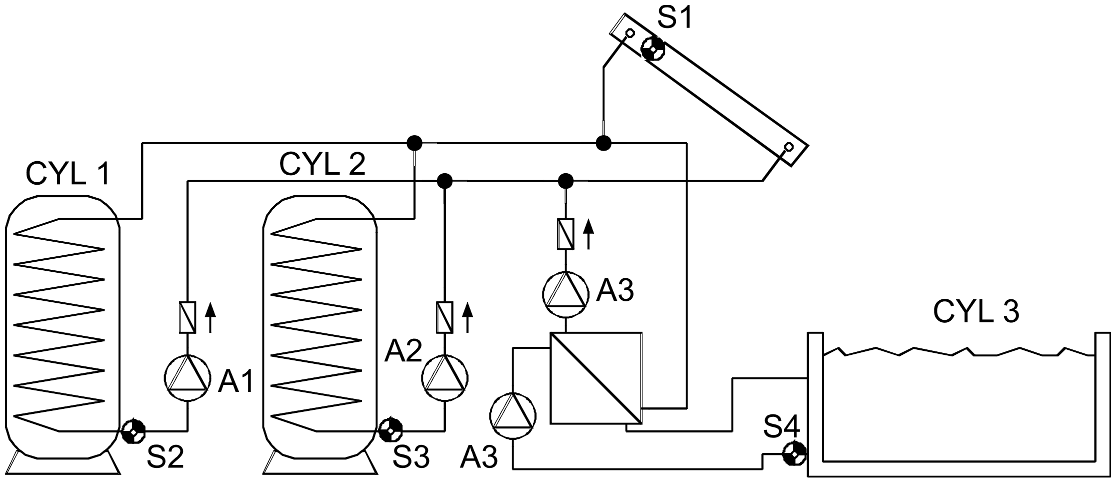
A3 (on) = S5 < min3 ***A3 (off) = S5 > max3*** (dominant)

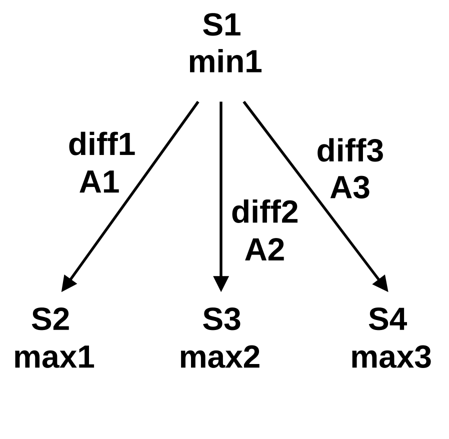
All programs +4: Both solar loops have separate switch-on thresholds at **S1:**
Output **A1** retains ***min1***, and **A2** switches at ***min2***.

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 **CYL 1** and **CYL 2** 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





Required settings:

max1 … limit CYL 1 **S2** → **A1**
max2 … limit CYL 2 **S3** → **A2**
max3 … limit CYL 3 **S4** → **A3**
min1 … switch-on temp. coll. **S1** → **A1, A2, A3**
min2 … see all programs +8
min3 … see all programs +8
diff1 … coll. **S1** – CYL 1 **S2** → **A1**
diff2 … coll. **S1** – CYL 2 **S3** → **A2**
diff3 … coll. **S1** – CYL 3 **S4** → **A3**
CET 1 ... OP 1 → OP 123

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 CYL 1 and CYL 2). **Speed control: Observe the comments on page 9!**

A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

Program 226: Instead of both pumps **A1** and **A3** one pump **A1** and a three-way valve **A3** are deployed. (pump - valve system between CYL 1 and CYL 3). **Speed control: Observe the comments on page 9!**

A1 ... common pump **A3** ... Valve (A3/S receives power when filling cylinder CYL 3)

Program 227: All three cylinders are fed via one pump (A1) and two serially connected three-way valves (**A2** and **A3**). When both valves have no power, CYL 1 is fed. **Speed control: Observe the comments on page 9!**

A1 ... common pump

A2 ... valve (A2/S receives power when filling cylinder CYL 2)

A3 ... valve (A3/S receives power when filling cylinder CYL 3)

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 cylinder 2, only pump **A1** and valve **A2** are switched on, when filling into cylinder 3, only pump **A1** and valve **A3** are switched on.

All programs +4:

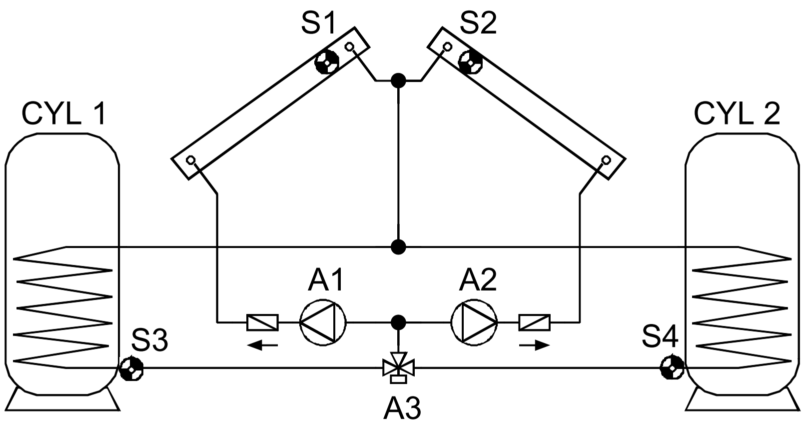
If all of the cylinders have reached their maximum temperature, loading to CYL 2 continues regardless of ***max2***.

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

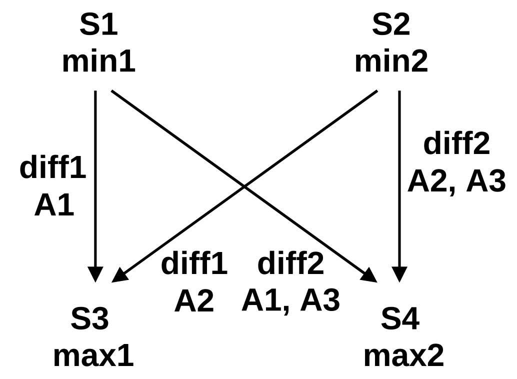
Output **A1** retains **min1**, but **A2** switches at **min2** and **A3** at **min3**.

The **priorities** for **CYL 1, CYL 2** and **CYL 3** 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



A1, **A2**... pumps **A3**……. switch-over valve (A3/S has power when loading CYL 2)



Required settings:

max1 … limit CYL 1 **S3** → **A1, A2**
max2 … limit CYL 2 **S4** → **A1, A2, A3**
min1 … switch-on temp. coll.1 **S1** → **A1**
min2 … switch-on temp. coll.2 **S2** → **A2**
diff1 … coll.1 **S1** – CYL 1 **S3** → **A1**
… coll.2 **S2** – CYL 1 **S3** → **A2**
diff2 … coll.1 **S1** – CYL 2 **S4** → **A1, A3**
… coll.2 **S2** – CYL 2 **S4** → **A2, A3**
diff3 … see all programs +1
CET 2 ... → ON

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)***

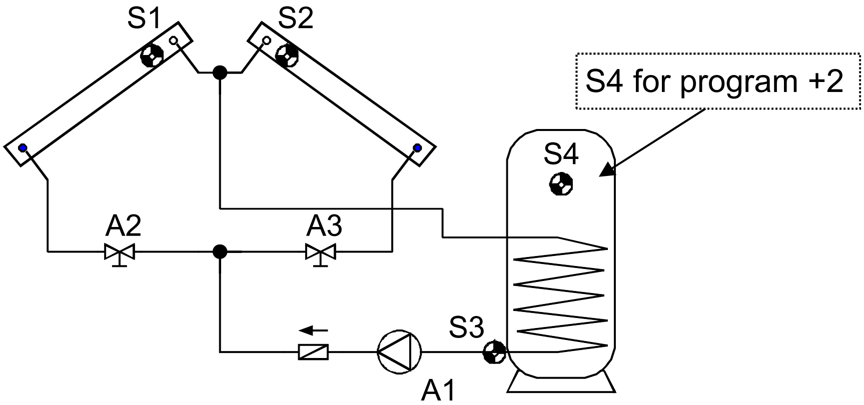
A3 = dependent on preset priority

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 cylinders. The **priorities** for **CYL 1, CYL 2** 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).

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



S1 **S2** **min1** **min2** **diff1** **diff2** **A1, A2** **A1, A3** **S3** **max1**	***Required settings:*** **max1** … limit CYL **S3** → **A1, A2, A3** **max2** … see all programs +2 **min1** … switch-on temp. coll.1 **S1** → **A1, A2** **min2** … switch-on temp. coll.2 **S2** → **A1, A3** **diff1** … coll.1 **S1** – CYL **S3** → **A1, A2** **diff2** … coll.2 **S2** – CYL **S3** → **A1, A3** **diff3** … see all programs +1 **CET 2 ... → ON**

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***.

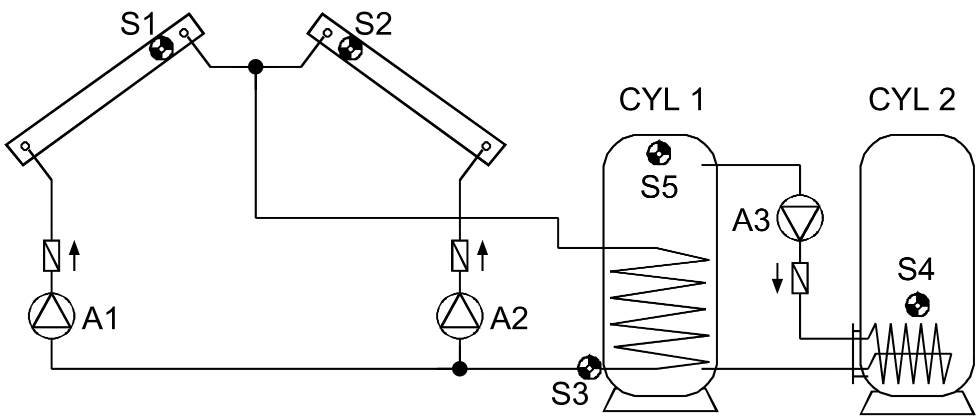
A1 = (A2 = on) or (A3 =on)
A2 = S1> (S3 + diff1) & S1 > min1 & S3 < max1
A3 = S2> (S3 + diff2) & S2 > min2 & S3 < max1

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



S1 min1 → (**diff1 A1**) → **S3 max1** **S2 min2** → (**diff1 A2**) → **S3 max1** **S5 min3** → (**diff2 A3**) → **S4 max2**	***Required settings:*** **max1** … limit CYL 1 **S3** → **A1, A2** **max2** … limit CYL 2 **S4** → **A3** **min1** … switch-on temp. coll.1 **S1** → **A1** **min2** … switch-on temp. coll.2 **S2** → **A2** **min3** … switch-on temp. CYL 1 **S5** → **A3** **diff1** … coll.1 **S1** – CYL 1 **S3** → **A1** … coll.2 **S2** – CYL 1 **S3** → **A2** **diff2** … CYL 1 **S5** – CYL 2 **S4** → **A3** **diff3** … see all programs +1 **CET 2** ... → **ON**

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.

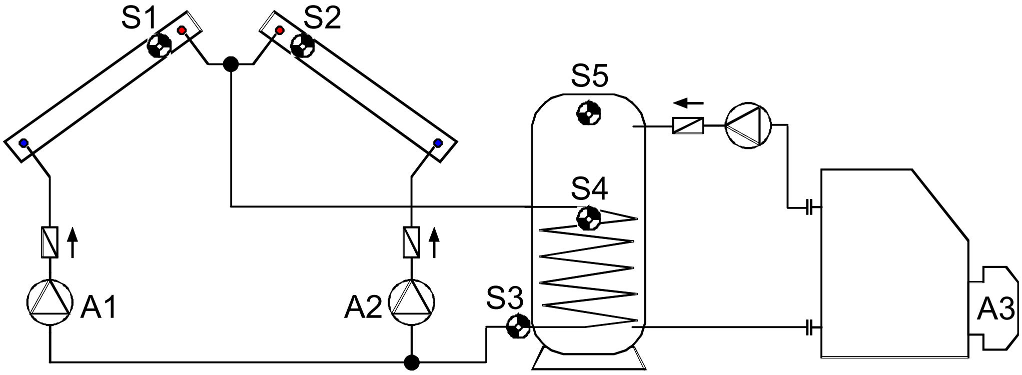
All programs +2:

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** / **S2** **min2** **diff1** **A1** ↘ **S3** **max1** ↙ **diff1** **A2**	**Burner** **A3** **S5 min3** **S4 max3**	***Required settings:*** **max1** … limit CYL **S3** → **A1, A2** **max3** … burner req. off CYL **S4** → **A3** **min1** … switch-on temp. coll.1 **S1** → **A1** **min2** … switch-on temp. coll.2 **S2** → **A2** **min3** … burner req. on CYL **S5** → **A3** **diff1** … coll.1 **S1** – CYL **S3** → **A1** … coll.2 **S2** – CYL **S3** → **A2** **diff3** … see all programs +1 **CET 2** ... → **ON**

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***.

$$A1 = S1 > (S3 + diff1)\ \&\ S1 > min1\ \&\ S3 < max1$$
$$A2 = S2 > (S3 + diff1)\ \&\ S2 > min2\ \&\ S3 < max1$$
$$A3\ (on) = S5 < min3 \qquad A3\ (off) = S4 > max3$$

All programs +1:

If the difference between 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**

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

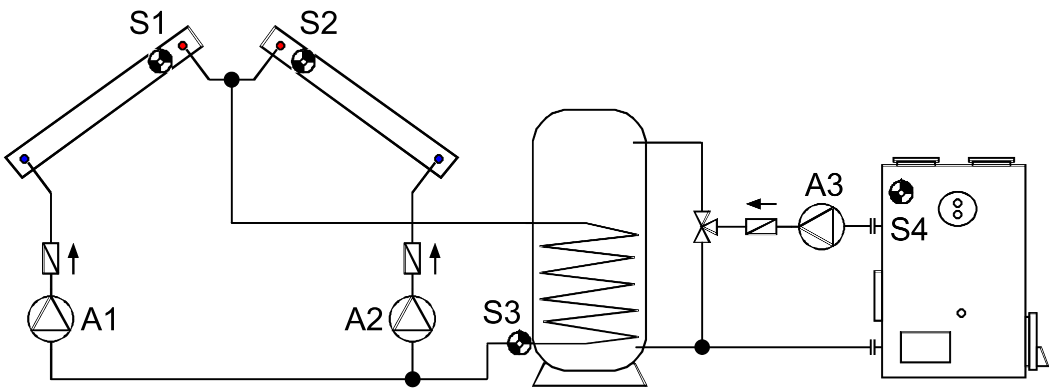
All programs +4:

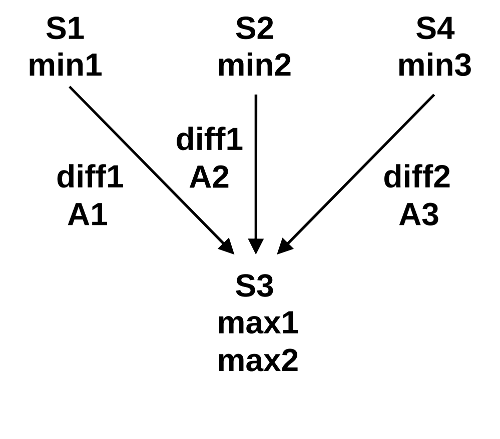
Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

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)





Required settings:

max1	… limit CYL **S3**	→ **A1, A2**
max2	… limit CYL **S3**	→ **A3**
min1	… switch-on temp. coll.1 **S1**	→ **A1**
min2	… switch-on temp. coll.2 **S2**	→ **A2**
min3	… switch-on temp. boiler **S4**	→ **A3**
diff1	… coll.1 **S1** – CYL **S3**	→ **A1**
	… coll.2 **S2** – CYL **S3**	→ **A2**
diff2	… boiler **S4** – CYL **S3**	→ **A3**
diff3	… see all programs +1	

CET 2 ... → **ON**

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:

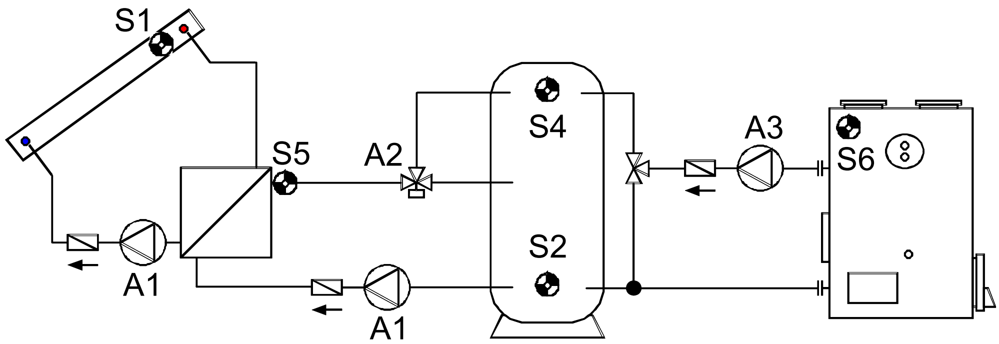
Instead of the pumps, one pump **A1** and a three-way valve **A2** are used.

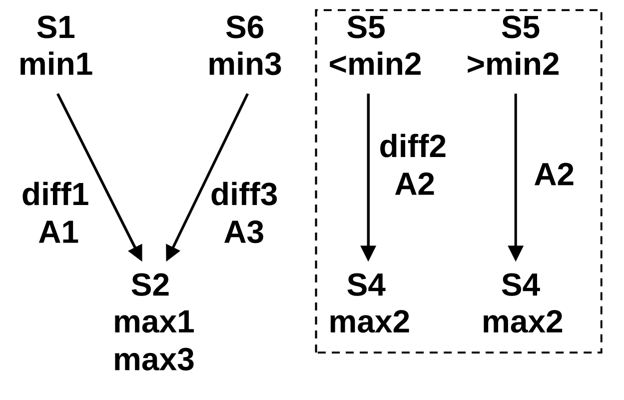
WARNING: This program is not intended for systems with two collector fields, since through a three-way valve one collector field is always operated at standstill.

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

Program 320 - layered cylinder and load pump

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





Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S4**	→ **A2**
max3	… limit CYL **S2**	→ **A3**
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp.ssl. **S5**	→ **A2**
min3	… switch-on temp. boiler **S6**	→ **A3**
diff1	… coll. **S1** – CYL **S2**	→ **A1**
diff2	… supply l. **S5** – CYL **S4**	→ **A2**
diff3	… boiler **S6** – CYL **S2**	→ **A3**

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 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 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.

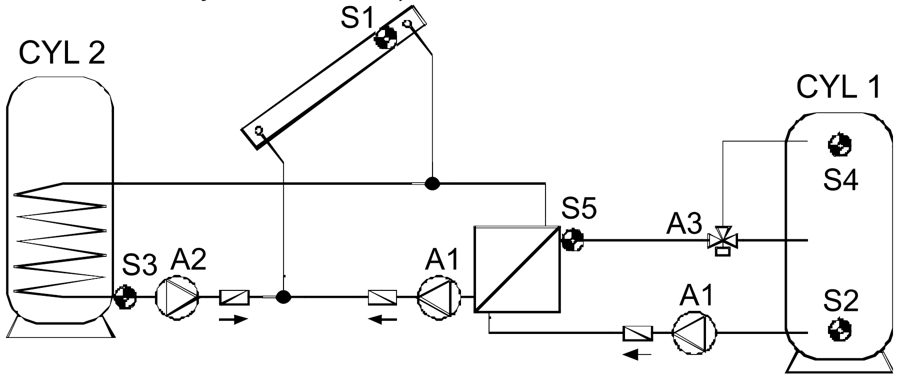
All programs +8 (independent load pump **A3**): the pump **A3** runs when:

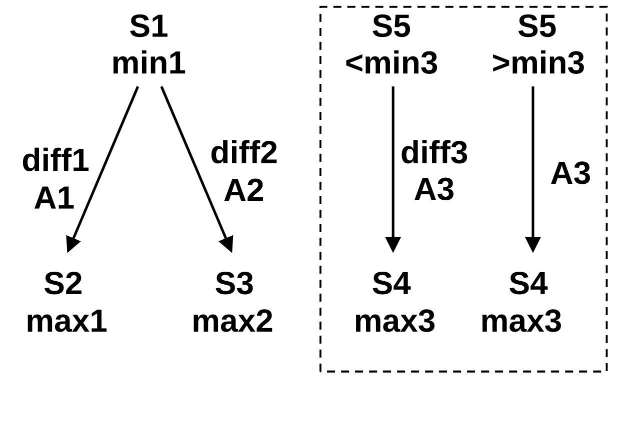
- **S6** is greater than threshold **min3** ◆ and **S6** is greater than **S3** by the difference ***diff3***
- and **S3** has not exceeded threshold ***max3***.

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

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

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





Required settings:

max1 … limit CYL 1 **S2** → **A1**
max2 … limit CYL 2 **S3** → **A2**
max3 … limit CYL 1 **S4** → **A3**
min1 … switch-on temp. coll. **S1** → **A1, A2**
min2 … see all programs +4
min3 … switch-on temp. ssl. **S5** → **A3**
diff1 … coll. **S1** – CYL 1 **S2** → **A**
diff2 … coll. **S1** – CYL 2 **S3** → **A2**
diff3 … supply l. **S5** – CYL 1 **S4** → **A3**
CET 1 ... OP 1 → OP 12

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 up** if:

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

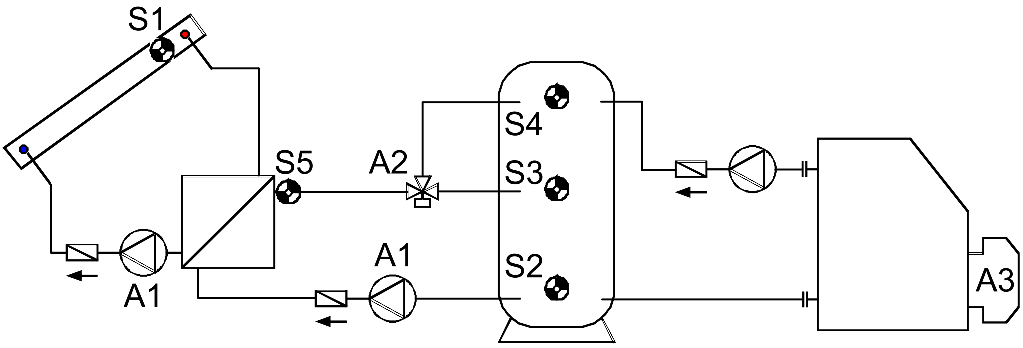
A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = S1 > (S3 + diff2) & S1 > min1 & S3 < max2
A3 = (S5 > min3 <u>or</u> S5 > (S4 + diff3)) & S4 < max3

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 **CYL 1** and **CYL 2** 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).

<u>**Program 352 - Layered cylinder and burner requirement**</u>
Layered system only effective with speed control activated.
(Absolute value control system: AC N1)



S1 min1	**S5 <min2**	**S5 >min2**	**Burner A3**
diff1 A1 ↓	**diff2 A2** ↓	**A2** ↓	**S4 min3** **S3 max3**
S2 max1	**S4 max2**	**S4 max2**	

Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S4**	→ **A2**
max3	… burner req. off CYL **S3**	→ **A3**
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp.ssl. **S5**	→ **A2**
min3	… burner req. on CYL **S4**	→ **A3**
diff1	… coll. **S1** – CYL **S2**	→ **A1**
diff2	… supply l. **S5** – CYL **S4**	→ **A2**

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 up** when:
- **S5** is greater than the threshold ***min2*** ◆ <u>**or**</u> **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***.

A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = (S5 > min2 <u>or</u> S5 > (S4 + diff2)) & S4 < max2
A3 (on) = S4 < min3 ***A3 (off) = S3 > max3***

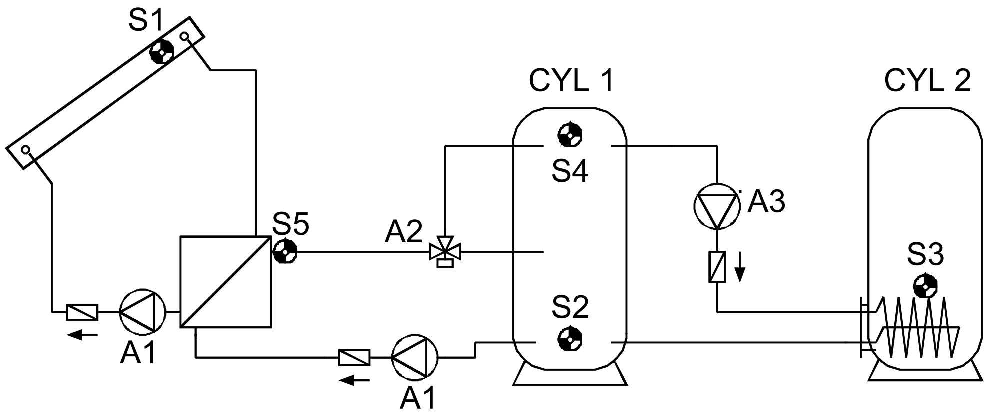
Program 353: If **S4** has reached **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.
If PSC (pump speed control) is activated, the speed level is set to the maximum level, if control output 1 is activated; the analog level for the maximum 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 ***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 cylinder and feed pump function

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



S1 min1 ↓ **diff1 A1** ↓ **S2 max1** **S5 <min2** ↓ **diff2 A2** ↓ **S4 max2** **S5 >min2** ↓ **A2** ↓ **S4 max2** **min3** → **diff3 A3** → **S3 max3**	***Required settings:*** **max1** … limit CYL 1 **S2** → **A1** **max2** … limit CYL 1 **S4** → **A2** **max3** … limit CYL 2 **S3** → **A3** **min1** … switch-on temp. coll. **S1** → **A1** **min2** … switch-on temp.ssl. **S5** → **A2** **min3** … switch-on temp. CYL 1 **S4** → **A3** **diff1** … coll. **S1** – CYL 1 **S2** → **A1** **diff2** … supply l. S5 – CYL 1 **S4** → **A2** **diff3** … CYL 1 **S4** – CYL 2 **S3** → **A3**

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 up** when:

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

The feed pump **A3** runs when:

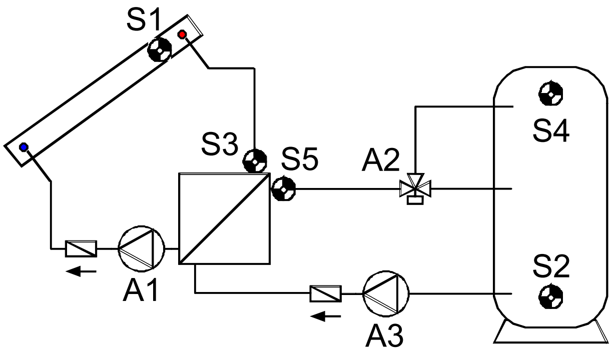
- **S4** is greater than the threshold ***min3*** ◆ and **S4** is greater than **S3** by the difference ***diff3***
- and **S3** has not exceeded the threshold ***max3***.

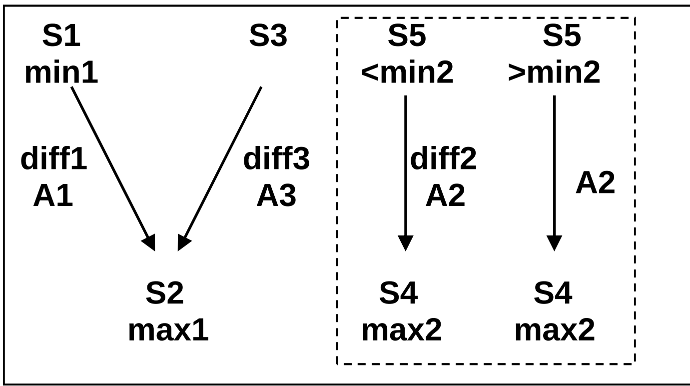
$$A1 = S1 > (S2 + diff1)\ \&\ S1 > min1\ \&\ S2 < max1$$
$$A2 = (S5 > min2\ \underline{or}\ S5 > (S4 + diff2))\ \&\ S4 < max2$$
$$A3 = S4 > (S3 + diff3)\ \&\ S4 > min3\ \&\ S3 < max3$$

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.

<u>Program 384 - Layered storage with bypass function</u>

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





Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S4**	→ **A2**
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp.ssl. 1 **S5**	→ **A2**
diff1	… coll. **S1** – CYL **S2**	→ **A1**
diff2	… supply l.1 **S5** – CYL **S4**	→ **A2**
diff3	… supply l.2 **S3** – CYL **S2**	→ **A3**

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 up** when:

- **S5** is greater than the threshold ***min2*** ◆ **<u>or</u> 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.

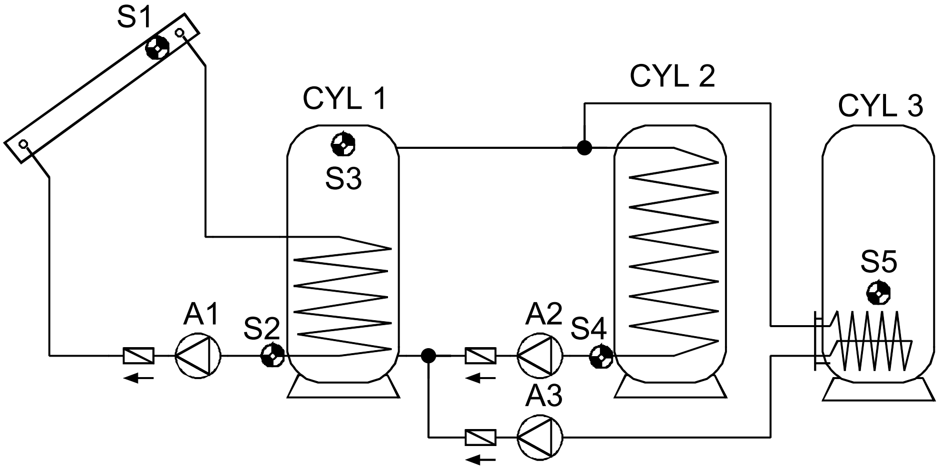
A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = (S5 > min2 <u>or</u> S5 > (S4 + diff2)) & S4 < max2
A3 = S3 > (S2 + diff3) & (A1 = on)

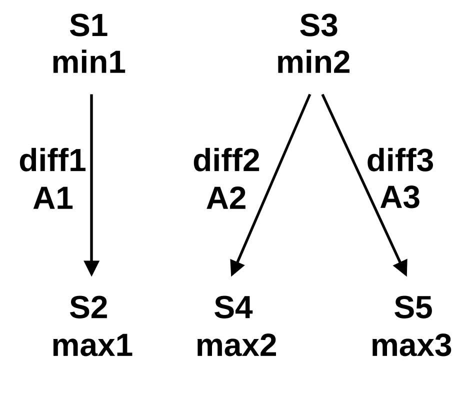
Program 385: If ***S4*** has reached **max2**, the quick warm-up phase has been completed, and the speed control is thus blocked ⇒ optimal efficiency.

