SEProX

from version 3.03

Solar controller

Manual for the
specialized craftsman

Installation
Operation
Functions and options
Troubleshooting

Equivalent to RESOL DeltaSol® BX: cTUVus certified to UL 60730-1:2009 / CSA E60730.1:2002 safety standards.

The Internet portal for easy and secure access to your system data – www.vbus.net

Thank you for buying this product.
Please read this manual carefully to get the best performance from this unit.
Please keep this manual carefully.

11213472

en-US/CA
Manual

Safety advice

Please pay attention to the following safety advice in order to avoid danger and damage to people and property.

Instructions

Attention should be paid to

- Valid national and local standards and regulations
- Respective valid standards and directives

Equipment to be installed and used in accordance with the rules of the National Electrical Code (NEC) or with Canadian Electrical Code (CEC), Part I.

These instructions are exclusively addressed to authorized skilled personnel.

- Only qualified electricians should carry out installation and maintenance work.
- Initial installation should be carried out by qualified personnel

Information about the product

Proper usage

The solar controller is designed for electronically controlling standard solar thermal systems and heating systems in compliance with the technical data specified in this manual.

Improper use excludes all liability claims.

Note:
Strong electromagnetic fields can impair the function of the controller.

➔ Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

Target group

These instructions are exclusively addressed to authorised skilled personnel.

Only qualified electricians should carry out electrical works.

Initial installation must be effected by the system owner or qualified personnel named by the system owner.

Description of symbols

WARNING! Warnings are indicated with a warning triangle!

➔ **They contain information on how to avoid the danger described.**

Signal words describe the danger that may occur, when it is not avoided.

- **WARNING** means that injury, possibly life-threatening injury, can occur.
- **ATTENTION** means that damage to the appliance can occur.

Note:
Notes are indicated with an information symbol.

➔ Arrows indicate instruction steps that should be carried out.

Disposal

- Dispose of the packaging in an environmentally sound manner.
- Dispose of old appliances in an environmentally sound manner. Upon request we will take back your old appliances bought from us and guarantee an environmentally sound disposal of the devices.

Subject to technical change. Errors excepted.

SEProX solar controller

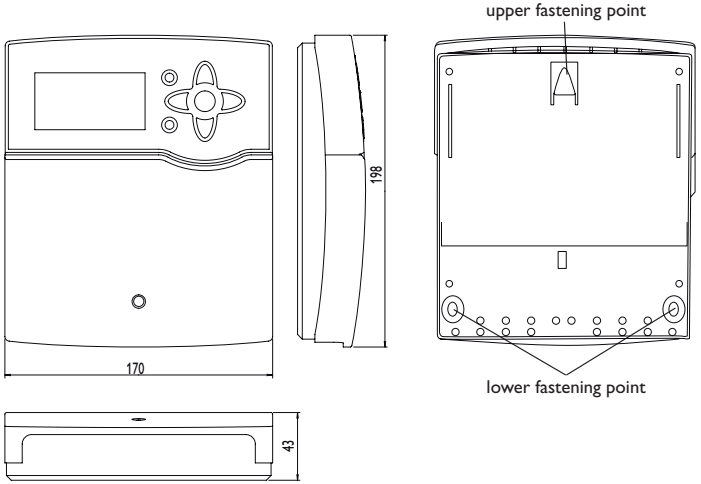
With its versatile software, the SEProX can control even complex systems easily and reliably. The SEProX is equipped with 26 pre-programmed basic systems for a broad range of 1- and 2-tank systems. Pre-defined functions facilitate system parameterization.

The integrated SD card slot enables an easy datalogging to an SD card as well as a quick and effortless transfer of logged system data to a PC. The extra-large display vouches for a precise visualization of the system status.

Contents

1 Overview

- **4 relay outputs, 5 Pt1000 temperature sensor inputs**
- **2 inputs for analogue Grundfos Direct Sensors™ temperature sensors**
- **2 PWM outputs for speed control of high-efficiency pumps**
- **26 basic systems to choose from**
- **Drainback option**
- **Unit °F and °C selectable**



Technical data

Inputs: 5 inputs for Pt1000 temperature sensors, 2 analogue Grundfos Direct Sensors™, 1 V40 impulse input,

Outputs: 3 semiconductor relays, 1 electromechanical relay, 2 PWM outputs

Switching capacity:
1 (1) A 240 V~ (semiconductor relay)
2 (1) A 240 V~ (electromechanical relay)

Total switching capacity: 4 A 240 V~

Power supply: 100 – 240 V~ (50 – 60 Hz)

Supply connection: type Y attachment

Standby: 0.57 W

Temperature controls class: I

Energy efficiency [%]: 1

Mode of operation: type 1.B.C.Y action

Rated impulse voltage: 2.5 KV

Data interface: VBus®, SD card slot

VBus® current supply: 35 mA

Functions: function control, operating hours counter, evacuated tube collector function, thermostat function, speed control, energy metering, etc.

Housing: plastic, PC-ABS and PMMA

Mounting: wall mounting, also suitable for mounting into patch panels

Indication / Display: System-Monitoring-Display, for visualization of the systems, 16-segment display, 7-segment display, 8 symbols, operating control LED (directional pad) and background illumination

Operation: 7 push buttons at the front of the housing

Protection type: IP 20 / DIN EN 60529

Protection class: I

Ambient temperature: 0 … 40 °C [0 … 104 °F]

Degree of pollution: 2

Dimensions: 198 x 170 x 43 mm

2 Installation

2.1 Mounting

WARNING! **Electric shock!**
Upon opening the housing, live parts are exposed!
➔ **Always disconnect the device from power supply before opening the housing!**

Note:
Strong electromagnetic fields can impair the function of the controller.
➔ Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

The unit must only be located in dry interior rooms.

The controller must additionally be supplied from a double pole switch with contact gap of at least 3 mm.

Please pay attention to separate routing of sensor cables and power supply cables.

In order to mount the device to the wall, carry out the following steps:

➔ Unscrew the crosshead screw from the cover and remove it along with the cover from the housing.

➔ Mark the upper fastening point on the wall. Drill and fasten the enclosed wall plug and screw leaving the head protruding.

➔ Hang the housing from the upper fastening point and mark the lower fastening points (centers 150 mm).

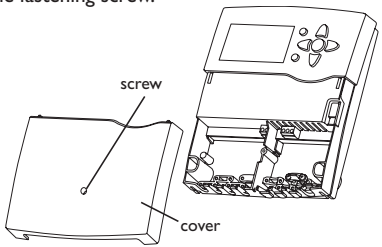
➔ Insert lower wall plugs.

➔ Fasten the housing to the wall with the lower fastening screw and tighten.

➔ Carry out the electrical wiring in accordance with the terminal allocation (see chap. 2.2).

➔ Put the cover on the housing.

➔ Attach with the fastening screw.



2.2 Electrical connection

WARNING! **Electric shock!**
Upon opening the housing, live parts are exposed!
➔ **Always disconnect the device from power supply before opening the housing!**

ATTENTION! **ESD damage!**
Electrostatic discharge can lead to damage to electronic components!
➔ **Take care to discharge properly before touching the inside of the device! To do so, touch a grounded surface such as a radiator or tap!**

Note:
Connecting the device to the power supply must always be the last step of the installation!

Note:
The pump speed must be set to 100 % when auxiliary relays or valves are connected.

The controller is supplied with power via a power supply cable. The power supply of the device must be 100 – 240 V~ (50 – 60 Hz).

The controller is equipped with 4 relays in total to which loads such as pumps, valves, etc. can be connected:

- Relays 1 … 3 are semiconductor relays, designed for pump speed control.
  Conductor R1 … R3
  Neutral conductor N
  Protective conductor ⏚
- Relay 4 is an electromechanical relay
  Conductor R4
  Neutral conductor N
  Protective conductor ⏚

Depending on the product version, power supply cables and sensor cables are already connected to the device. If that is not the case, please proceed as follows:

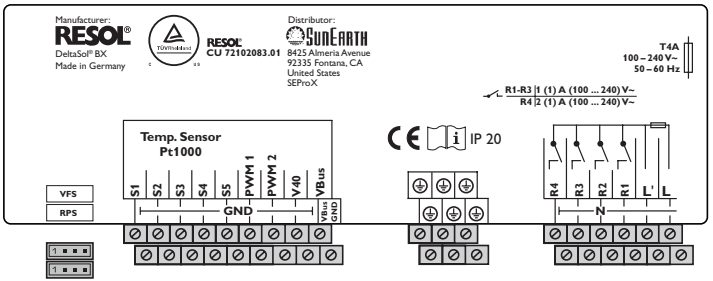
Connect the **temperature sensors** (S1 to S5) to the corresponding terminals with either polarity:

S1 = Sensor 1 (collector sensor)
S2 = Sensor 2 (tank sensor bottom)
S3 = Sensor 3 (e. g. tank sensor top)
S4 = Sensor 4 (e. g. tank sensor tank 2)
S5 = Sensor 5 (e. g. sensor collector 2)

Connect the **Grundfos Direct Sensors™** to the inputs marked VFS and RPS.

A **V40** flowmeter can be connected to the terminals V40 and GND (either polarity).

The terminals marked PWM are control outputs for high-efficiency pumps (PWM1 is allocated to R1, PWM2 is allocated to R2).



The **power supply connection** is at the terminals:

Neutral conductor N
Conductor L
Conductor L' (L' is not connected with the power supply cable. L' is a fused contact permanently carrying voltage.)
Protective conductor ⏚

Note:
For further information about energy metering with Grundfos Direct Sensors™ see page 64.

Note:
The connection depends on the system layout selected (see page 7).

Note:
For more details about the commissioning procedure see page 39.

2.3 Data communication / Bus

The controller is equipped with a **VBus®** for data transfer and energy supply to external modules. The connection is to be carried out at the terminals marked **VBus** (either polarity).

One or more **VBus®** modules can be connected via this data bus, such as:

- GA3 Large Display module / SD3 Smart Display
- AM1 Alarm Module
- DL2 Datalogger
- DL3 Datalogger

Furthermore, the controller can be connected to a PC or integrated into a network via the VBus®/USB or VBus®/LAN interface adapter (not included).

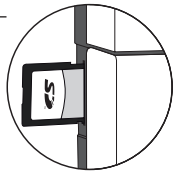
Note:
More accessories on page 72.

2.4 SD memory card slot

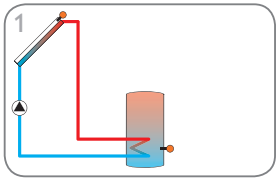
The controller is equipped with an SD card slot.

With an SD card, the following functions can be carried out:

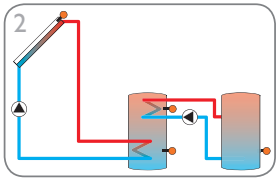
- Store measurement and balance values onto the SD card. After the transfer to a computer, the values can be opened and visualized, e. g. in a spreadsheet.



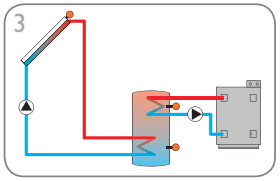
Note:
For more information about using an SD card, see page 66.



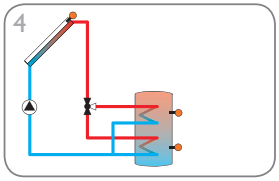
Solar system with 1 tank (page 9)



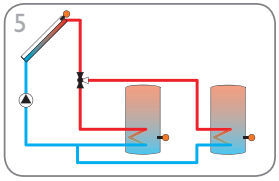
Solar system with 2 tanks and heat exchange (page 10)



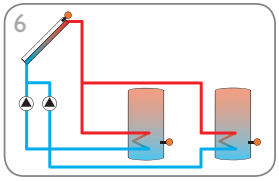
Solar system with 1 tank and backup heating (page 11)



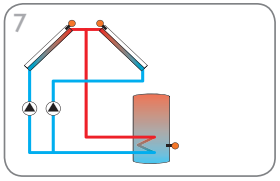
Solar system with 1 tank and 3-port valve for vertical tank loading (page 11)



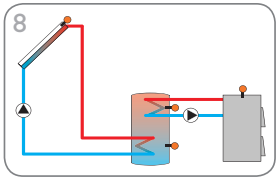
Solar system with 2 tanks and valve logic (page 13)



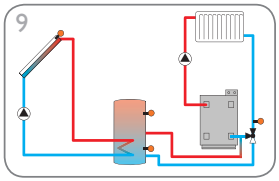
Solar system with 2 tanks and pump logic (page 14)



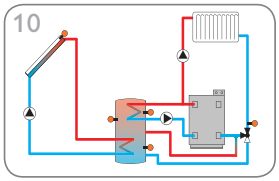
Solar system with east-/west collectors (page 15)



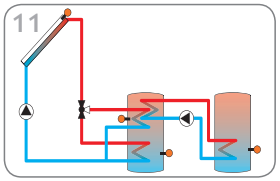
Solar system with 1 tank and solid fuel boiler (page 16)



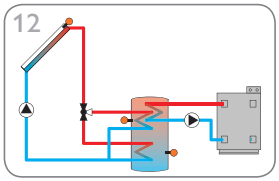
Solar system with 1 tank and return preheating (page 17)



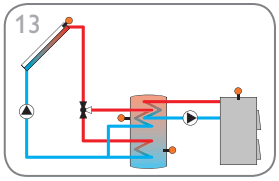
Solar system with 1 tank, return preheating and backup heating (page 18)



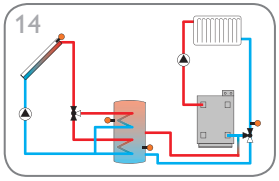
Solar system with vertical tank loading and heat exchange (page 19)



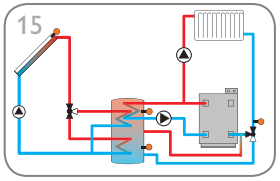
Solar system with vertical tank loading and backup heating (page 20)



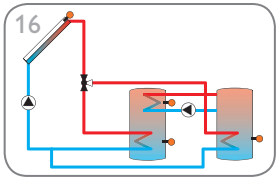
Solar system with vertical tank loading and solid fuel boiler (page 21)



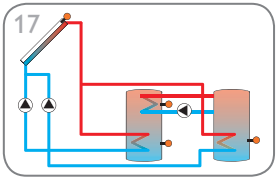
Solar system with vertical tank loading and return preheating (page 22)



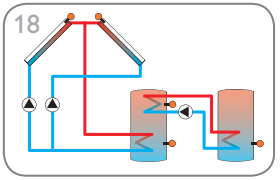
Solar system with vertical tank loading, return preheating and backup heating (page 23)



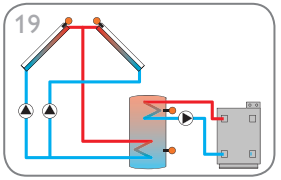
Solar system with vertical tank loading and heat exchange (page 24)



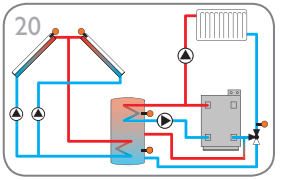
Solar system with 2 tanks, valve logic and heat exchange (page 25)



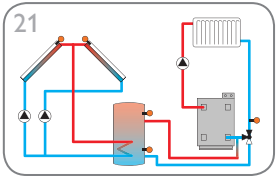
Solar system with east-/west collectors, 2 tanks, pump logic and heat exchange (page 26)



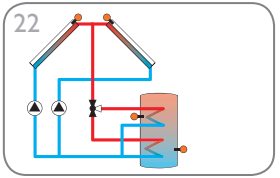
Solar system with east-/west collectors and backup heating (page 27)



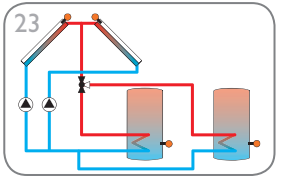
Solar system with east-/west collectors, return preheating and backup heating (page 28)



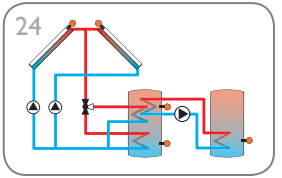
Solar system with east-/west collectors and return preheating (page 29)



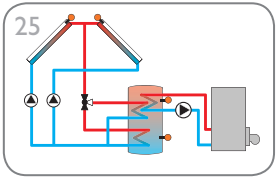
Solar system with east-/west collectors and vertical tank loading (page 30)



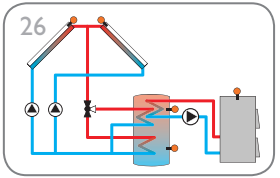
Solar system with with east-/west collectors, 2 tanks and valve logic (page 31)



Solar system with east-/west collectors and heat exchange (page 32)



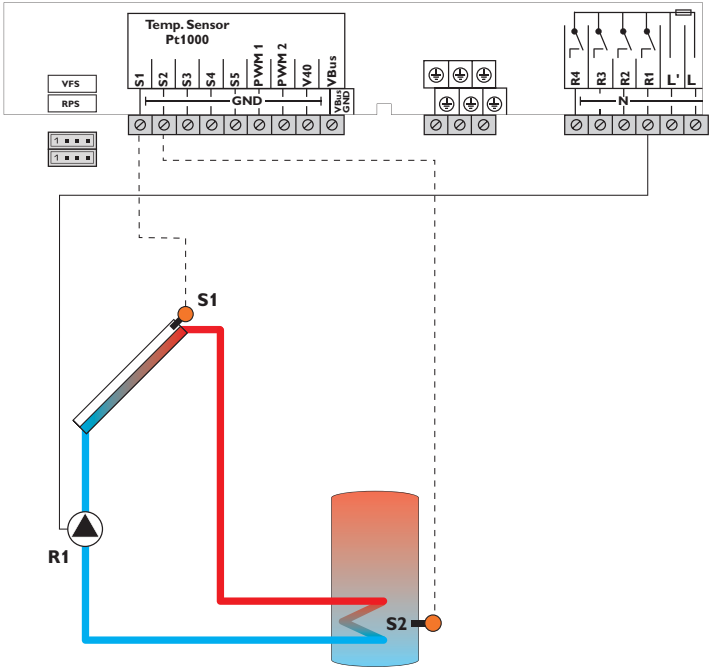
Solar system with east-/west collectors and backup heating (page 33)



Solar system with east-/west collectors and solid fuel boiler (page 34)

2.6 Systems

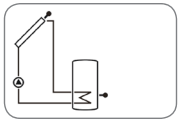
System 1: Standard solar system with 1 tank



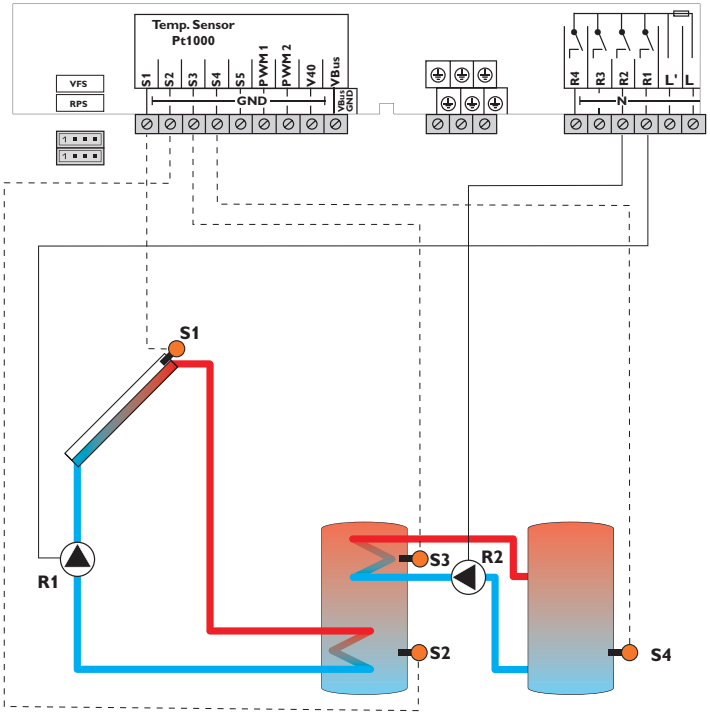
Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Free	3/GND
S4	Free	4/GND
S5	Free	5/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Free	R2/N/PE
R3	Free	R3/N/PE
R4	Free	R4/R4

The controller calculates the temperature difference between collector sensor S1 and tank sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the tank will be loaded until the switch-off temperature difference or the maximum tank temperature is reached.



System 2: Solar system with 1 tank and heat exchange

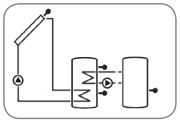


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature heat exchange source	3/GND
S4	Temperature heat exchange sink	4/GND
S5	Free	5/GND

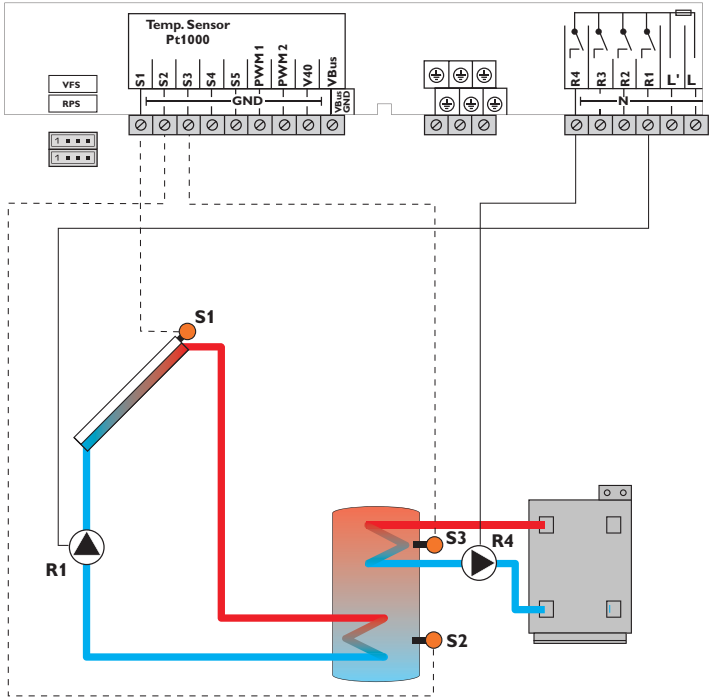
Relay		
R1	Solar pump	R1/N/PE
R2	Tank loading pump	R2/N/PE
R3	Free	R3/N/PE
R4	Free	R4/N/PE

The controller calculates the temperature difference between collector sensor S1 and tank sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the tank will be loaded until the switch-off temperature difference or the maximum tank temperature is reached.

Heat exchange control to an existent tank via an additional pump (R2) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).



System 3: Solar system with 1 tank and backup heating

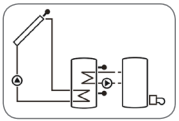


Sensors		
S1	Temperature collector	1 / GND
S2	Temperature tank bottom	2 / GND
S3	Temperature backup heating	3 / GND
S4	Free	4 / GND
S5	Free	5 / GND

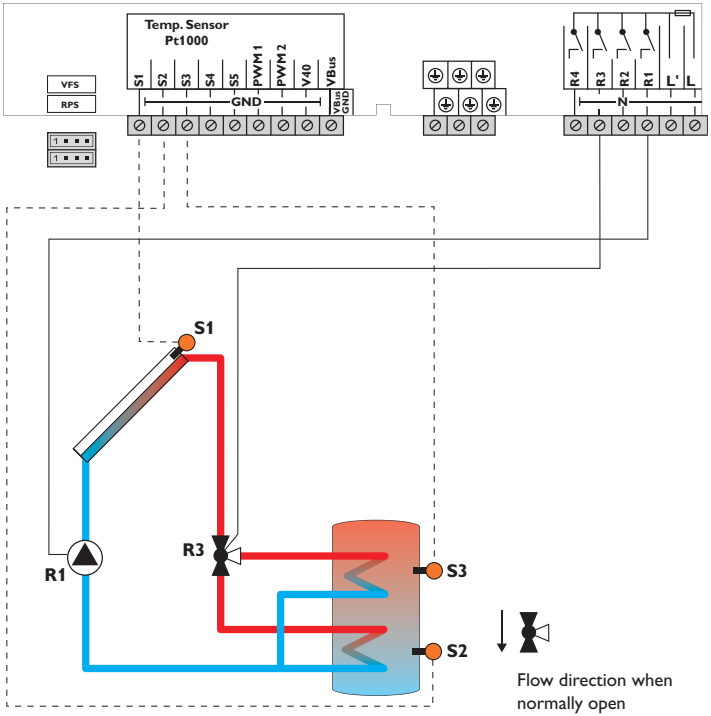
Relay		
R1	Solar pump	R1 / N / PE
R2	Free	R2 / N / PE
R3	Free	R3 / N / PE
R4	Backup heating / Tank loading pump	R4 / N / PE

The controller calculates the temperature difference between collector sensor S1 and tank sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the tank will be loaded until the switch-off temperature difference or the maximum tank temperature is reached.

Backup heating (R4) can be carried out with a thermostat function (S3). If the value at S3 reaches the switch-on temperature for the backup heating, the relay is switched on. If the value exceeds the switch-off temperature for the backup heating, the relay is switched off again.



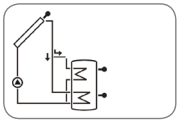
System 4: Solar system with 1 tank and vertical tank loading



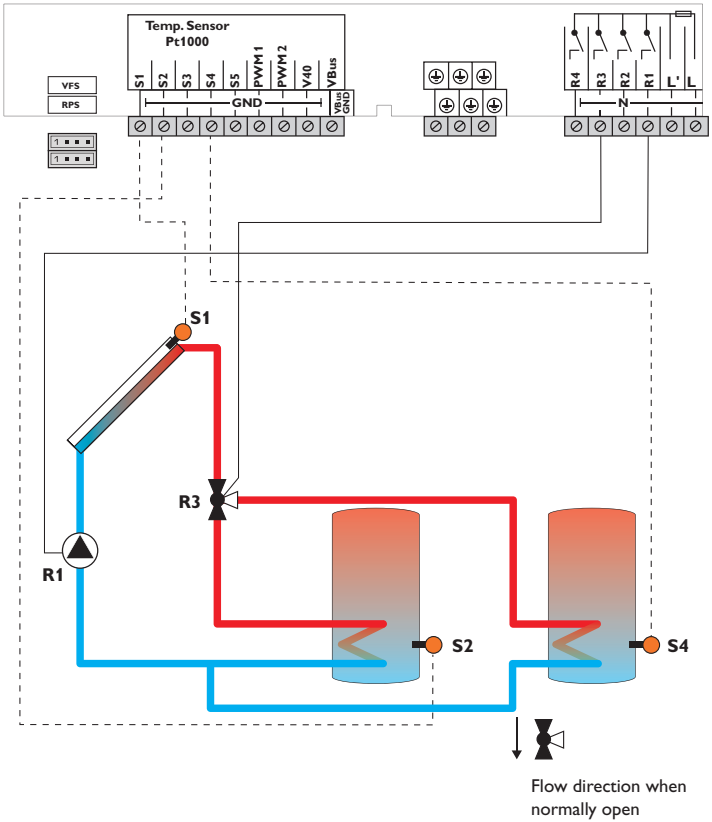
Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top	3/GND
S4	Free	4/GND
S5	Free	5/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Free	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Free	R4/N/PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of the upper zone of the tank.



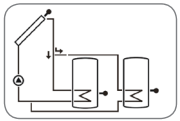
System 5: 2-tank solar system with valve logic



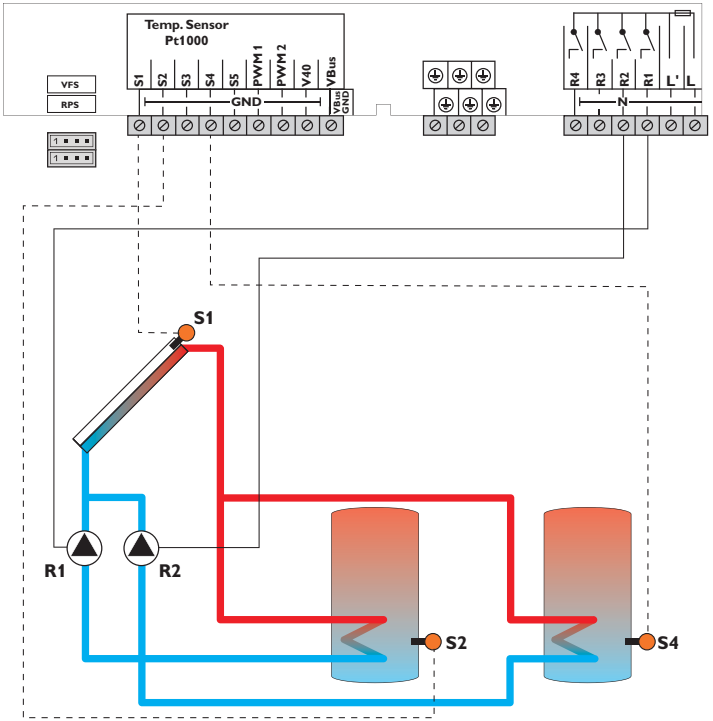
Sensors		
S1	Temperature collector	1 / GND
S2	Temperature tank 1 bottom	2 / GND
S3	Free	3 / GND
S4	Temperature tank 2 bottom	4 / GND
S5	Free	5 / GND

Relay		
R1	Solar pump	R1 / N / PE
R2	Free	R2 / N / PE
R3	Solar valve	R3 / N / PE
R4	Free	R4 / N / PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S4. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of tank 1.



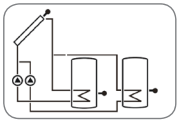
System 6: 2-tank solar system with pump logic



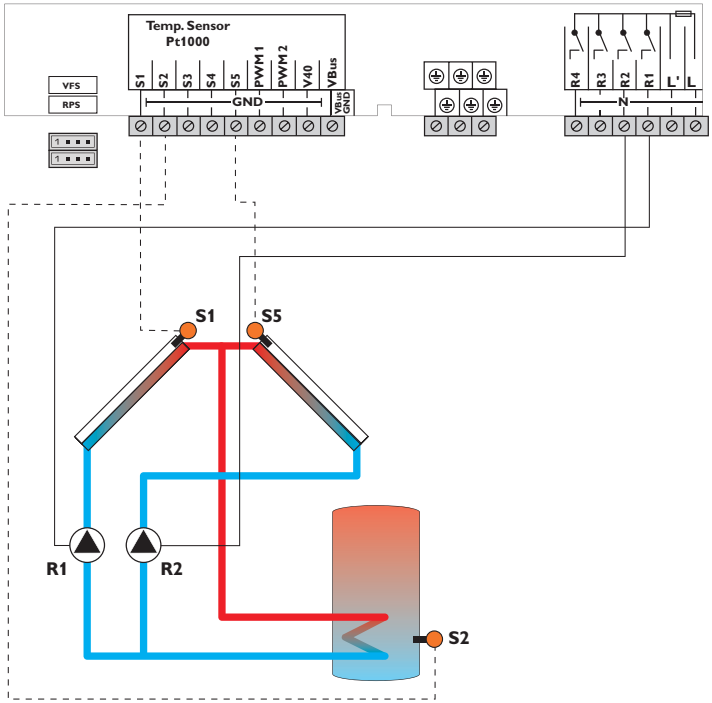
Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank 1 bottom	2/GND
S3	Free	3/GND
S4	Temperature tank 2 bottom	4/GND
S5	Free	5/GND

Relay		
R1	Solar pump tank 1	R1/N/PE
R2	Solar pump tank 2	R2/N/PE
R3	Free	R3/N/PE
R4	Free	R4/R4

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S4. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1 and/or R2) will be activated and the corresponding tank will be loaded up to the adjusted tank maximum or set temperature respectively at most. The priority logic effects prior loading of tank 1.



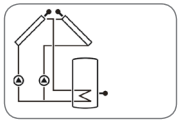
System 7: Solar system with east-/ west collectors



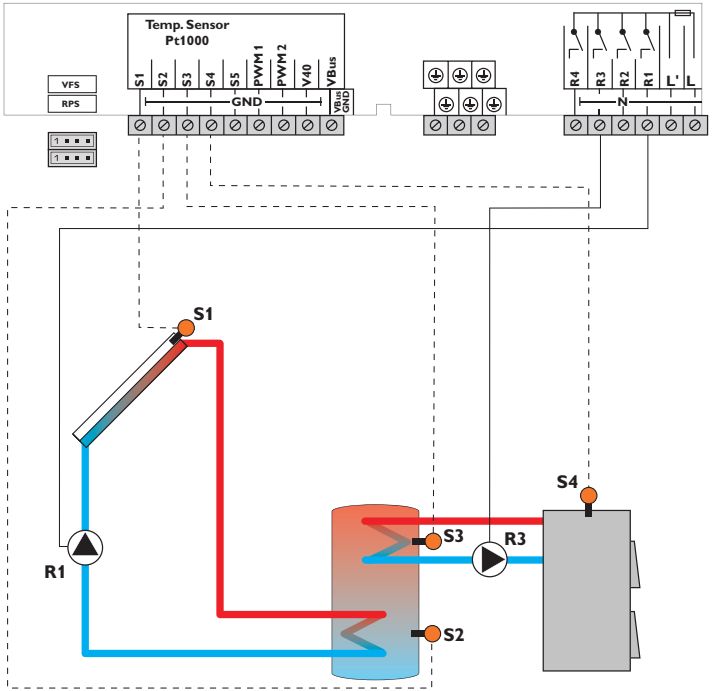
Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Free	3/GND
S4	Free	4/GND
S5	Temperature collector 2	5/GND

Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Free	R3/N/PE
R4	Free	R4/R4

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensor S2. If one of the measured temperature difference is higher than the adusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be switched on, thus loading the tank until either the switch-off temperature difference or the tank maximum temperature is reached.



System 8: Solar system with 1 tank and backup heating with solid fuel boiler

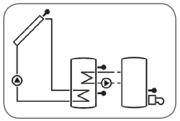


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top	3/GND
S4	Temperature solid fuel boiler	4/GND
S5	Free	5/GND

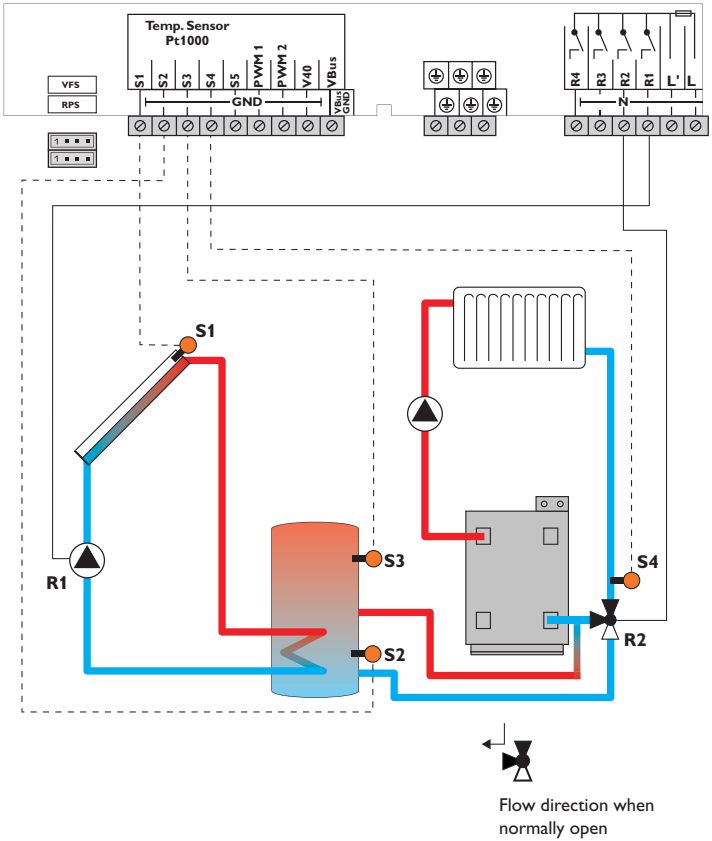
Relay		
R1	Solar pump	R1/N/PE
R2	Free	R2/N/PE
R3	Loading pump Solid fuel boiler	R3/N/PE
R4	Free	R4/N/PE

The controller calculates the temperature difference between collector sensor S1 and tank sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the tank will be loaded until the switch-off temperature difference or the maximum tank temperature is reached.

With another temperature differential function (S4 heat source/S3 heat sink), back-up heating of the tank with a solid fuel boiler can be carried out via another pump (R3).



System 9: Solar system with 1 tank and return preheating

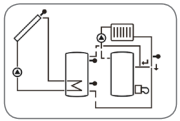


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank return preheating	3/GND
S4	Temperature heating return	4/GND
S5	Free	5/GND

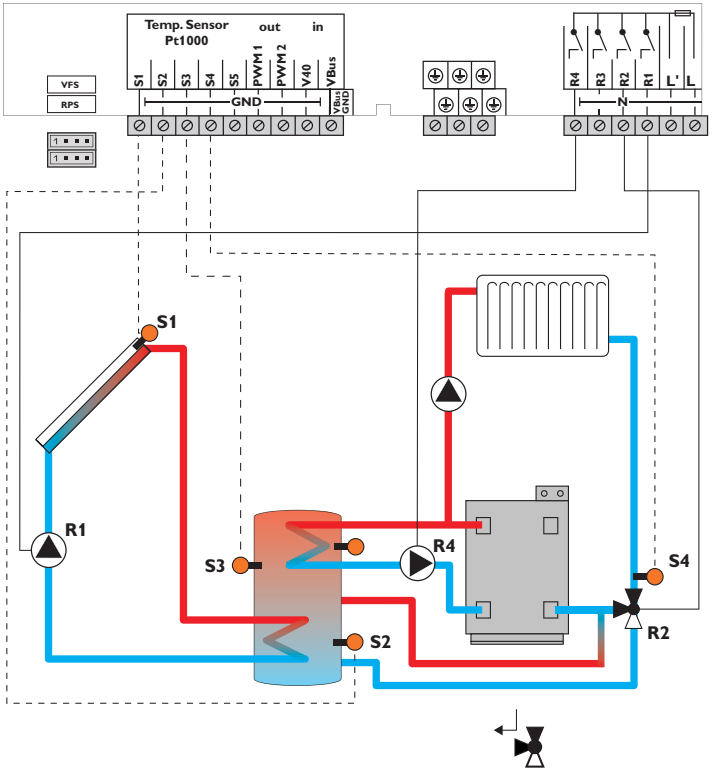
Relay		
R1	Solar pump	R1/N/PE
R2	Valve return preheating	R2/N/PE
R3	Free	R3/N/PE
R4	Free	R4/N/PE

The controller calculates the temperature difference between collector sensor S1 and tank sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the tank will be loaded until the switch-off temperature difference or the maximum tank temperature is reached.

With another temperature differential function (S3 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R2).



System 10: Solar system with 1 tank, return preheating and thermostatic backup heating



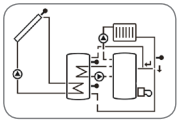
Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank return preheating/ Temperature backup heating	3/GND
S4	Temperature heating return	4/GND
S5	Free	5/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Valve return preheating	R2/N/PE
R3	Free	R3/N/PE
R4	Backup heating/ Tank loading pump	R4/N/PE

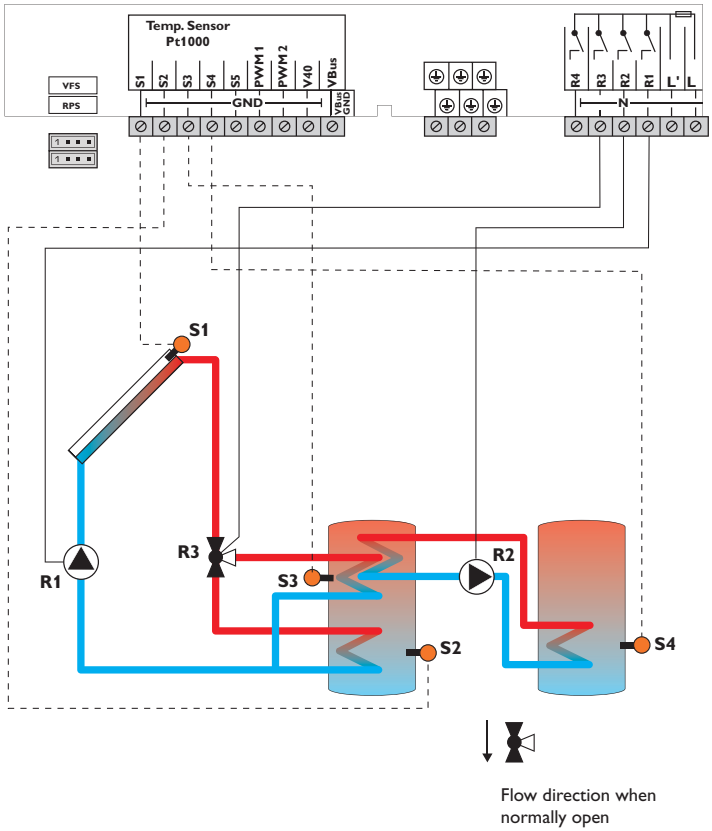
The controller calculates the temperature difference between collector sensor S1 and tank sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the tank will be loaded until the switch-off temperature difference or the maximum tank temperature is reached.

Backup heating (R4) can be carried out with a thermostat function (S3). If the value at S3 reaches the switch-on temperature for the backup heating, the relay is switched on. If the value exceeds the switch-off temperature for the backup heating, the relay is switched off again.

With another temperature differential function (S3 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R2).



System 11: Solar system with vertical tank loading and heat exchange control

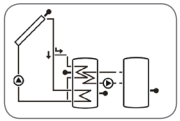


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top/ Temperature heat exchange source	3/GND
S4	Temperature heat exchange sink	4/GND
S5	Free	5/GND

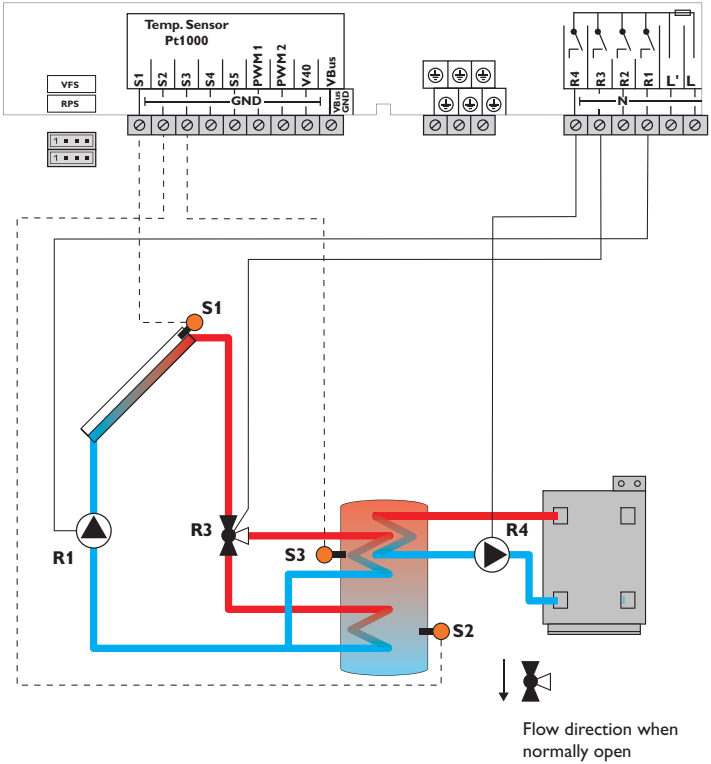
Relay		
R1	Solar pump	R1/N/PE
R2	Tank loading pump	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Free	R4/N/PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of the upper zone of the tank.