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





Required settings:

max1 … limit CYL 1 **S2** → **A1**
max2 … limit CYL 2 **S4** → **A2**
max3 … limit CYL 3 **S5** → **A3**
min1 … switch-on temp. coll. **S1** → **A1**
min2 … switch-on temp. CYL 1 **S3** → **A2, A3**
min3 … see all programs +2
diff1 … coll. **S1** – CYL 1 **S2** → **A1**
diff2 … CYL 1 **S3** – CYL 2 **S4** → **A2**
diff3 … CYL 1 **S3** – CYL 3 **S5** → **A3**

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***.

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

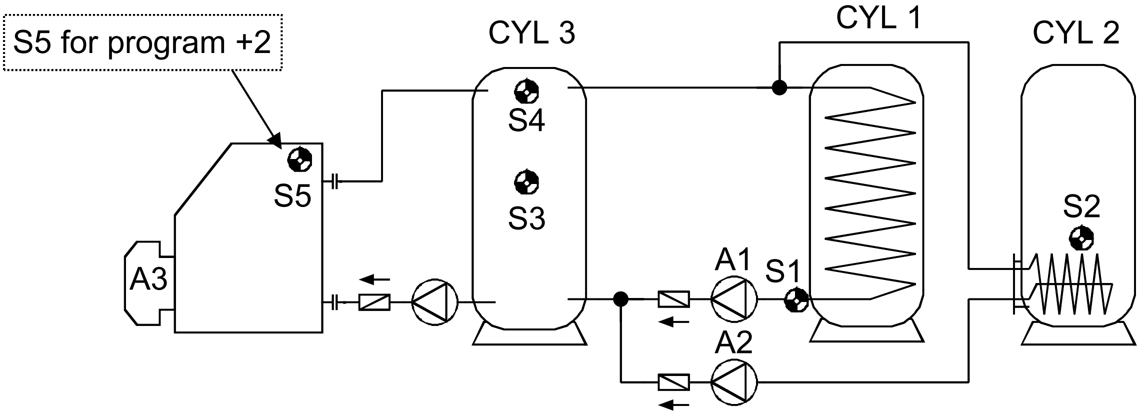
All programs +1: Instead of both pumps **A2** and **A3** one pump **A2** and a three-way valve **A3** are deployed. Without a priority allocation, cylinder 3 is filled by priority.
A2 ... common pump **A3** ... Valve (A3/S receives power when filling cylinder CYL 3)

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 **CYL 2** and **CYL 3** can be set in the parameter menu under **PA**.

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

Priority assignment between **CYL 1** and **CYL 2** possible



S4 min1 → diff1 A1 → S1 max1; S4 min1 → diff2 A2 → S2 max2	Burner A3	***Required settings:***		
	S4 min3	**max1**	… limit CYL 1 **S1**	→ **A1**
	S3 max3	**max2**	… limit CYL 2 **S2**	→ **A2**
		max3	… burner req. off CYL 3 **S3**	→ **A3**
		min1	… switch-on temp. CYL 3. **S4**	→ **A1, A2**
		min2	… see all programs +2	
		min3	… burner req. on CYL 3 **S4**	→ **A3**
		diff1	… CYL 3 **S4** – CYL 1 **S1**	→ **A1**
		diff2	… CYL 3 **S4** – CYL 2 **S2**	→ **A2**
		diff3	… see all programs +2	

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***.

$$A1 = S4 > (S1 + diff1)\ \&\ S4 > min1\ \&\ S1 < max1$$
$$A2 = S4 > (S2 + diff2)\ \&\ S4 > min1\ \&\ S2 < max2$$
$$A3\,(on) = S4 < min3 \qquad A3\,(off) = S3 > max3$$

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, cylinder 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

All programs +2:

In addition, the feed pump **A1** switches on when the temperature of the cylinder **S1** (CYL 1) varies by ***diff3*** from the boiler flow temperature.

In addition, the feed pump **A2** switches on when the temperature of the cylinder **S2** (CYL 2) varies by ***diff3*** from the boiler flow 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***.

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

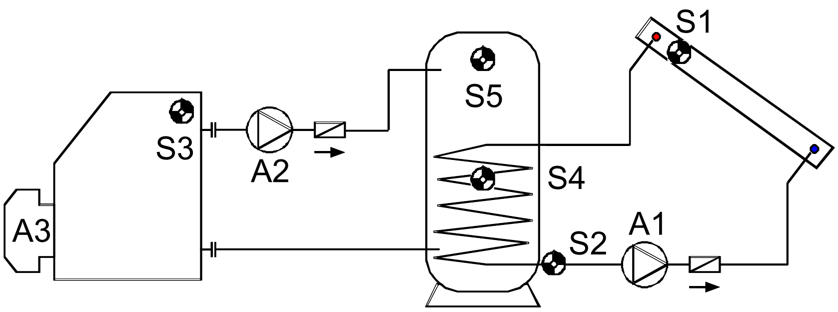
$$A2 = (S4 > (S2 + diff2)\ \&\ S4 > min1\ \&\ S2 < max2)$$
$$\text{or} \quad (S5 > (S2 + diff3)\ \&\ S5 > min2\ \&\ S2 < max2)$$

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

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

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 **CYL 1** and **CYL 2** can be set in the parameter menu under **PA**.

<u>Program 432 - Solar power system, burner requirement, and one feed pump</u>



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

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:

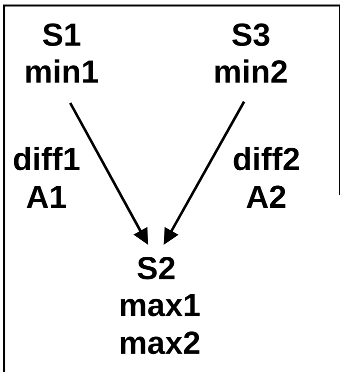
- **S3** is greater than the threshold ***min2*** ◆ and **S3** is greater than **S4** by the difference ***diff2***
- and **S4** has not exceeded the threshold ***max2***.

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 ***A3 (off) = S4 > max3***

Program 433:



Burner
A3

S5 min3
S4 max3

Required settings:

max1	… limit CYL **S2**	→ **A1**
max2	… limit CYL **S2**	→ **A2**
max3	… burner req. off CYL **S4**	→ **A3**
min1	… switch-on temp. coll.1 **S1**	→ **A1**
min2	… switch-on temp. boiler 2 **S3**	→ **A2**
min3	… burner req. on CYL **S5**	→ **A3**
diff1	… coll. **S1** – CYL **S2**	→ **A1**
diff2	… boiler **S3** – CYL **S2**	→ **A2**

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 ***A3 (off) = S4 > max3***

All programs +2:

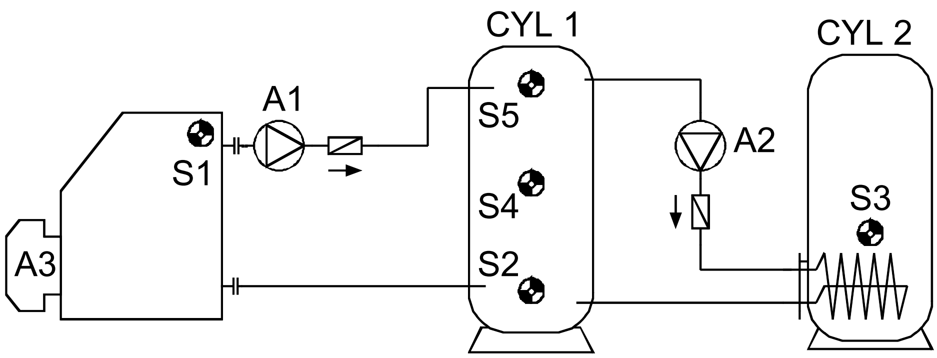
The burner requirement (**A3**) only occurs via sensor **S5**.

A3 (on) = S5 < min3 ***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



S1 min1 → (diff1, A1) → S2 max1 S5 min2 → (diff2, A2) → S3 max2	Burner A3 S5 min3 S4 max3	***Required settings:***	
		max1 … limit CYL 1 **S2**	→ **A1**
		max2 … limit CYL 2 **S3**	→ **A2**
		max3 … burner req. off CYL 1 **S4**	→ **A3**
		min1 … switch-on temp. boiler **S1**	→ **A1**
		min2 … switch-on temp. CYL 1 **S5**	→ **A2**
		min3 … burner req. on CYL 1 **S5**	→ **A3**
		diff1 … boiler **S1** – CYL 1 **S2**	→ **A1**
		diff2 … CYL 1 **S5** – CYL 2 **S3**	→ **A2**
		diff3 … see all programs +2	

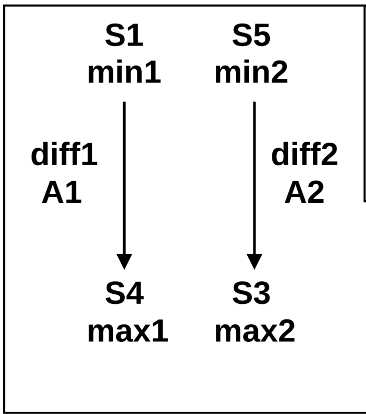
Program 448: Feed pump **A1** runs when:
- **S1** is greater than the threshold ***min1*** ◆ and **S1** is greater than **S2** by the difference ***diff1***
- and **S2** has not exceeded the threshold ***max1***.

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:



Burner
A3

S5 min3
S4 max3

Required settings:

max1	… limit CYL 1 **S4**	→ **A1**
max2	… limit CYL 2 **S3**	→ **A2**
max3	… burner req. off CYL 1 **S4**	→ **A3**
min1	… switch-on temp. boiler **S1**	→ **A1**
min2	… switch-on temp. CYL 1 **S5**	→ **A2**
min3	… burner req. on CYL 1 **S5**	→ **A3**
diff1	… boiler **S1** – CYL 1 **S4**	→ **A1**
diff2	… CYL 1 **S5** – CYL 2 **S3**	→ **A2**
diff3	… see all programs +2	

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 cylinder **S3** (CYL 2) 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)***

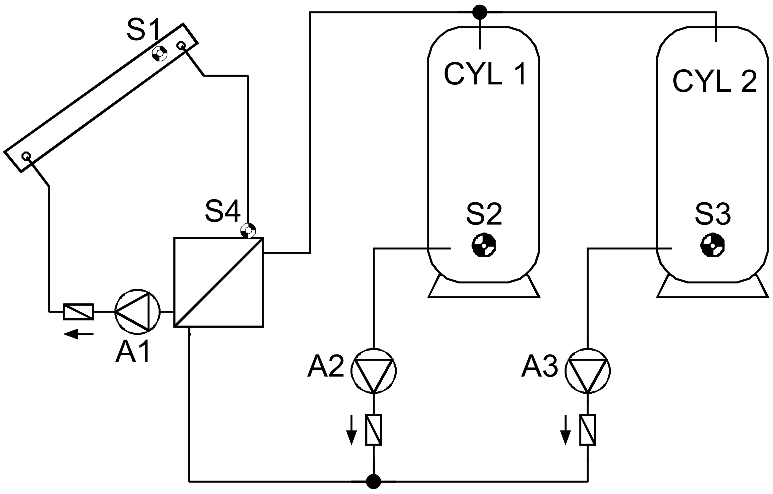
All programs +4: The burner requirement (**A3**) only occurs via sensor **S5**.

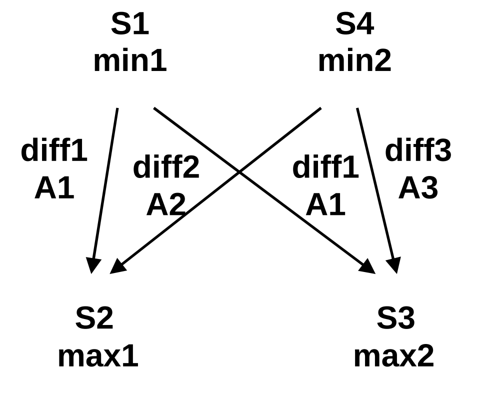
A3 (on) = S5 < min3 ***A3 (off) = S5 > max3*** (dominant)

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





Required settings:

max1	… limit CYL 1 **S2**	→ **A1, A2**
max2	… limit CYL 2 **S3**	→ **A1, A3**
min1	… switch-on temp. coll. **S1**	→ **A1**
min2	… switch-on temp. ssl. **S4**	→ **A2, A3**
min3	… see all programs +2	
diff1	… coll. **S1** – CYL 1 **S2**	→ **A1**
	… coll. **S1** – CYL 2 **S3**	→ **A1**
diff2	… supply l. **S4** – CYL 1 **S2**	→ **A2**
diff3	… supply l. **S4** – CYL 2 **S3**	→ **A3**

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***.

A1 = (S1 > (S2 + diff1) or S1 > (S3 + diff1)) & S1 > min1
& (S2 < max1 or S3 < max2)

A2 = S4 > (S2 + diff2) & S4 > min2 & S2 < max1
A3 = S4 > (S3 + diff3) & S4 > min2 & S3 < max2

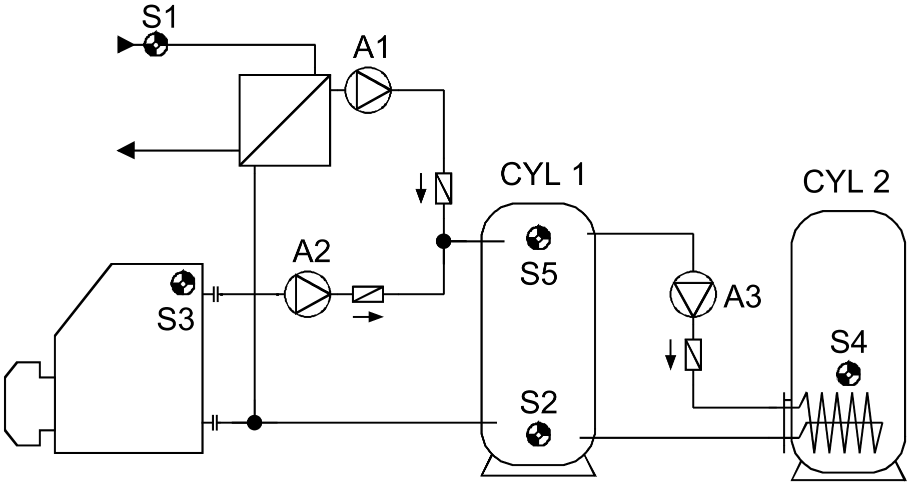
All programs+1: Instead of both pumps **A2** and **A3** one pump **A2** and a three-way valve **A3** are deployed. Valve **A3**/S receives power when filling cylinder **CYL 2**.

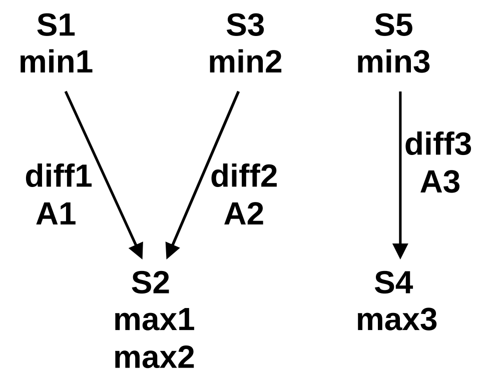
Speed control via control outputs: **COP 1 and COP 2** are set to the highest speed as soon as value **max1** is reached.**All programs +2:** Both secondary solar loops have separate switch-on thresholds at **S4**:
Output **A2** retains ***min2***, and **A3** switches at ***min3***.

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 **CYL 1** and **CYL 2** 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





Required settings:

max1	… limit CYL 1 **S2**	→ **A1**
max2	… limit CYL 1 **S2**	→ **A2**
max3	… limit CYL 2 **S4**	→ **A3**
min1	… switch-on t. heat source **S1**	→ **A1**
min2	… switch-on temp. boiler **S3**	→ **A2**
min3	… switch-on temp. CYL 1 **S5**	→ **A3**
diff1	… heat source **S1** – CYL 1 **S2**	→ **A1**
diff2	… boiler **S3** – CYL 1 **S2**	→ **A2**
diff3	… CYL 1 **S5** – CYL 2 **S4**	→ **A3**

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:

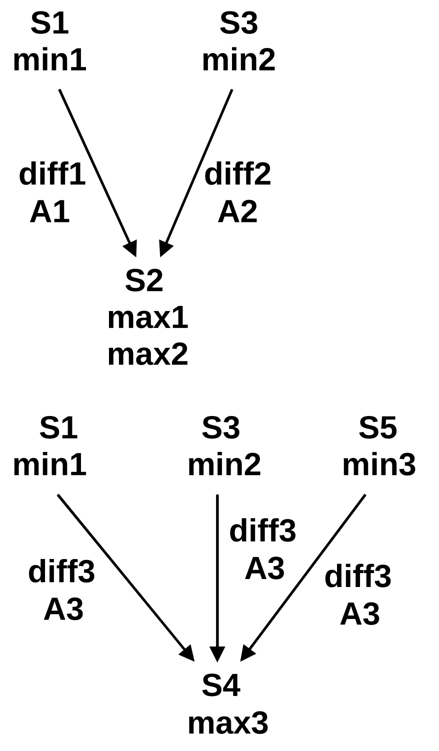
- **S3** is greater than the threshold ***min2*** ◆ and **S3** is greater than **S2** by the difference ***diff2***
- and **S2** has not exceeded the threshold ***max2***.

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***.

A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = S3 > (S2 + diff2) & S3 > min2 & S2 < max2
A3 = S5 > (S4 + diff3) & S5 > min3 & S4 < max3

Program 481:



Required settings:

max1	… limit CYL 1 **S2**	→ **A1**
max2	**…** limit CYL 1 **S2**	→ **A2**
max3	… limit CYL 2 **S4**	→ **A3**
min1	**…** switch-on. t. heat source **S1**	→ **A1, A3**
min2	**…** switch-on temp. boiler **S3**	→ **A2, A3**
min3	**…** switch-on. temp. CYL 1**S5**	→ **A3**
diff1	… heat source **S1** – CYL 1 **S2**	→ **A1**
diff2	… boiler **S3** – CYL 1 **S2**	→ **A2**
diff3	… heat source **S1** – CYL 2 **S4**	→ **A3**
	boiler **S3** – CYL 2 **S4**	→ **A3**
	CYL 1 **S5** – CYL 2 **S4**	→ **A3**

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

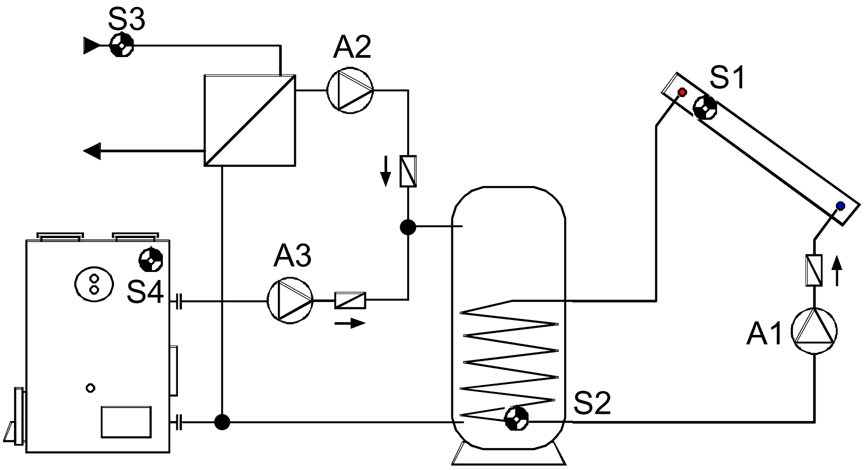
- **S3** is greater than threshold ***min2*** ◆ and **S3** is higher than **S4** by the difference ***diff3***
- and **S4** has not exceeded threshold ***max3.***

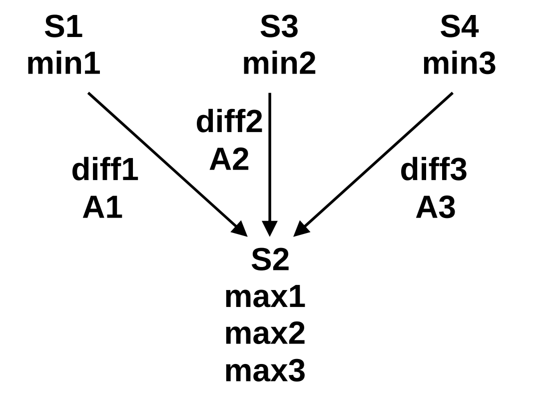
or

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

A3 = (S1 > (S4 + diff3) & S1 > min & S4 < max3)
or (S3 > (S4 + diff3) & S3 > min2 & S4 < max3)
or (S5 > (S4 + diff3) & S5 > min3 & S4 < max3)

Program 496 - 1 consumer and 3 feed pump functions





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

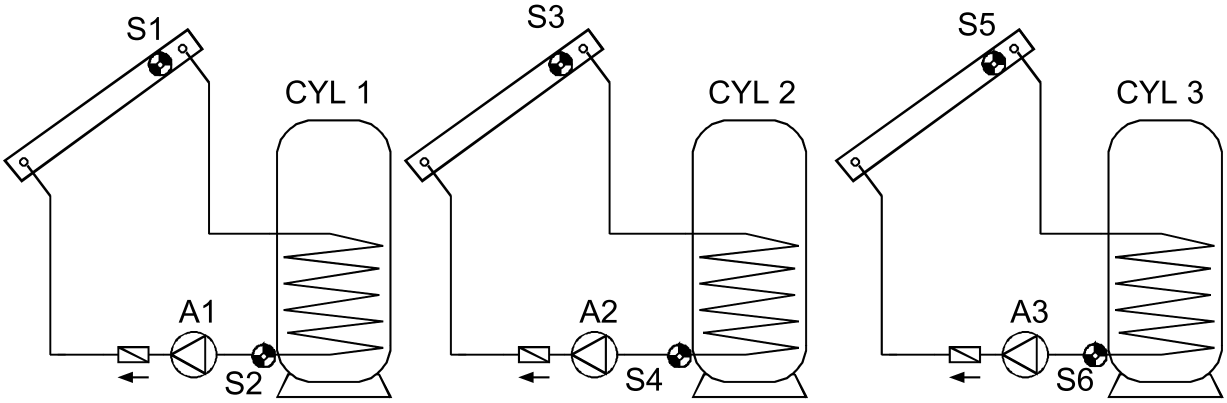
Program 496: Solar pump **A1** runs when:
- **S1** is greater than the threshold ***min1*** ◆ and **S1** is greater than **S2** by the difference ***diff1***
- and **S2** has not exceeded the threshold ***max1***.

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



S1 **min1** → **diff1 A1** → **S2** **max1** **S3** **min2** → **diff2 A2** → **S4** **max2** **S5** **min3** → **diff3 A3** → **S6** **max3**	***Required settings:*** **max1** … limit CYL 1 **S2** → **A1** **max2** … limit CYL 2 **S4** → **A2** **max3** … limit CYL 3 **S6** → **A3** **min1** … switch-on temp. coll.1 **S1** → **A1** **min2** … switch-on temp. coll.2 **S3** → **A2** **min3** … switch-on temp. coll.3 **S5** → **A3** **diff1** … coll.1 **S1** – CYL 1 **S2** → **A1** **diff2** … coll.2 **S3** – CYL 2 **S4** → **A2** **diff3** … coll.3 **S5** – CYL 3 **S6** → **A3**

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***.

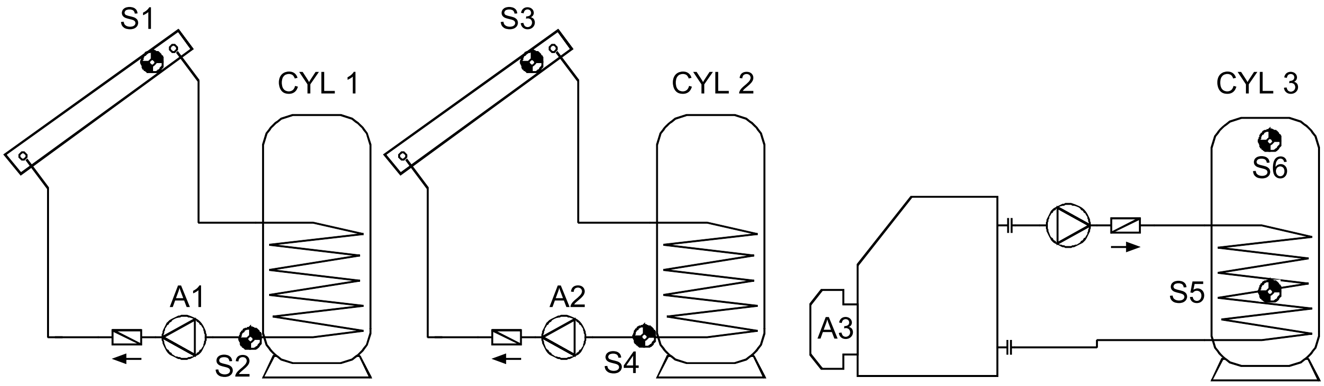
The feed pump **A3** runs when:

- **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***.

A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = S3 > (S4 + diff2) & S3 > min2 & S4 < max2
A3 = S5 > (S6 + diff3) & S5 > min3 & S6 < max3

All programs+1: if sensor **S2** has reached the threshold ***max1*** pump **A2** is activated and pump **A1** 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



S1 min1	S3 min2	Burner A3	Required settings:	
diff1 A1 ↓	↓ diff2 A2	S6 min3 S5 max3	**max1** … limit CYL 1 **S2**	→ **A1**
S2 max1	S4 max2		**max2** … limit CYL 2 **S4**	→ **A2**
			max3 … burner req. off CYL 3 **S5**	→ **A3**
			min1 … switch-on temp. coll.1 **S1**	→ **A1**
			min2 … switch-on temp. coll.2 **S3**	→ **A2**
			min3 … burner req. on CYL 3 **S6**	→ **A3**
			diff1 … coll.1 **S1** – CYL 1 **S2**	→ **A1**
			diff2 … coll.2 **S3** – CYL 2 **S4**	→ **A2**

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***.

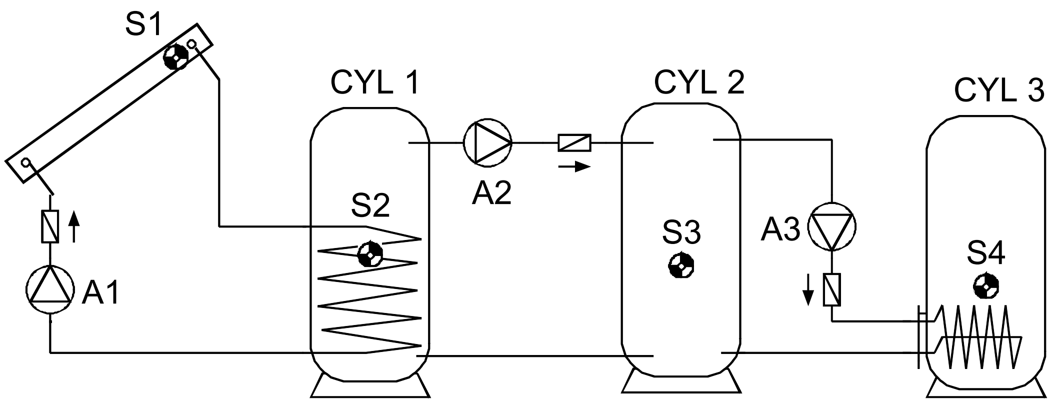
Output **A3** switches on when **S6** falls below threshold ***min3***.
Output **A3** switches off (dominant) when **S5** exceeds ***max3***.

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



S1 **min1** **diff1** ↓ **A1** **max1** **S2** **min2** **diff2** ↓ **A2** **max2** **S3** **min3** **diff3** ↓ **A3** **S4** **max3**	***Required settings:*** **max1** … limit CYL 1 **S2** → **A1** **max2** … limit CYL 2 **S3** → **A2** **max3** … limit CYL 3 **S4** → **A3** **min1** … switch-on temp. coll **S1** → **A1** **min2** … switch-on temp. CYL 1 **S2** → **A2** **min3** … switch-on temp. CYL 2 **S3** → **A3** **diff1** … coll. **S1** – CYL 1 **S2** → **A1** **diff2** … CYL 1 **S2** – CYL 2 **S3** → **A2** **diff3** … CYL 2 **S3** – CYL 3 **S4** → **A3**

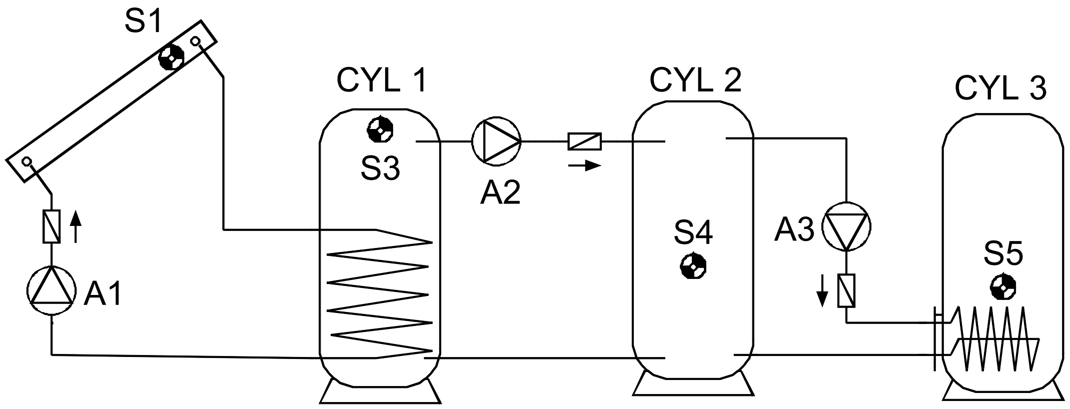
Program 544: Solar pump **A1** runs when:
- **S1** is greater than the threshold ***min1*** ◆ and **S1** is greater than **S2** by the difference ***diff1***
- and **S2** has not exceeded the threshold ***max1***.