Heat exchange control to an existent tank via an additional pump (R2) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).



System 12: Solar system with vertical tank loading and thermostatic backup heating

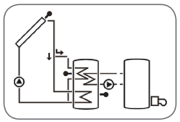


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank return preheating/ Temperature backup heating	3/GND
S4	Free	4/GND
S5	Free	5/GND

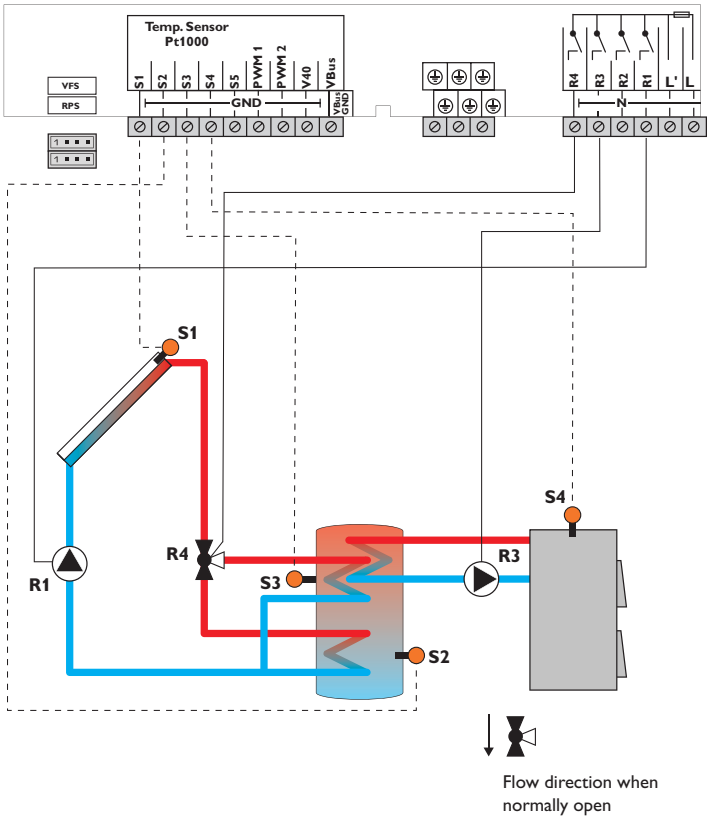
Relay		
R1	Solar pump	R1/N/PE
R2	Free	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Backup heating/Tank loading pump	R4/N/PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of the upper zone of the tank.

Backup heating (R4) can be carried out with a thermostat function (S3). If the value at S3 reaches the switch-on temperature for the backup heating, the relay is switched on. If the value exceeds the switch-off temperature for the backup heating, the relay is switched off again.



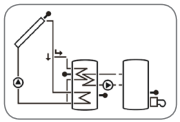
System 13: Solar system with vertical tank loading and backup heating with solid fuel boiler



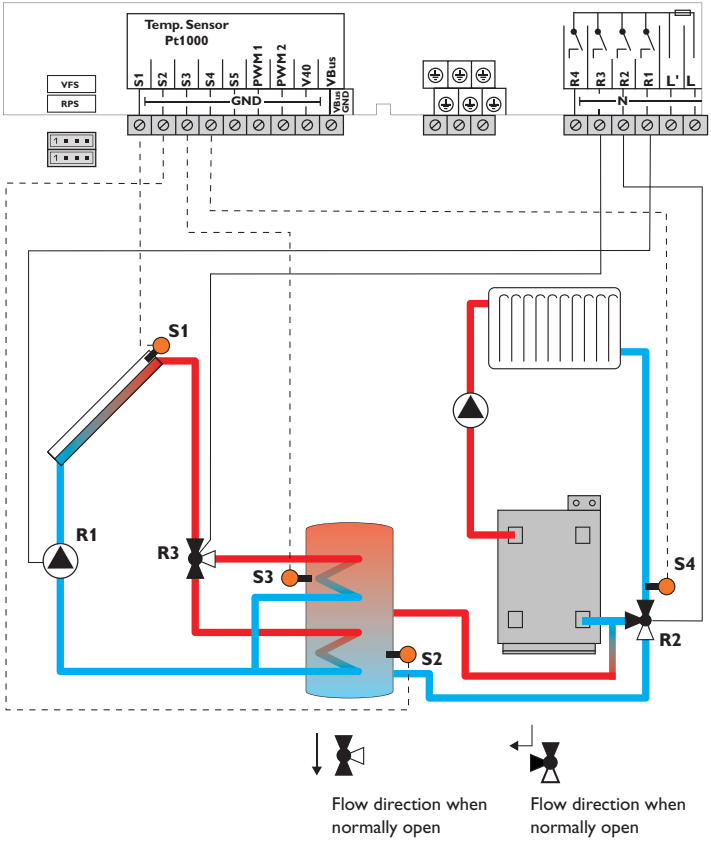
Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top/ Temperature tank - solid fuel boiler	3/GND
S4	Temperature solid fuel boiler	4/GND
S5	Free	5/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Free	R2/N/PE
R3	Loading pump Solid fuel boiler	R3/N/PE
R4	Solar valve	R4/N/PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R4). The priority logic effects prior loading of the upper zone of the tank. With another temperature differential function (S4 heat source/S3 heat sink), backup heating of the tank with a solid fuel boiler can be carried out via another pump (R3).



System 14: Solar system with vertical tank loading and return preheating

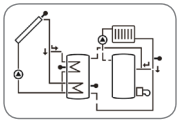


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top/ Temperature tank return preheating	3/GND
S4	Temperature heating return	4/GND
S5	Free	5/GND

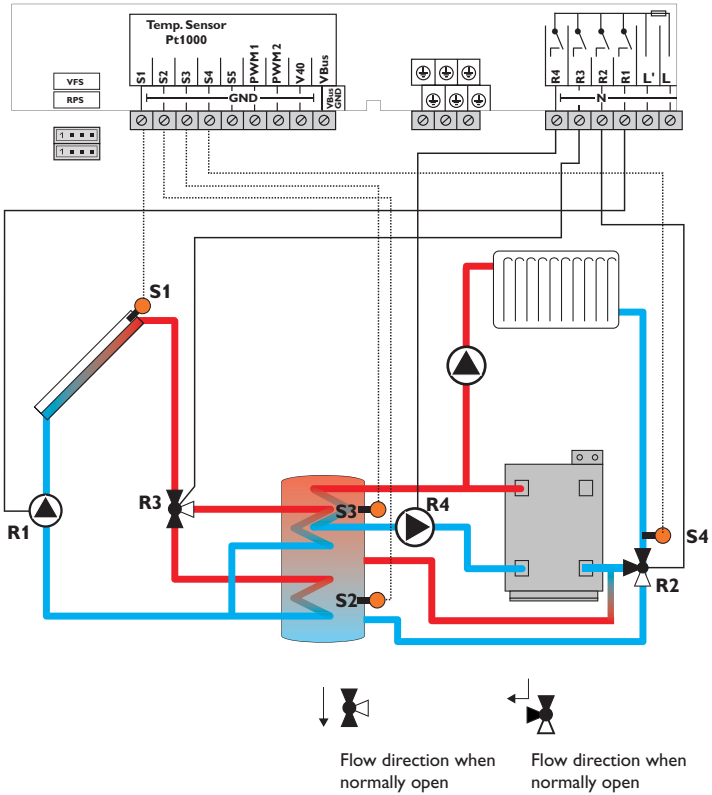
Relay		
R1	Solar pump	R1/N/PE
R2	Valve return preheating	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Free	R4/N/PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of the upper zone of the tank.

With another temperature differential function (S5 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R2).



System 15: Solar system with vertical tank loading, return preheating and backup heating



Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top/ Temperature tank return preheating	3/GND
S4	Temperature return	4/GND
S5	Free	5/GND

Relay		
R1	Solar pump tank	R1/N/PE
R2	Valve return preheating	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Backup heating/Tank loading pump	R4/N/PE

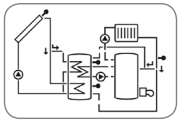
The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3).

The priority logic effects prior loading of the upper zone of the tank.

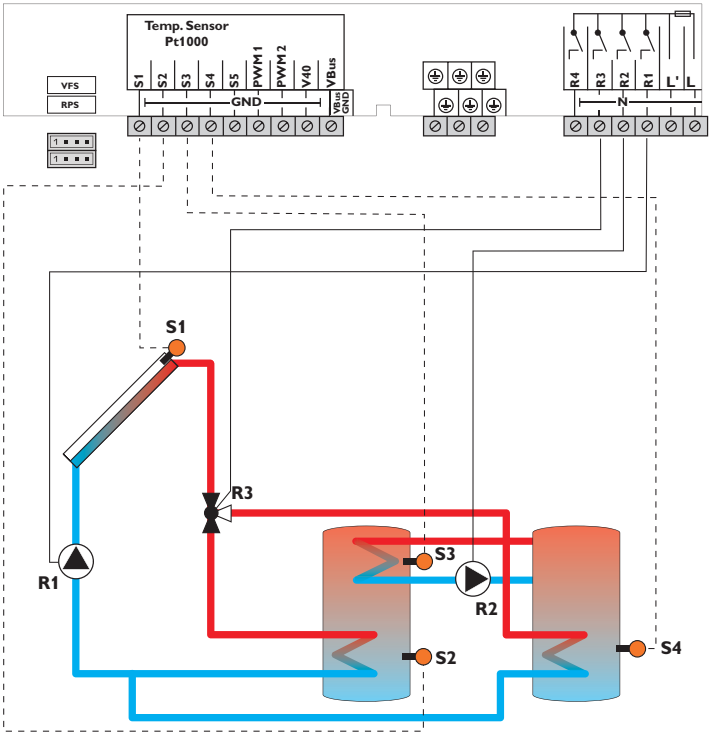
With another temperature differential function (S3 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R2).

Backup heating (R4) can be carried out with a thermostat function (S3).

If the value at S3 reaches the switch-on temperature for the backup heating, the relay is switched on. If the value exceeds the switch-off temperature for the backup heating, the relay is switched off again.



System 16: 2-tank solar system with valve logic and heat exchange control



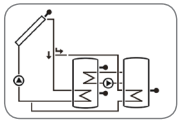
Flow direction when normally open

Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature heat exchange source	3/GND
S4	Temperature tank 2 bottom and heat exchange sink	4/GND
S5	Free	5/GND

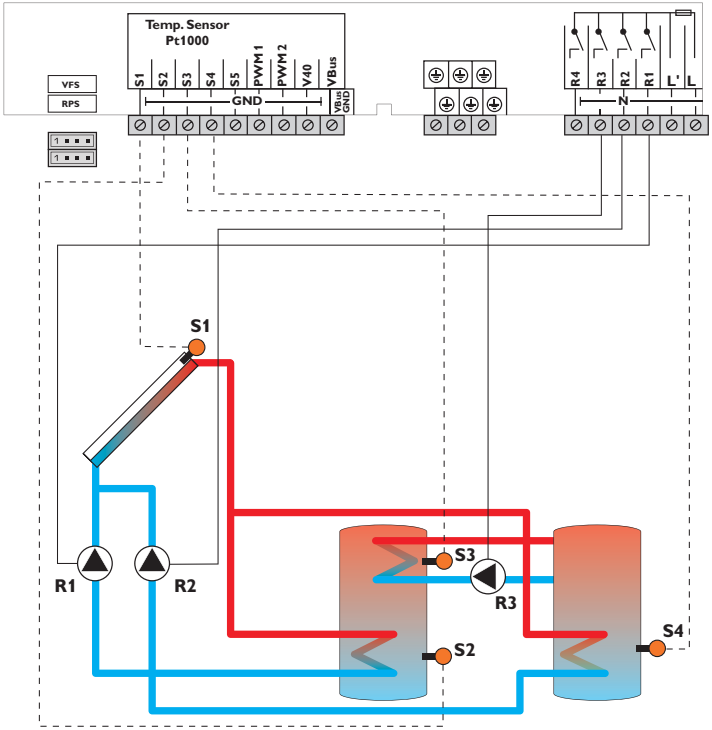
Relay		
R1	Solar pump	R1/N/PE
R2	Tank loading pump	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Free	R4/N/PE

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S4. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding tank will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of tank 1.

Heat exchange control to an existent tank via an additional pump (R2) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).



System 17: 2-tank solar system with pump logic and heat exchange control

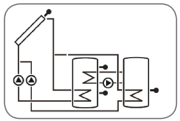


Sensors		
S1	Temperature collector	1/GND
S2	Temperature tank 1 bottom	2/GND
S3	Temperature heat exchange source	3/GND
S4	Temperature tank 2 bottom and heat exchange sink	4/GND
S5	Free	5/GND

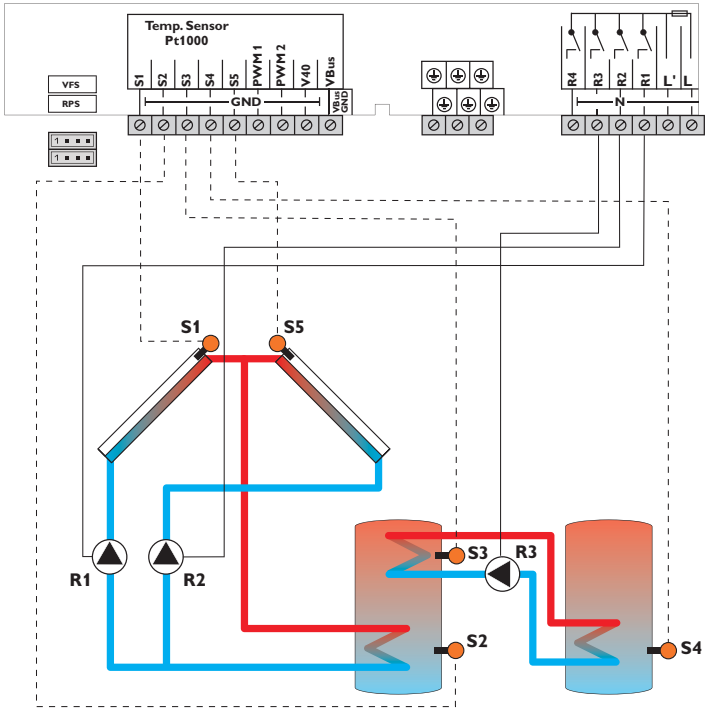
Relay		
R1	Solar pump tank 1	R1/N/PE
R2	Solar pump tank 2	R2/N/PE
R3	Tank loading pump	R3/N/PE
R4	Free	R4/R4

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S4. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1 and/or R2) will be activated and the corresponding tank will be loaded up to the adjusted tank maximum or set temperature respectively at most. The priority logic effects prior loading of tank 1.

Heat exchange control to an existent tank via an additional pump (R3) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).



System 18: Solar system with east-/west collectors and heat exchange control

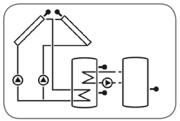


Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature heat exchange source	3/GND
S4	Temperature heat exchange sink	4/GND
S5	Temperature collector 2	5/GND

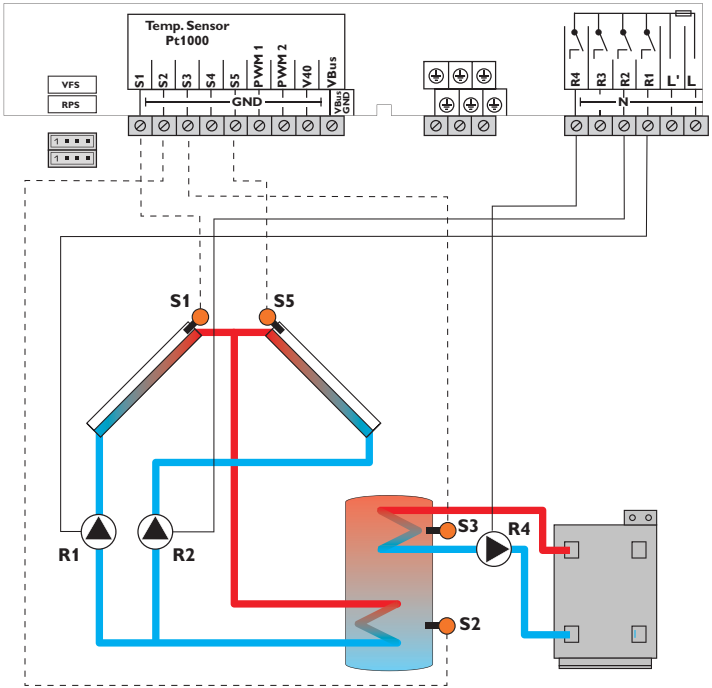
Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Tank loading pump	R3/N/PE
R4	Free	R4/N/PE

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensor S2. If one of the measured temperature difference is higher than the adusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be switched on, thus loading the tank until either the switch-off temperature difference or the tank maximum temperature is reached.

Heat exchange control to an existent tank via an additional pump (R3) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).



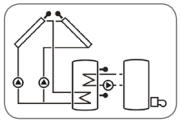
System 19: Solar system with east-/west collectors and thermostatic backup heating



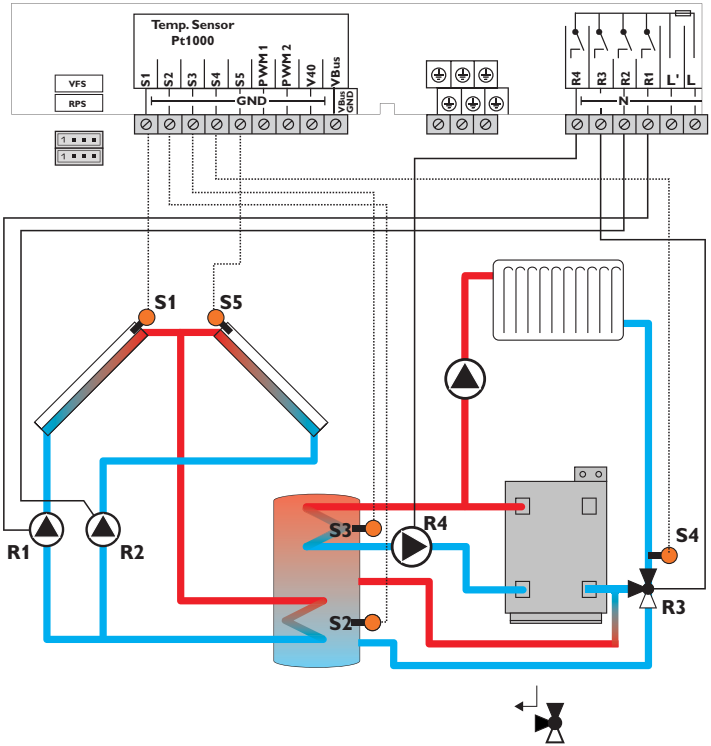
Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature backup heating	3/GND
S4	Free	4/GND
S5	Temperature collector 2	5/GND

Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Free	R3/N/PE
R4	Backup heating/Tank loading pump	R4/N/PE

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensor S2. If one of the measured temperature difference is higher than the adusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be switched on, thus loading the tank until either the switch-off temperature difference or the tank maximum temperature is reached. Backup heating (R4) can be carried out with a thermostat function (S3). If the value at S3 reaches the switch-on temperature for the backup heating, the relay is switched on. If the value exceeds the switch-off temperature for the backup heating, the relay is switched off again.



System 20: Solar system with east-/west collectors, return preheating and backup heating



Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top/ Temperature tank return preheating	3/GND
S4	Temperature heating return	4/GND
S5	Temperature collector 2	5/GND

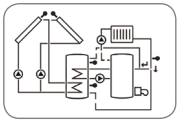
Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Return preheating	R3/N/PE
R4	Backup heating/Tank loading pump	R4/N/PE

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensor S2. If one of the measured temperature difference is higher than the adusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be switched on, thus loading the tank until either the switch-off temperature difference or the tank maximum temperature is reached.

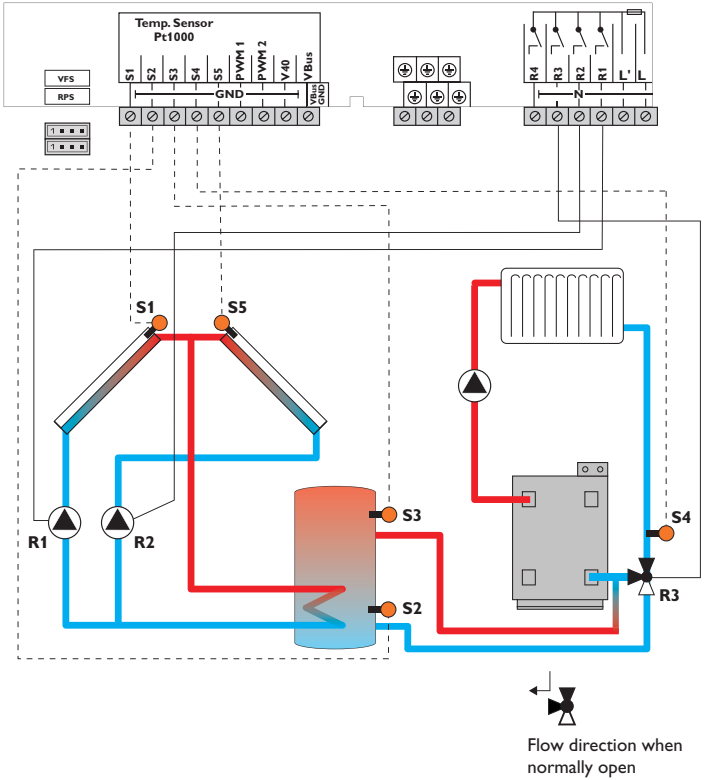
With another temperature differential function (S3 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R3).

Backup heating (R4) can be carried out with a thermostat function (S3).

If the value at S3 reaches the switch-on temperature for the backup heating, the relay is switched on. If the value exceeds the switch-off temperature for the backup heating, the relay is switched off again.



System 21: Solar system with east-/west collectors and return preheating

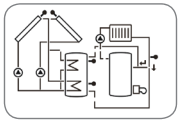


Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank return preheating	3/GND
S4	Temperature heating return	4/GND
S5	Temperature collector 2	5/GND

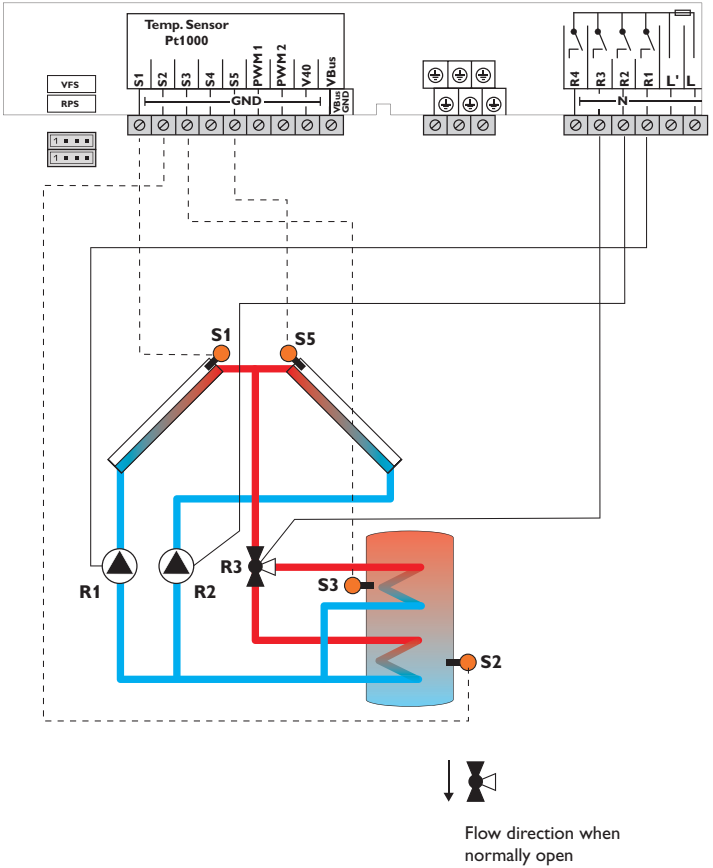
Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Valve return preheating	R3/N/PE
R4	Free	R4/N/PE

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensor S2. If one of the measured temperature difference is higher than the adusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be switched on, thus loading the tank until either the switch-off temperature difference or the tank maximum temperature is reached.

With another temperature differential function (S3 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R3).



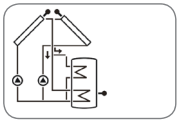
System 22: Solar system with vertical tank loading and east-/west collectors



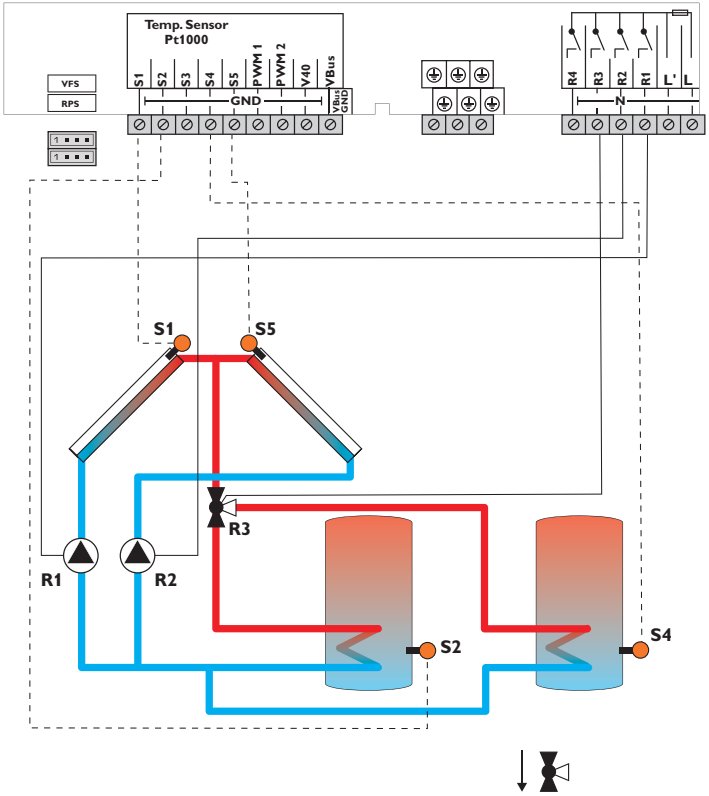
Sensors		
S1	Temperature collector 1	1 / GND
S2	Temperature tank bottom	2 / GND
S3	Temperature tank top	3 / GND
S4	Free	4 / GND
S5	Temperature collector 2	5 / GND

Relay		
R1	Solar pump collector 1	R1 / N / PE
R2	Solar pump collector 2	R2 / N / PE
R3	Solar valve	R3 / N / PE
R4	Free	R4 / N / PE

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensors S2 and S3. If one of the measured temperature differences is higher than the adjusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of the upper zone of the tank.



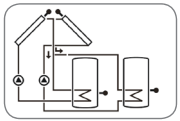
System 23: Solar system with east-/west collectors and 2 tanks (valve logic)



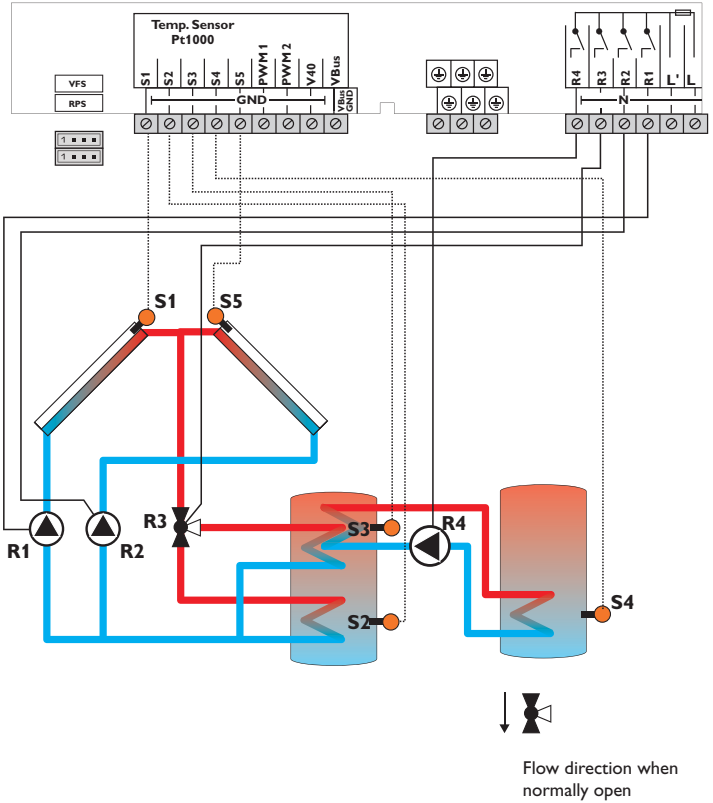
Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank 1 bottom	2/GND
S3	Free	3/GND
S4	Temperature tank 2 bottom	4/GND
S5	Temperature collector 2	5/GND

Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Free	R4/R4

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensors S2 and S3. If one of the measured temperature differences is higher than the adjusted switch-on temperature differences, the corresponding pump (R1 and/or R2) or both pumps will be activated and the corresponding tank will be loaded up to the adjusted maximum temperature via the valve (R3). The priority logic effects prior loading of tank 1.



Arrangement 24: Solar system with east-/west collectors, vertical tank loading and heat exchange

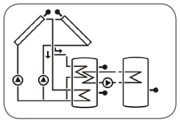


Flow direction when normally open

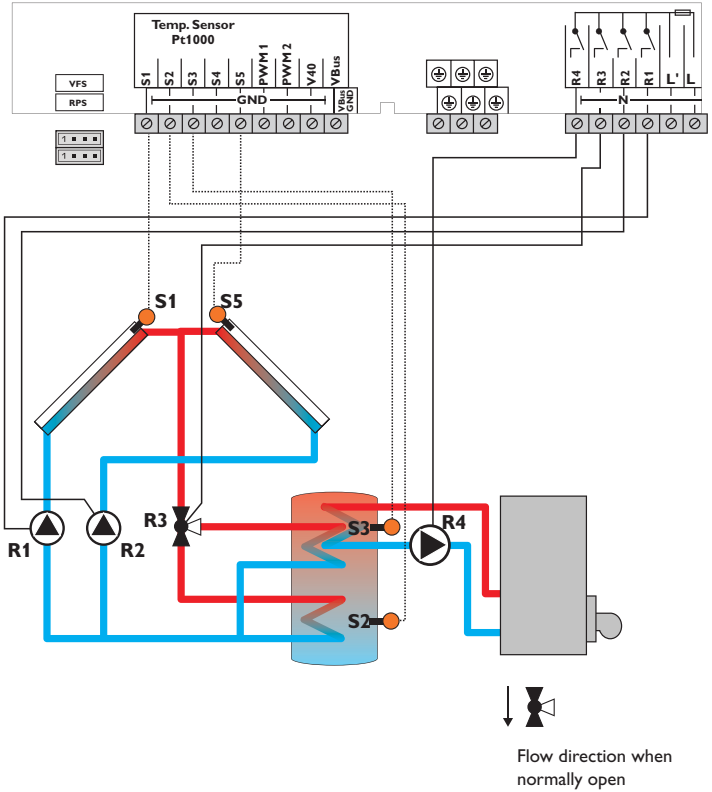
Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top/ Heat exchange source	3/GND
S4	Temperature heat exchange sink	4/GND
S5	Temperature collector 2	5/GND

Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Heat exchange pump	R4/R4

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensors S2 and S3. If one of the measured temperature differences is higher than the adjusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R3). The priority logic effects prior loading of the upper zone of the tank. Heat exchange control to an existent tank via an additional pump (R4) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).



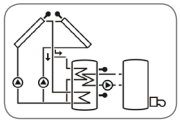
Arrangement 25: Solar system with east-/west collectors, vertical tank loading and thermostatic backup heating



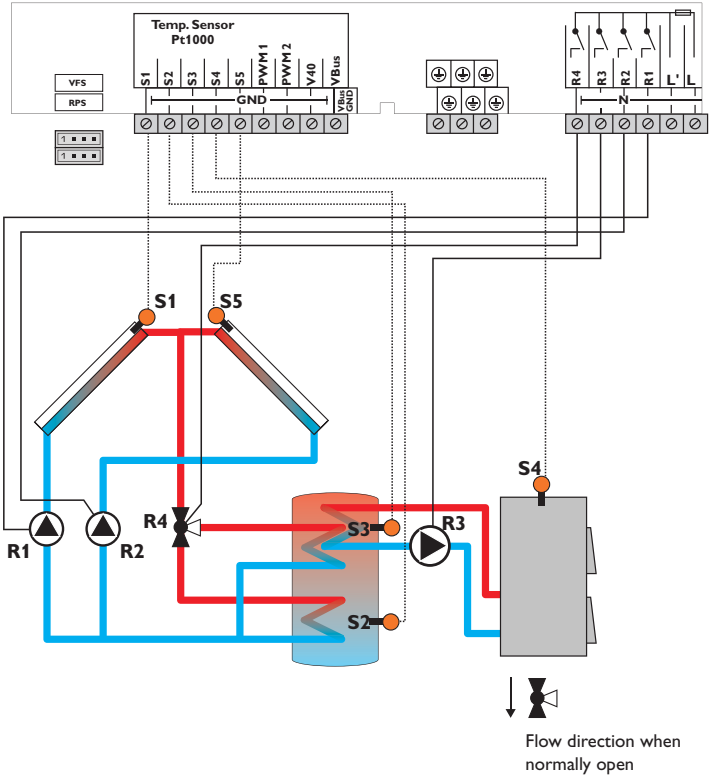
Sensors		
S1	Temperature collector 1	1/GND
S2	Temperature tank bottom	2/GND
S3	Temperature tank top	3/GND
S4	Free	4/GND
S5	Temperature collector 2	5/GND

Relay		
R1	Solar pump collector 1	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R3	Solar valve	R3/N/PE
R4	Backup heating/Tank loading pump	R4/R4

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensors S2 and S3. If one of the measured temperature differences is higher than the adjusted switch-on temperature differences, the corresponding pump (R1, R2) or both pumps will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum via the valve (R3). The priority logic effects prior loading of the upper zone of the tank.
DHW backup heating (R4) can be carried out with a thermostat function (S3).



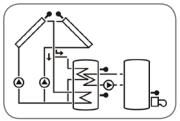
Arrangement 26: Solar system with east-/west collectors, vertical tank loading and backup heating with solid fuel boiler



Sensors		
S1	Temperature collector 1	1 / GND
S2	Temperature tank bottom	2 / GND
S3	Temperature tank top	3 / GND
S4	Temperature solid fuel boiler	4 / GND
S5	Temperature collector 2	5 / GND

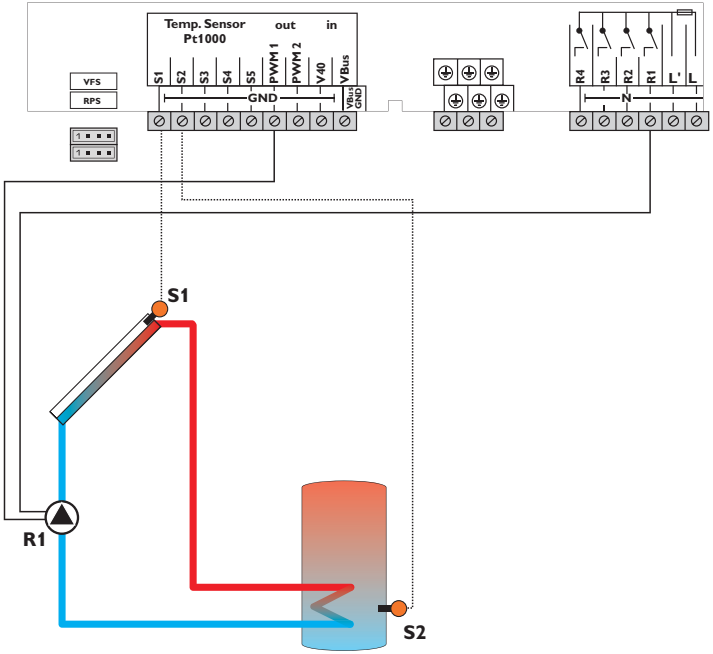
Relay		
R1	Solar pump collector 1	R1 / N / PE
R2	Solar pump collector 2	R2 / N / PE
R3	Loading pump Solid fuel boiler	R3 / N / PE
R4	Solar valve	R4 / R4

The controller compares the temperatures at the collector sensors S1 and S5 to the tank temperature at sensors S2 and S3. If one of the measured temperature differences is higher than the adjusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be activated and the corresponding tank zone will be loaded up to the adjusted tank maximum or set temperature respectively via the valve (R4). The priority logic effects prior loading of the upper zone of the tank. With another temperature differential function (S4 heat source / S3 heat sink), backup heating of the tank with a solid fuel boiler can be carried out via another pump (R3).



Electrical connection of a high-efficiency pump (HE pump)

Speed control of a HE pump is possible via a PWM signal. The pump has to be connected to the relay (power supply) as well as to one of the PWM outputs 1/2 of the controller. In the PUMP adjustment channel, one of the PWM control types as well as a relay have to be selected (see page 59).



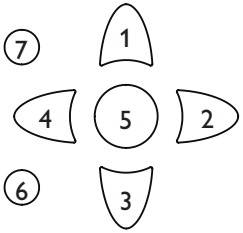
Note:
For more information about loading logic, see page 59.

3 Operation and function

3.1 Buttons

The controller is operated via the 7 buttons next to the display. They have the following functions:

Button 1 - scrolling upwards
Button 3 - scrolling downwards
Button 2 - increasing adjustment values
Button 4 - reducing adjustment values
Button 5 - confirming
Button 6 - menu button for changing between the status and the menu level
Button 7 - escape button for changing into the previous menu



3.2 Menu structure

Status level
TCOL
TCOL2
TSTB
TSTT
…

Menu level
ARR
LOAD
COL
…

Adjustment level
DT O
DT F
DT S
S SET
S MAX
SMAXS
…

The menu structure of the controller consists of 3 levels: the status level, the menu level and the adjustment level.

The status level consists of different display channels which indicate display values and messages.

The menu level consists of several menu items, each of which consists of sub-menus and adjustment channels. Each of these menu items represents a function or option which can be selected. If a function or option is selected, the controller changes to the adjustment level in which the corresponding parameters of the function or option are available.

In order to activate or deactivate a function, it must be selected in the menu level. The display changes to the adjustment menu in which all adjustments required can be carried out.

During normal operation of the controller, the display is in the status level.

Menu level

If it is possible to jump into a menu, PUSH is indicated below the menu item. Use button (5) to access the menu. In order to leave the menu, press button (7).

If an option is deactivated, it will appear in the menu level with the addition OFF.

Note:
Some of the menu items depend on the selected system and the adjusted options. Therefore, they are only displayed if they are available.

Note:
The abstract from the menu structure is for information on the structure of the controller menu and is therefore not complete.

3.3 Selecting menu points and adjusting values

During normal operation of the controller, the display is in the status level.

In order to leave the status level and access the menu level, press button (6).

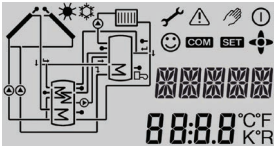
The display indicates the level with the selectable menus. In order to change the parameters of a menu item, select the menu item and press button (5). The display changes to the adjustment level. The adjustment channels are characterised by the indication **SET**.

- ➔ Select the desired channel by pressing the buttons (1) and (3).
- ➔ Confirm the selection with button (5), **SET** flashes (adjustment mode).
- ➔ Adjust the value, the function or the option using the buttons (2) and (4).
- ➔ Confirm the selection with button (5), **SET** permanently appears, the adjustment has been saved.

If no button has been pressed within a couple of minutes, the adjustment is cancelled and the previous value is retained.

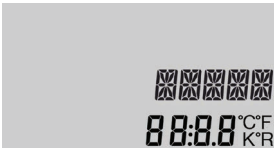
4 System-Monitoring-Display

System-Monitoring-Display



The System-Monitoring-Display consists of 3 blocks: channel display, tool bar and system screen.

Channel display



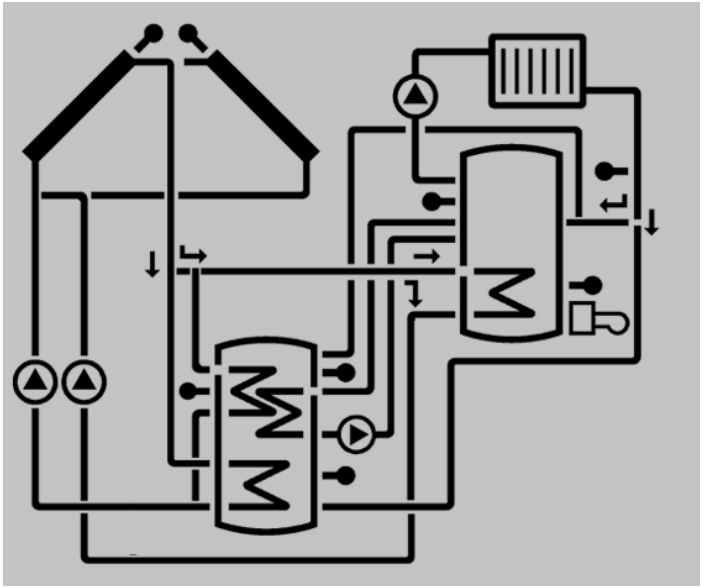
The channel display consists of 2 lines. The upper display line is an alphanumeric 16-segment display. In this line, mainly channel names and menu items are displayed. In the lower 7-segment display, values are displayed.

Tool bar

The additional symbols in the tool bar indicate the current system state.

4.1 System screen

The system selected is indicated in the System-Monitoring-Display. It consists of several system component symbols which are – depending on the current status of the system – either flashing, permanently shown or not indicated.



Collectors
with collector sensor

Tank 1 and 2 with heat exchanger

3-port valves
Only the flow direction or current switching position is indicated.