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



S1 **min1** ↓ **diff1 A1** **S2** **max1** **S3** **min2** ↓ **diff2 A2** **S4** **max2** **min3** **S5** **max3** ← **diff3 A3**	***Required settings:*** **max1** … limit CYL 1 **S2** → **A1** **max2** … limit CYL 2 **S4** → **A2** **max3** … limit CYL 3 **S5** → **A3** **min1** … switch-on temp. coll. **S1** → **A1** **min2** … switch-on temp. CYL 1 **S3** → **A2** **min3** … switch-on temp. CYL 2 **S4** → **A3** **diff1** … coll. **S1** – CYL 1 **S2** → **A1** **diff2** … CYL 1 **S3** – CYL 2 **S4** → **A2** **diff3** … CYL 2 **S4** – CYL 3 **S5** → **A3**

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***.

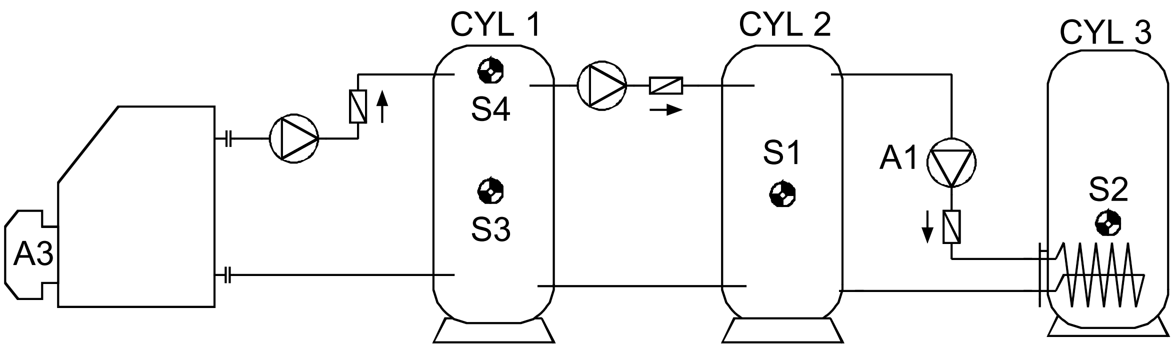
A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = S3 > (S4 + diff2) & S3 > min2 & S4 < max2
A3 = S4 > (S5 + diff3) & S4 > min3 & S5 < max3

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



S4 **min2** **diff2 A2** ↓ **S1** **max2** **min1** **diff1 A1** ↓ **S2** **max1**	**Burner** **A3** **S4 min3** **S3 max3**	***Required settings:*** **max1** … limit CYL 3 **S2** → **A1** **max2** … limit CYL 2 **S1** → **A2** **max3** … burner req. off CYL 1 **S3** → **A3** **min1** … switch-on temp. CYL 2 **S1** → **A1** **min2** … switch-on temp. CYL 1 **S4** → **A2** **min3** … burner req. on CYL 1 **S4** → **A3** **diff1** … CYL 2 **S1** – CYL 3 **S2** → **A1** **diff2** … CYL 1 **S4** – CYL 2 **S1** → **A2**

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***.

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

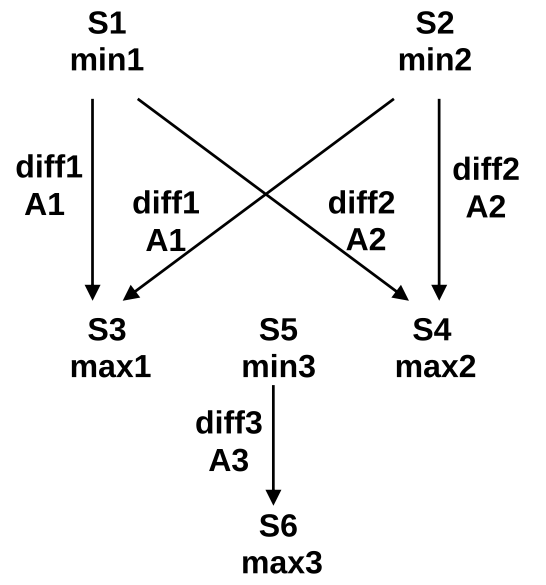
A3 (on) = S4 < min3 ***A3 (off) = S3 > max3***

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

A3 (on) = S4 < min3 ***A3 (off) = S4 > max3*** (dominant)

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

No diagram available!



Required settings:

max1 … limit CYL 1 **S3** → **A1**
max2 … limit CYL 2 **S4** → **A2**
max3 … limit CYL 3 **S6** → **A3**
min1 … switch-on t. boiler1 **S1** → **A1**
min2 … switch-on t. boiler2 **S2** → **A2**
min3 … switch-on temp. coll. **S5** → **A3**
diff1 … boiler 1 **S1** – CYL 1 **S3** → **A1**
… boiler 2 **S2** – CYL 1 **S3** → **A1**
diff2 … boiler 1 **S1** – CYL 2 **S4** → **A2**
… boiler 2 **S2** – CYL 2 **S4** → **A2**
diff3 … coll. **S5** – CYL 3 **S6** → **A3**

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***.

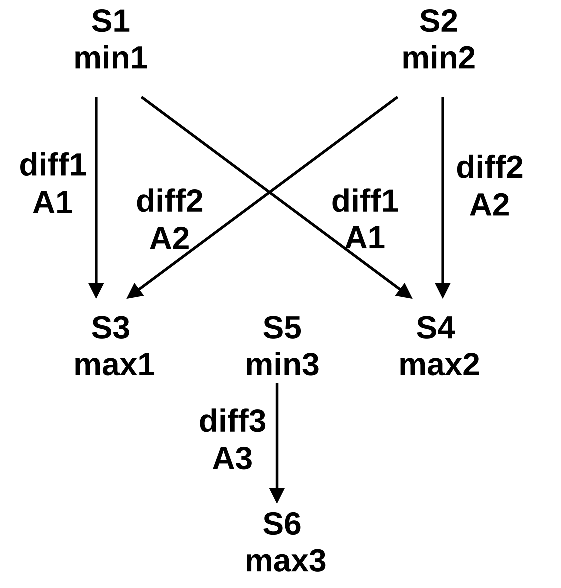
The feed pump **A3** runs when:
- **S5** is greater than the threshold ***min3*** ◆ and **S5** is greater than **S6** by the difference ***diff3***
- and **S6** has not exceeded the threshold ***max3***

A1 = S1 > (S3 + diff1) & S1 > min1 & S3 < max1
or S2 > (S3 + diff1) & S2 > min2 & S3 < max1

A2 = S1 > (S4 + diff2) & S1 > min1 & S4 < max2
or S2 > (S4 + diff2) & S2 > min2 & S4 < max2

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

Program 593:



Required settings:

max1	… limit CYL 1 **S3**	→ **A1,** → **A2**
max2	… limit CYL 2 **S4**	→ **A1,** → **A2**
max3	… limit CYL 3 **S6**	→ **A3**
min1	… switch-on t. boiler1 **S1**	→ **A1**
min2	… switch-on t. boiler2 **S2**	→ **A2**
min3	… switch-on temp. coll. **S5**	→ **A3**
diff1	… boiler 1 **S1** – CYL 1 **S3**	→ **A1**
	… boiler 1 **S1** – CYL 2 **S4**	→ **A1**
diff2	… boiler 2 **S2** – CYL 1 **S3**	→ **A2**
	… boiler 2 **S2** – CYL 2 **S4**	→ **A2**
diff3	… coll. **S5** – CYL 3 **S6**	→ **A3**

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.***

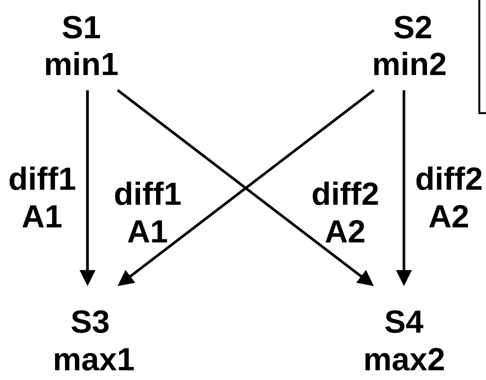
$$A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$
or
$$S1 > (S4 + diff1) \ \& \ S1 > min1 \ \& \ S4 < max2$$

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



Burner A3

S6 min3
S5 max3

Required settings:

max1	… limit CYL 1 **S3**	→ **A1**
max2	… limit CYL 2 **S4**	→ **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** – CYL 1 **S3**	→ **A1**
	… boiler2 **S2** – CYL 1 **S3**	→ **A1**
diff2	… boiler1 **S1** – CYL 2 **S4**	→ **A2**
	… boiler2 **S2** – CYL 2 **S4**	→ **A2**

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***.

A1 = S1 > (S3 + diff1) & S1 > min1 & S3 < max1
or S2 > (S3 + diff1) & S2 > min2 & S3 < max1

A2 = S1 > (S4 + diff2) & S1 > min1 & S4 < max2
or S2 > (S4 + diff2) & S2 > min2 & S4 < max2

A3 (on) = S6 < min3 ***A3 (off) = S5 > max3***

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

A3 (on) = S6 < min3 ***A3 (off) = S6 > max3*** (dominant)

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

A3 (on) = S2 < min3 ***A3 (off) = S5 > max3*** (dominant)

Program 611:
As with program 608, but the burner requirement (**A3**) comes from sensor **S2**.

A3 (on) = S2 < min3 ***A3 (off) = S2 > max3*** (dominant)

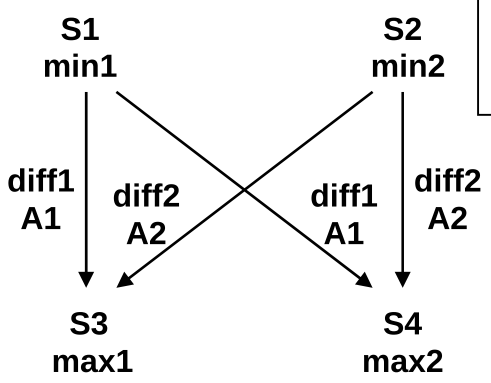
Program 612:
As with program 608, but the burner requirement (**A3**) comes from **S4** and **S5**.

A3 (on) = S4 < min3 ***A3 (off) = S5 > max3*** (dominant)

Program 613:
As with program 608, but the burner requirement (**A3**) comes from sensor **S4**.

A3 (on) = S4 < min3 ***A3 (off) = S4 > max3*** (dominant)

All programs +8:



Burner
A3
S6 min3
S5 max3

Required settings:

max1	… limit CYL 1 **S3**	→ **A1,** → **A2**
max2	… limit CYL 2 **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** – CYL 1 **S3**	→ **A1**
	… boiler1 **S1** – CYL 2 **S4**	→ **A1**
diff2	… boiler2 **S2** – CYL 1 **S3**	→ **A2**
	… boiler2 **S2** – CYL 2 **S4**	→ **A2**

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.***

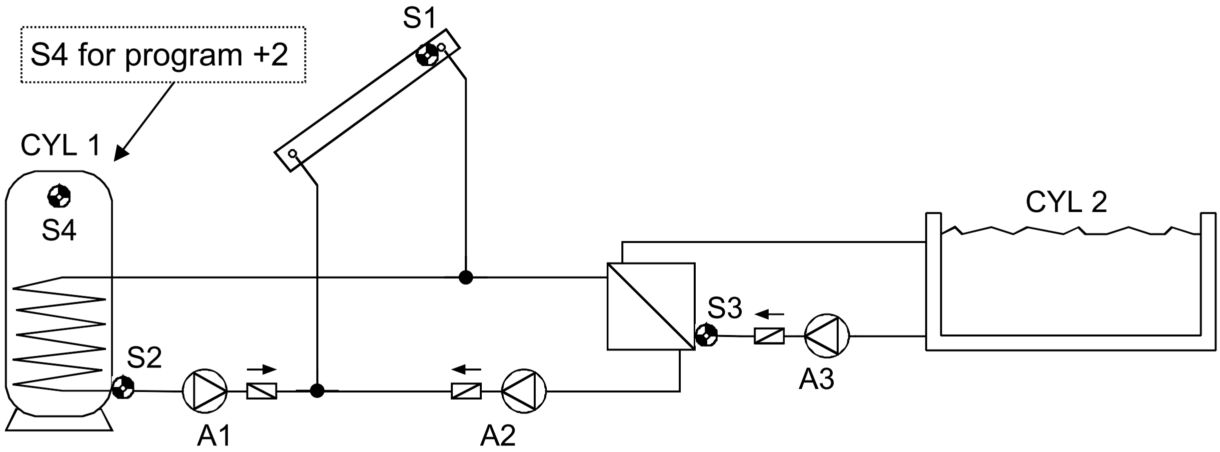
or

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

A1 = S1 > (S3 + diff1) & S1 > min1 & S3 < max1
or ***S1 > (S4 + diff1) & S1 > min1 & S4 < max2***

A2 = S2 > (S3 + diff2) & S2 > min2 & S3 < max1
or ***S2 > (S4 + diff2) & S2 > min2 & S4 < max2***

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



S1 **min1** **diff1** **diff2** **A1** **A2, (A3)** **S2** **S3** **max1** **max2**	***Required settings:*** **max1** … limit CYL 1 **S2** → **A1** **max2** … limit CYL 2 **S3** → **A2** **max3** … see all programs +2 **min1** … switch-on temp. coll. **S1** → **A1, A2** **min2** … see all programs +4 **diff1** … coll. **S1** – CYL 1 **S2** → **A1** **diff2** … coll. **S1** – CYL 2 **S3** → **A2** **CET 1 ... OP 1 → OP 12**

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: OPO 3)
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) <u>or</u> (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, cylinder 2 is filled by priority.

A1 ... common pump **A2** ... Valve (A2/S receives power when filling cylinder CYL 2)

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.**

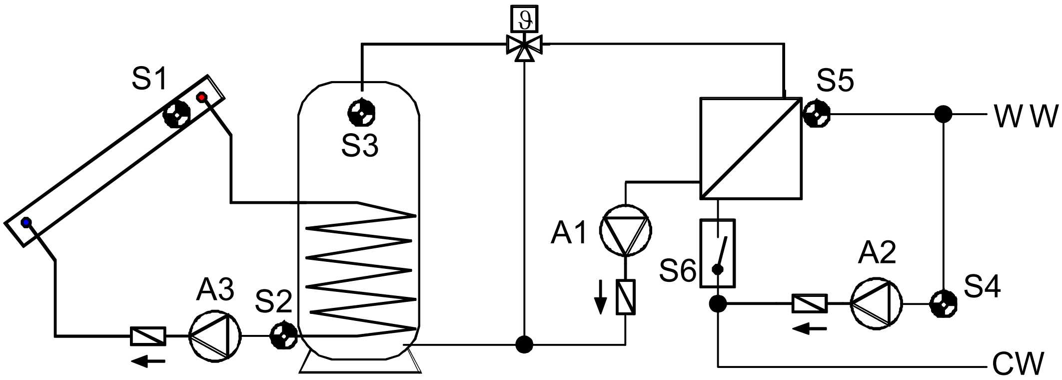
Output **A1** retains ***min1***, and **A2** switches at ***min2***.

The **priorities** for **CYL 1** and **CYL 2** 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.

S1 **min1** ↓ **diff1 A3** **S2** **max1** / **S3** **min2** ↓ **diff2 A2** **S4** **max2**	***Required settings:***
	max1 … limit CYL **S2** → **A3**
	max2 … limit circ. return **S4** → **A2**
	min1 … switch-on temp. coll. **S1** → **A3**
	min2 … switch-on temp CYL **S3** → **A2**
	min3 … see all programs +4
	diff1 … coll. **S1** – CYL **S2** → **A3**
	diff2 … CYL **S3** – circ. return **S4** → **A2**
A1 = FS (S6) = ON	**CET 1 ... OP 1 → OP 3**

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***.

A1 = flow switch (S6) = ON
A2 = S3 > (S4 + diff2) & S3 > min2 & S4 < max2
A3 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1

All programs +1:

Circulation pump **A2** is only switched on when in addition to the basic function the volume flow switch **(FS) S6** is **ON**.

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

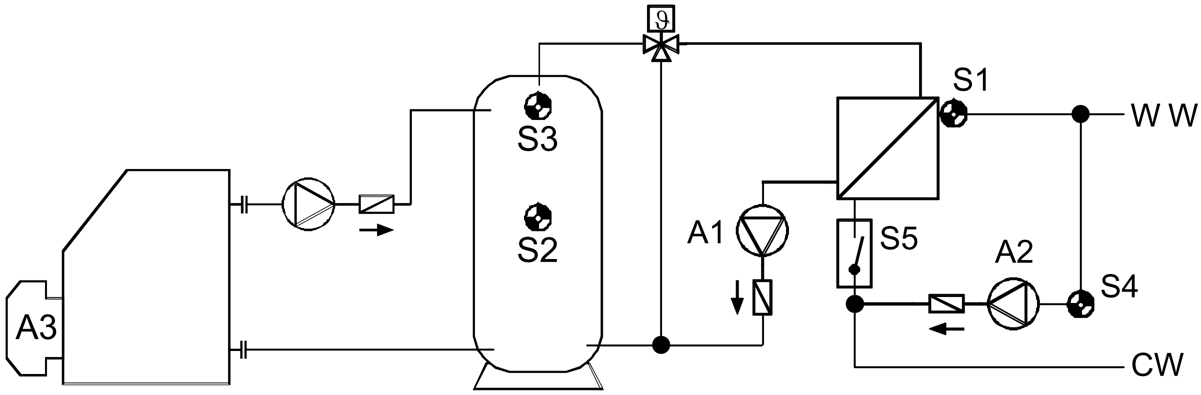
- the flow switch **(FS) S6** detects flow or pump **A2** is switched on.

A1 = A2 or flow switch (S6) = ON

<u>Program 656 - Preparation of hot water including circulation and burner requirement</u>

Only makes sense if the speed control is activated!

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



S3 **min1** **diff1** **A2** **S4** **max1** **A1 = FS (S5) = ON**	**Burner** **A3** **S3 min3** **S2 max3**	***Required settings:*** **max1** … limit circulation return **S2** → **A2** **max3** … burner req. off CYL **S2** → **A3** **min1** … switch-on temp. CYL **S3** → **A3** **min2** … see all programs +4 **min3** … burner req. on CYL **S3** → **A3** **diff1** … CYL **S3** – circulation return **S4** → **A2**

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 = flow switch (S5) = ON

A2 = S3 > (S4 + diff1) & S3 > min1 & S4 < max1

A3 (on) = S3 < min3 ***A3 (off) = S2 > max3***

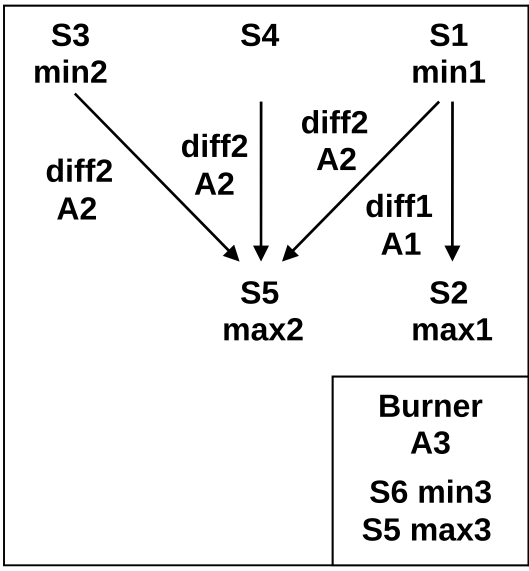
All programs +1: Circulation pump **A2** is only switched on when in addition to the basic function the volume flow switch **(FS) S5** is on (**A1** = ON).

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

A3 (on) = S3 < min3 ***A3 (off) = S3 > max3*** (dominant)

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

No diagram available



Required settings:

max1 … limit CYL 1 **S2** → **A1**
max2 … limit CYL 2 **S5** → **A2**
max3 … burner req. off CYL 2 **S5** → **A3**
min1 **...** switch-on t. boiler1 **S1** → **A1, A2**
min2 **...** switch-on t. boiler2 **S3** → **A2**
min3 … burner req. on SP CYL 2 **S6** → **A3**
diff1 … boiler1 **S1 –** CYL 1 **S2** → **A1**
diff2 … boiler1 **S1** – CYL 2 **S5** → **A2**
… boiler2 **S3** – CYL 2 **S5** → **A2**
… boiler3 **S4** – CYL 2 **S5** → **A2**

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.***

A1 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1
A2 = S1 > (S5 + diff2) & S1 > min1 & S5 < max2
or ***S3 > (S5 + diff2) & S3 > min2 & S5 < max2***
or ***S4 > (S5 + diff2) & S5 < max2***

A3 (on) = S6 < min3 ***A3 (off) = S5 > max3***

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

A3 (on) = S6 < min3 ***A3 (off) = S6 > max3*** (dominant)

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

A3 (on) = S5 < min3 ***A3 (off) = S5 > max3*** (dominant)

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 cylinders (in-oxydable) 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.
- **cylinder 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 cylinder 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 cylinder 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 cylinder using the immersion sleeve as a reference sensor for the heater's hydraulics or - flush with the cylinder'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 (inoxydable). The heat exchanger has to be installed upright with the hot water outlet on top.

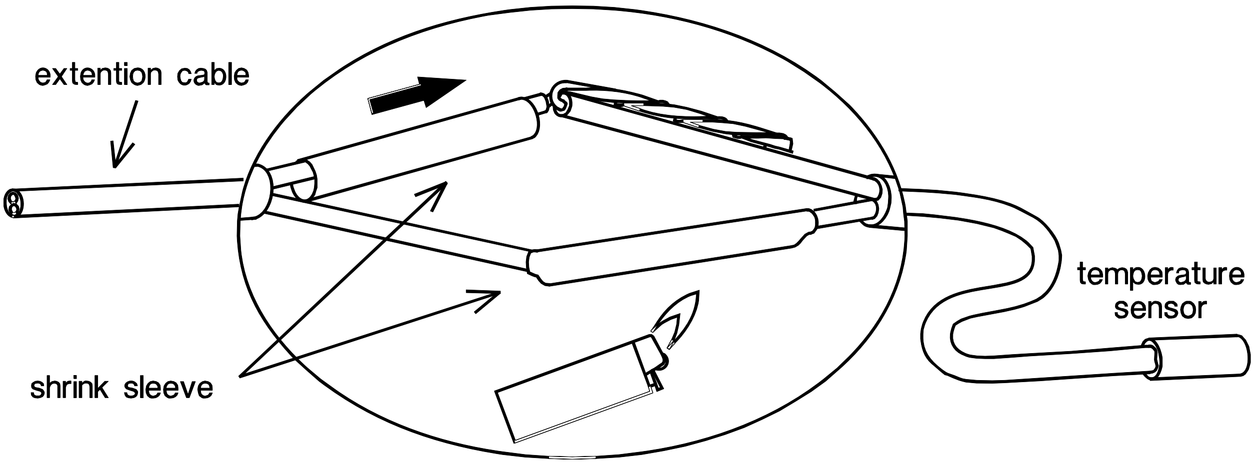
● **Radiant heat sensor:** To get a measurement according to the collector's position, it should be parallel to the collector. It should thus be screwed onto the metal sheet or next to the collector along an extension of the assembly rail. To this end, the sensor case has a blind hole that can be opened 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.

Installing the unit

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

Only work on the control system when it is dead.

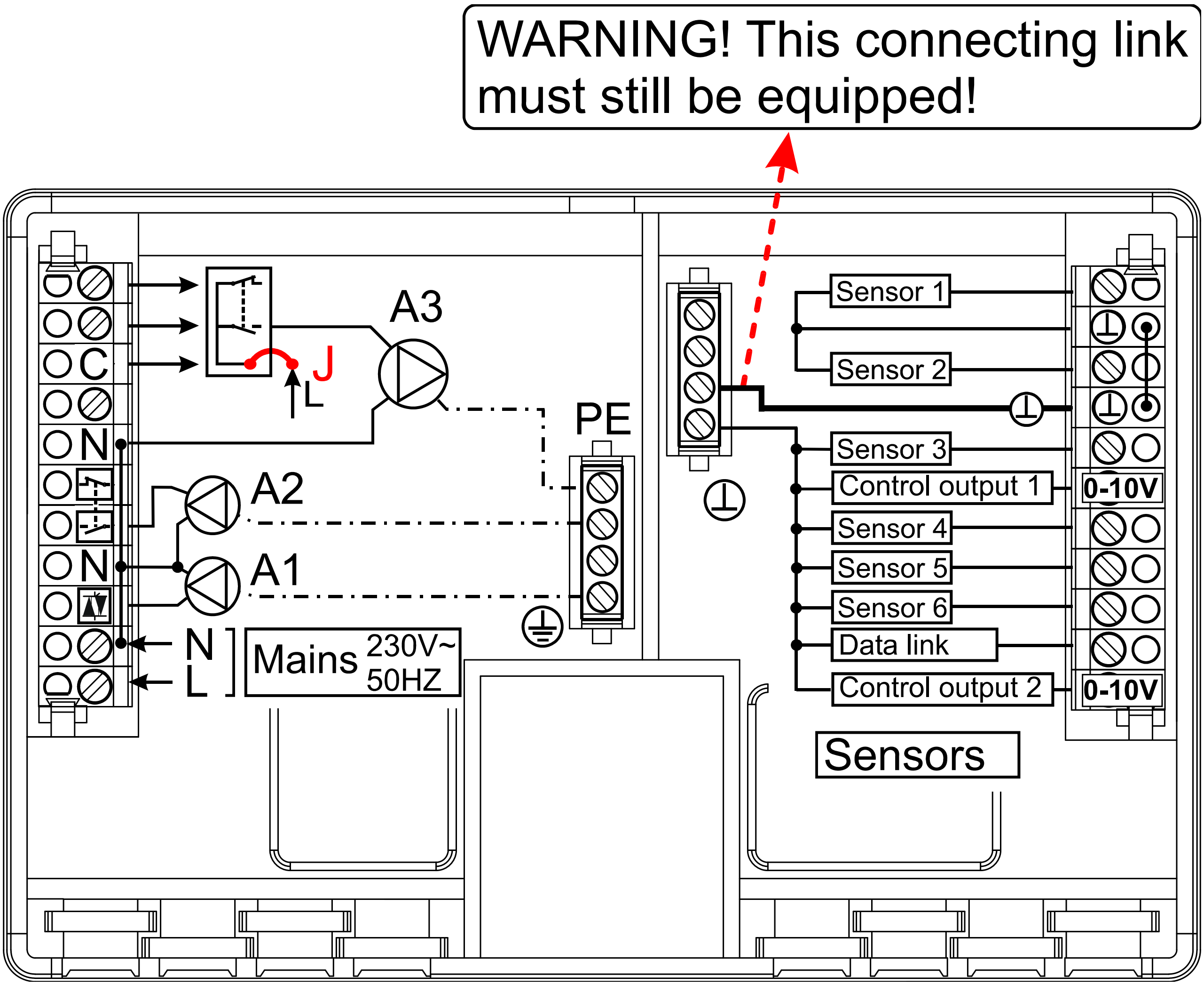
Unscrew the screw on the top of the case and take off the lid. The control electronics is in the lid. Contact pins are used to restore the connection to the clamps in the lower part of the case when it is put back on. The basin of the case can be screwed on through the two holes to the wall using the 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 lightening. 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.



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 inputs 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 line (DL-Bus)

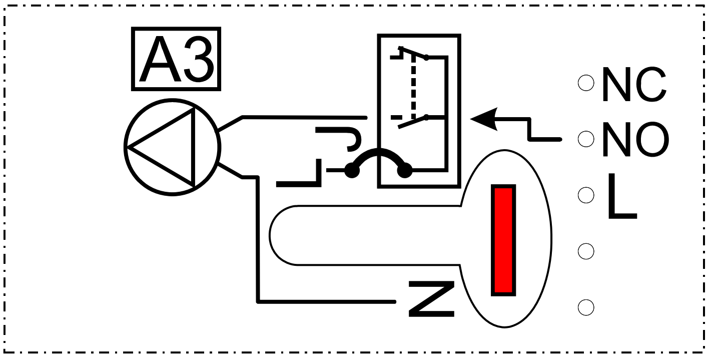
The bi-directional data link (DL-Bus) was developed for the ESR/UVR series and is only compatible with products of the Technische Alternative company. Any cable with a cross section of 0.75 mm² can be used for the data link (e.g. twin-strand) having a max. length of 30 m. For longer cables, we recommend the use of shielded cable.

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 sepa-rate 12V power unit for power supply.

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

Switch output 3 to potential-free

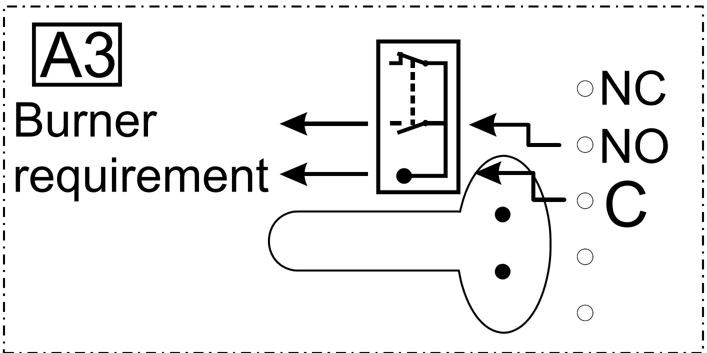
By removing the jumper **J** the relay output A3 can be made potential-free.



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

Example: Connection of a pump

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



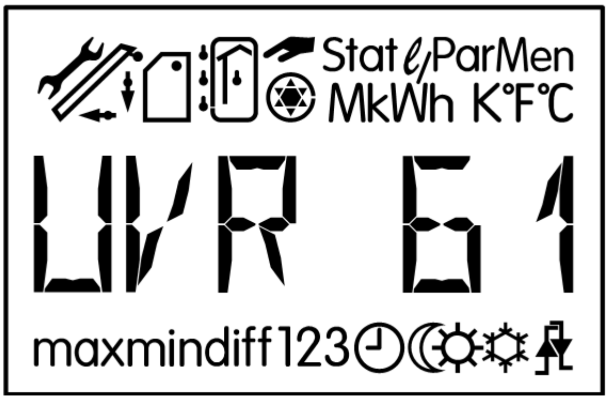
If the jumper is removed, then output 3 is potential-free.