Temperature sensor

Heating circuit
(Return preheating)

Pump

Backup heating
with burner symbol

4.2 Further indications

Smiley

If the controller operates faultlessly (normal operation), a smiley ☺ is displayed.

Fault indication

If the controller detects a malfunction, the operating control LED flashes red and the symbols of the warning triangle ⚠ and the wrench are additionally displayed.

Symbol	Permanently shown	Flashing
Status indications:		
⏻	Relay active	
☼	Tank maximum limitation active (tank maximum temperature has been exceeded)	Collector cooling function active, system cooling or tank cooling active
❄	Antifreeze option activated	Collector temp. below minimum temp., antifreeze function active
⚠		Collector emergency shutdown active
⚠ + ✋		Manual mode active
⚠ + ☼		Tank emergency shutdown active
SET		Adjustment mode
COM	SD card is being used	SD card is full
✥	Indication of the buttons available in the menu item	
☺	Normal operation	
Fault indication:		
⚠ + 🔧		Sensor fault

5 Status level / Measurement values

During normal operation of the controller, the display is in the status level. This one indicates the measurement values shown in the table.

In addition to the display values, possible error messages are indicated in the status level (see page 69).

Display	Description
BLPR1	Blocking protection R1
BLPR2	Blocking protection R2
BLPR3	Blocking protection R3
INIT	Initialization
FLLT	Filling time
STAB	Stabilization
TCOL	Temperature collector
TCOL1	Temperature collector 1
TCOL2	Temperature collector 2
TSTB	Temperature tank bottom
TST1B	Temperature tank 1 bottom
TSTT	Temperature tank top
TST2B	Temperature tank 2 bottom
TSFL	Temperature solar flow
TSRE	Temperature solar return
TSFB	Temperature solid fuel boiler
TSTR	Temperature tank return preheating
TRET	Temperature return
S3	Temperature sensor 3
S4	Temperature sensor 4
S5	Temperature sensor 5
n1	Speed relay 1
n2	Speed relay 2
n3	Speed relay 3
n4	Status relay 4
h R1	Operating hours relay 1
h R2	Operating hours relay 2
h R3	Operating hours relay 3
h R4	Operating hours relay 4
L/h	Flow rate Grundfos Direct Sensor™
BAR	System pressure
TSFL	Temperature solar flow VFS
TSRE	Temperature solar return RPS
TFHQM	Temperature flow energy metering
TRHQM	Temperature return energy metering
L/h	Flow rate V40 or flow gauge
kWh	Heat quantity in kWh
TDIS	Disinfection temperature
CDIS	Countdown thermal disinfection
DDIS	Heating period thermal disinfection
TIME	Time
DATE	Date

* R4 is an electromechanical relay not suitable for speed control. Therefore, its status is indicated with 0 % or 100 % respectively.

6 Commissioning

When the hydronic system is filled and ready for operation, connect the controller to the power supply.

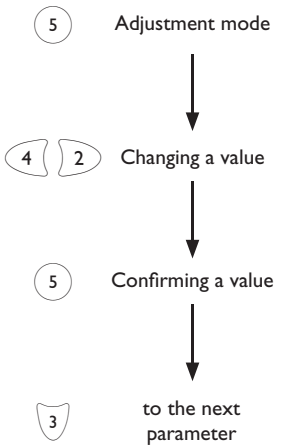
The controller runs an initialization phase in which all symbols are indicated in the display. The directional pad flashes red.

When the controller is commissioned or when it is reset, it will run a commissioning menu after the initialization phase. The commissioning menu leads the user through the most important adjustment channels needed for operating the system and starts with the indication of the BX version number.

Commissioning menu

The commissioning menu consists of the channels described in the following. In order to make an adjustment, push button (5). **SET** starts flashing and the adjustment can be made. Acknowledge the message by pressing button (5). Press button (3), the next channel will appear on the screen.

Button navigation



Commissioning

1. Language:

➔ Adjust the desired menu language.

2. Temperature unit:

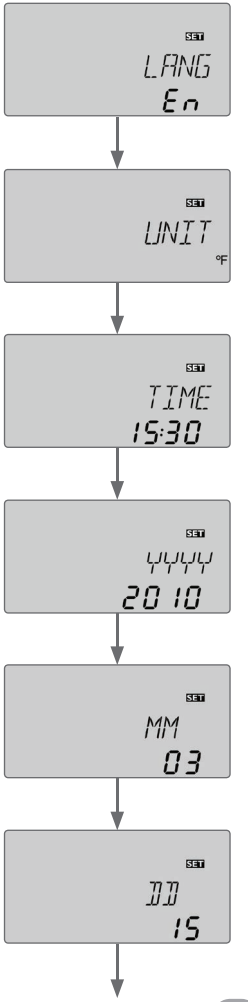
➔ Adjust the desired temperature unit.

3. Time:

➔ Adjust the clock time. First of all adjust the hours, then the minutes.

4. Date:

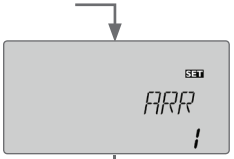
➔ Adjust the date. First of all adjust the year, then the month and then the day.



Commissioning

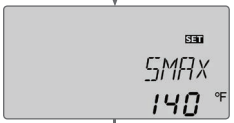
5. Arrangement:

➔ Adjust the desired system (see page 46).



6. Maximum tank temperature:

➔ Adjust the maximum tank temperature. In 2-tank systems, the adjustment has to be carried out for **S1MAX** and **S2MAX** as well (see page 48).



7. Loading tank 2:

➔ Switch on or off the "loading tank 2" option (see page 48).

Note:
"Loading tank 2" is only available if a 2-tank system or vertical tank loading has been previously selected in the sub-channel **ARR**.

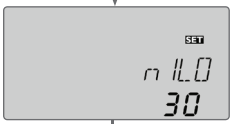
8. Pump control type:

➔ Select the pump control type for **PUMP1**. In systems with 2 pumps, carry out this adjustment for **PUMP2** as well.

9. Minimum speed:

➔ Adjust the minimum speed of the pump PUMP1. In systems with 2 pumps, carry out this adjustment for PUMP2 as well.

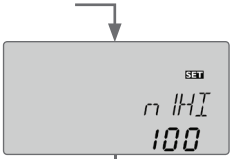
Note:
The minimum speed can only be adjusted if pulse control (PULS) or PWM control (A, b, C) has been selected in the sub-channel **PUMP1,2**.



10. Maximum speed:

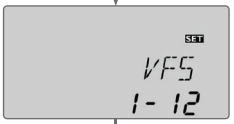
➔ Adjust the maximum speed of the pump PUMP1. In systems with 2 pumps, carry out this adjustment for PUMP2 as well.

Note:
The maximum speed can only be adjusted if pulse control (PULS) or PWM control (A, b, C) has been selected in the sub-channel **PUMP1,2**.



11. Range of the flow rate sensor:

➔ Adjust the range of the sensor, if the flow rate sensor is connected.



12. Range of the pressure sensor:

➔ Adjust the range of the sensor, if the pressure sensor is connected.

➔ Complete the commissioning menu by pressing button (5):

The controller is then ready for operation and normally the factory settings will give close to optimum operation.

7 Indications, functions and options

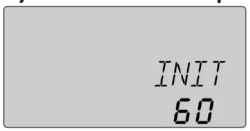
Note:
The values and adjustment channels as well as the adjustment ranges depend on the system selected, the functions and options as well as the user code entered and the system components connected to the controller.

7.1 Status level

Display of blocking protection time

BLPR(2, 3)
Blocking protection active

Display of drainback time periods



INIT
Initialization active
Indicates the time adjusted in **tDTO**, running backwards.

FLLT
Filling time active
Indicates the time adjusted in **tFLL**, running backwards.

STAB
Stabilization
Indicates the time adjusted in **tSTB**, running backwards.

Display of collector temperatures

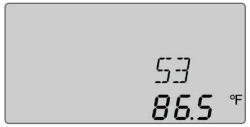
TCOL(2)
Collector temperature
Display range: -40 … +260 °C [-104 … +500 °F]
Displays the current collector temperature.
- TCOL : Collector temperature (1-collector system)
- TCOL1: Collector temperature 1 (2-collector system)
- TCOL2: Collector temperature 2 (2-collector system)

Display of tank temperatures

TSTB, etc.
Tank temperatures
Display range: -40 … +260 °C [-104 … +500 °F]
Displays the current tank temperature.
- TSTB : Tank temperature bottom
- TSTT : Tank temperature top

in 2-tank systems (only if available):
- TST1T : Temperature tank 1 top
- TST1B : Temperature tank 1 bottom
- TST2T : Temperature tank 2 top
- TST2B : Temperature tank 2 bottom

Display of temperatures at S3, S4 and S5



S3, S4, S5
Sensor temperatures
Display range: -40 … +260 °C [-104 … +500 °F]
Indicates the current temperature at the corresponding additional sensor (without control function).

- S3 : Temperature sensor 3
- S4 : Temperature sensor 4
- S5 : Temperature sensor 5

Note:
Only if temperature sensors are connected, will S3, S4 and S5 be displayed.

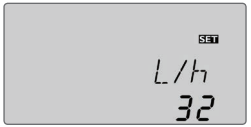
Note:
In systems with return preheating, S3 / S5 is used as the heat source sensor **TSTR**.

Display of further temperatures

TSFB, etc.
Further measured temperatures
Display range: -40 … +260 °C [-104 … +500 °F]
Indicates the current temperature at the corresponding sensor. The display of these temperatures depends on the system selected.

- TSFB : Temperature solid fuel boiler
- TRET : Temperature heating return
- TSTR : Temperature tank return preheating
- TFHQM : Temperature flow (HQM)
- TRHQM : Temperature return (HQM)

Display of flow rate



L/h
Flow rate
Display range: 0 … 9999 l/h
Indicates the currently measured flow rate. The flow rate value is used for calculating the heat quantity supplied (V40/VFS).

Display of pressure

BAR
Pressure
Display range: 0 … 10 bar
Indicates the current system pressure.

Note:
The pressure will only be indicated if a pressure sensor is used.

Display of speed

n1%, n2%, n3%

Current pump speed

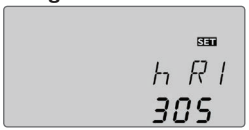
Display range:

30 … 100 % (standard pump)

20 … 100 % (HE pump)

Indicates the current speed of the corresponding pump.

Operating hours counter



h R (1, 2, 3, 4)

Operating hours counter

The operating hours counter accumulates the operating hours of the relay (h R1 / h R2 / h R3 / h R4). Full hours are displayed.

The accumulated operating hours can be set back to zero. As soon as one of the operating hours channels is selected, the symbol **SET** is displayed.

➔ In order to access the reset mode of the counter, press the set button (5).

The display symbol **SET** will flash and the operating hours will be set to 0.

➔ Confirm the reset with the set button (5) in order to finish the reset.

In order to interrupt the reset process, do not press any button for about 5 s. The display automatically returns to the display mode.

Display of heat quantity

kWh/MWh

Heat quantity in kWh / MWh

Indicates the heat quantity produced in the system. For this purpose, the energy metering option has to be enabled. The flow rate as well as the values of the reference sensors flow and return are used for calculating the heat quantity supplied. It is shown in kWh in the **kWh** channel and in MWh in the **MWh** channel. The overall heat quantity results from the sum of both values.

The accumulated heat quantity can be set back to zero. As soon as one of the display channels of the heat quantity is selected, the symbol **SET** is displayed.

➔ In order to access the reset mode of the counter, press the set button (5) for approx. 2 s.

SET starts flashing and the heat quantity value will be set back to zero.

➔ Confirm the reset with the set button in order to finish the reset.

In order to interrupt the reset process, no button should be pressed for about 5 s. The display automatically returns to the display mode.

Indication of thermal disinfection

TDIS
Disinfection temperature
Display range: -40 … +260 °C [-104 … +500 °F]

If the thermal disinfection option (**OTDIS**) is activated and the disinfection period is in progress, the disinfection temperature measured at the reference sensor is displayed in this channel.

CDIS
Countdown monitoring period
Display range: 0 … 30:0 … 24 (dd:hh)

If the thermal disinfection option (**OTDIS**) is activated and the monitoring period is in progress, the remaining time of the monitoring period is displayed as **CDIS** (in days and hours), counting backwards.

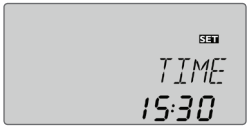
SDIS
Starting time
Display range: 0:00 … 24:00 (time)

If the thermal disinfection option (**OTDIS**) is activated and a starting delay time has been adjusted, the delay time is displayed (flashing) in this channel.

DDIS
Disinfection period
Display range: 0:00 … 23:59 (hh:mm)

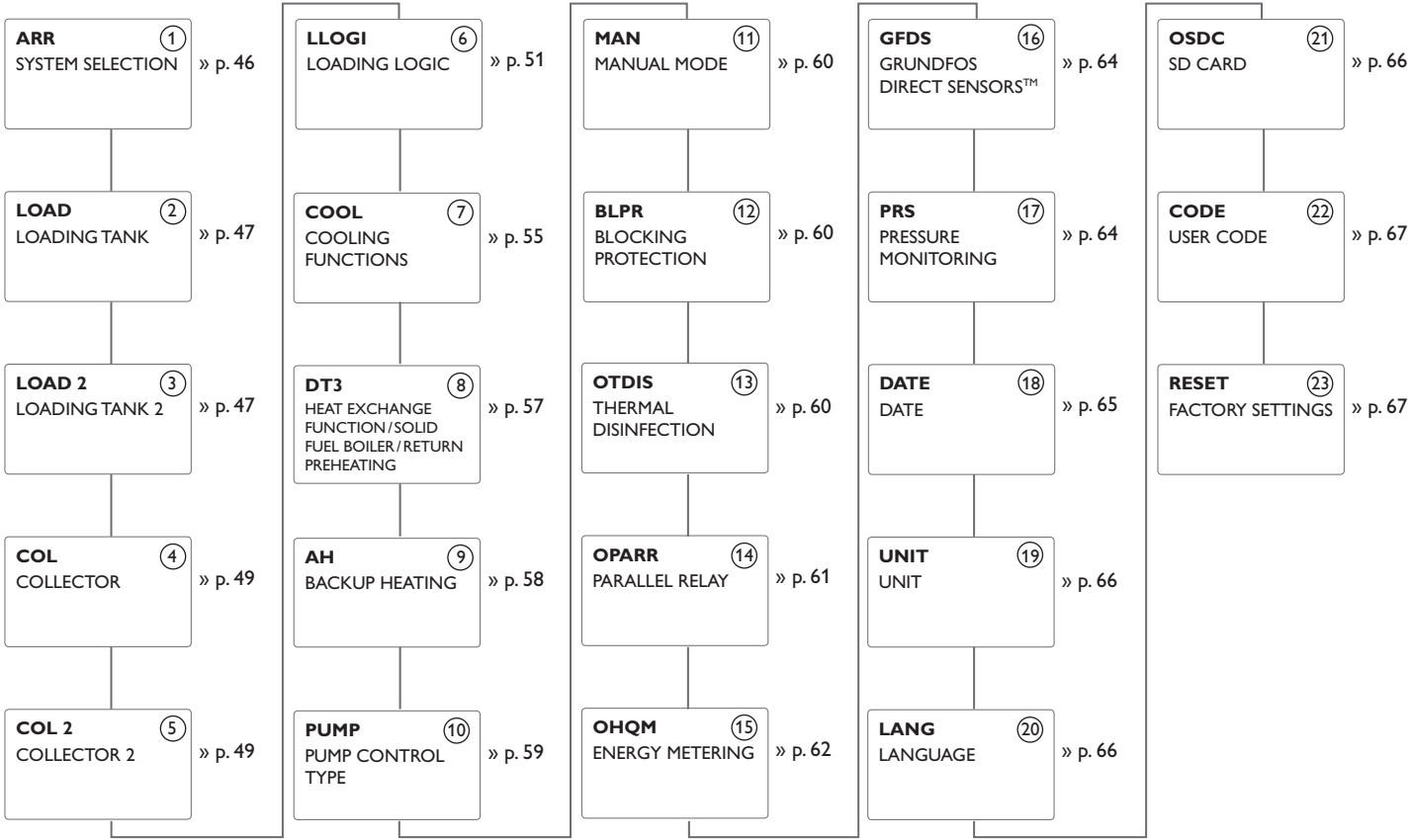
If the thermal disinfection option (**OTDIS**) is activated and the disinfection period is in progress, the remaining time of the heating period is displayed (in hours and minutes) in this channel, counting backwards.

Display of time



TIME
Time

Indicates the current clock time.



Parameters shown in the following with a dashed line depend on options and are only indicated if they are available in the system selected.

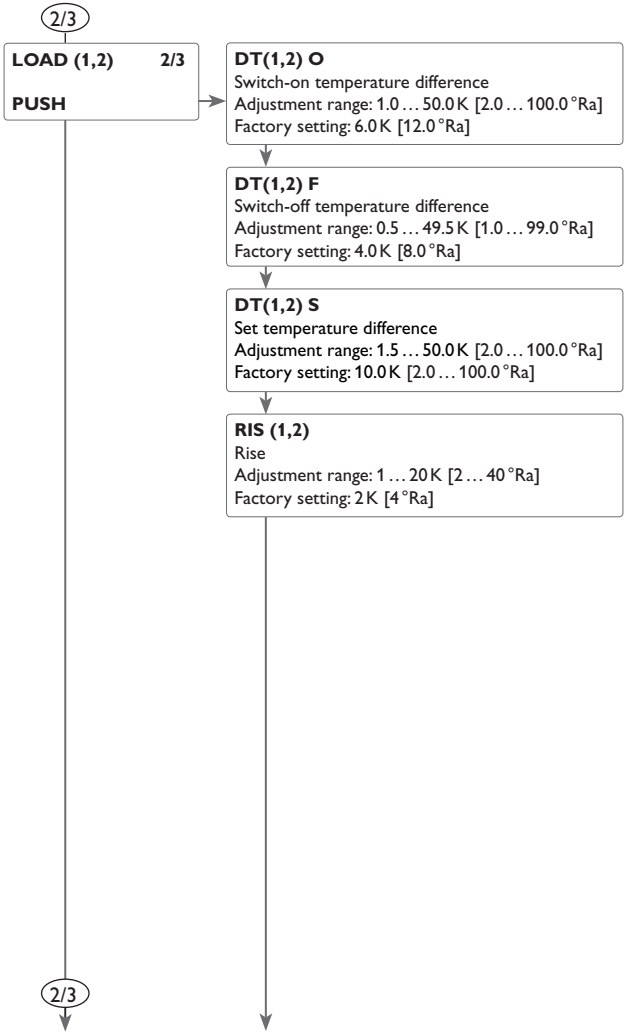
Adjustment level

Note:
If the controller is commissioned for the first time, the commissioning menu will start. The subsequent selection of a new system will reset all other adjustments to the factory settings.

(1) System

Selecting the system

Selection of the appropriate system. Each system has pre-programmed options and adjustments which can be activated or changed respectively if necessary. Select the system first (see page 35).



(2/3) ΔT control

The controller works as a standard differential controller. If the temperature reaches or exceeds the switch-on temperature difference, the pump switches on. When the temperature difference reaches or falls below the adjusted switch-off temperature difference, the respective relay switches off.

Note:
The switch-on temperature difference must be 0.5 K [1.0 °Ra] higher than the switch-off temperature difference. The set temperature difference must be at least 0.5 K [1.0 °Ra] higher than the switch-on temperature difference.

Note:
In systems with 2 tanks or vertical tank loading, 2 separate menus (**LOAD** and **LOAD 2**) will be displayed.

Speed control

If the temperature difference reaches or exceeds the switch-on temperature difference, the pump switches on at 100 % speed for 10 s. Then, the speed is reduced to the minimum pump speed value.

If the temperature difference reaches the adjusted set value, the pump speed increases by one step (10 %). The response of the controller can be adapted via the parameter **RIS**. Each time the difference increases by the adjustable rise value, the pump speed increases by 10 % until the maximum pump speed of 100% is reached. If the temperature difference decreases by the adjustable rise value, pump speed will be decreased by one step.

Note:
To enable speed control, the corresponding relay has to be set to **AUTO** or **nLO**, **nHI** (adjustment channel **MAN**) and the pump control type has to be set to PULS, PWM A, b, or C (adjustment channel PUMP).

2/3

S(1,2)MAX
Maximum tank temperature
Adjustment range: 4 … 95 °C [40 … 200 °F]
Factory setting: 60 °C [°F]

SMXS1(2)
Sensor maximum tank temperature
Adjustment range:
1-tank system S2, S3
2-tank system S4, S5
Factory setting:
1-tank system S2
2-tank system S4

LST2
Loading tank 2
Selection: ON / OFF
Factory setting: ON

4/5

(2/3) Tank maximum temperature and Sensor tank maximum temperature

If the tank temperature reaches the adjusted maximum temperature, the tank will no longer be loaded in order to avoid damage caused by overheating. If the maximum tank temperature is exceeded, ☼ is displayed.

The sensor for tank maximum limitation can be selected. The maximum limitation always refers to the sensor selected.

Switch-on hysteresis: -2 K [-4 °Ra]

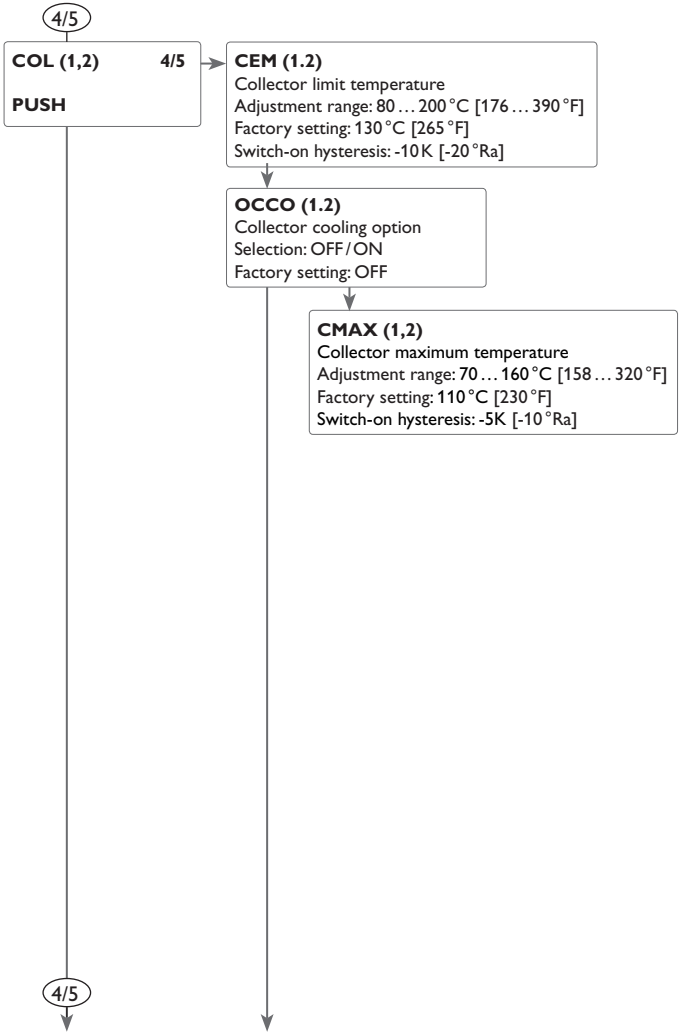
If S3 is selected, the differential control will be carried out using S1 and S2. The temperature at S2 can exceed the adjusted limit temperature, the system will not switch off. If the value at S3 reaches the limit temperature, the system will be switched off.

Note:
In systems with 2 tanks or vertical tank loading, 2 separate menus (**LOAD** and **LOAD 2**) will be displayed.

Loading tank 2

In a 2-tank system, the second tank can be switched off for loading via the parameter LST2.

If **LST2** is adjusted to **OFF**, the system runs like a 1-tank system. The representation in the display remains the same.



(4/5) Collector emergency shutdown

When the collector temperature exceeds the adjusted collector limit temperature, the solar pump (R1 / R2) switches off in order to protect the system components against overheating (collector emergency shutdown). If the collector limit temperature is exceeded, ⚠ is displayed (flashing).

Note:
If the drainback option is activated, the adjustment range of the collector emergency temperature is changed to 80 … 95 °C [176 … 200 °F]. Factory setting will be 95 °C [200 °F].

Note:
In systems with east-/west collectors 2 separate menus (**COL** and **COL 2**) will be displayed.

WARNING! **Risk of injury! Risk of system damage by pressure surge!**

If water is used as the heat transfer fluid in pressureless systems, water will boil at 100 °C [210 °F].

➔ **In pressureless systems with water as the heat transfer fluid, do not set the collector limit temperature higher than 95 °C [200 °F].**

Collector cooling

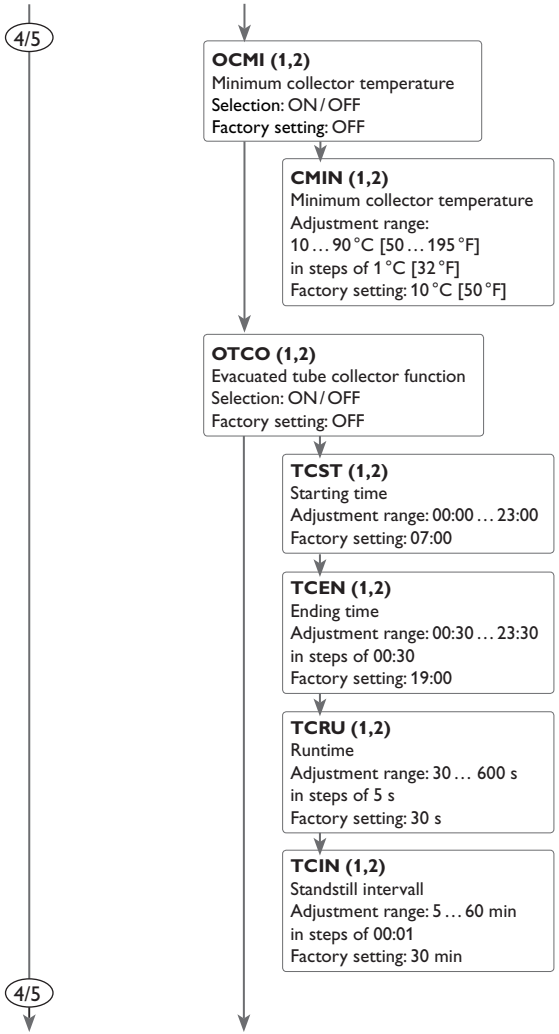
The collector cooling function keeps the collector temperature within the operating range by heating the tank. If the tank temperature reaches 95 °C [200 °F] the function will switch off for safety reasons.

If the tank temperature exceeds the adjusted maximum tank temperature, the solar system is switched off. If the collector temperature increases to the adjusted maximum collector temperature, the solar pump is activated until the collector temperature falls below the maximum collector temperature. The tank temperature may then exceed the maximum temperature, but only up to 95 °C [200 °F] (emergency shutdown of the tank).

If the collector cooling is active, ☼ is displayed (flashing).

Note:
This function is only available if the system cooling function and the heat dissipation function are not activated.

Note:
In systems with east-/west collectors 2 separate menus (**COL** and **COL 2**) will be displayed.



(4/5) Collector minimum temperature

The minimum collector temperature is the minimum switch-on temperature which must be exceeded for the solar pump (R1 / R2) to switch on. If the collector temperature falls below the adjusted minimum temperature, ❄ is displayed (flashing).

Note:
In systems with east-/west collectors 2 separate menus (**COL** and **COL 2**) will be displayed.

Evacuated tube collector function

This function is used for improving the switch-on behaviour in systems with non-ideal sensor positions (e. g. with some evacuated tube collectors).

This function operates within an adjusted time frame. It activates the collector circuit pump for an adjustable runtime between adjustable standstill intervals in order to compensate for the delayed temperature measurement.

If the runtime is set to more than 10 seconds, the pump will be run at 100 % for the first 10 s of the runtime. For the remaining runtime, the pump will be run at the adjusted minimum speed.

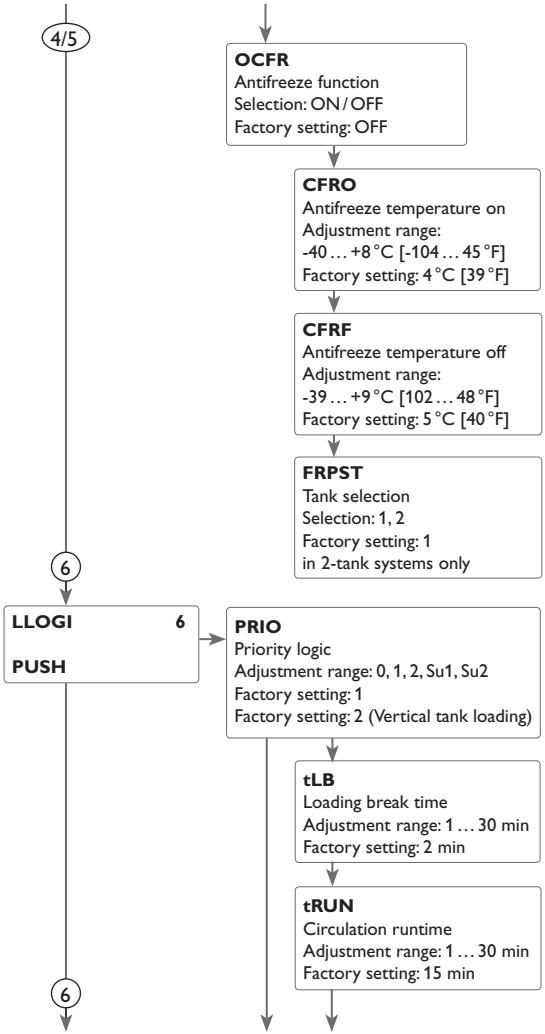
If the collector sensor is defective or the collector is blocked, this function is suppressed or switched off.

2-collector systems

In 2-collector systems, the evacuated tube collector function is available for each individual collector field.

In 2-collector systems, the evacuated tube collector function will affect the inactive collector field only. The solar pump of the active collector field will remain switched on until the switch-off conditions are fulfilled.

Note:
If the drainback option is activated, the evacuated tube collector function will not be available.



(4/5) Antifreeze function

The antifreeze function activates the loading circuit between the collector and the tank when the collector temperature falls below the adjusted temperature **CFRO**. This will protect the fluid against freezing or coagulating. If **CFRF** is exceeded, the solar pump will be switched off again.

The antifreeze function will be suppressed if the tank temperature of the selected tank falls below 5 °C [40 °F]. In 2-tank systems, the function will switch to the second tank, in systems with vertical tank loading, it will switch to the upper tank zone. If the temperature of the second tank (or of the upper tank zone respectively) also falls below 5 °C [40 °F], the system will be switched off.

Note:
In systems with east-/west collectors, the antifreeze function will work on both collector fields.

Note:
Since this function uses the limited heat quantity of the tank, the antifreeze function should be used in regions with few days of temperatures around the freezing point.

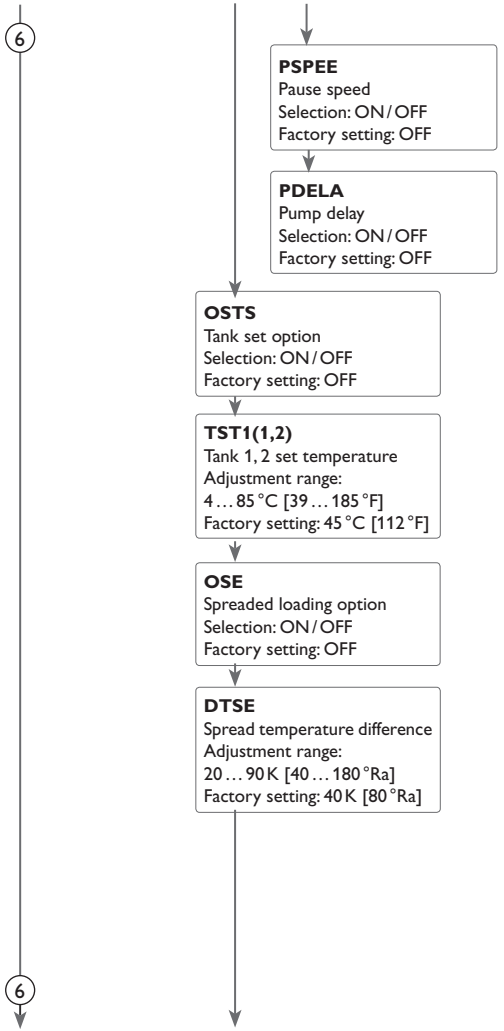
(6) Priority logic

Priority logic can be used in 2-tank systems or systems with vertical tank loading only and determines how the heat is divided between the tanks.

Different types of priority logic are adjustable:

- tank sequence control (1 and 2)
- successive loading (Su 1 and Su 2)
- parallel loading (0)

1. If **PRIO 1** or **2** is adjusted, the corresponding tank (1 = tank 1/tank top; 2 = tank 2/tank bottom) will be loaded with priority if its switch-on conditions are fulfilled and if it is not blocked. If the priority tank is not blocked but its switch-on conditions are not fulfilled, the tank sequence control starts provided that the switch-on conditions of the subordinate tank are fulfilled. If a subordinate tank can be loaded, it will be loaded for the oscillating loading time **tRUN**. After the loading time has ended, the pump is switched off for the loading break **tLB**. If during this time the priority tank can be loaded, it will be loaded. If the priority tank has reached its maximum temperature, the subordinate tank will be loaded up to its maximum temperature without tank sequence control.



2. If priority **Su 1** or **Su 2** is adjusted, the priority tank will be loaded up to its maximum temperature. If the maximum temperature is reached, the second tank will be loaded. If the temperature of the first tank falls below **SMAX**, the second tank will no longer be loaded, regardless of whether the switch-on conditions of the priority tank or of the subordinate tank are fulfilled or not.
3. In systems with 2 pumps, both tanks will be loaded if the corresponding switch-on conditions are fulfilled if **PRIO 0** is adjusted. In systems with 3-port valves, the tank with the lowest temperature will be loaded first until its temperature is by 5 K [10 °Ra] above the other tank. Loading will be switched to the other tank. Then, the 2 tanks will be loaded alternately in steps of 5 K [10 °Ra].

Successive loading option

Successive loading means that the priority tank will be loaded up to its maximum temperature. If it is reached, the second tank will be loaded. If the temperature of the first tank falls below the maximum temperature, the second tank will no longer be loaded, regardless of whether the switch-on conditions of the priority tank or of the subordinate tank are fulfilled or not.

Spreaded loading option

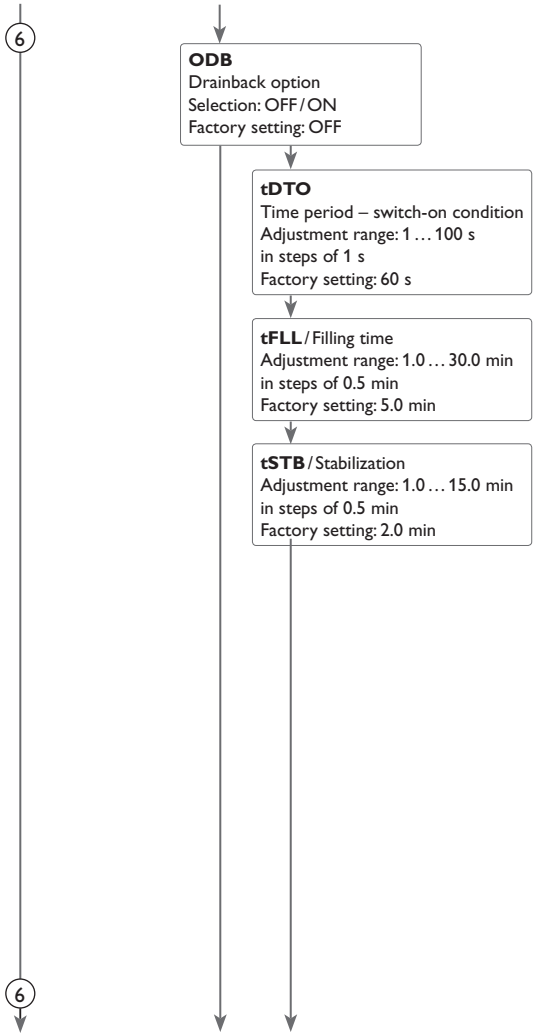
In 2-tank systems with 2 pumps, a spreaded loading function can be activated:

As soon as the adjustable temperature difference **DTSE** between the collector and the priority tank is reached, the second tank will be loaded in parallel unless it is blocked. If the temperature difference falls by 2 K [4 °Ra] below **DTSE**, the pump is switched off.

The collector temperature has to be higher than the tank temperature.

Loading logic

In systems with 2 tanks or vertical tank loading, tank sequence control can be adjusted. In 1-tank systems, only the menu item **PDELA** will be available.



(6) Drainback option

In a drainback system the heat transfer fluid will flow into a holding tank if solar loading does not take place. The drainback option initiates the filling process if solar loading is about to start. If the drainback option is activated, the following adjustment can be made.

Note:
A drainback system requires additional components such as a holding tank. The drainback option should only be activated if all components required are properly installed.

Time period – switch-on condition

The parameter **tDTO** is used for adjusting the time period during which the switch-on condition must be permanently fulfilled.

Filling time

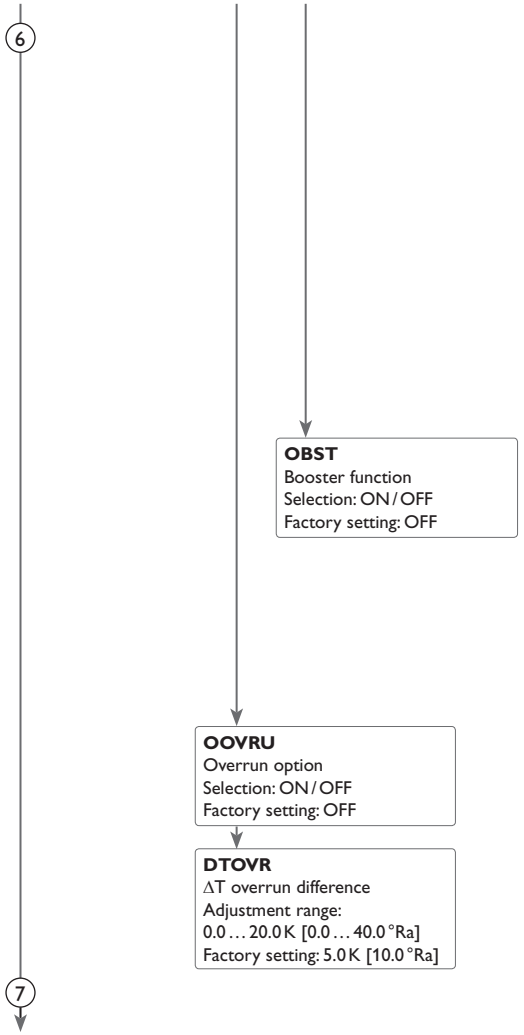
The filling time can be adjusted using the parameter **tFLL**. During this period, the pump runs at 100 % speed.

Stabilization

The parameter **tSTB** is used for adjusting the time period during which the switch-off condition will be ignored after the filling time has ended.

Note:
If the drainback option is activated, the cooling functions and the anti-freeze function will not be available.

Note:
The drainback option is only available in systems with 1 tank and 1 collector field and if no cooling function is activated.



6

Note:
If the drainback function **ODB** is activated, the factory settings of the parameters **DT O**, **DT F** and **DT S** will be adapted to values suiting drainback systems:
DT O = 10 K [20 °Ra]
DT F = 4 K [8 °Ra]
DT S = 15 K [30 °Ra]
Additionally, the adjustment range and the factory setting of the collector emergency shutdown **CEM** will change:
Adjustment range: 80 … 120 °C [176 … 248 °F]; Factory setting: 95 °C [200 °F]
Adjustments previously made in these channels will be overridden and have to be entered again if the drainback option is deactivated later on.

Note:
If the holiday function is activated, the drainback option will not be available.

Booster function

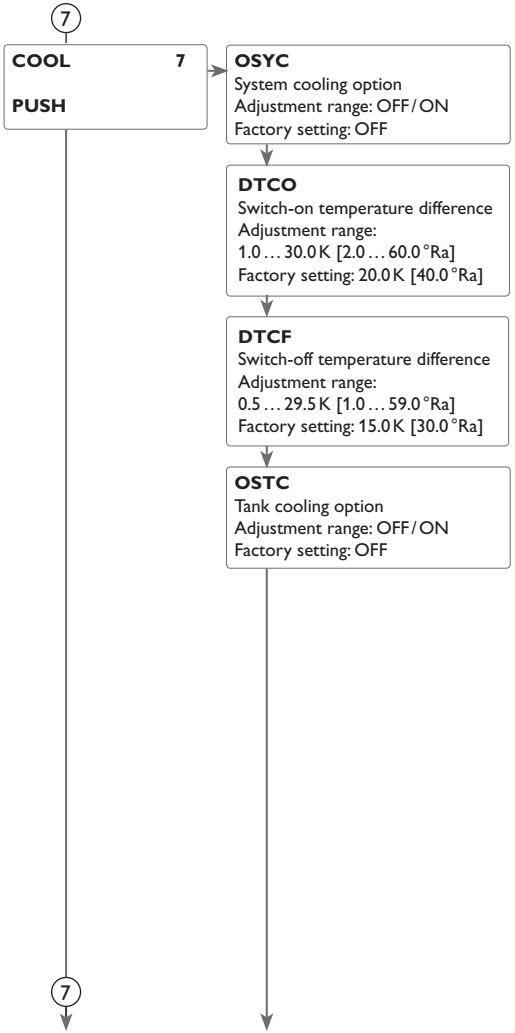
This function is used for switching on a second pump when filling the solar system. When solar loading starts, R3 is energized in parallel to R1. After the filling time has elapsed, R2 switches off.

Note:
The booster function is available in systems 1, 2, 3, 8, 9 and 10 only.

Note:
The overrun function is only available, if both Grundfos Direct Sensors™ (VFS and RPS) are used.

Overrun

By means of this function, tank loading continues after the temperature difference between the collector and the tank has fallen below the switch-off difference. It switches off if the temperature difference between the allocated flow and return sensors falls below the switch-off difference **DT(1,2) F**.



(7) Cooling functions

Different cooling functions can be activated: system cooling, tank cooling and heat dissipation.

Note:
If the temperature at the tank sensor reaches 95 °C [200 °F], all cooling functions will be blocked. The switch-on hysteresis is -2 K [-4 °Ra].

Note:
If one of the cooling functions or the antifreeze function is activated, the drainback option will not be available.

System cooling

The system cooling function aims to keep the solar system operational for a longer time. The function overrides the maximum tank temperature to provide thermal relief of the collector field and the heat transfer fluid on hot days.