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.



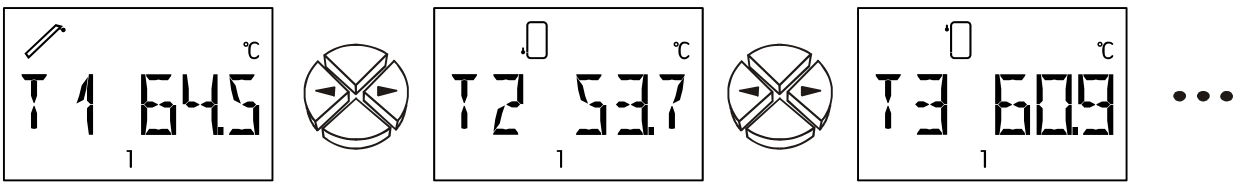
⇦⇨ = Navigation keys to select the display and change parameters.

⇩ = 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 normal operation, the left/right arrows ⇦⇨ are the navigation keys to select the desired display, such as collector or storage cylinder temperature. Each time a key is pressed, another icon appears with the respective temperature.

Above the text line, the icon for the text is always displayed (in the example given, the collector temperature). Below the text line, all of the tips are displayed during the setting of parameters.



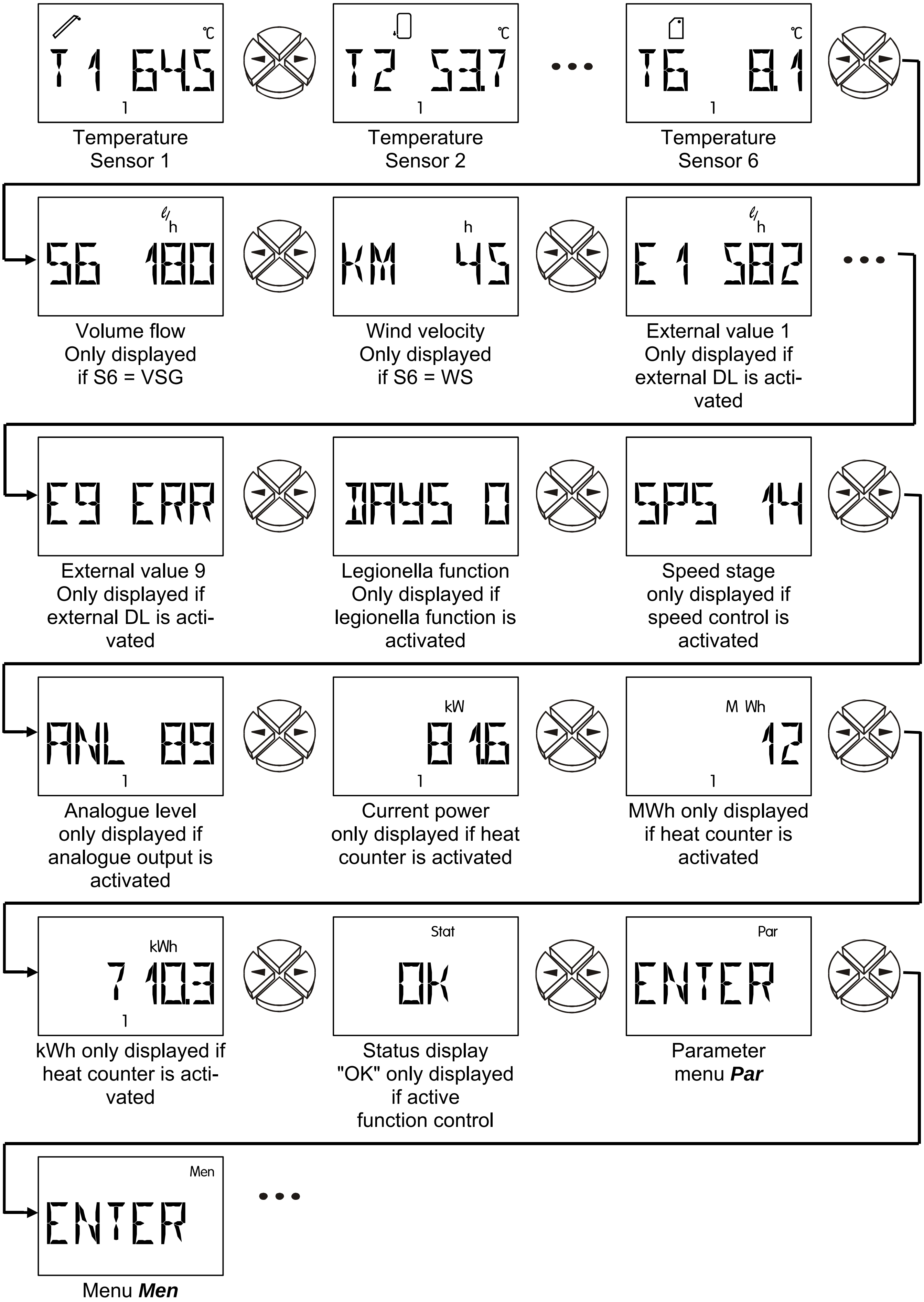
To the side of the display, the currently active outputs are identifiable on the green illuminated figures 1 - 3. If the speed control is active, the output 1 display flashes according to the speed stage.

3

2

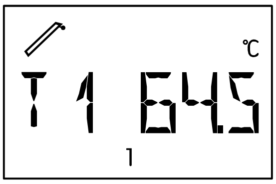
1

The main level

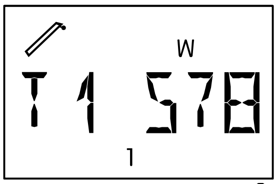


T1 to **T6** Displays the value measured at the sensor (S1 - T1, S2 - T2, etc.). The display (unit) depends on the settings of the sensor type.

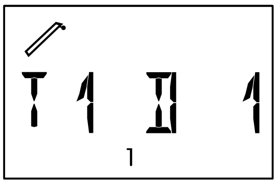
Display types:



Temperature in °C



Radiation in W/m^2 (radiation sensor)



Digital status 1 = ON (digital input)

If in the **SENSOR** menu (main menu **ENTER/*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 cylinder. 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. The number of control outputs is displayed below the text rows.

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 have 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. The number of heat quantity counters is displayed below the text rows.

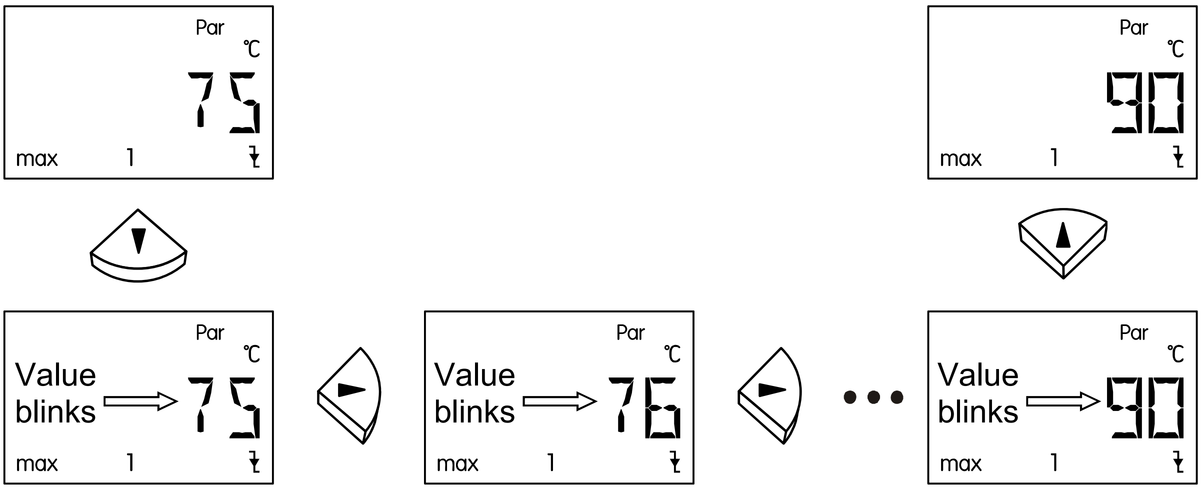
Stat: Display of the system's status. Depending on the program selected, various system statuses are monitored. If any problems have occurred, this menu contains all of the information.

Par: The navigation keys on the parameter level (⇦, ⇨) allow you to select the icons under the temperature display and the text line. 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, the system protection functions, function control etc. Use the keys for navigation and to make changes as usual. The dialogue is only set up via the text line. 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.

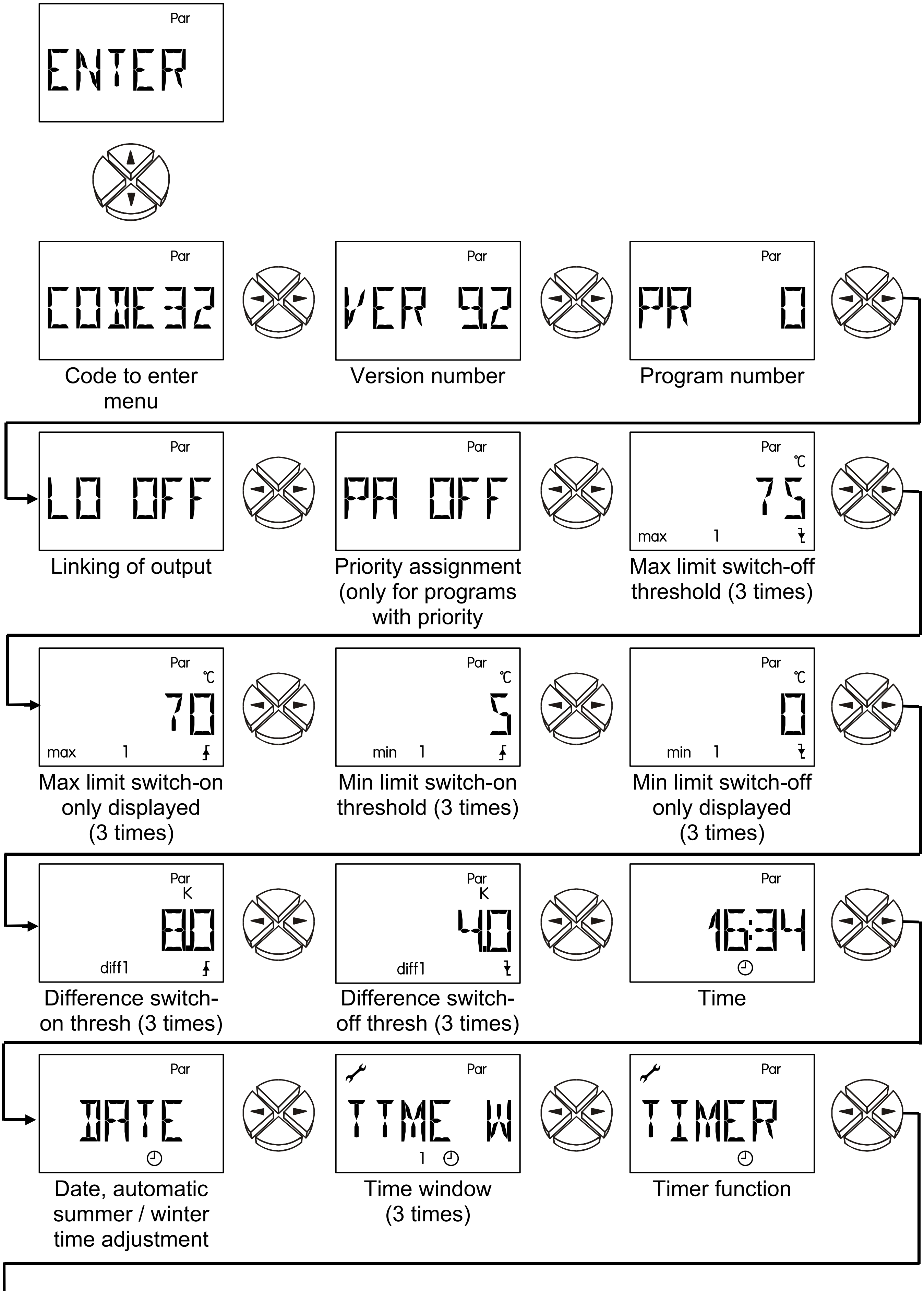
The settings of the parameters and menu functions ex works can be restored at any time using the down key (entry) when plugging the unit in. If this occurs, WELOAD will appear in the display for three seconds.

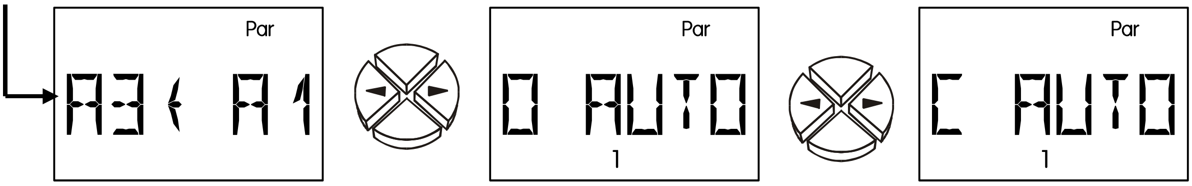
Changing a value (parameter)



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*





Assign free outputs (according to diagram)

Automatic / manual mode (3 times) for outputs 1 – 3

Automatic / manual mode (2 times) for the control outputs

Brief description

CODE **Code** to enter the menu. The other menu items are only displayed once the correct code has been entered

VER **Ver**sion number

PR Selection of the **pr**ogram number

LO **L**inking of **o**utputs (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 **P**riority **a**ssignment (this menu item is only displayed for program diagrams with priority)

max↓ **Max**imum limit - switch-off threshold (3 times)

max↑ **Max**imum limit - switch-on threshold (3 times)

min↑ **Min**imum limit - switch-on threshold (3 times)

min↓ **Min**imum limit - switch-off threshold (3 times)

diff↑ **Dif**ference - switch-on threshold (3 times)

diff↓ **Dif**ference - 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.

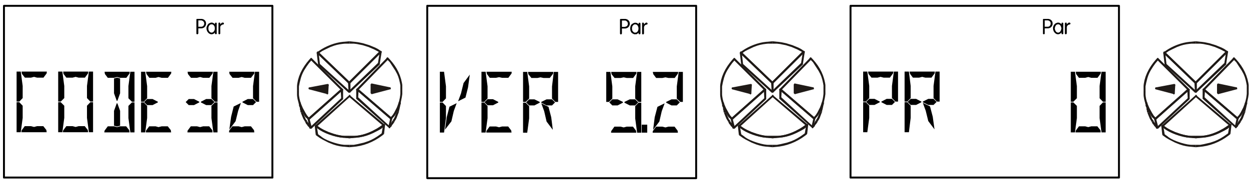
TIME W **Time w**indow (available 3 times)

TIMER **Timer** function

A3⇦ A1 Assignment of unused outputs

O AUTO **O**utput in **auto**matic 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*

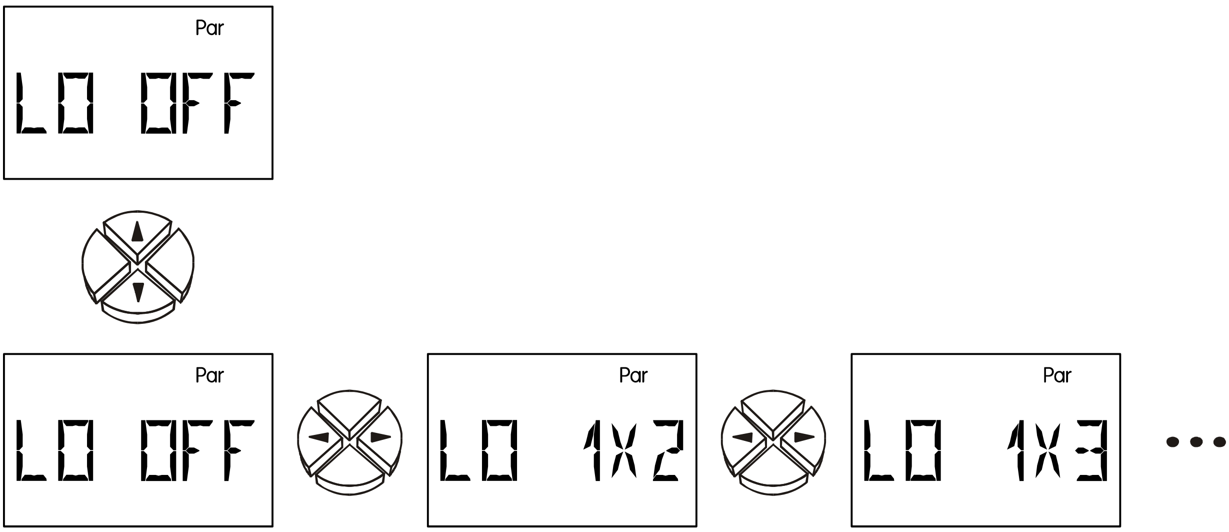
Display of the software **ver**sion. It cannot be changed as it indicates the intelligence of the device and must be provided if there are any queries.

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

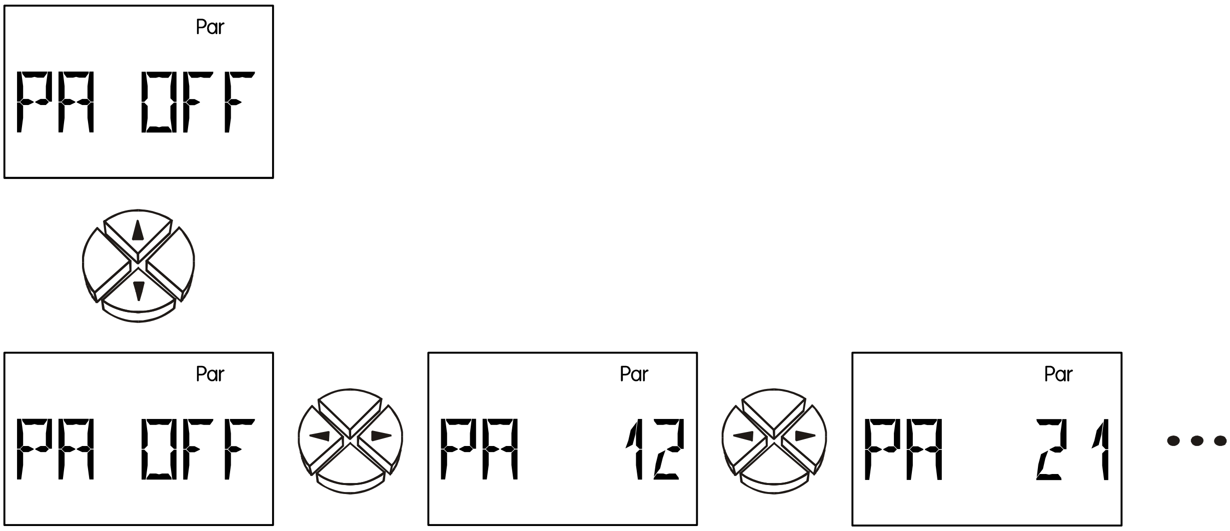
IMPORTANT: All outputs set in menu functions relate directly to the terminal outputs and not to the program diagram. This means that if an output is transposed, it must be taken into account for parameterization of the functions and priority allocations.

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

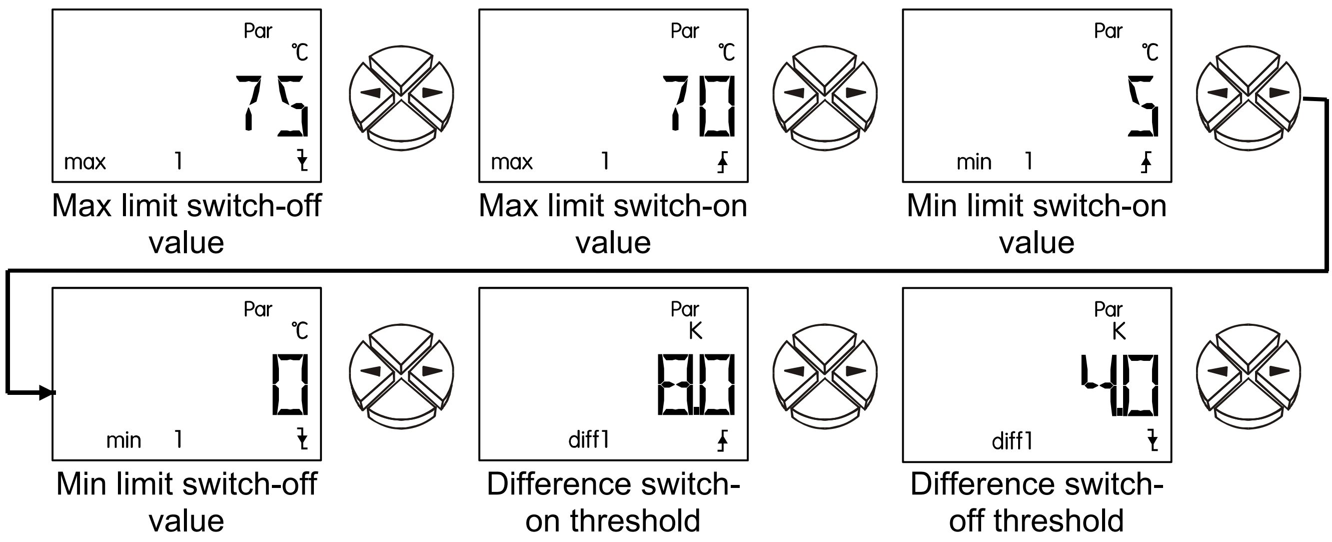
Set values (*max, min, diff*)

The number of maximum thresholds, minimum thresholds, and differences is displayed according to the set program number. The distinction between the same thresholds (such as max1, max2, max3) is displayed by the index (**1**, **2**, or **3**) in the lowest line. Each threshold comprises two values. I.e. all switching thresholds are divided into on and off thresholds!

NOTICE: Almost all threshold values consist of a switch-on and a switch-off value; their position to each other is fixed (A > B or B > A). When a parameter is set, the computer always limits the threshold value (such as **max1 on**) if it comes within 1K of the second threshold (such as **max1 off**) to prevent "negative hysteresis". If a threshold cannot be changed, the second threshold has to be changed first.

All thresholds (**min**, **diff**, **max**) can be disabled individually. The respective threshold is shutdown 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.

Example: Program number 0



max ↓ When a sensor reaches this temperature, the output is blocked. (ex works = 75°C)

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. (ex works = 70°C)

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. (ex works = 5°C)

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. (ex works = 0°C)

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↓**)

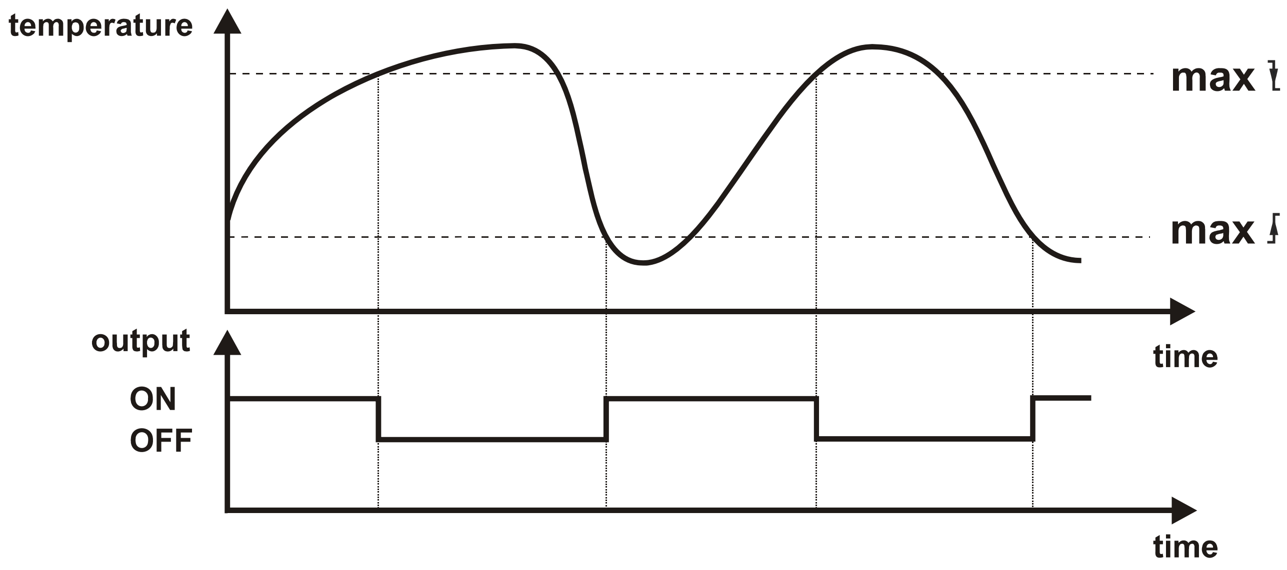
diff ↑ When the temperature difference between the two set sensors exceeds this value, this output is released. **diff** is the basic function (differential control) of this unit for most programs. Recommendation: In solar applications, **diff ↑** should be set to 7 - 10K. Somewhat lower values suffice for the feed pump program. (ex works = 8K)

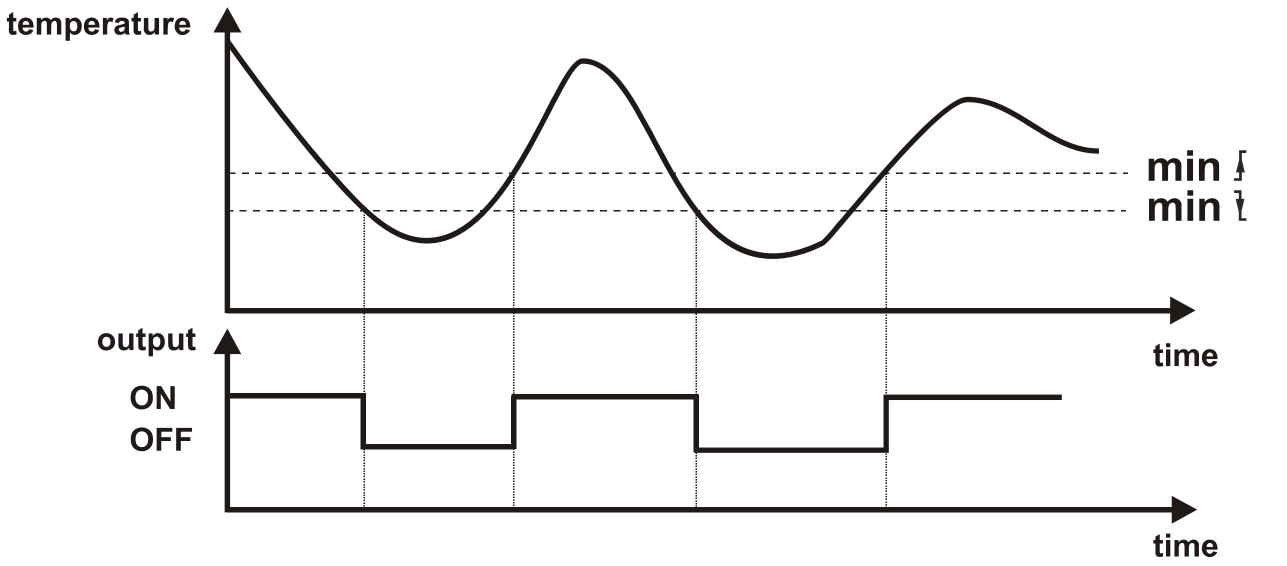
diff ↓ The output released previously when **diff ↑** was reached is blocked again when this temperature difference is reached. Recommendation: **diff ↓** should be set at around 3 - 5K (ex works = 4K). Although the software allows for a minimum difference of 0.1K between the switch-on / off difference, no value below 2K should be entered due to transducer and measurement tolerances. (ex works = 4K)

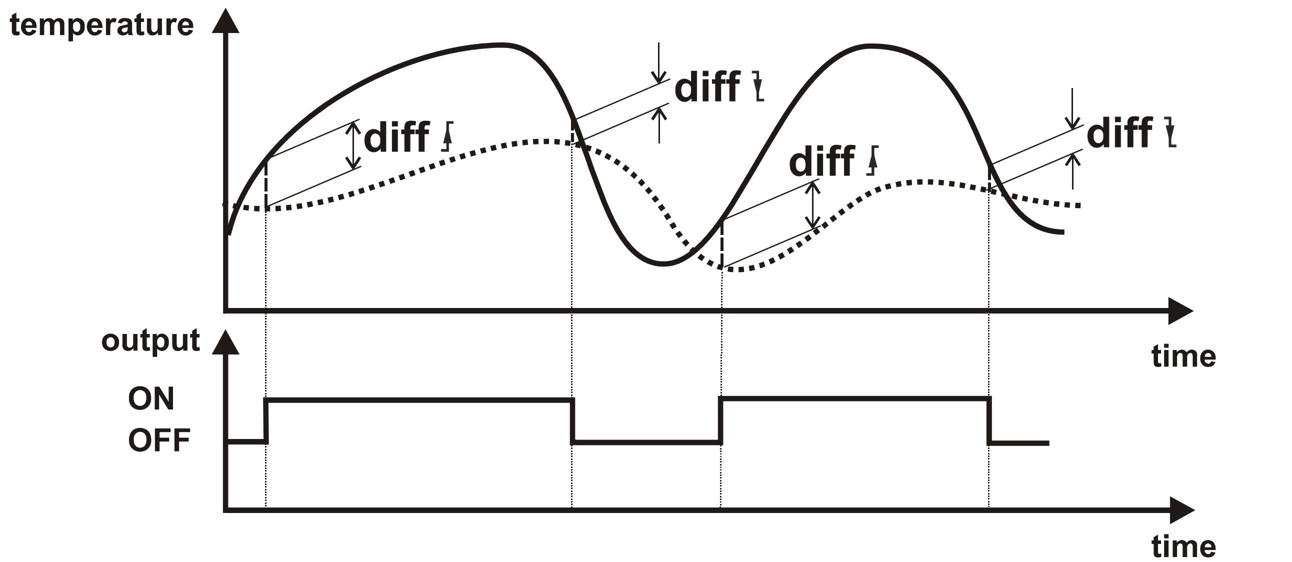
Setting range: 0.0 to 9.9K in increments of 0.1K

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



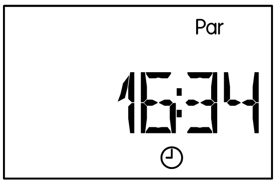




Time

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.