If the tank temperature is higher than the adjusted maximum tank temperature and the switch-on temperature difference **DTCO** is reached, the solar pump remains switched on or will be switched on. Solar loading is continued until either the temperature difference falls below the adjusted value **DTCF** or the collector limit temperature is reached.

In 2-tank systems the sequence of the tanks can be adjusted.

If the system cooling is active, ☼ is displayed (flashing).

Note:
This function will only be available if the collector cooling function, the heat dissipation function, and the drainback option are not activated.

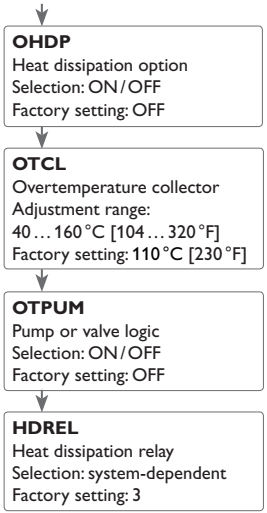
Tank cooling

When the tank cooling function is activated, the controller aims to cool down the tank during the night in order to prepare it for solar loading on the following day.

If the adjusted maximum tank temperature is exceeded and the collector temperature falls below the tank temperature, the system will be reactivated in order to cool down the tank.

DT O and **DT F** (LOAD 1/2) are used as the reference temperature differences.

7



8

(7) Heat dissipation

The Heat dissipation function can be used to direct excess heat generated by strong solar irradiation to an external heat exchanger (e. g. fan coil) in order to keep the collector temperature within the operating range.

The heat dissipation function can either use an additional pump or valve (**OTPUM ON** = pump logic, **OTPUM OFF** = valve logic).

Variant pump:

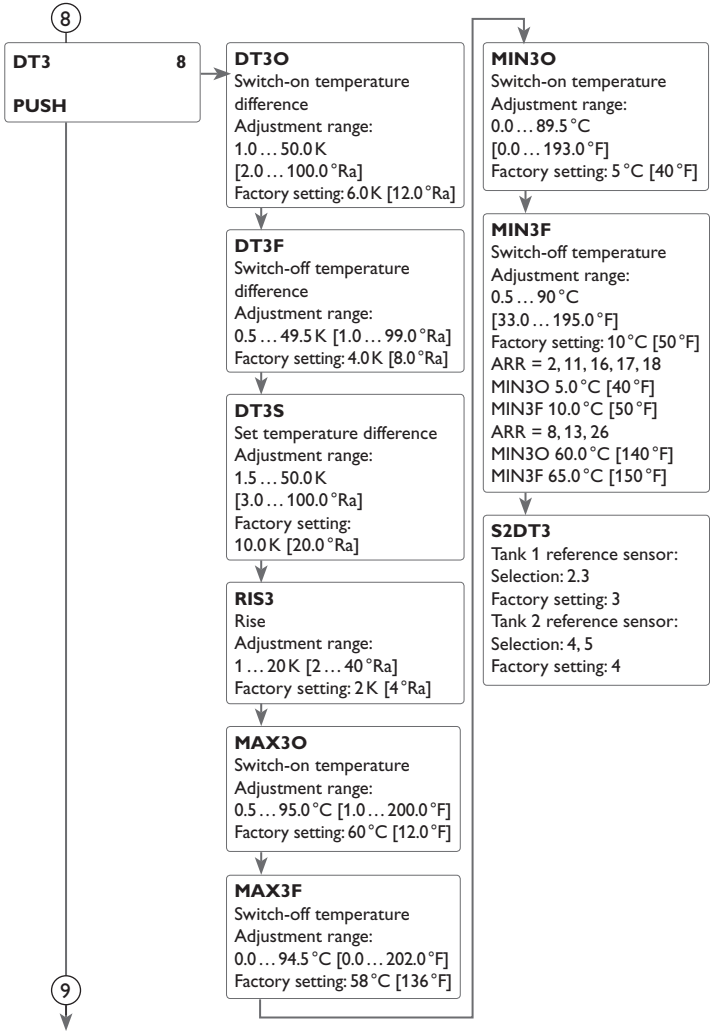
The allocated relay is energized with 100 %, if the collector temperature reaches the adjusted switch-on temperature.

If the collector temperature falls by 5 K [10 °Ra] below the adjusted collector overtemperature, the relay will be switched off. In the variant pump, the heat dissipation function works independently from solar loading.

Variant valve:

The allocated relay will be energized in parallel to the solar pump, if the collector temperature reaches the adjusted collector overtemperature. If the collector temperature falls by 5 K [10 °Ra] below the adjusted collector overtemperature, the relay will be switched off.

Note:
The adjustable value **OTCL** is blocked against the collector emergency temperature **CEM** by 10 K [20 °Ra]. This function will only be available if the collector cooling function, the heat dissipation function, and the drainback option are deactivated.



(8) DT3 / Heat exchange function / Solid fuel boiler / Return preheating

Heat exchange function

The Heat exchange function can be used for transferring heat from a heat source to a heat sink.

The relay (system-dependent) is energized when all switch-on conditions are fulfilled:

- the temperature difference between the sensors heat source and heat sink has exceeded the switch-on temperature difference.
- the temperature at the heat source sensor has exceeded the minimum temperature
- the temperature at the heat sink sensor has fallen below the maximum temperature

When the Set temperature difference is exceeded, pump speed control starts. For every increase or decrease by the rise value, the pump speed will be adjusted by 10%.

Solid fuel boiler

The Solid fuel boiler function can be used for transferring heat from a solid fuel boiler to a tank.

The relay (system-dependent) is energized when all switch-on conditions are fulfilled:

- the temperature difference between the sensors heat source and heat sink has exceeded the switch-on temperature difference.
- the temperature at the solid fuel boiler sensor has exceeded the minimum temperature
- the temperature at the tank sensor has fallen below the maximum temperature

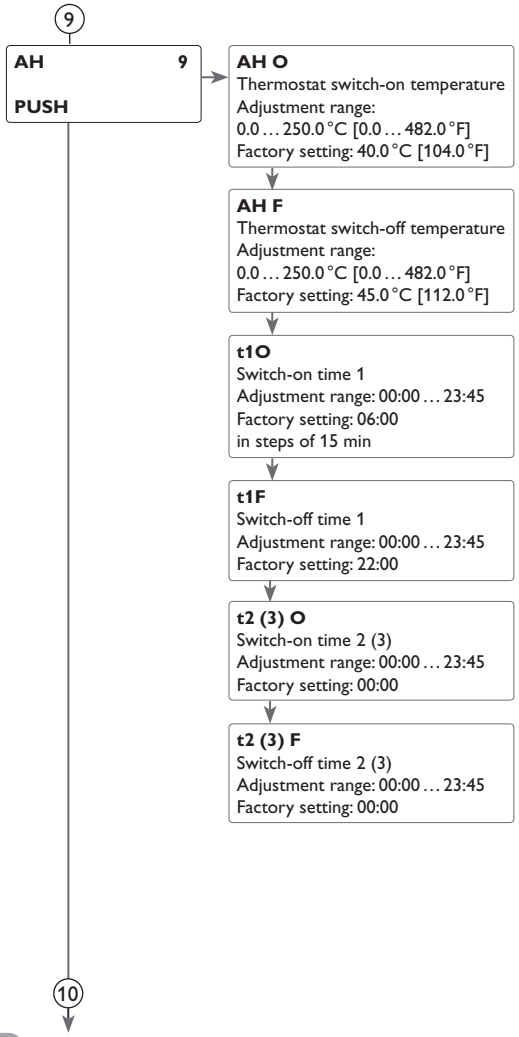
When the Set temperature difference is exceeded, pump speed control starts.
For every increase or decrease by the rise value, the pump speed will be adjusted by one step (10%).

Return preheating

The Return preheating function can be used for transferring heat from a heat source to the heating circuit return.

The relay (system-dependent) is energized when the following switch-on condition is fulfilled:

- the temperature difference between the sensors tank return and heating circuit return has exceeded the switch-on temperature difference.



(9) Backup heating / Thermostat function

The thermostat function works independently from the solar operation and can e. g. be used for using surplus energy or for backup heating.

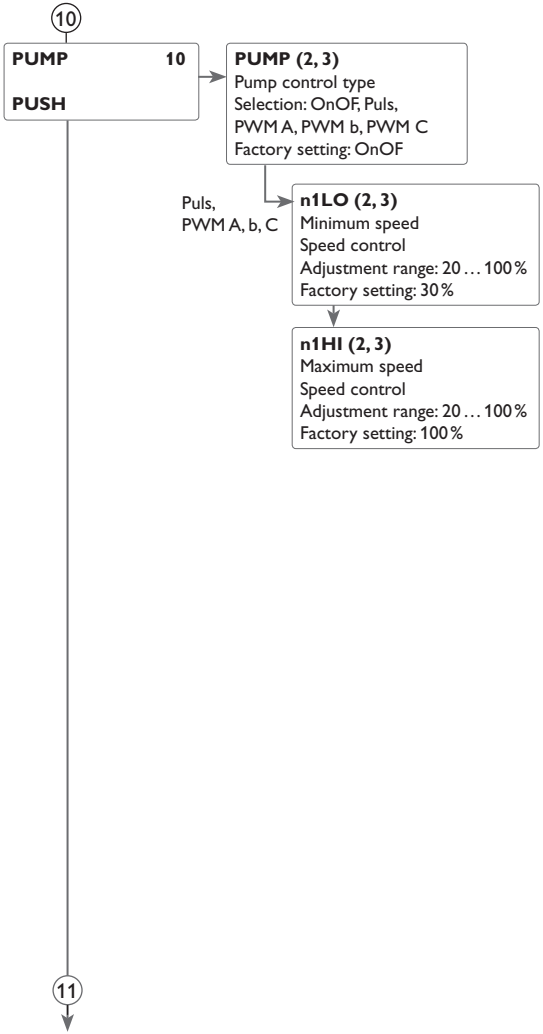
- **AHO < AHF**
  thermostat function for backup heating
- **AHO > AHF**
  thermostat function for using surplus energy

In order to block the thermostat function for a certain period, there are 3 time frames t1 … t3. The switch-on and switch-off times can be adjusted in steps of 15 min. If the switch-on and the switch-off times are identical, the time frame is inactive.

If the thermostat function is supposed to run from 06:00 a.m. and 09:00 a.m. only, adjust t1 O to 06:00 a.m. and t1 F to 09:00 a.m.

The first time frame is factory set from 06:00 to 22:00.

If all time frames are set to 00:00, the thermostat function is solely temperature dependent.



(10) Pump control type

With this parameter, the relay control type can be adjusted. The following types can be selected:

Adjustment for standard pump without speed control

• OnOF: Pump on / pump off

Adjustment for standard pump with speed control

• PULS : Burst control via semiconductor relay

Adjustment for high-efficiency pump (HE pump)

- PWM A (Wilo) (for R1 and R2 only)
- PWM b (Grundfos) (for R1 and R2 only)
- PWM C (Laing) (for R1 and R2 only)

Note:
For more information about connecting HE pumps, see page 35.

Relay allocation for PWM outputs

PWM1 is allocated to R1, PWM2 is allocated to R2.

Minimum speed

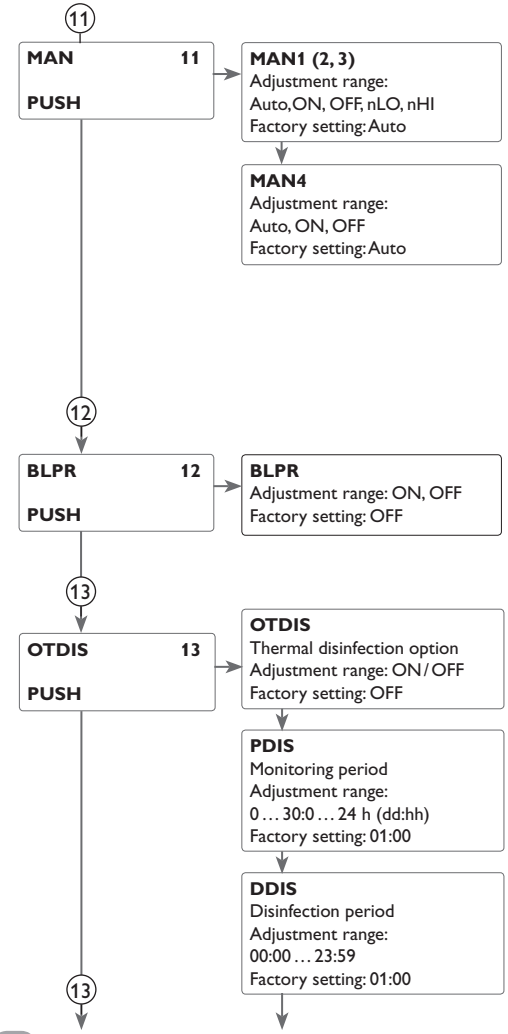
In the adjustment channel **n1Lo (2,3)**, a relative minimum speed for a connected pump can be allocated to the outputs R1, R2 and R3.

Note:
When loads which are not speed-controlled (e. g. valves) are used, the pump speed value of the corresponding relay must be set to 100 % or the control type must be set to OnOF in order to deactivate pump speed control.

Maximum speed

In the adjustment channel **n1HI (2,3)**, a relative maximum speed for a connected pump can be allocated to the outputs R1, R2 and R3.

Note:
When loads which are not speed-controlled (e. g. valves) are used, the pump speed value of the corresponding relay must be set to 100 % or the control type must be set to OnOF in order to deactivate pump speed control.



(11) Manual mode

For control and service work, the operating mode of the relays can be manually adjusted. For this purpose, select the adjustment channel MAN1(2, 3, 4) (for R1, 2, 3, 4) in which the following adjustments can be made:

Operating mode

AUTO : relay in automatic mode

OFF : relay is switched off

n1LO : relay is switched with adjusted minimum speed (not if PUMP = OnOF)

n1HI : relay is switched with adjusted maximum speed

Note:
After service and maintenance work, set the relay mode back to **AUTO**. Normal operation is not possible in manual mode.

(12) Blocking protection

In order to protect the pumps against blocking after standstill, the controller is equipped with a blocking protection function. This function switches on the relays one after another every day at 12:00 a.m. for 10 s at 100 %.

(13) Thermal disinfection

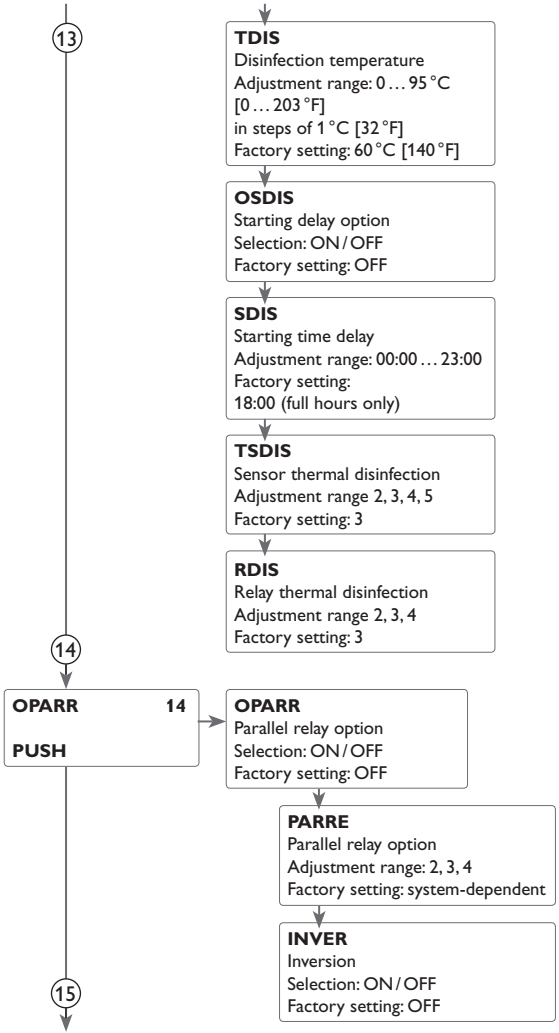
This function helps to contain the spread of Legionella in DHW tanks by systematically activating the backup heating.

One sensor and one relay can be selected for this function.

For thermal disinfection, the temperature at the allocated sensor has to be monitored. Protection is ensured when, during the monitoring period, the disinfection temperature is continuously exceeded for the entire disinfection period.

The monitoring period starts as soon as the temperature at the allocated sensor falls below the disinfection temperature. When the monitoring period ends, the allocated reference relay activates the backup heating. The disinfection period starts, if the temperature at the allocated sensor exceeds the disinfection temperature.

Thermal disinfection can only be completed when the disinfection temperature is exceeded for the duration of the disinfection period without any interruption.



(13) Starting time delay

If the starting delay option is activated, a starting time for the thermal disinfection with starting delay can be adjusted. The activation of the backup heating is then delayed until that starting time after the monitoring period has ended.

If the monitoring period ends, for example, at 12:00 o'clock, and the starting time has been set to 18:00, the reference relay will be energized with a delay of 6 hours at 18:00 instead of 12:00 o'clock.

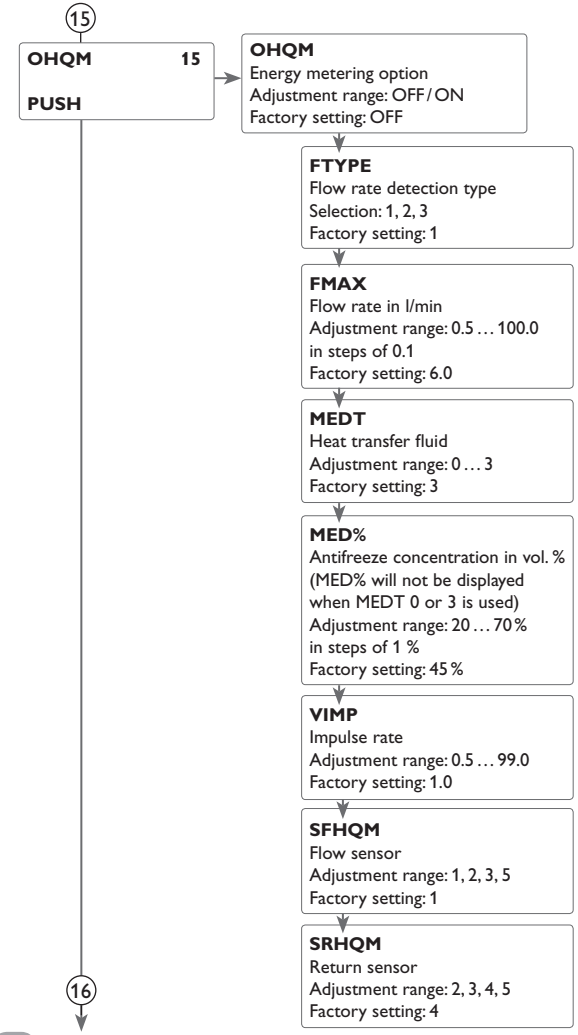
Note:
If the thermal disinfection option is activated, the display channels **TDIS**, **CDIS**, **SDIS** and **DDIS** will be displayed.

(14) Parallel relay

With this function, e. g. a valve can be controlled in parallel to the pump via a separate relay.

If solar loading takes place (R1 and/or R2) or if a solar function is active, the relay selected will be energized. The parallel relay can also be energized inversely.

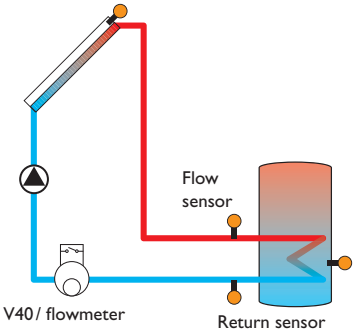
Note:
If R1 and/or R2 are in the manual mode, the selected parallel relay will not be energized.



15 Energy metering

The energy metering can be carried out in 3 different ways: without V40 flowmeter, with V40 flowmeter or with Grundfos Direct Sensor™.

Note:
The most precise energy metering is achieved by using sensors in the flow and return pipes as well as a flowmeter.
In 2-collector systems, energy metering can only be carried out with sensors installed in the common flow and return pipes.



Example of flow and return sensor positions for energy metering with a fixed flow rate value (flowmeter) or a V40 flowmeter.

➔ Enable the energy metering option in the channel **OHQM**.
➔ Select the type of flow rate detection in the channel **FTYPE**.

Flow rate detection type:

1 : Fixed flow rate value (flowmeter)
2 : V40
3 : Grundfos Direct Sensor™ VFS

⑮ Energy metering with fixed flow rate value

The heat quantity balancing (estimation) uses the difference between the flow and return temperatures and the entered flow rate (at 100 % pump speed).

➔ Adjust **1** in the channel **FTYPE**.

➔ Read the flow rate (l/min) and adjust it in the **FMAX** channel.

➔ Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

Note:
Energy metering with a fixed flow rate value is not possible in systems with 2 solar pumps.

Antifreeze type:

0 : Water
1 : Propylene glycol
2 : Ethylene glycol
3 : Tyfocor® LS / G-LS

Energy metering with V40 flowmeter:

The energy metering uses the difference between the flow and return temperatures and the flow rate transmitted by the flowmeter.

➔ Adjust **2** in the channel **FTYPE**.

➔ In the channel **FIMP**, adjust the impulse rate corresponding to the V40 flowmeter used.

➔ Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

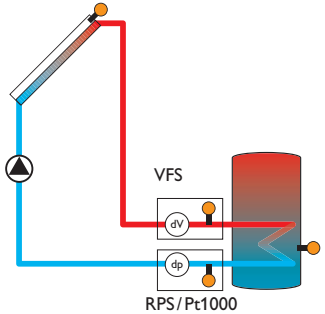
Energy metering with Grundfos Direct Sensor™:

The energy metering uses the difference between flow and return temperature and the flow rate transmitted by the VFS sensor.