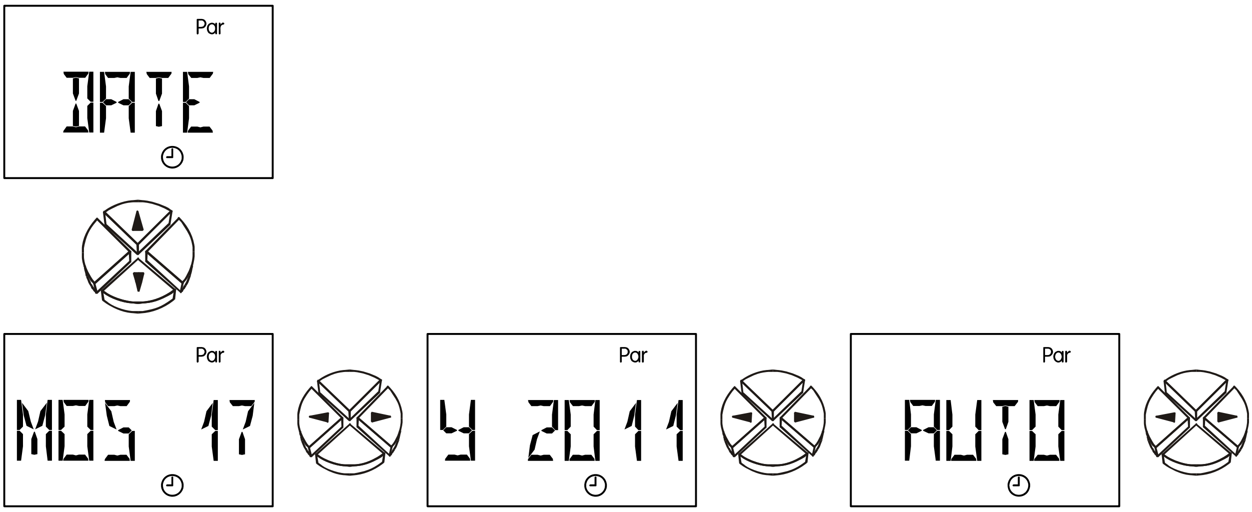
Time

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 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 **M**onth (Example: May the 17th): 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 **Y**ear

AUTO **Auto**matic 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.

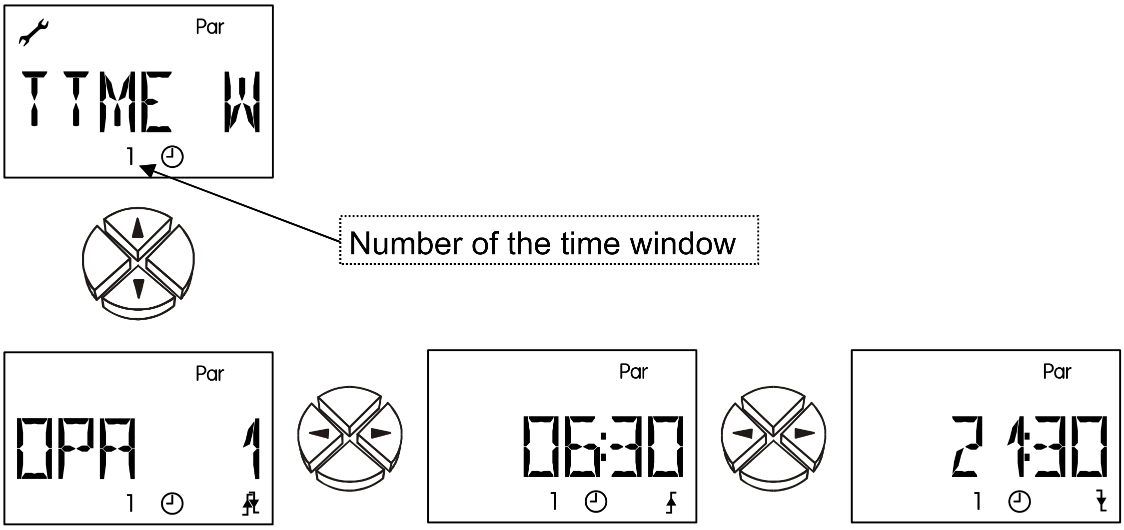
Time window *TIME W* (3 times)

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.



Assigned outputs | Release time | Block time

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** (**O**R) 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

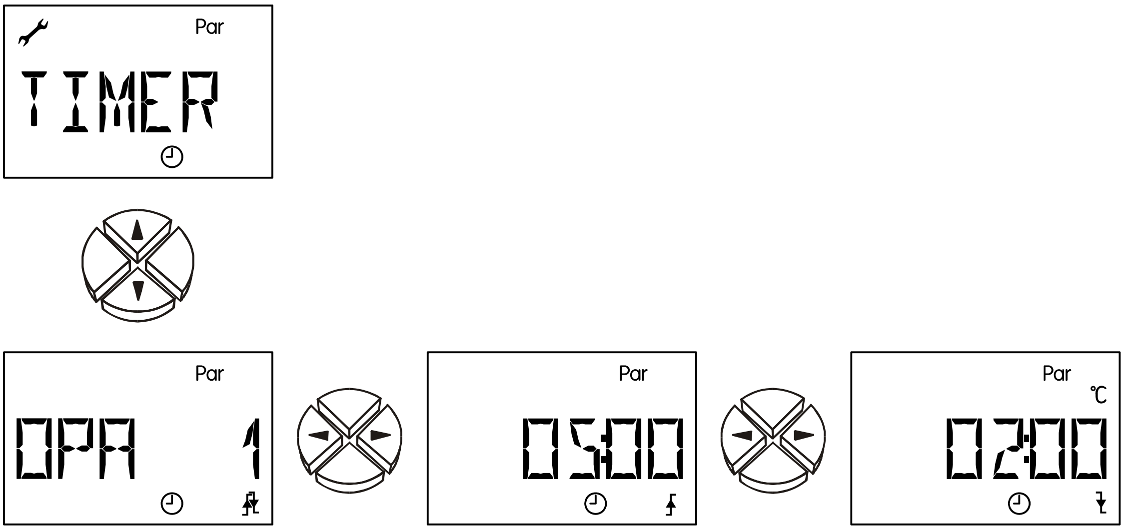
↓ The time at which the set outputs are blocked (ex works = 00:00 AM)
Setting range: 12:00 AM to 11:50 PM in increments of 10 min

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 alternatively.**



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 **o**utputs. (ex works = --)

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

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

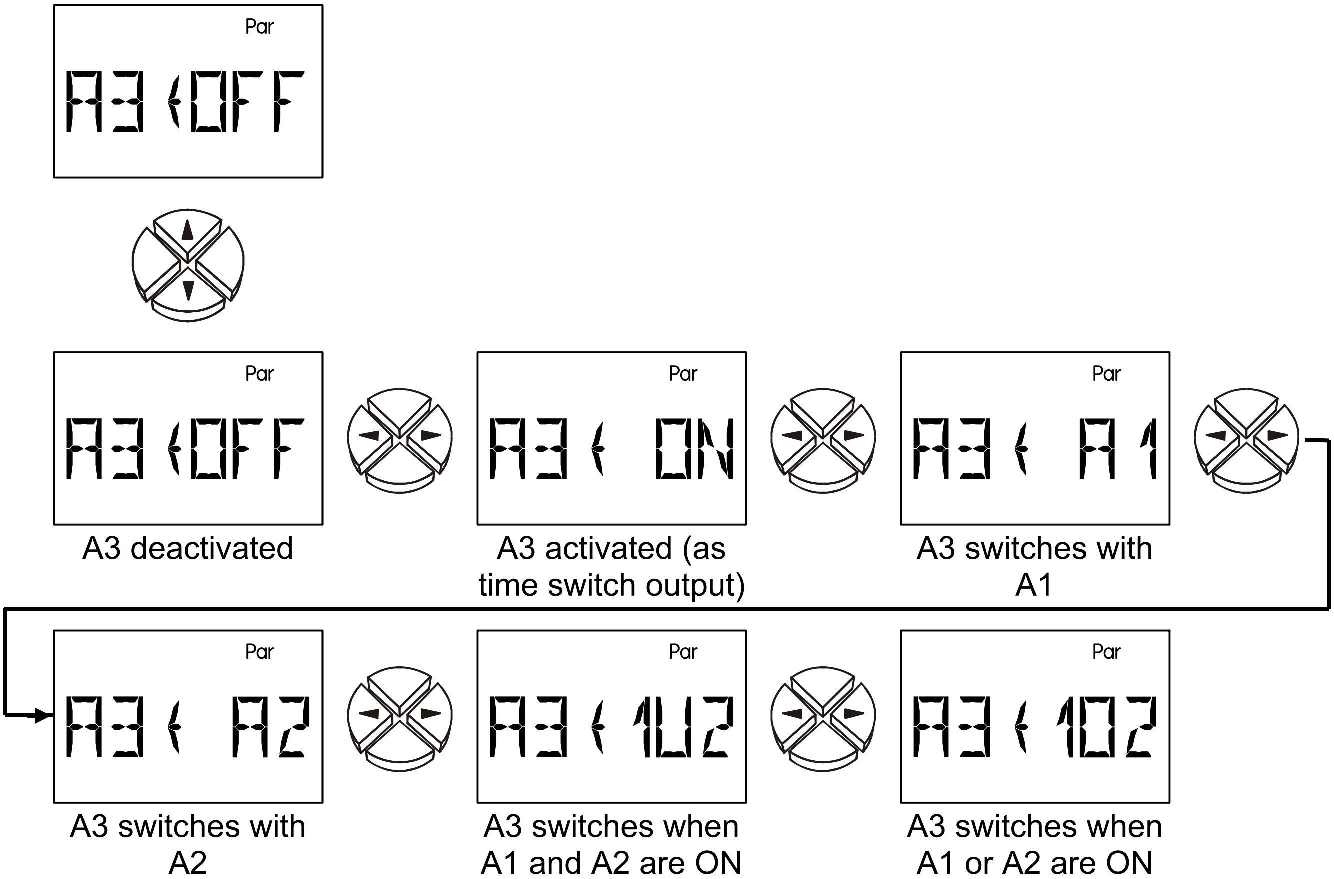
Setting range: Combination of all outputs (e.g. OP1, OP 23, OP 123)
OPA 1 to OPA123 and OPO 1 to OPO 123
OP -- = no output (timer function deactivated)

↑ — 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 <= OFF*

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



A3⇦OFF Output A3 has no function

A3⇦ON Output A3 is released and available as e.g. time switch output (setting: OPA 3)

A3⇦A1 Output A3 switches together with output A1

A3⇦A2 Output A3 switches together with output A2

A3⇦1U2 Output A3 switches if output A1 and output A2 have activated.
A3 = A1 & A2

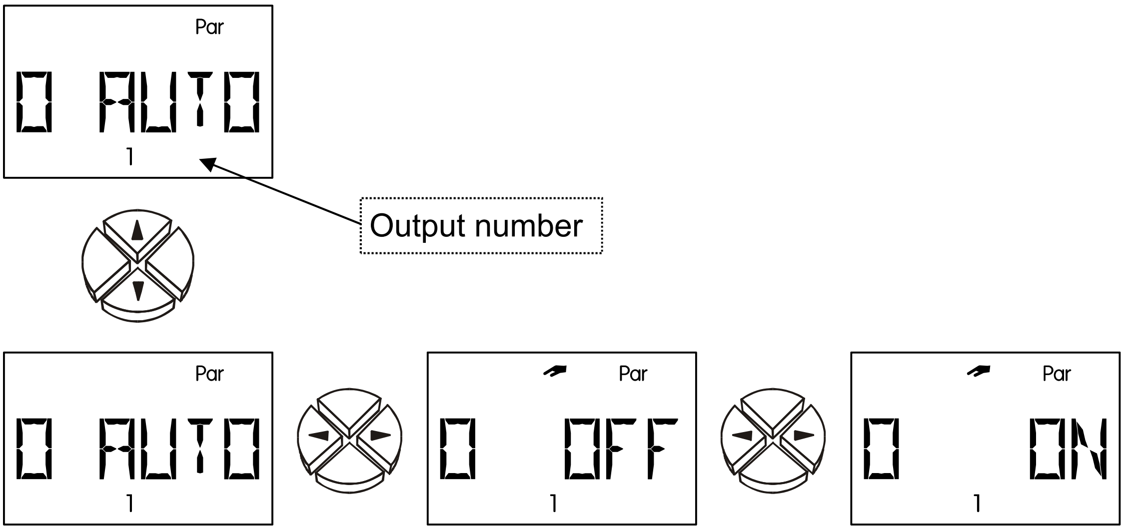
A3⇦1O2 Output A3 switches if output A1 or output A2 have activated.
A3 = A1 or A2

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

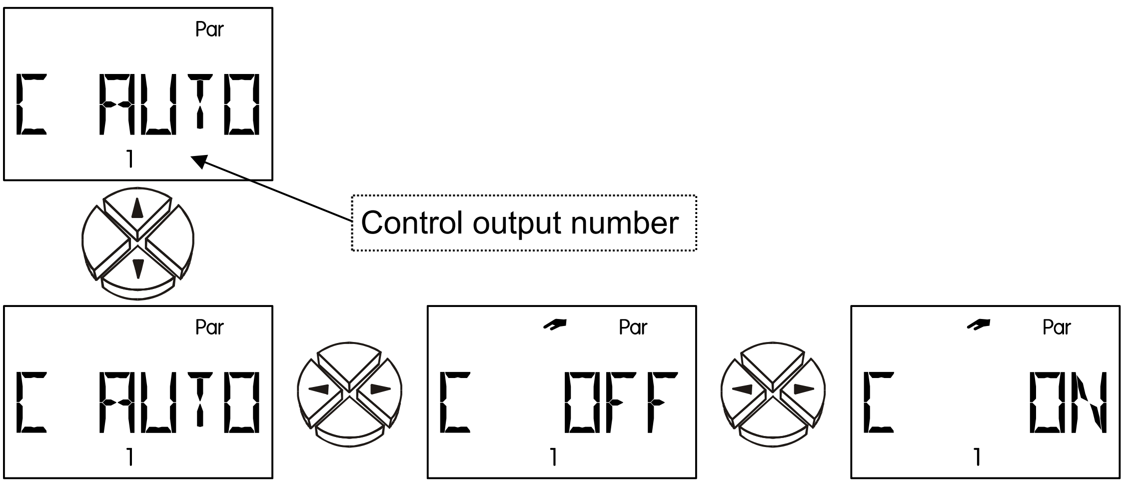


Automatic mode | Manual OFF | Manual ON

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.

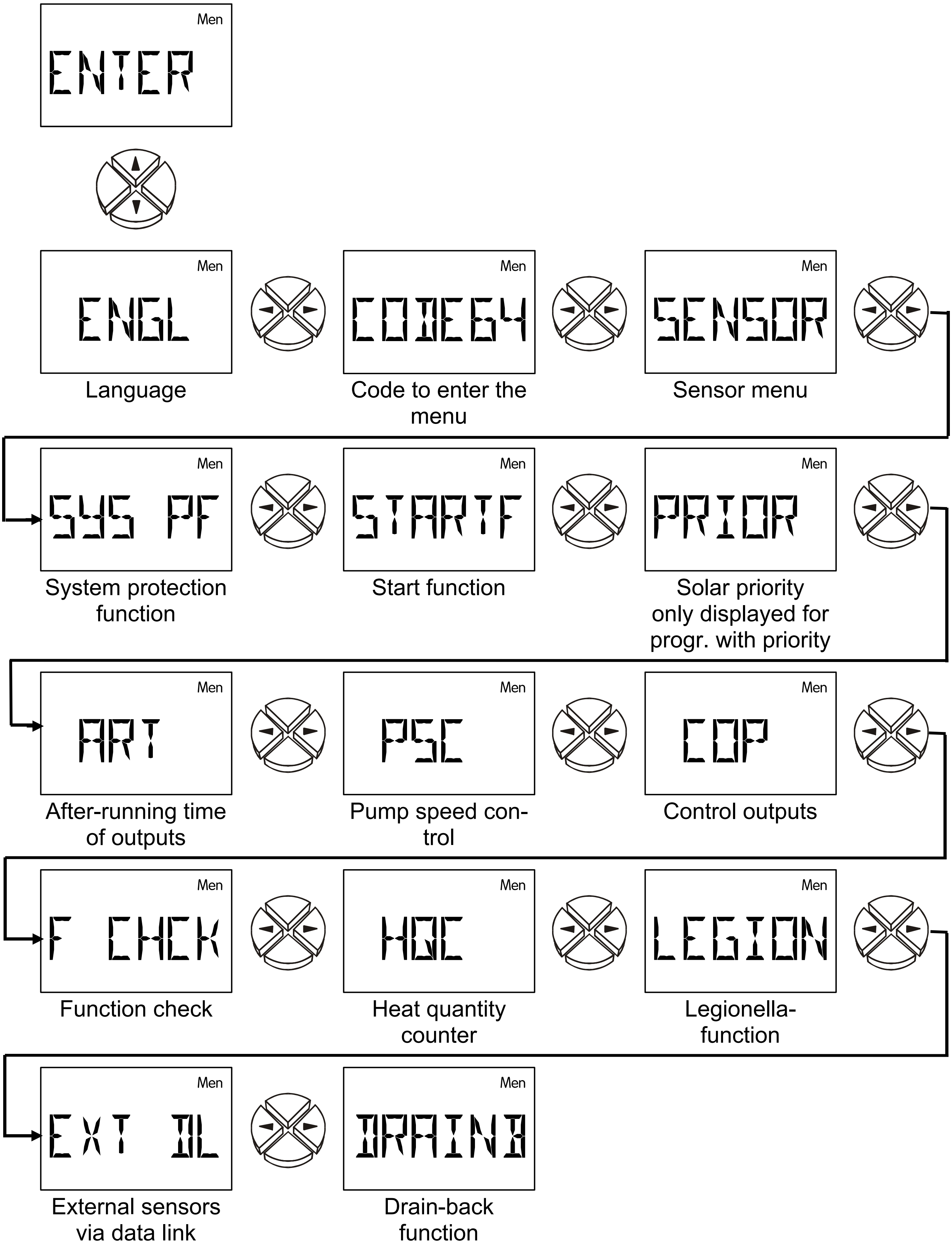
C AUTO The 2 control outputs are set to automatic mode and can be changed over to manual mode (**C ON**, **C OFF**) for test purposes. **To indicate manual mode a flashing hand symbol appears.** (ex works = AUTO)

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*



Men
ENTER
Men
ENGL
Language
Men
CODE64
Code to enter the menu
Men
SENSOR
Sensor menu
Men
SYS PF
System protection function
Men
STARTF
Start function
Men
PRIOR
Solar priority only displayed for progr. with priority
Men
ART
After-running time of outputs
Men
PSC
Pump speed con-trol
Men
COP
Control outputs
Men
F CHCK
Function check
Men
HQC
Heat quantity counter
Men
LEGION
Legionella-function
Men
EXT DL
External sensors via data link
Men
DRAINB
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 = **Engl**ish. 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 **S**ystem **p**rotection **f**unction: collector overheating limiter (2 times) and
frost protection function (2 times)
Collector cooling function
Anti-blocking protection

STARTF **Start f**unction (2 times): start aid for solar power systems

PRIOR Solar **prior**ity: only for program diagrams with more than one solar circle

ART **A**fter-**r**unning **t**ime: can be set for each output.

PSC **P**ump **s**peed **c**ontrol: constant temperature thanks this feature.

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

As analogue output (0-10 V): output of a voltage between 0 and 10 V.

As 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 **F**unction **check:** monitoring of sensor malfunctions,
short circuits and
circulation checks

HQC **H**eat **q**uantity **c**ounter: operation with the volume flow encoder or
operation with fixed volume flow

LEGION **Legion**ella protection function

EXT DL **Ext**ernal sensor values from the data link

DRAINB Function for drain-back systems

Language *DEUT, ENGL, INTER*

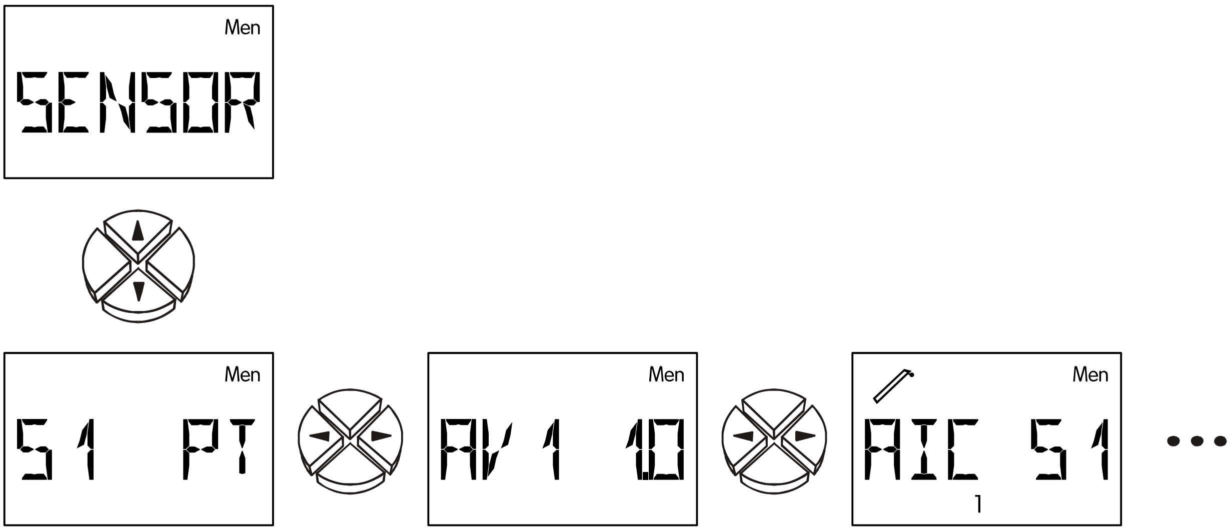
Language selection: The entire menu can be switched to the desired user language even before the code is provided. The following languages are available: German (***DEUT***), English (***ENGL***) and international (***INT***) for French, Italian and Spanish.

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*

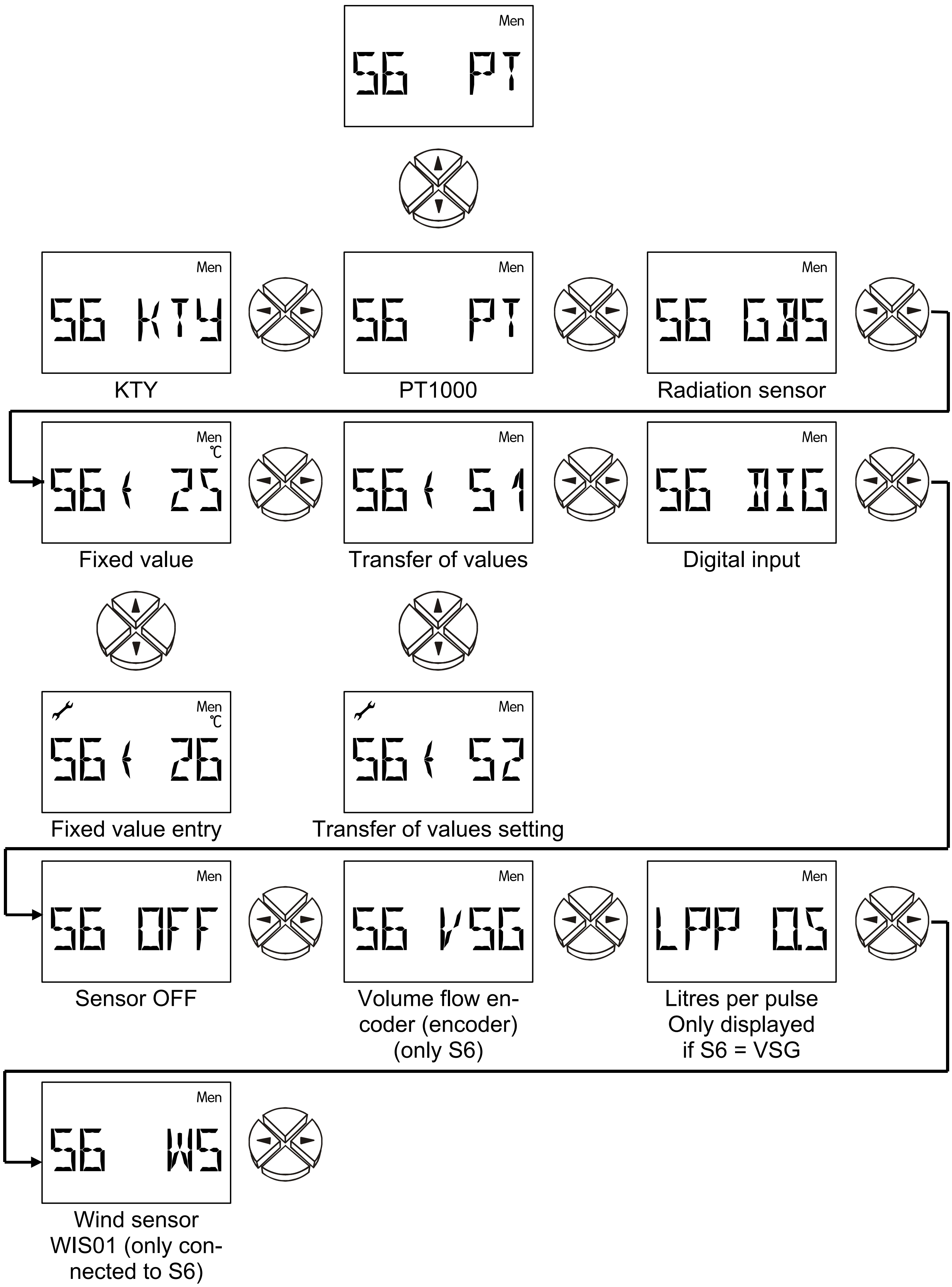


Sensor | Average determination | Assigning icons

These 3 menu items 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. KTY 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 off 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 **Dig**ital input: such as when a volume flow switch is used.
Input short-circuited: Display: D1
Input interrupted: Display: D0

OFF The sensor is not displayed on the main level. The sensor value is set to 0°C.

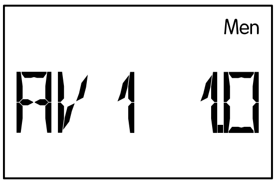
VSG Volume flow encoder: **Only sensor S6** to read-in the **pulses** from a volume flow encoder

LPP **L**itres **p**er **p**ulse = the volume flow encoder's pulse rate (only when 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*

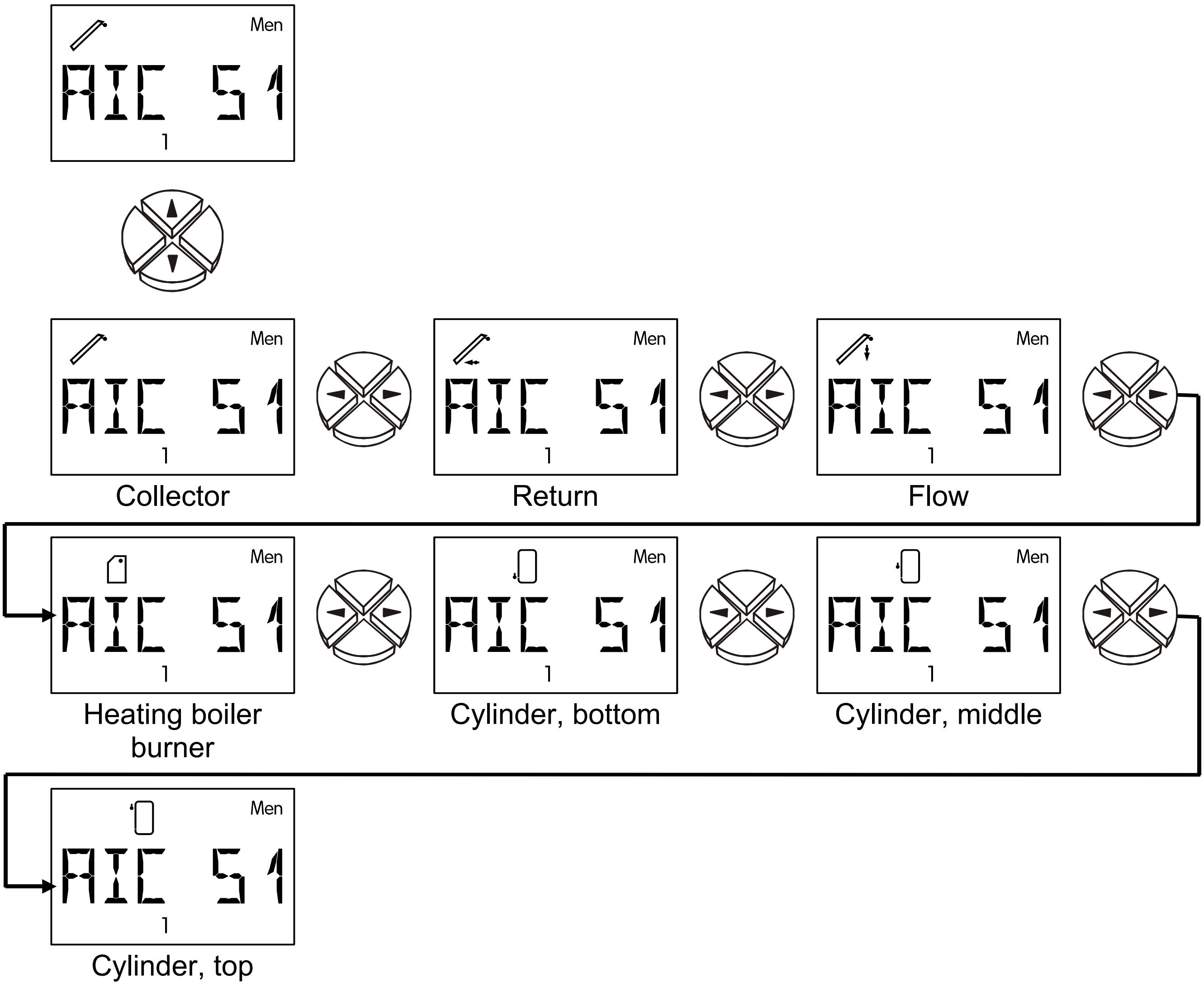
Setting of the time in seconds over which an averaging of the measured value should be carried out (ex works = 1.0s).



Example: AV1 1.0 Create an **av**erage 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

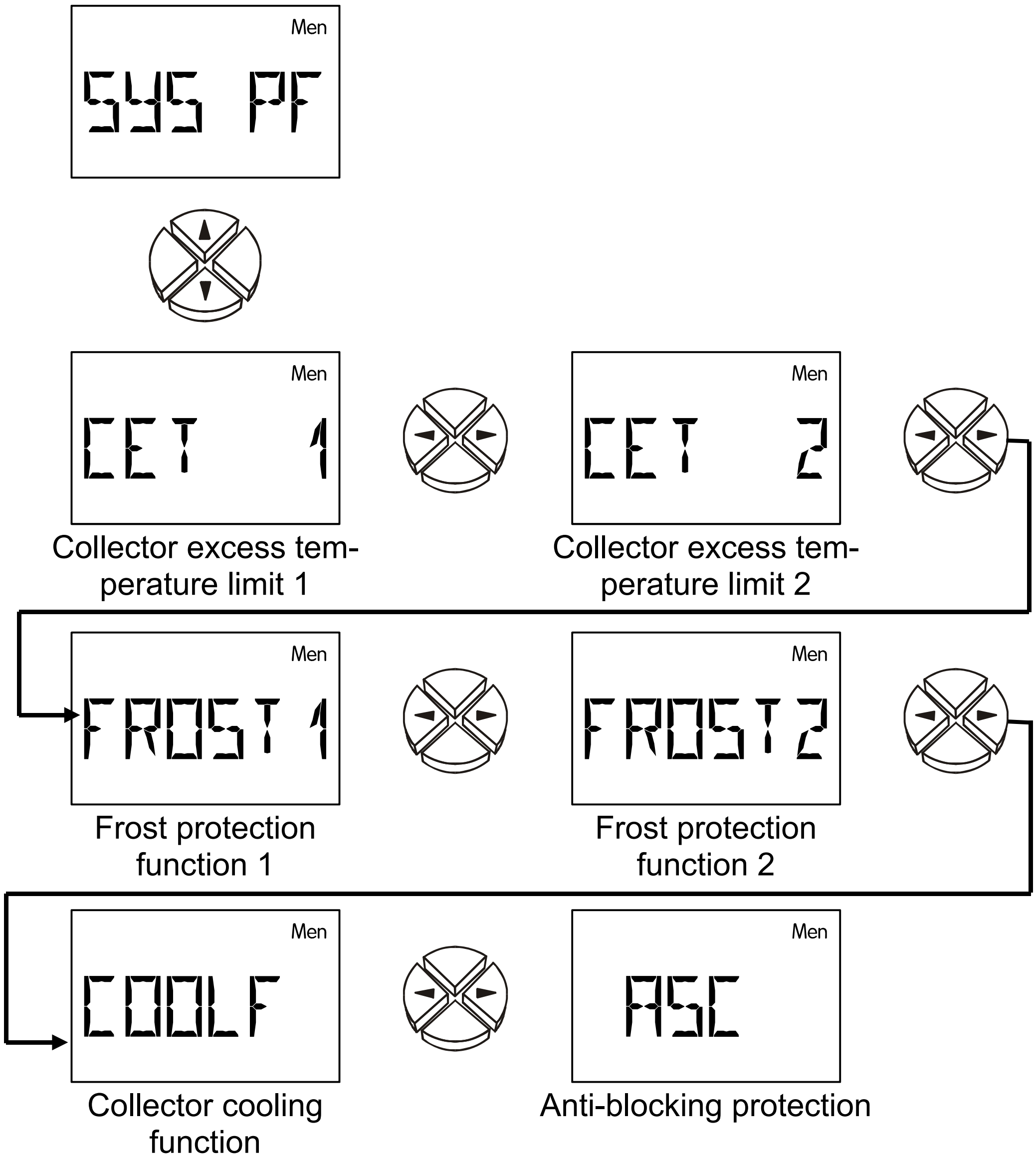
Assigning icons *AIC*



One of the icons displayed above can be assigned to each sensor. Each icon is available three times, which is displayed in the bottom line by the index (1, 2 or 3). Contrary to the above graphic each symbol appears three times with a different index before switching to the next.

Symbol allocation has no influence on the control function.

System protection function *SYS PF*



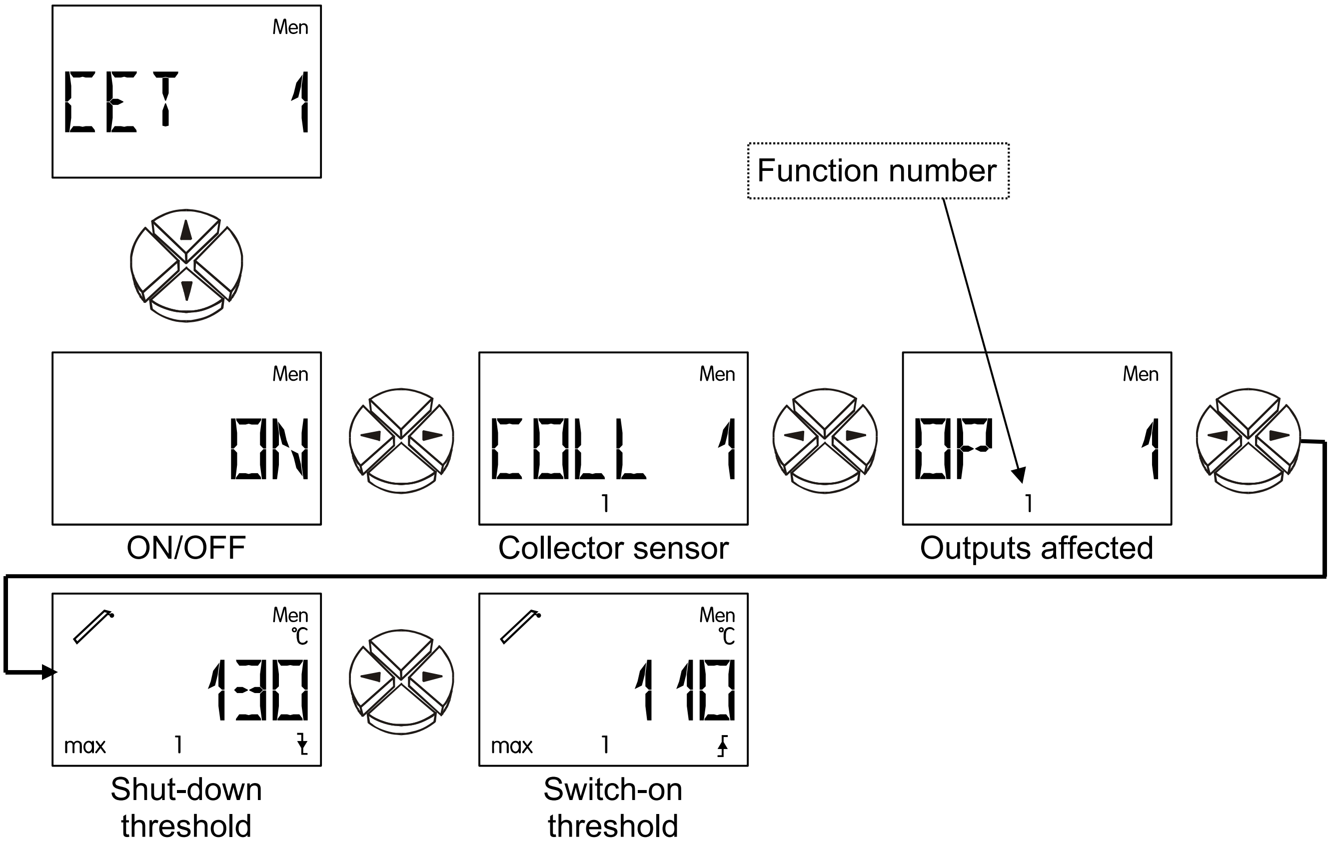
Two collector excess temperature limiter functions and two frost protection functions are available. These functions can be set completely independently of the program diagram selected.

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 **C**ollector **e**xcess **t**emperature limit ON/OFF (ex works$_1$ = ON, ex works$_2$ = OFF)

COLL Setting of the **coll**ector sensor (S1 to S6) to be monitored.
(ex works$_1$ = S1, ex works$_2$ = S2)
Setting range: S1 to S6

OP Setting of the **o**ut**p**uts to be blocked when the switch-off threshold is exceeded. (ex works$_1$ = OP1, ex works$_2$ = 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)

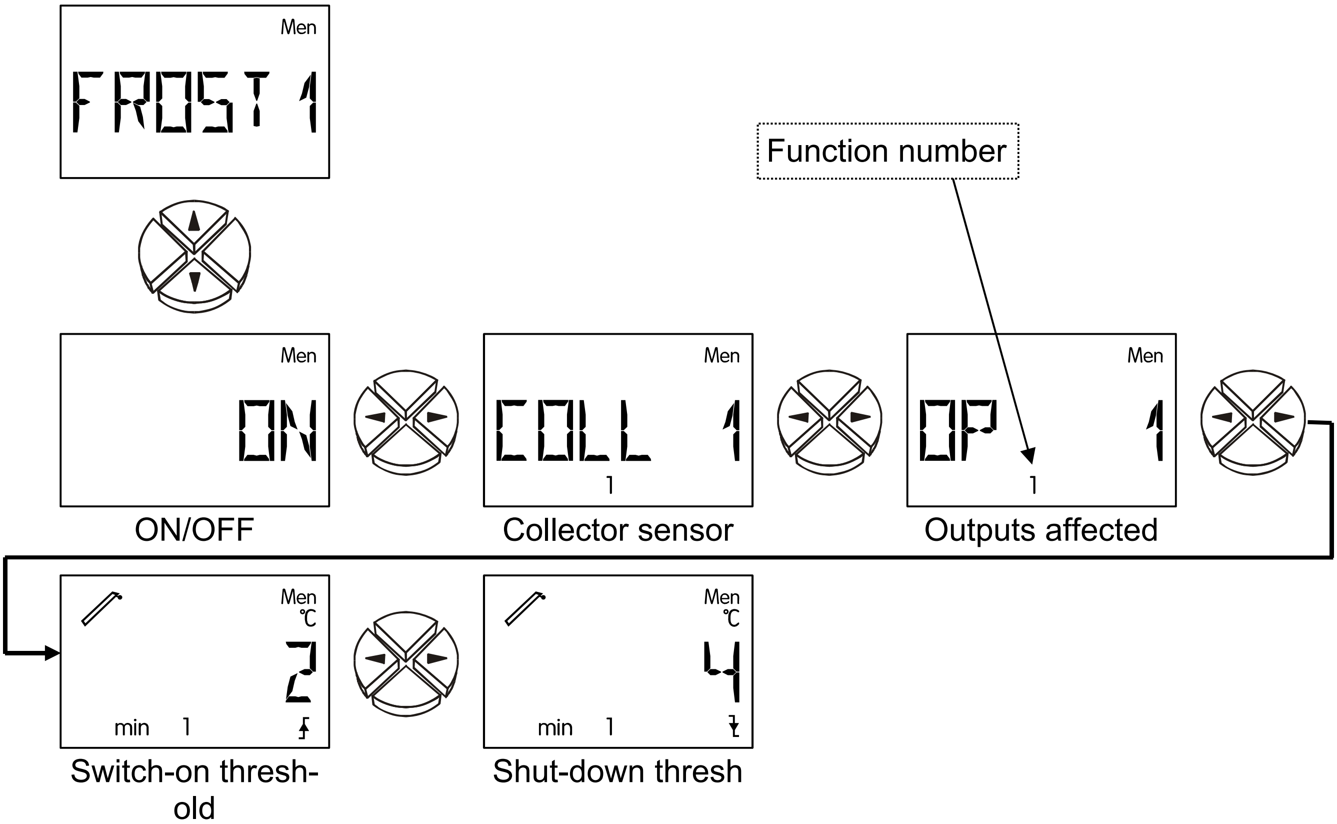
max ↓ Temperature above which the outputs set are to be blocked
(ex works$_1$ = ex works$_2$ = 130°C)
Setting range: 0°C to 200°C in increments of 1°C

max ↑ Temperature above which the outputs set are to be released.
(ex works$_1$ = ex works$_2$ = 110°C)
Setting range: 0°C to 199°C in increments of 1°C

The collector overheating protection function is available twice and is indicated by the index (1 or 2) in the lower display line.

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 cylinder suffices to keep the collector at a minimum temperature for the few hours below freezing. At **min ↑** of 2°C on the collector sensor, the settings in the chart release the solar pump and block it again at **min ↓** of 4°C.



ON / OFF Frost-protection function ON/OFF (ex works$_1$ = ex works$_2$ = OFF)

COLL Setting of the **coll**ector sensor (S1 to S6) to be monitored
(ex works$_1$ = S1, ex works$_2$ = S2)
Setting range: S1 to S6

OP Setting of the **o**ut**p**uts 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 works$_1$ = OP1, ex works$_2$ = OP2)
Setting range: combination of all outputs (such as OP1, OP23, OP123)

min ↑ Temperature above which the outputs set are to be switched on
(ex works$_1$ = ex works$_2$ = 2°C)
Setting range: -30°C to 119°C in increments of 1°C

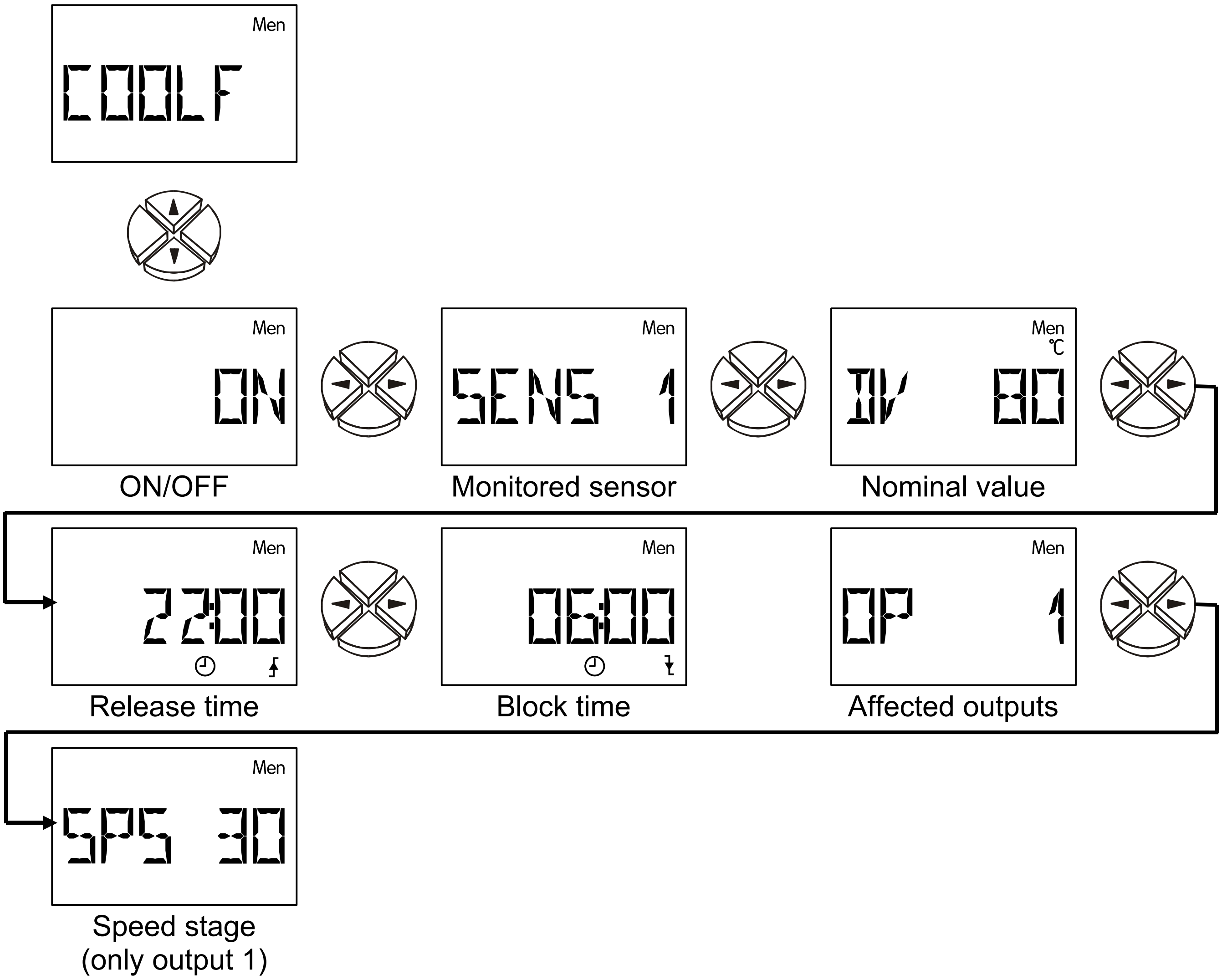
min ↓ Temperature above which the outputs set are to be switched off
(ex works$_1$ = ex works$_2$ = 4°C)
Setting range: -29°C to 120°C in increments of 1°C

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 indicated by the index (1 or 2) in the lower display line.
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 cylinder is allowed to cool overnight so that the following day heat can be taken in again.

If the selected sensor (cylinder 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 O1.



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

SENS Monitored (cylinder) **sens**or
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.

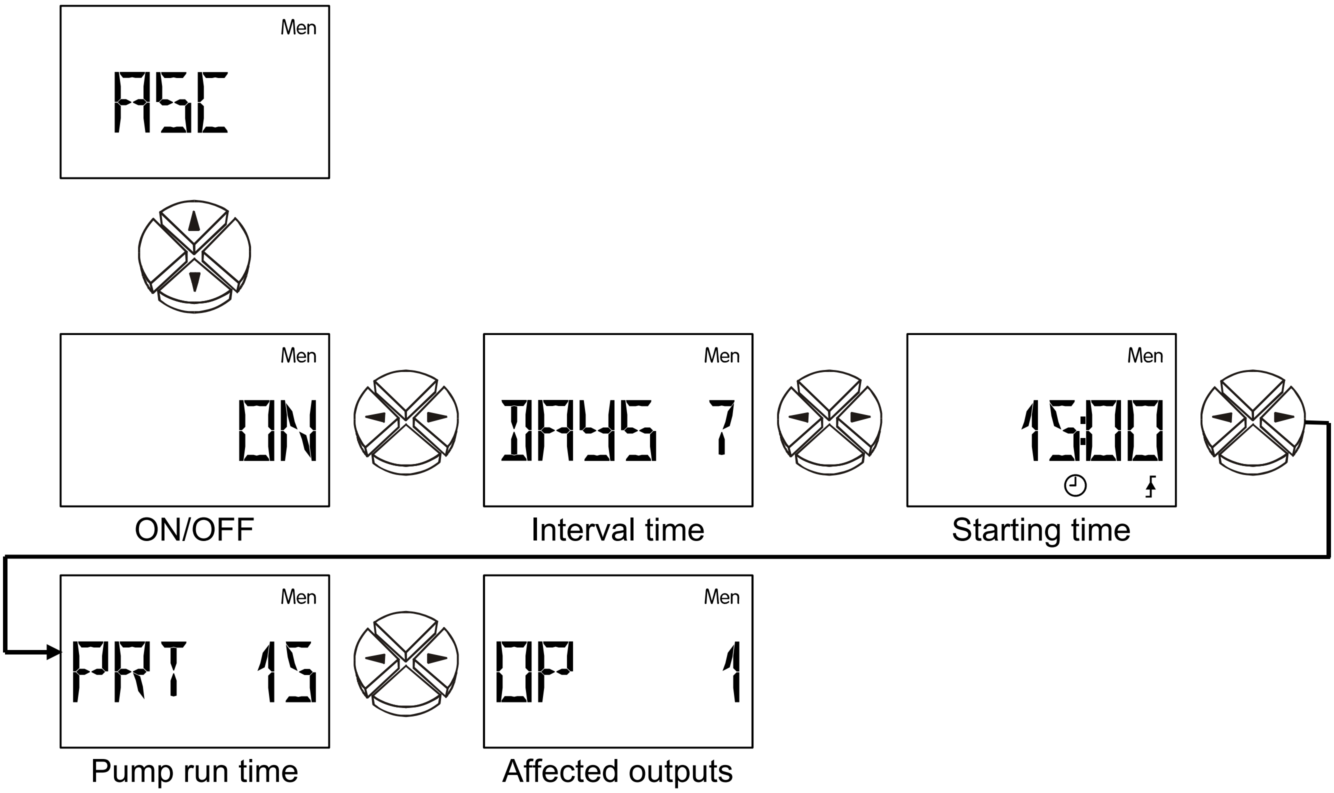
Setting range: Combinations of all outputs (ex works = OP1)

SPS Speed stage with which the pump is to run (only output O1, 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 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 **P**ump **r**un **t**ime 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 **o**ut**p**uts 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)

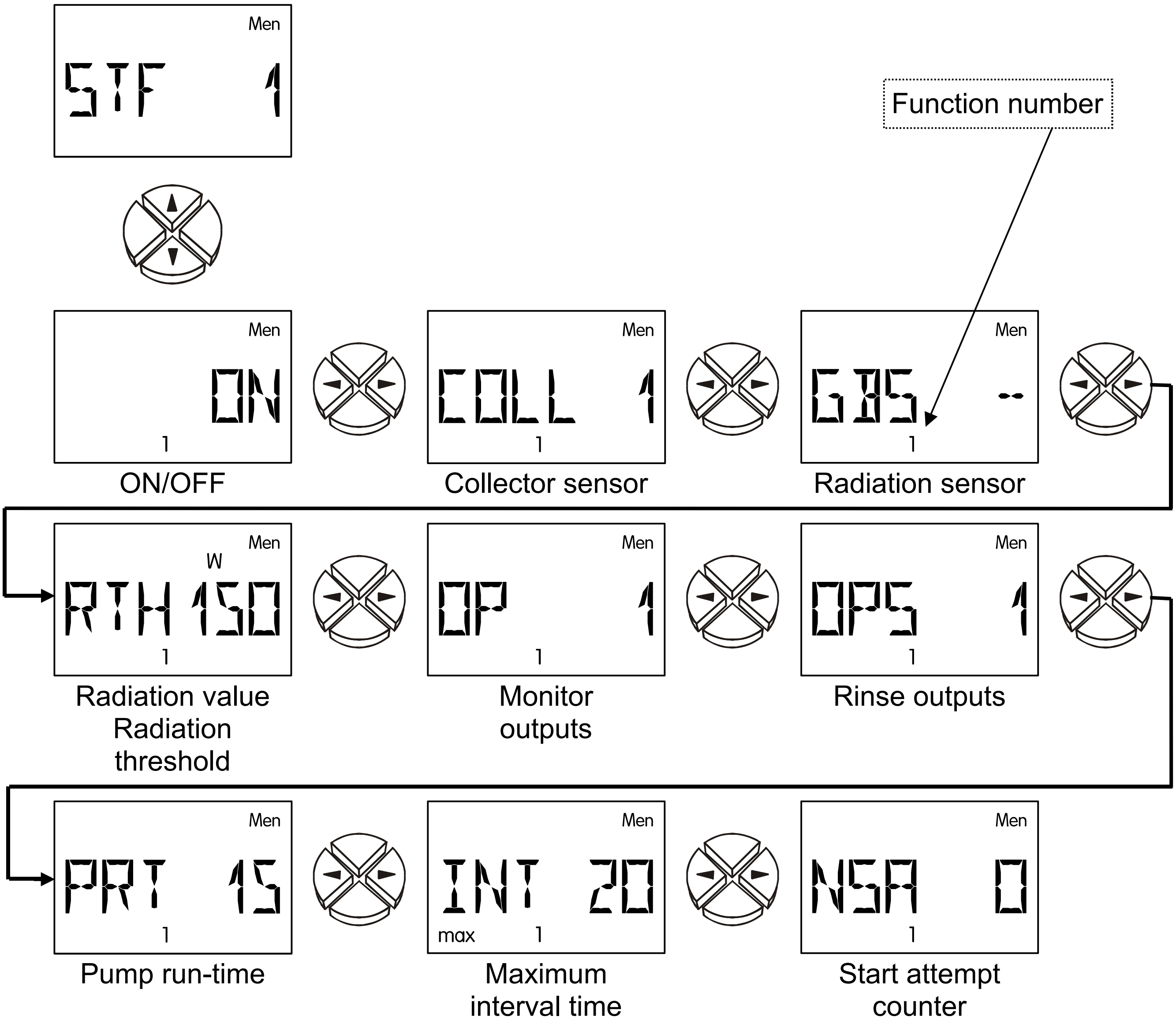
In the morning, solar power systems sometimes do not "start" quickly enough because the warm heat transfer medium does not reach the collector sensor. Flat collector panels and **forced-circulation vacuum tubes** generally lack sufficient gravitational force.

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 **coll**ector 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 (**r**adiation **th**reshold) 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 **O**ut**p**uts 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 **O**ut**p**uts 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 **P**ump **r**un-**t**ime (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 **int**erval 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

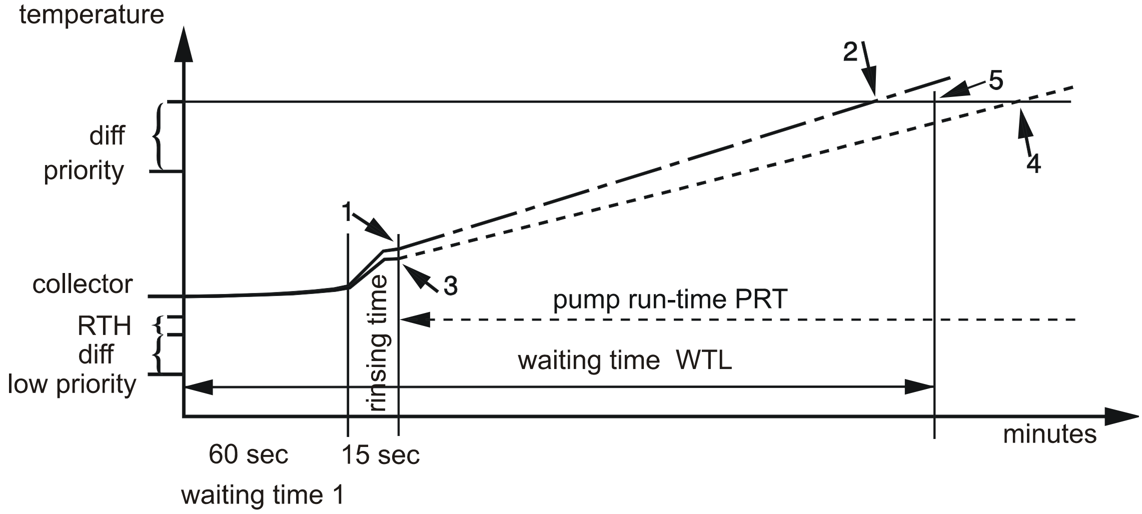
NSA **N**umber of **s**tart **a**ttempts (= counter). The system is automatically reset for a start attempt if the last start attempt was more than four hours ago.

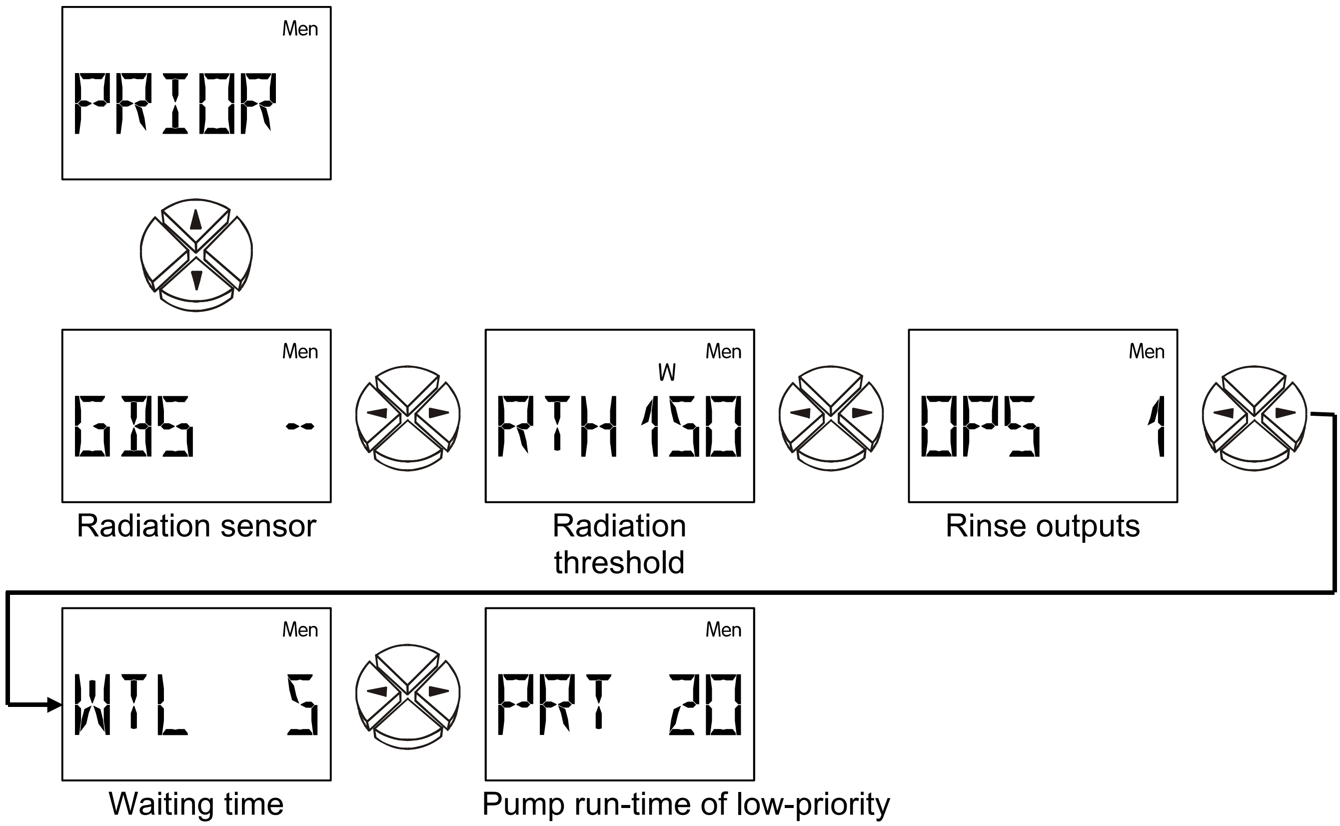
Priority *PRIOR*

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).**





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 (**r**adiation **th**reshold) 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 **O**ut**p**uts used for **r**insing. **I**f 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, OPS123…)

WTL **W**aiting **t**ime of **l**ow 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

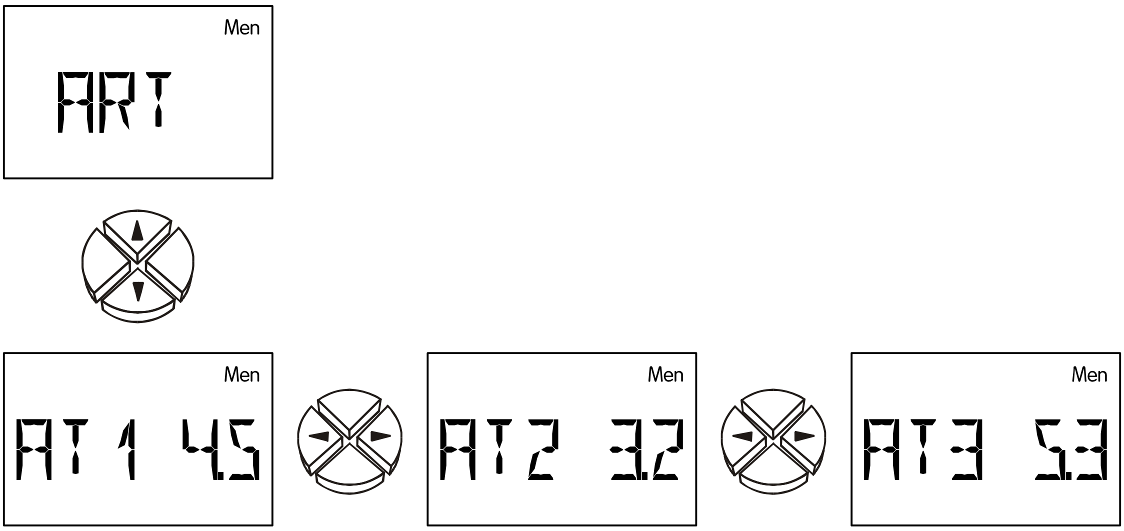
PRT **P**ump **r**un-**t**ime of low-priority. If the solar radiation to switch to priority is not sufficient, the low priority is allowed again for this time.

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

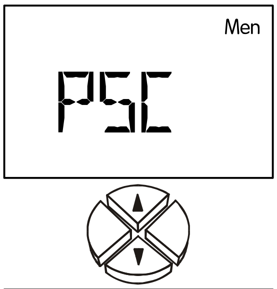
AT1 **A**fter-**r**unning **t**ime output 1 (ex works = 0)

Setting range: 0 (no after-running time) to 9 minutes in increments of 10 secs

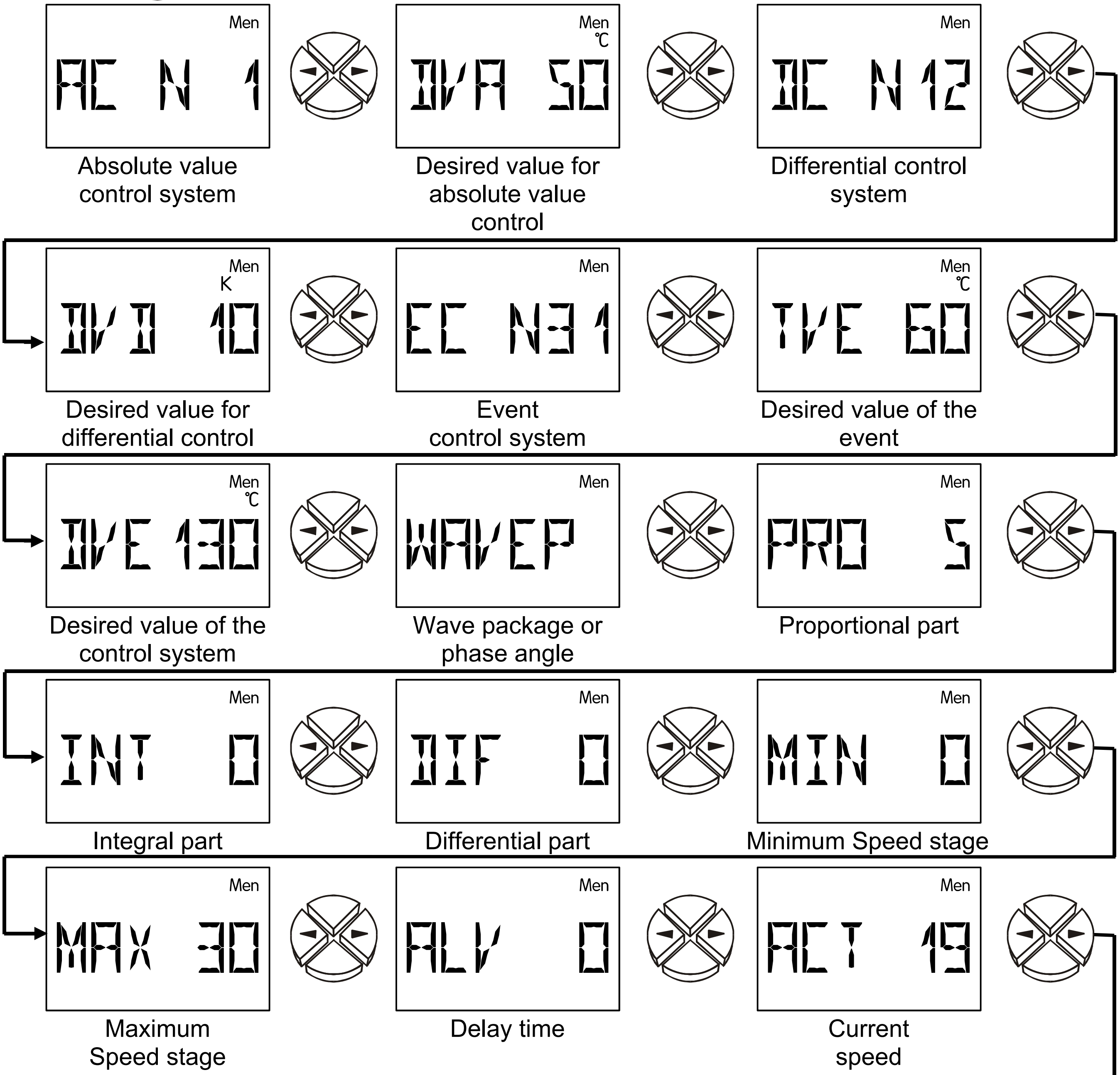
AT2, AT3 After-running time for outputs 2 and 3 (ex works = 0)

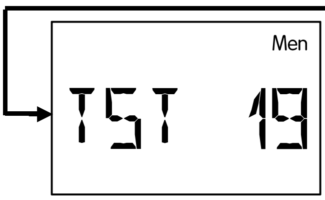
Pump speed control *PSC*

Pump speed control PSC is <u>not</u> suitable for electronic or high efficiency pumps.



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





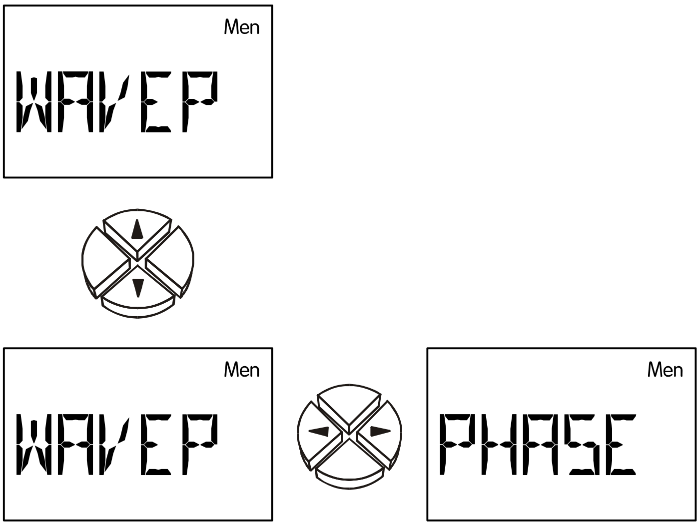
Setting of test speed

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.

<u>The description of the parameter values follows in the menu "COP".</u>

Waveform

Two waveforms are available for motor control. (ex works = WAVEP)



WAVEP Wave packets - only for circulating pumps with standard motor dimensions. Here, individual half cycles are bled in to the pump motor. The pump runs on pulses and only produces a smooth flow of the heat transfer medium when the rotor's moment of inertia has been overcome.

Benefit: Great dynamics of 01:10, well suited for usual commercial pumps without internal electronics and a motor length of around 8 cm.

Drawback: Linearity depends on the pressure loss; there is some noise, not suitable for pumps with evidently deviating motor diameters and / or length from 8 cm.

<u>Wave packet control is not suitable for electronic or high efficiency pumps.</u>

PHASE **Phase** angle - for pumps and ventilation motors. The pump is switched to the grid within each half cycle at a certain point (phase).

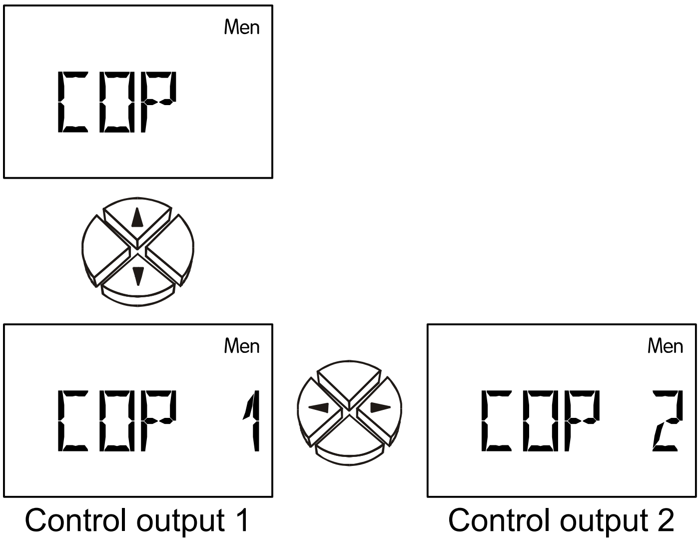
Benefit: Suitable for almost all motor types

Drawback: Low dynamics of 01:03 for pumps. **The device has to have a filter upstream to fulfill the CE standards for interference suppression**

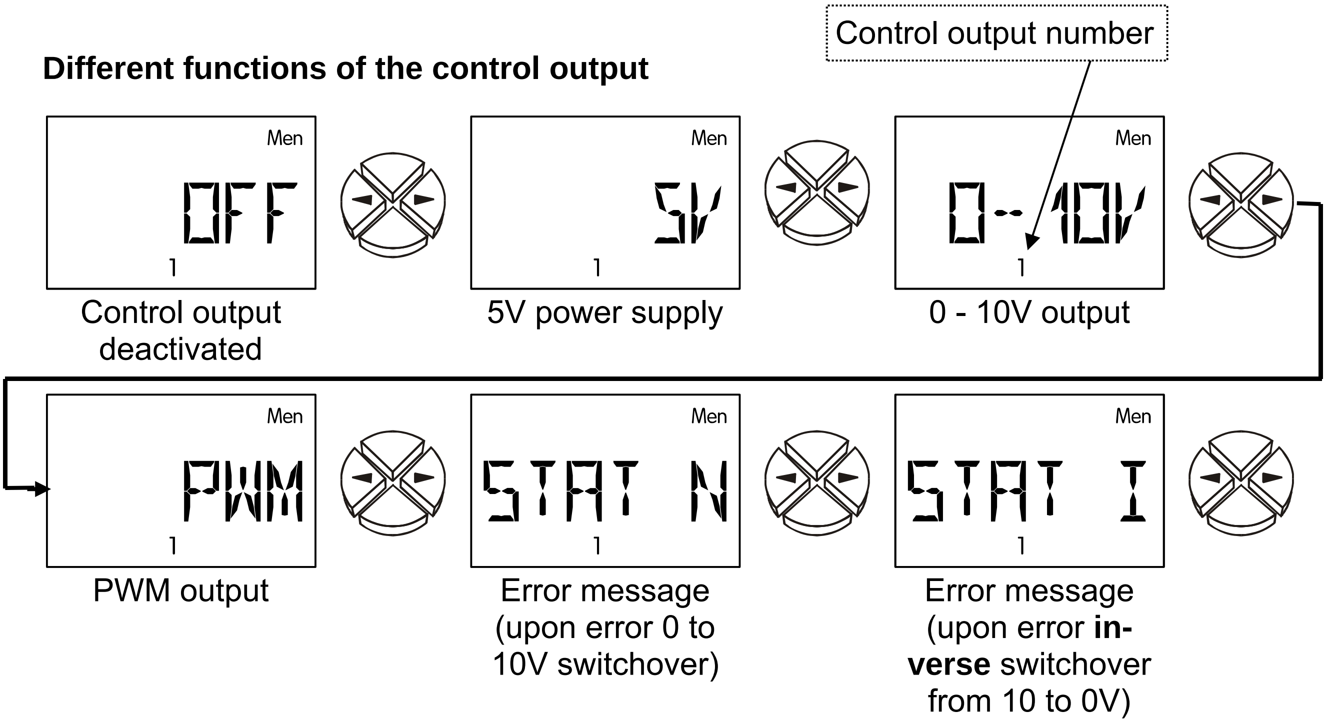
NOTICE

The menu allows a choice between wave packet and phase angle however in the standard version the output of waveform "phase angle" is not possible.
Special versions on request.

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



Different functions of the control output



OFF Control output deactivated; output = 0V

5V Power supply; output = 5V

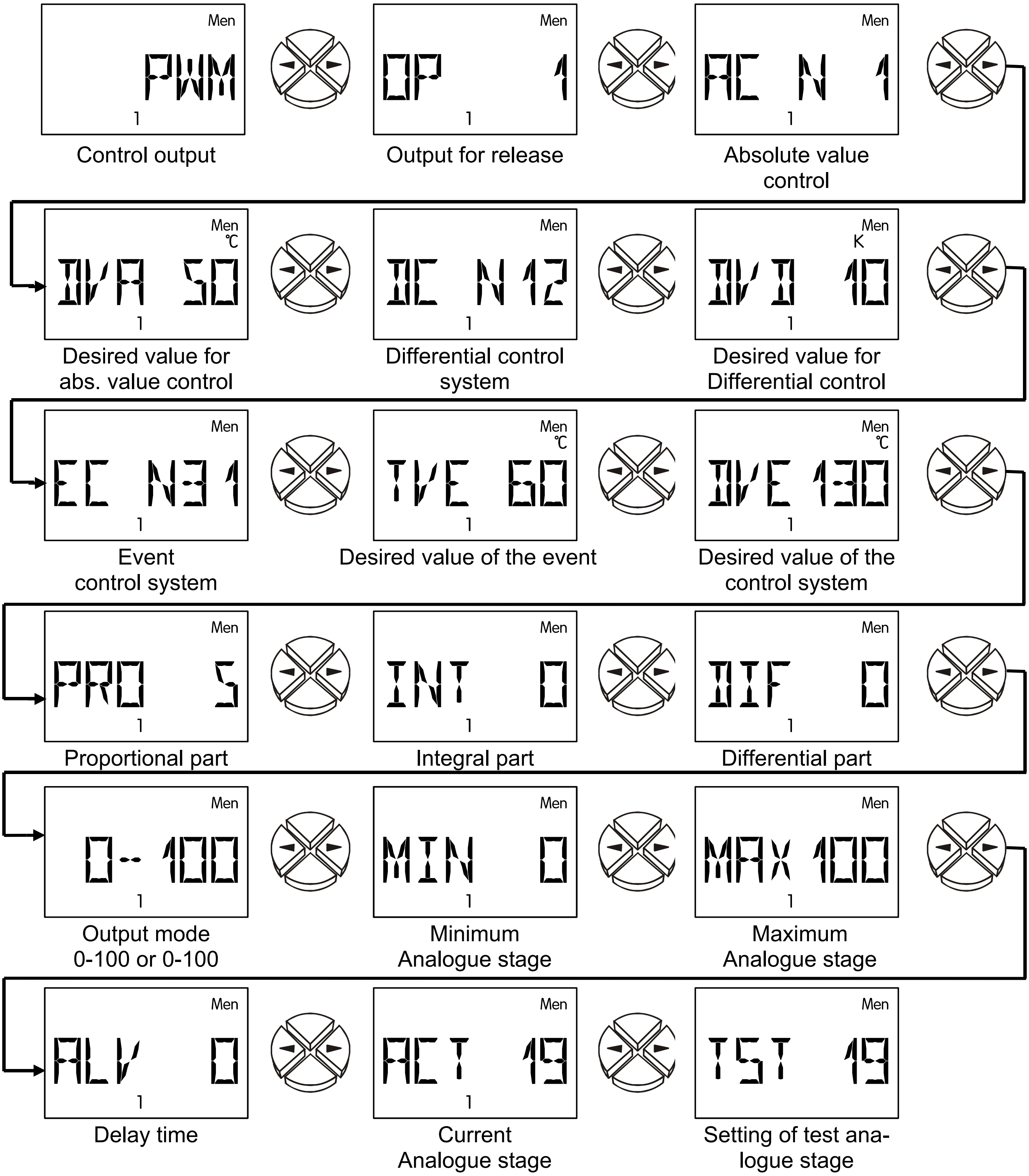
0–10V PID – controller; output= 0-10V in 0.1V increments

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 ***Stat*** (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 from10V to 0V). Upon collector excess temperature switch-off **CETOFF**, 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.

<u>Warning!</u> 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 to10V in 0.1V increments.

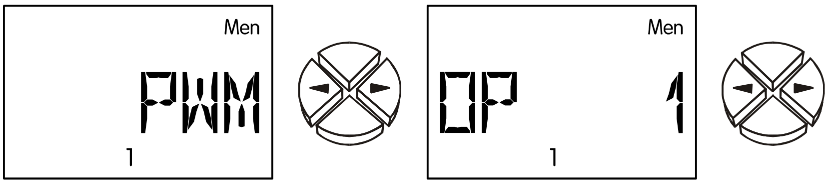
As PWM a digital signal with a frequency of 500 Hz (level approx.10 V) and a variable duty cycle from 0 to 100% is created.

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:

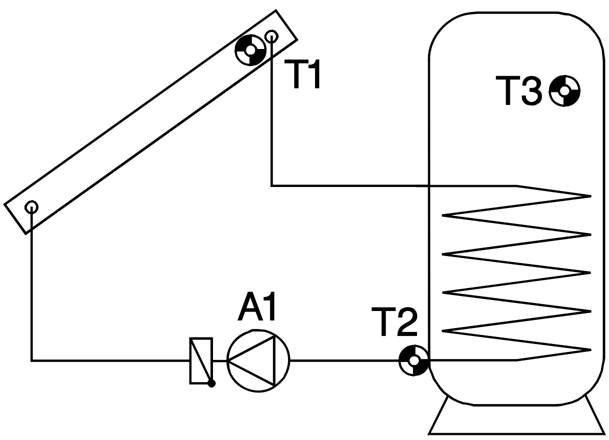
1. If the control output is set to **0-10 V** or **PWM**, **no** output is selected **and no** absolute value control, differential control or event control is activated, a **constant** voltage of 10 V (=100 % PWM) is emitted (mode 0-100).
2. If **no** output is selected **and** absolute value control, 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.

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:

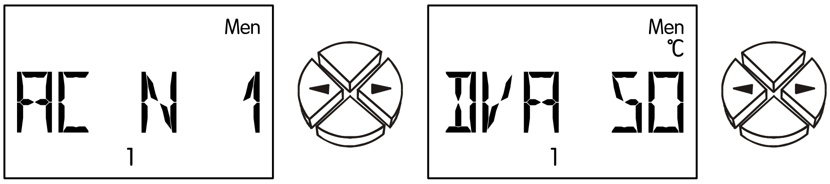


Absolute value control = maintaining a sensor

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 cylinder. The flow rate will then be reduced. The longer dwell time in the exchanger cools the heat transfer medium more, thus reducing S2. It does not make sense to keep S3 constant as the variation in the flow rate does not directly affect S3; hence, no regulator circuit will result.

The absolute control is set via two parameter windows. The **example** has typical settings for the hydraulics:



AC N 1 **A**bsolute value **c**ontrol in **n**ormal operation, with sensor S**1** 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.

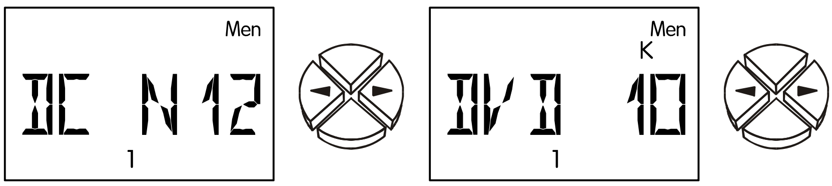
DVA 50 The **d**esired **v**alue for **a**bsolute value control is **50**°C. In the example, S1 is thus kept at 50°C. (ex works = 50°C)

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 **D**ifferential **c**ontrol in **n**ormal operation between sensors S**1** and S**2**.
(ex works = --)
Setting range: DC N12 to DC N65, DC I12 to DC I65)
DC -- = differential control is disabled.

DVD 10 The **d**esired **v**alue for **d**ifferential 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)

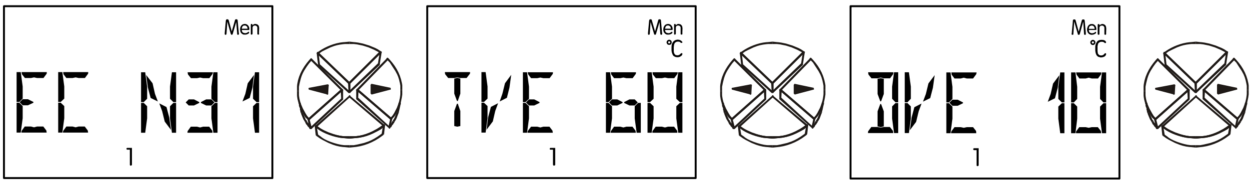
Setting range: 0.0 to 9.9K in increments of 0.1K,
10 to 99K in increments of 1K

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 **E**vent **c**ontrol in **n**ormal operation, an event at sensor S**3** leads to a constant level at sensor S**1**. (ex works = --)
Setting range: EC N12 to EC N65, EC I12 to EC I65)
EC -- = event control is disabled.

TVE 60 The **t**hreshold **v**alue for **e**vent 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

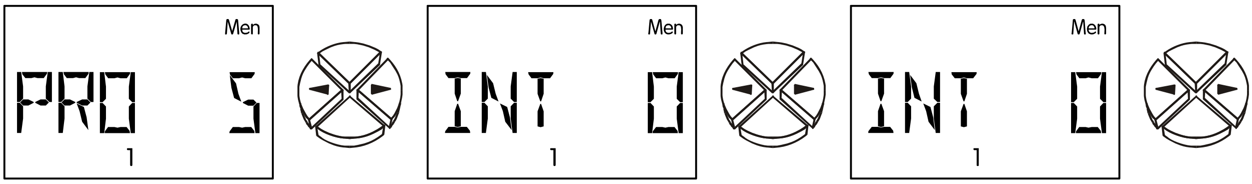
DVE 10 The **d**esired **v**alue for **e**vent control is **10**°C. As soon as the event has occurred, S1 is kept at 10°C. (ex works = 130°C)
Setting range: 0 to 199°C in increments of 1°C

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

In the **example**, keeping the collector temperature at 50°C with the absolute value control is blocked when the cylinder 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 **Pro**portional 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.**5**K 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 **Int**egral part of the PID controller **5**. It periodically adjusts the speed relative to the deviation remaining from the proportional part. For each **1**K 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 **Dif**ferential 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.**5**K 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 9 until the system is instable. In other words, the pump speed changes rhythmically and can be read in the menu with the command ACT. Every proportional part that becomes instable 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.

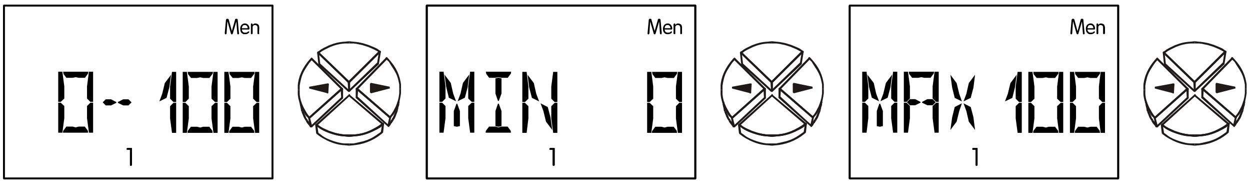
$$PRO = 1{,}6 \times P_{krit} \qquad INT = \frac{PRO \times t_{krit}}{20} \qquad DIF = \frac{PRO \times 8}{t_{krit}}$$

A typical result of **hygienic service water** 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:

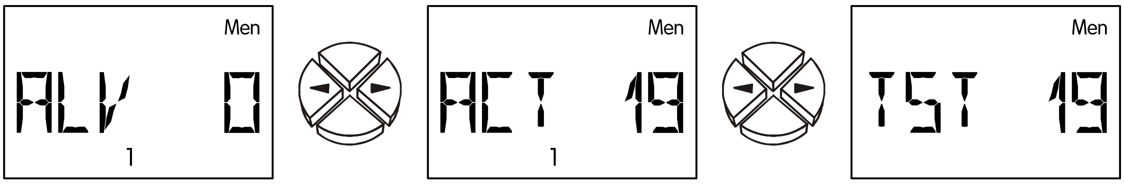


0-100 Output mode setting: 0-100 corresponds to 0->10V or 0->100% PWM, 100-0 corresponds to 10->0V or 100->0% PWM (inverse). (WE = 0-100)

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:

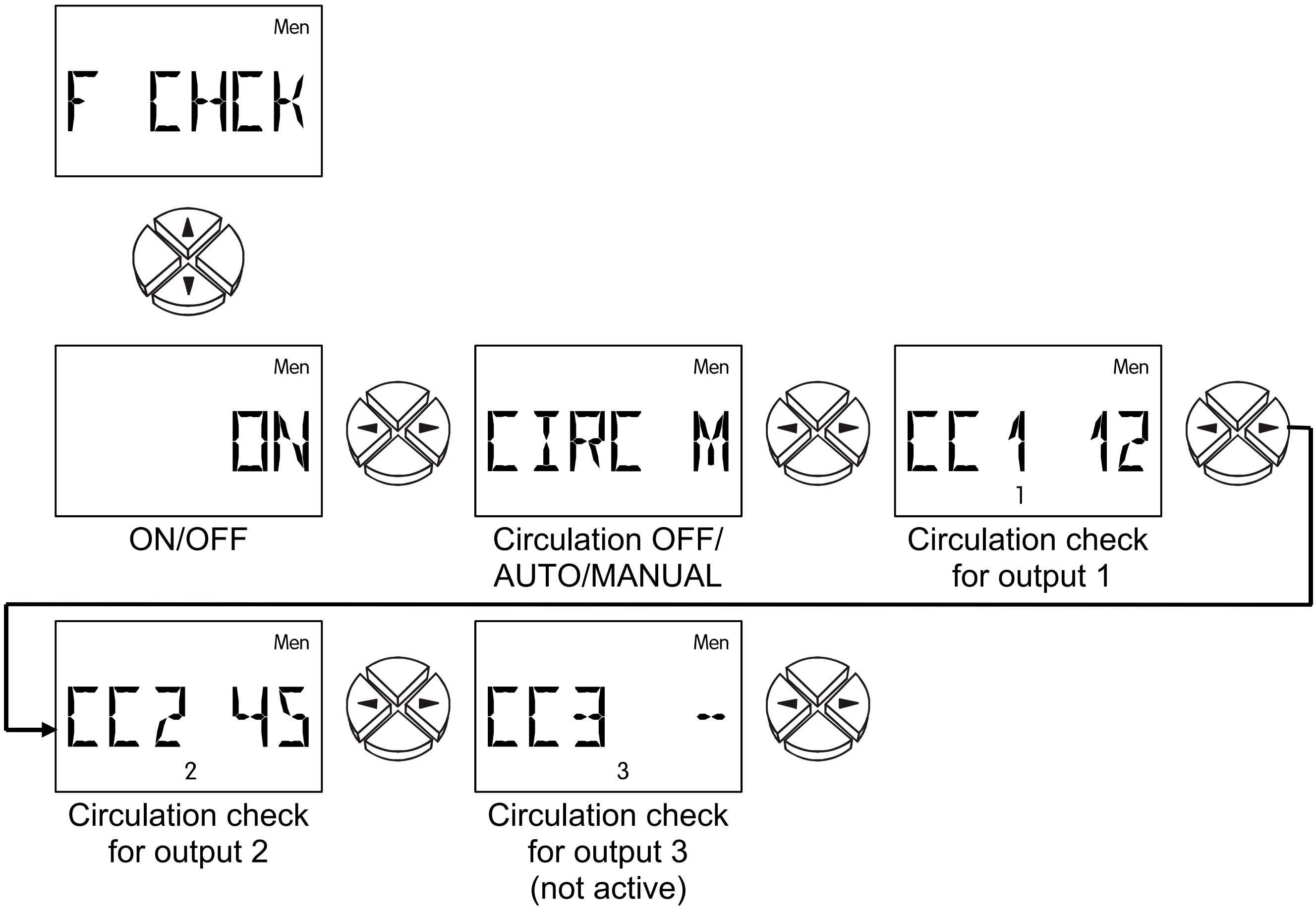
ACT 19 The pump is currently running at stage **19** (actual value).

TST 19 The speed stage **19** is currently being **test**ed. 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 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 **ci**rculation **c**heck 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 **ci**rculation check for output **2**.

CC3 Manual **ci**rculation check for output **3**.

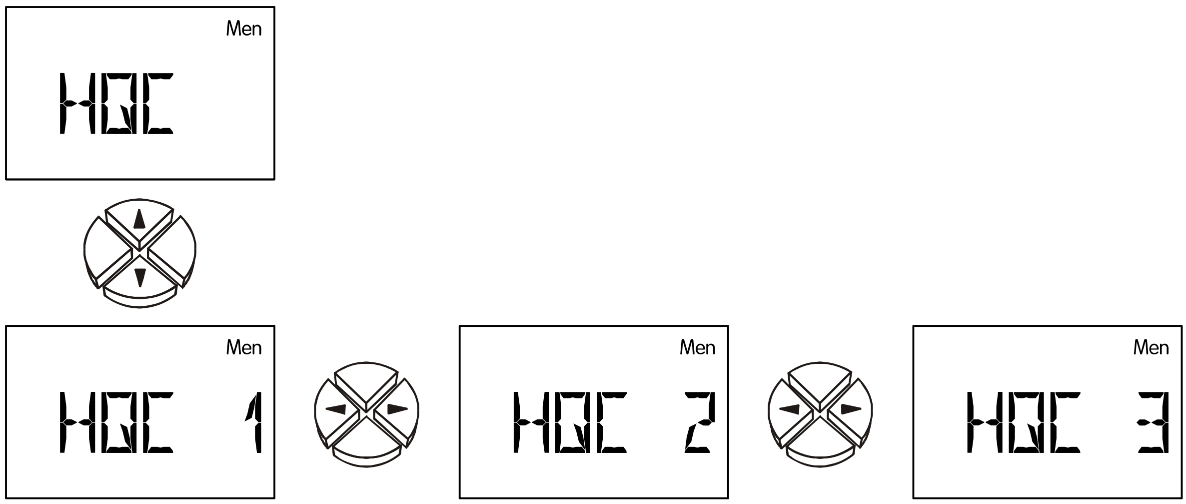
The error messages are entered in the menu ***Stat***. If ***Stat*** is blinking, an error or special system status has been detected (see “status display ***Stat***”).

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.

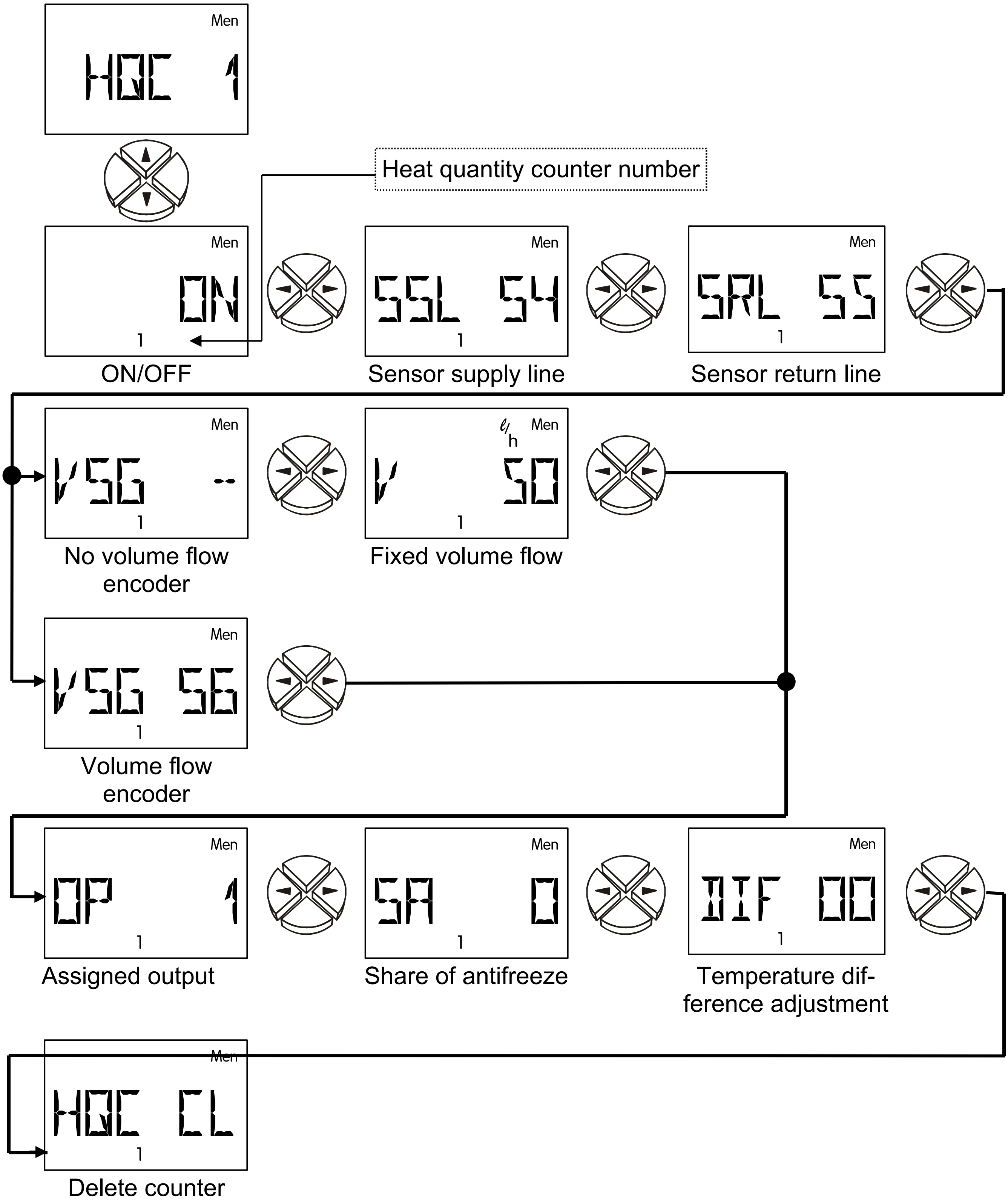
Heat quantity counter *HQC* (3 times)

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:
flow temperature, return temperature, flow rate (volume flow)

In solar systems a correct installation of sensor (see sensor installation - collector sensor on flow collection tube, cylinder 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 flow 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


Men
HQC 1
Heat quantity counter number
ON
ON/OFF
SSL S4
Sensor supply line
SRL S5
Sensor return line
VSG --
No volume flow encoder
l/h
V 50
Fixed volume flow
VSG S6
Volume flow encoder
OP 1
Assigned output
SA 0
Share of antifreeze
DIF 00
Temperature difference adjustment
HQC CL
Delete counter

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

SSL **S**ensor input for **s**upply **l**ine temperature (ex works = S4)

Setting range: S1 to S6 Input of the flow sensor
E1 to E9 Value from external sensor via DL

SRL **S**ensor input for **r**eturn **l**ine 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

LPP Litres per pulse

Setting range: VSG S6 = volume flow encoder **at input 6**.
VSG E1 to E9 = Value from external sensor **via DL-Bus**
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 **V**olume 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 **S**hare of **a**ntifreeze 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 **dif**ference between the flow and return 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 **Cl**ear **h**eat **q**uantity **c**ounter. 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 +/- 0.5K. For KTY sensors the equivalent figure is +/- 1K. The unit’s measurement equipment is accurate down to +/- 0.5K 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 been 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,
- 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	Men S6 VSG	The VSG (pulse encoder) must only be connected to input 6, hence: menu "SENSOR", sensor setting S6 to "S6 VSG"
2	Men LPP 0.5	Checking and possible alteration of the LPP value (litre per impulse)
3	Men ON 1	Access to menu "HQC", selection of heat quantity counter 1 - 3, setting to "ON"
4	Men SSL S4 1	Setting of the flow sensor in the SSL display, in the example shown, sensor S4
5	Men SRL S5 1	Setting of the return sensor in the SRL display, in the example shown, sensor S5
6	Men VSG S6 1	Entry of "S6" in the VSG display as the VSG is the sensor S6
7	Men OP 1 1	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: OP 12).
8	Men SA 0 1	Indication of the antifreeze fraction SA in %
9	Men DIF 0.0 1	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 flow which is connected to the FTS4-50DL)

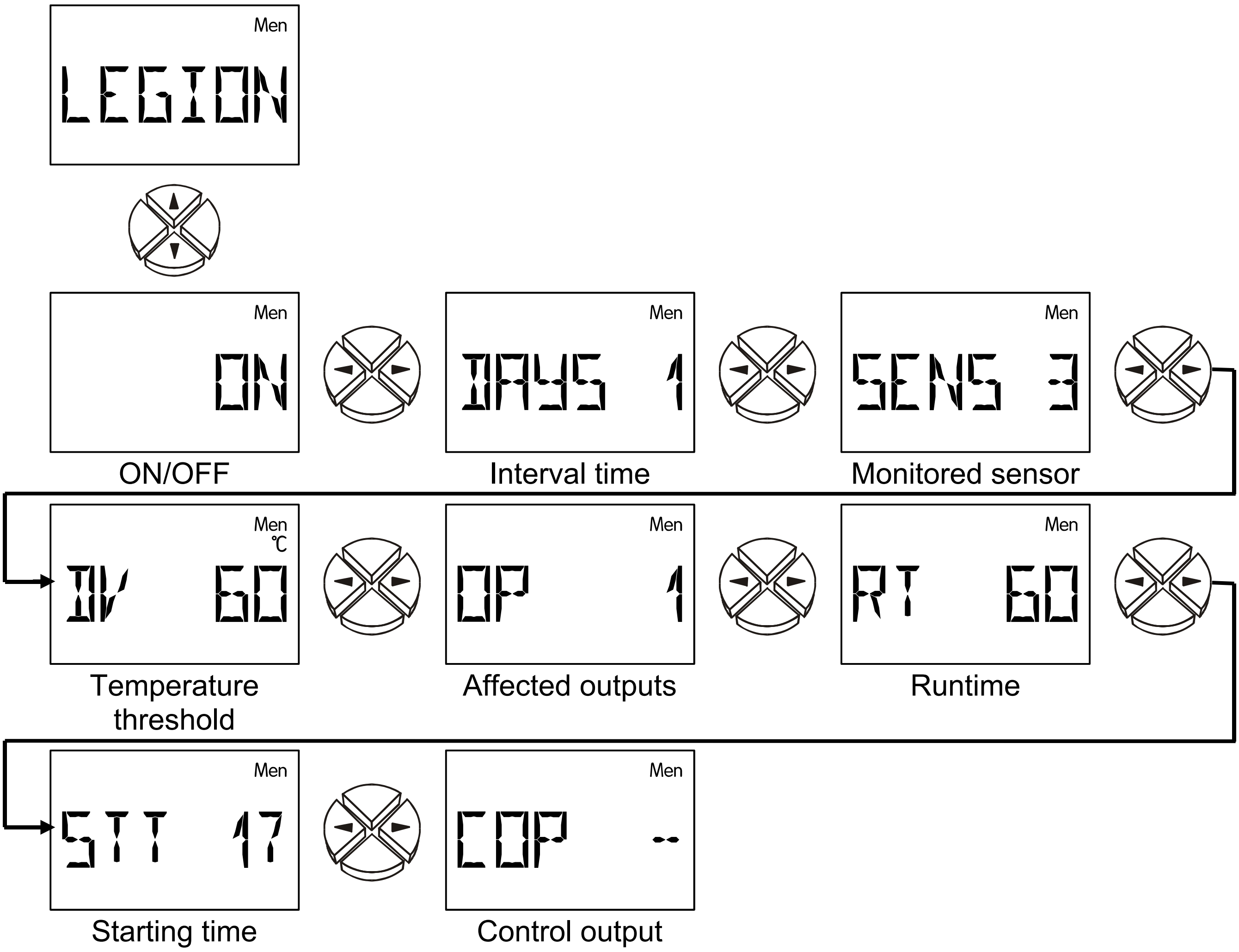
	Display	
1	Men E1 11	The FTS4-50DL is connected to the data link (external sensor), hence: menu "EXT DL", setting of the volume flow encoder in the display of the external sensor "E1": 11 (address 1, index 1)
2	Men E2 12	Setting the sensor temperature of the FTS4-50DL: Menu "EXT DL", in the display "E2": 12 (address 1, index 2)
3	Men E3 13	If an external temperature sensor is connected for the flow on the FTS4-50DL: menu "EXT DL", in the display "E3": 13, Pt1000 sensor (address 1, index 3) is used
4	Men ON 1	Access to menu "HQC", selection of heat quantity counter 1 - 3, setting to "ON"
5	Men SSL E3	Setting of the flow sensor in the "SSL" display, if, as shown in the example, external sensor: E3 (see point 3), otherwise specification of the corresponding flow sensor S1 - S6
6	Men SRL E2	Setting of the return sensor in the SRL display, by using the temperature sensor on the FTS4-50DL: E2 (see point 2)
7	Men VSG E1	Display VSG: entry VSG E1, i.e. the volume flow encoder is external sensor E1 (see point 1)
8	Men OP 1 1 / Men SA 0 1 / Men DIF 0.0 1	Specification of the allocated outputs OP, dependent on the selected program, specification of the antifreeze fraction and sensor compensation

No volume flow encoder:

	Display	
1	Men ON 1	Access to menu "HQC", selection of heat quantity counter 1 - 3, setting to "ON"
2	Men SSL S4 1	Setting of the flow sensor in the SSL display, in the example shown, sensor S4
3	Men SRL S5 1	Setting of the return sensor in the SRL display, in the example shown, sensor S5
4	Men VSG -- 1	Entry of "--" in the VSG display, as no volume flow encoder is being used
5	l/h Men V 50 1	Entry of the fixed volume flow in litres/hour of the allocated output (it makes sense to only allocate one output)
6	Men OP 1 1 / Men SA 0 1 / Men DIF 0.0 1	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 cylinder 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 ***Stat***.



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 = 1 day)

SENS Specifies which **sens**or 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)

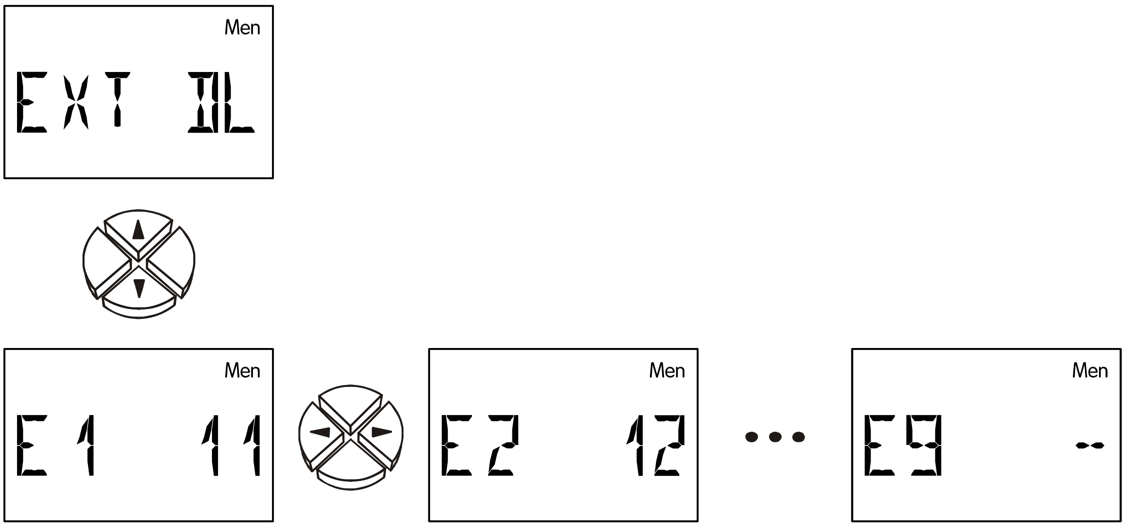
OP This output is switched on if the selected sensor does not exceed the temperature threshold within the specified time interval **RT**.
Adjustment range: Combination of all outputs (e.g. OP 1, OP 23, OP 123).
(ex works = OP1)

RT Minimum runtime. If the specified cylinder 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).

E1 -- The external value 1 is deactivated and faded out in the main level.

E1 11 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 61-3 delivers the maximum bus load 100%. For example, the electronic sensor FTS4-50**DL** has a bus load of 25%, therefore up to a max. 4 FTS4-50**DL** can be connected to the DL bus. The bus loads of the electronic sensors are listed in the technical data of the respective sensors.

Drain-Back Function *DRAINB*

This additional function may only be activated with programs <u>for a collector field with a consumer</u> (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 cylinder, which when the pump is stationary receives all the heat transfer medium above the cylinder.

System start up is triggered either by a **radiation sensor** or by the exceeding of the temperature difference **diff ↑** between the **collector-** and **cylinder sensor**.

During the **filling time** the pump runs at full speed to lift the heat transfer medium above the highest point of the system. Optionally, a second pump ("booster pump") can be connected to a free output, so that the filling pressure is increased.

Filling of the collector with cold heat transfer medium leads to the short-term undershooting of the switching difference **diff ↓**. In the following **stabilisation time** the pump continues to run irrespective of the temperature difference **diff ↓** at the **calculated speed**.

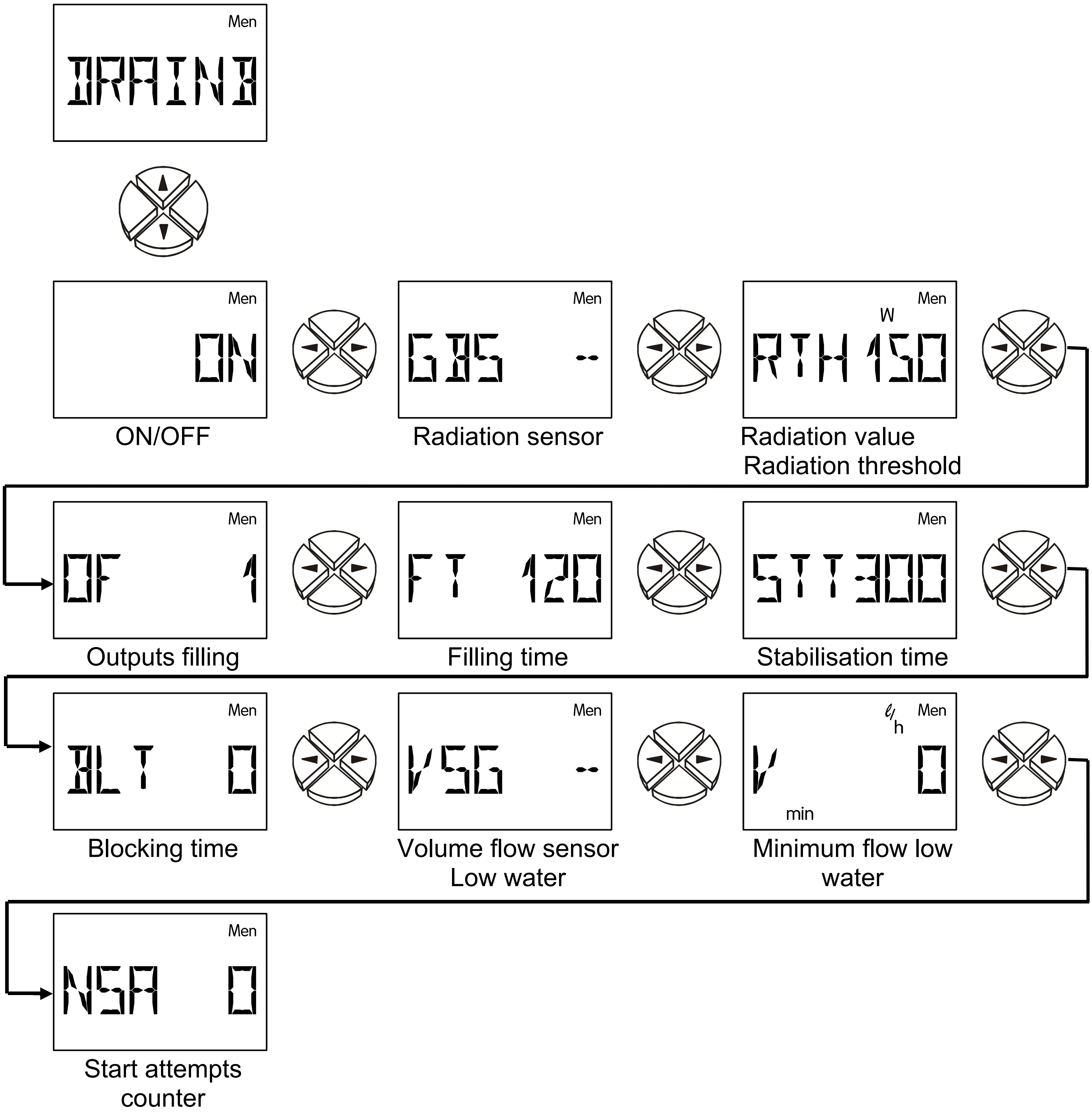
If the pump is switched off during normal operation (e.g. as a result of undershooting of the temperature difference **diff ↓** or collector overtemperature switch-off), then the heat transfer medium runs out of the collector field back to the expansion cylinder.

A volume flow sensor is suitable for use as low water protection (VSG... or FTS...DL). If the volume flow falls below a minimum value **after the 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 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 cylinder 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 **v**olume 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 on and off.
(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 *Stat*

The stats display offers information in special system situations and when problems occur. It is primarily intended for us 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 a five status ranges:

- ◆ **Function check and collector excess temperature not active** = no system response is analyzed. Only a bar appears in the display under ***Stat***.
- ◆ **Collector excess temperature is active** = the excess temperature that occurs at the collector during system standstill only displays **CETOFF** (**c**ollector **e**xcess **t**emperature cut-**off** active) under ***Stat*** during this time.
- ◆ **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 **CIRCER** (**cir**culation **err**or) is issued. The index in the lower display line shows the output where a circulation error has occurred.
- ◆ **Legionella protection function is active** = During the runtime **RT** "**LEGION"** is displayed under ***Stat***.
- ◆ **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.

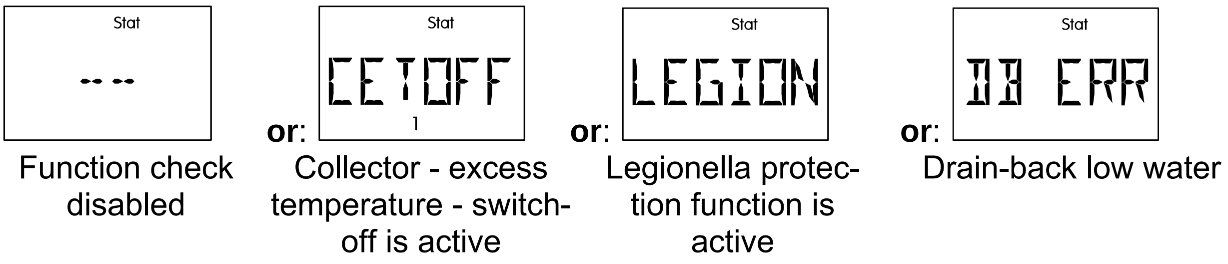
Error messages remain displayed (and ***Stat*** blinks) even after the error has disappeared; they have to be deleted in the status menu via the command **CLEAR**.

You can only enter the status menu if there has been an error. Then, **ENTER** is displayed instead of **OK** or **CETOFF** in ***Stat*.**

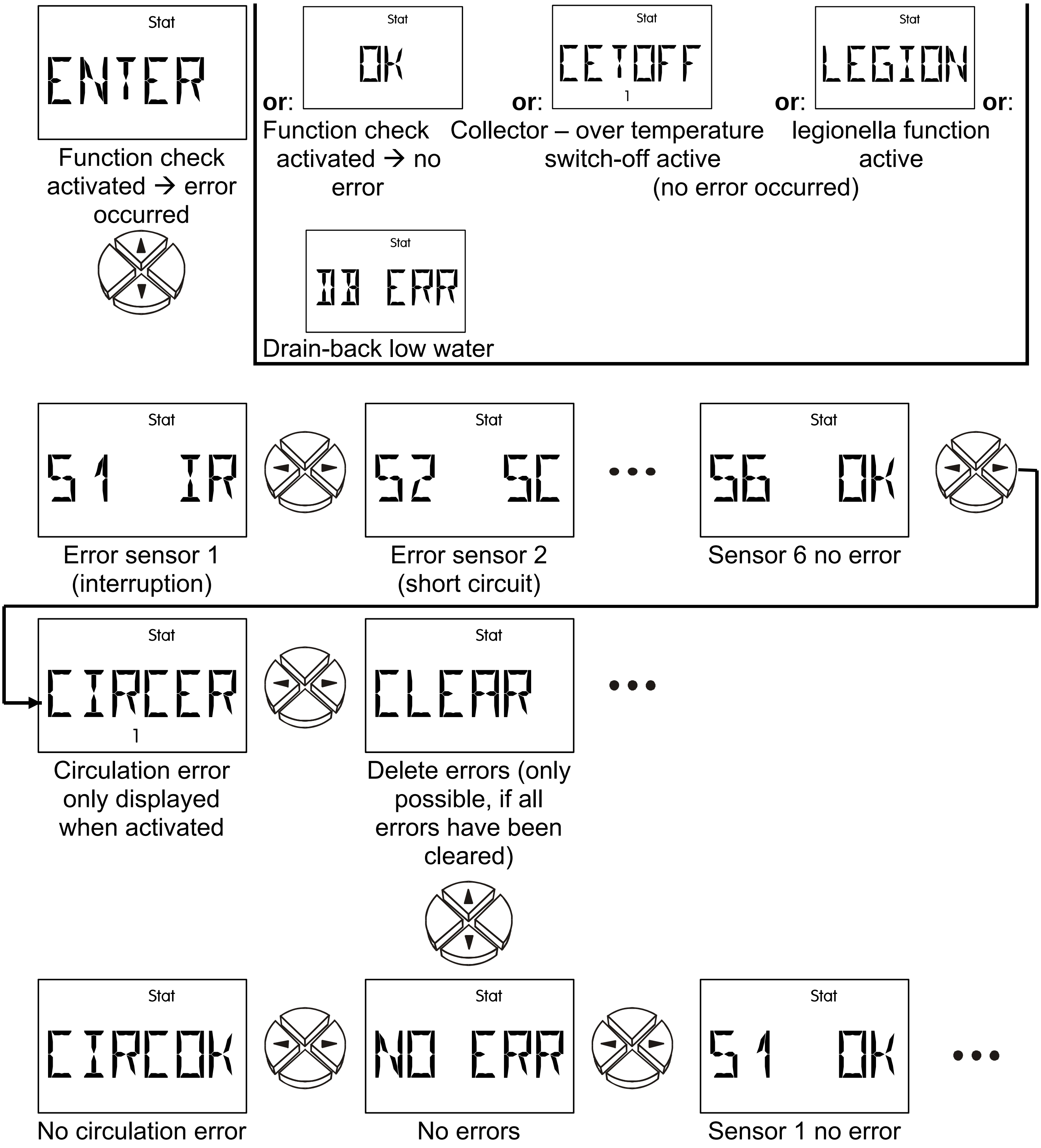
OK appears under ***Stat*** if the monitoring functions are activated and the system is running well. If anything special happens, ***Stat*** blinks regardless of the display position.

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 activated



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.

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 ↓	75 °C	°C	max1 on ↑	70 °C	°C
max2 off ↓	75 °C	°C	max2 on ↑	70 °C	°C
max3 off ↓	75 °C	°C	max3 on ↑	70 °C	°C
min1 on ↑	5 °C	°C	min1 off ↓	0 °C	°C
min2 on ↑	5 °C	°C	min2 off ↓	0 °C	°C
min3 on ↑	5 °C	°C	min3 off ↓	0 °C	°C
diff1 on ↑	8 K	K	diff1 off ↓	4 K	K
diff2 on ↑	8 K	K	diff2 off ↓	4 K	K
diff3 on ↑	8 K	K	diff3 off ↓	4 K	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**		
O1 <=	OFF		Output 1	AUTO	
O2 <=	OFF		Output 2	AUTO	
O3 <=	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
Waveform	WAVEP				
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 CONT*					
ON/OFF	OFF		Circulation control CIRC --/A/M	--	
Circulation O1 CC1	--		Circulation O2 CC2	--	
Circulation O3 CC3	--				

	EX	CS		EX	CS
Heat counter *HQC*					
Heat counter *HQC 1*					
ON/OFF	OFF				
Feed SSL	S4		Return SRL	S5	
Volume flow encoder VSG	--		**or** Volume flow V	50 l/h	l/h
Outputs OP	--				
Share of antifreeze SA	0%	%			
Heat counter *HQC 2*					
ON/OFF	OFF				
Feed SSL	S4		Return SRL	S5	
Volume flow encoder VSG	--		**or** Volume flow V	50 l/h	l/h
Outputs OP	--				
Share of antifreeze SA	0%	%			
Heat counter *HQC 3*					
ON/OFF	OFF				
Feed SSL	S4		Return SRL	S5	
Volume flow encoder VSG	--		**or** Volume flow V	50 l/h	l/h
Outputs OP	--				
Share of antifreeze SA	0%	%			

Legionella protection *LEGION*					
ON/OFF	OFF				
DAYS	7		Sensor SENS	3	
Nominal value DV	90°C	°C	Outputs OP	1	
Runtime RT	60	min	Starting time STT	17	h
Control output COP	--				

External sensors *EXT DL*					
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 *DRAINB*					
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 low water VSG	--	
Minimum flow V	0 l/h	l/h			

Technical data

Power supply: 210 ... 250V~ 50-60 Hz
Power input: max. 2.8 W
Fuse: 3.15 A fast-acting (device + output)
Supply cable: 3x 1mm^2 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: optional for temperature sensor (KTY (2 kΩ), PT1000),
radiation sensor, as digital input,
or as impulse 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

Cylinder 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 PT1000 – to 240°C continuous load (momentary to 260°C)
KF KTY – to 160°C continuous load

The sensor lines on the inputs having a cross-section of 0.50 mm^2 can be extended to a length of 50 m.

Consumers (e.g.: pumps, valves...) having a cable cross-section of 0.75 mm^2 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: type. +- 0.3%

Technical support

We offer our customers free support in the event of questions or issues with **our products**.

Important: in order to answer your questions, we require the device serial number **in every case**.

If you are unable to locate the serial number, help with finding it is available on our homepage: https://www.ta.co.at/haeufige-fragen/seriennummern/

You can submit your request on our homepage using the following link: https://www.ta.co.at/support/.

As an alternative to the contact form, you can also call us during office hours on the following number: +43 (0)2862 53635

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]
UVR61-3	1	1	1.8	1.49 / 2.37	1.8 / 2.8

[1]Definitions according to Official Journal of the European Union C 207 dated 03/07/2014

[2] The classification applied is based on optimum utilisation and correct application of the products. The actual applicable class may differ from the classification applied.

[3] Contribution of the temperature controller to seasonal central heating efficiency in percent, rounded to one decimal place

[4] No output active = standby / all outputs and the display active

EU Declaration of conformity

Document- Nr. / Date:	TA17004 / 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:	UVR61-3, UVR61-PV
Product brand:	Technische Alternative RT GmbH
Product description:	Three circuit 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 +A1: 2011 + AC2012	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
EN 61000-6-2: 2005 + AC2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 50581: 2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Position of CE - label: On packaging, manual and type label

Issuer: Technische Alternative RT GmbH
A- 3872 Amaliendorf, Langestraße 124

This declaration is submitted by

Dipl.-Ing. Andreas Schneider, General manager,
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.

Technische Alternative RT GmbH

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