➔ Adjust **3** in the channel **FTYPE**.

➔ Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

Note:
If variant 3 is selected, the sensors must first be activated in the **GFDS** menu item (see page 64).



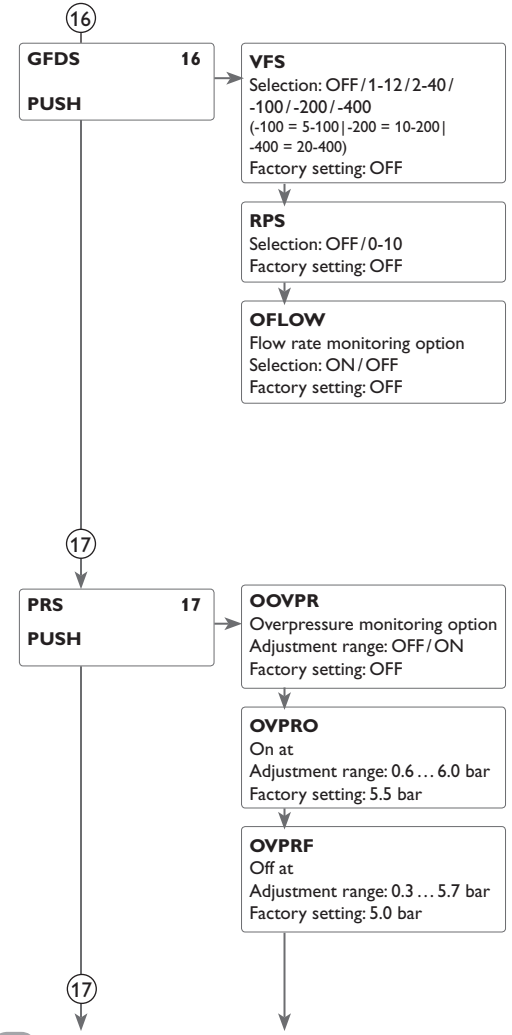
HQM sensors

If the flow rate detection type 1, 2, or 3 (flowmeter, V40, or Grundfos Direct Sensor™ VFS) has been adjusted, the flow and the return sensor for energy metering can be selected.

➔ In the channel **SFHQM** select the flow sensor.

➔ In the channel **SRHQM** select the return sensor.

For this function, free sensors at an appropriate position can be selected.



(16) Grundfos Direct Sensors™

In this menu the Grundfos Direct Sensors™ can be registered.

For Grundfos Direct Sensor™ positioning, see the system layout drawing on p. 63!

If Grundfos Direct Sensors™ are connected and registered, flow rate monitoring **OFLOW** can be carried out during solar loading. For that purpose, the VFS sensor must be installed in the solar flow. If no flow rate has been detected for 30 s, the error message **EFLOW** is displayed in the status menu (see flow rate monitoring option).

Note:
To deactivate a Grundfos Direct Sensor™, the functions using this sensor have to be deactivated first.

Flow rate monitoring

The Flow rate monitoring function can be used to detect malfunctions that impede the flow rate. This will prevent system damage, e. g. through a dry run of the pump.

Note:
To deactivate the VFS or RPS sensor, the functions using this sensor have to be deactivated first.

(17) Pressure monitoring

Note:
The pressure monitoring function will only be available when an RPS type Grundfos Direct Sensor™ is connected.

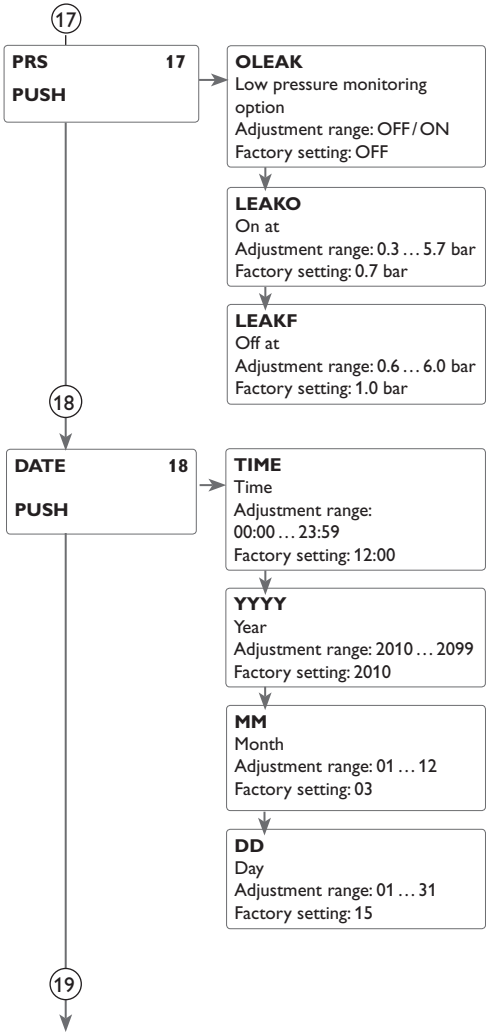
The Pressure monitoring function can be used for detecting overpressure or low pressure conditions inside the system. This will prevent system damage.

Overpressure

If the system pressure exceeds the adjustable switch-on value, an error message will appear.

When the pressure reaches or falls below the adjustable switch-off value, the message disappears.

Note:
For the **Overpressure monitoring** function, the switch-on value has to be adjusted at least 0.1 bar higher than the switch-off value. The adjustment ranges will automatically adapt to that.



Low pressure (leakage)

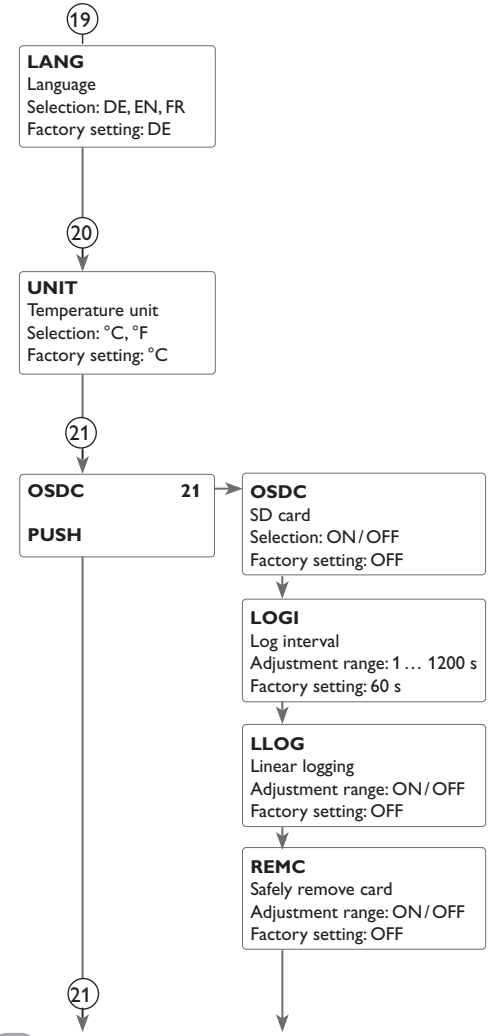
If the system pressure falls below the adjustable switch-on value, an error message will appear.

When the pressure reaches or exceeds the adjustable switch-off value, the message disappears.

Note:
For the **Low pressure monitoring** function, the switch-off value has to be adjusted at least 0.1 bar higher than the switch-on value. The adjustment ranges will automatically adapt to that.

(18) Time and date

The controller is equipped with a real time clock required e. g. for the thermostat function.



(19) Language

In this adjustment channel the menu language can be selected.

- DE : German
- EN : English
- FR : French

(20) Units

In this adjustment channel the temperature unit can be selected.
The unit can be switched between °C and °F during operation.

(21) SD card

The controller is equipped with an SD card slot for SD memory cards.
With an SD card, the following functions can be carried out:

- Logging measurement and balance values. After the transfer to a computer, the values can be opened and visualized, e. g. in a spreadsheet.

While an SD card is being used, the symbol **COM** will be displayed. If the SD card is full, **COM** will start flashing.

Starting the logging

➔ Insert the SD card into the slot.

Logging will start immediately.

➔ Adjust the desired logging interval **LOGI**.

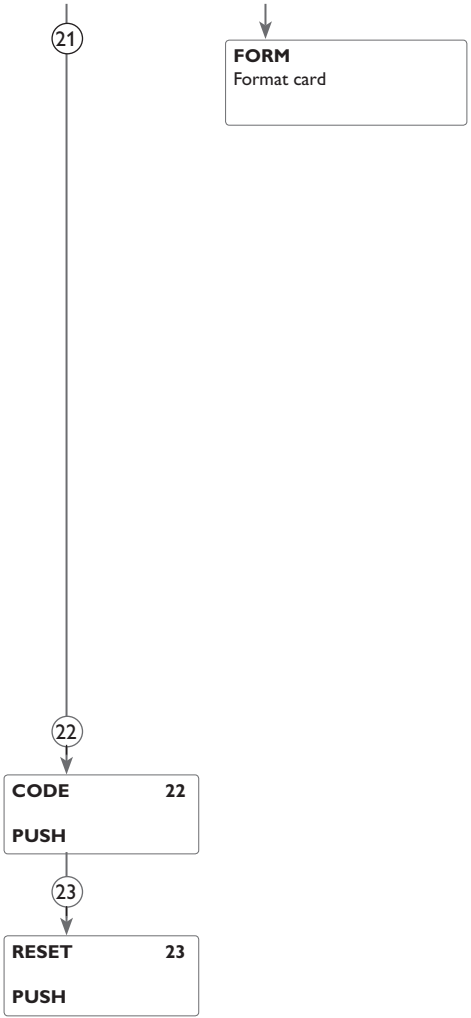
When **LLOG** is activated, data logging will stop if the capacity limit is reached. The message **CFULL** will be displayed.

With non-linear logging (when LLOG is deactivated), the oldest data logged onto the SD card will be overwritten as soon as the capacity limit is reached.

Completing the logging process

➔ Select the menu item **REMC.**

➔ After **--REM** is displayed remove the card from the slot.



(21) Formatting the SD card

➔ Select the menu item **FORM.**

➔ During the formatting process, **--FORM** will be displayed.

The content of the card will be deleted and the card will be formatted with the FAT file system.

Messages possible	Description
FSYS	File system error
CTYP	Card type is not supported
WRIT	Error during writing
NOCRD	No card in slot
LOGG	Logging is possible
WRITP	Card is write-protected
CFULL	Card full
RTIME	Remaining logging time in days
REMC	Safely remove card command
--REM	Card is being removed
FORM	Formatting SD card command
--FORM	Formatting in progress
LOGI	Logging interval in min
LLOG	Linear logging

Note:
Because of the increasing size of the data packets, the remaining logging time does not decrease linearly. The data packet size can increase, e. g. with the increasing operating hours value.

(22) Code

The user code can be entered in the **CODE** menu (see page 68).

(23) Reset

By means of the reset function, all adjustments can be set back to the factory settings. To do so, the installer code must be entered (see page 68).

8 User code and short menu – Adjustment values

CODE

The access to some adjustment values can be restricted via a user code (customer).

1. Installer **0262** (Factory setting)
All menus and adjustment values are shown and all values can be altered.

2. Customer **0000**
The installer level is not shown, adjustment values can be changed partly.

For safety reasons, the user code should generally be set to the customer code before the controller is handed to the customer!

➔ In order to restrict the access, enter 0000 in the menu item **CODE**.

The display changes to the status level. The short menu shown will then be available in the adjustment level. The short menu suits the selected system.

➔ In order to authorise access to the installer level, enter 0262 in the menu item **CODE**.

Short menu

Channel	Factory setting	Adjustment range	Designation
TIME	12:00	00:00 … 23:59	Time
DT O	6	1.0 … 50.0	Switch-on temperature difference tank
DT F	4	0.5 … 49.5	Switch-off temperature difference tank
DT S	10	1.0 … 50.0	Set temperature difference tank
S MAX	60	4 … 95	Tank maximum limitation
DT1O	6	1.0 … 50.0	Switch-on temperature difference tank 1
DT1F	4	0.5 … 49.5	Switch-off temperature difference tank 1
DT1S	10	1.0 … 50.0	Set temperature difference tank 1
S1MAX	60	4 … 95	Tank maximum limitation tank 1
DT2O	6	1.0 … 50	Switch-on temperature difference tank 2
DT2F	4	0.5 … 49.5	Switch-off temperature difference tank 2
DT2S	10	1.5 … 50.0	Set temperature difference tank 2
S2MAX	60	4 … 95	Tank maximum limitation tank 2
LST2	On	On / OFF	Loading tank 2 on
MAN1	Auto	Auto / On / OFF / n LO / n HI	Manual mode pump 1
MAN2	Auto	Auto / On / OFF / n LO / n HI	Manual mode pump 2
MAN3	Auto	Auto / On / OFF / n LO / n HI	Manual mode pump 3
MAN4	Auto	Auto / On / OFF	Manual mode pump 4
CODE	0000	0000 / 0262	User code

9 Messages

In the case of an error, the directional pad starts flashing red and a message is indicated in the status display. A warning triangle is additionally indicated. If more than one error or fault condition has occurred, only the one with the highest priority will be displayed as a message in the status display.

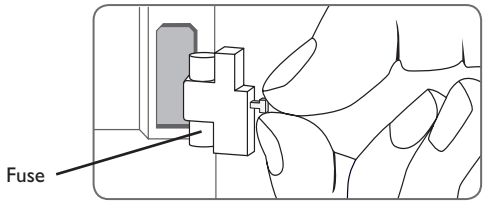
In the case of a sensor error, the system is switched off, and a message appears on the display marked by an "E". Additionally, a corresponding value for the error type assumed is indicated.

Error message	Value	Cause	Solution
FS1 … 7; FS6, 8	-88.8	Short circuit at sensor 1 … 7	Check the cable.
	888.8	Broken cable at sensor 1 … 7	
EVFS	9999	Error at Grundfos Direct Sensor™ VFS	Sensor fault. Check and, if necessary, correct the connection of the sensor plugs. If a sensor signal does not appear, the sensor has to be replaced.
ERPS	9999	Error at Grundfos Direct Sensor™ RPS	
ELEAK	Measured minimum pressure	Leakage error	Check the system for a leakage.
EPRES	Measured maximum pressure	Pressure error	Check the functioning of the valves and pumps.
EFLOW		Flow rate error Threshold values for VFS 1 - 10: 1.0 - 1.1 l/min Threshold values for VFS 2 - 40: 2.0 - 2.1 l/min	Check the pump. Check whether a flow rate exists.
PARAM		Remote parameterization	Do not parameterize the controller via the push buttons during remote parameterization.

After the error has been removed, the error message disappears.

10 Troubleshooting

If a malfunction occurs, a message will appear on the display of the controller.



The display is permanently off.

Press button (5). Display illuminated?

- no → Check the power supply of the controller. Is it disconnected?
  - no → The fuse of the controller could be blown. The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.
  - yes → Check the supply line and reconnect it.
- yes → Controller has been in standby, everything o.k.

Directional pad flashes red. The symbol is indicated on the display and the symbol ⚠ flashes.

Sensor fault. An error code instead of a temperature is shown on the corresponding sensor display channel.

- 888.8 → Cable is broken. Check the cable.
- - 88.8 → Short circuit. Check the cable.

Disconnected temperature sensors can be checked with an ohmmeter. Please check if the resistance values correspond with the table.

°C	°F	Ω	°C	°F	Ω
-10	14	961	55	131	1213
-5	23	980	60	140	1232
0	32	1000	65	149	1252
5	41	1019	70	158	1271
10	50	1039	75	167	1290
15	59	1058	80	176	1309
20	68	1078	85	185	1328
25	77	1097	90	194	1347
30	86	1117	95	203	1366
35	95	1136	100	212	1385
40	104	1155	105	221	1404
45	113	1175	110	230	1423
50	122	1194	115	239	1442

Resistance values of Pt1000 sensors

Pump is overheated, but no heat transfer from the collector to the tank, flow and return have the same temperature; perhaps also bubbling in the lines.

- Air or gas bubbles in the system?
  - no → Is the collector circuit blocked at the dirt trap?
    - yes → Clean dirt trap
    - no
  - yes → Vent the system; increase the system pressure to a static primary pressure of at least plus 0.5 bar; if necessary continue to increase pressure; switch the pump on and off for a short time.

Pump starts up very late.

- Switch-on temperature difference ΔTon too large?
  - yes → Change ΔTon and ΔToff correspondingly.
  - no → Non-ideal position of the collector sensor (e. g. flatscrew sensor instead of sensor in immersion sleeves).
    - yes → Activate evacuated tube collector function if necessary.
    - o.k.

Pump starts for a short moment, switches off, switches on again, etc.

- Temperature difference at the controller too small?
  - yes → Change ΔTon and ΔToff correspondingly.
    - no → o.k.
  - no → Wrong position of collector sensors?
    - yes → Mount the collector sensor at solar flow (warmest collector output); use immersion sleeve of the respective collector.
    - no → Plausibility control of the option evacuated tube collector special function

The temperature difference between tank and collector increases enormously during operation; the collector circuit cannot dissipate the heat.

- Collector circuit pump defective?
  - yes → Check / replace it
  - no → Heat exchanger calcified?
    - yes → Decalcify it
    - no → Heat exchanger blocked?
      - yes → Clean it
      - no → Heat exchanger too small?
        - yes → Replace with correctly sized one.

The solar circuit pump does not work, although the collector is considerably warmer than the tank.

Display illuminated? If not, press button (5). Display illuminated again?
- yes → Does the pump start up in manual operation?
  - no → Is the pump current enabled by the controller?
    - no → Controller might be defective - replace it.
    - yes → Is the pump stuck?
      - yes → Turn the pump shaft using a screwdriver; now passable?
        - no → Pump is defective - replace it.
  - yes → The adjusted temperature difference for starting the pump is too high; choose a value which makes more sense.
- no → There is no current; check fuses / replace them and check power supply.

Tanks cool down at night.

Collector circuit pump runs during the night?
- yes → Check controller
- no → Collector temperature at night is higher than the outdoor temperature.
  - yes → Check the non-return valves in the flow and the return pipe for functional efficiency.
  - no → Sufficient tank insulation?
    - yes → a
    - no → Increase insulation.

a

Insulation close enough to the tank?
- yes → Are the tank connections insulated?
  - yes → Warm water outflow upwards?
    - no → Does the DHW circulation run for a very long time?
      - no → Circulation pump and blocking valve should be switched off for 1 night; less tank losses?
        - yes → Check the non-return valve in warm water circulation - o.k.
          - yes → The gravitation circulation in the circulation line is too strong; insert a stronger valve in the non-return valve or an electrical 2-port valve behind the circulation pump; the 2-port valve is open when the pump is activated, otherwise it is closed; connect pump and 2-port valve electrically in parallel; activate the circulation again. Deactivate pump speed control!
          - no → Clean or replace it.
        - no → Check whether the pumps of the after-heating circuit run at night; check whether the non-return valve is defective; problem solved?
          - no → Further pumps which are connected to the solar tank must also be checked.
      - yes → Use the circulation pump with timer and switch-off thermostat energy-efficient circulation).
    - yes → Change connection and let the water flow sidewards or through a siphon (downwards); less tank losses now?
      - no → Does the DHW circulation run for a very long time?
      - yes → o.k.
- no → Replace insulation or increase it.

Are the tank connections insulated?
- yes → Warm water outflow upwards?
- no → Insulate the connections.

11 Accessories

Sensors

Overvoltage protection device

VFS and RPS Grundfos Direct Sensors™

V40 flowmeter

VBus® / USB & VBus® / LAN interface adapters

Smart Display SD3 / Large Display GA3

AM1 Alarm module

DL2 Datalogger

DL3 Datenlogger

11.1 Sensors and measuring instruments

Sensors
The product range includes high-precision platinum temperature sensors, flatscrew sensors, outdoor temperature sensors, indoor temperature sensors, cylindrical clip-on sensors, also as complete sensors with immersion sleeve.

Overvoltage protection device
In order to avoid overvoltage damage at collector sensors (e.g. caused by local lightning storms), we recommend installing the SP10 Overvoltage protection.

VFS and RPS Grundfos Direct Sensors™
The RPS Grundfos Direct Sensor™ is an analogue sensor that measures both temperature and pressure. The VFS Grundfos Direct Sensor™ is an analogue sensor that measures both temperature and flow rate.

V40 flowmeter
The V40 is a measuring instrument for detecting the flow of water or water/glycol mixtures. After a specific volume has passed, the V40 reed switch sends an impulse to the calorimeter. The heat quantity used is calculated by the calorimeter using these impulses and the measured temperature difference with the help of pre-defined parameters (glycol type, concentration, heat capacity, etc.).

11.2 VBus® accessories

SD3 Smart Display / GA3 Large Display
The SD3 Smart Display is designed for simple connection to controllers via the VBus®. It is used for visualizing data issued by the controller: collector temperature, tank temperature and energy yield of the solar thermal system. The use of high-efficiency LEDs and filter glass assures a high optical brilliance. An additional power supply is not required. One module is required per controller.
The GA3 is a completely mounted large display module for visualization of collector- and tank temperatures as well as the heat quantity yield of the solar system via one 6-digit and two 4-digit 7-segment displays. An easy connection to all controllers with a VBus® is possible. The front plate is made of antireflective filterglass and is printed with a light-resistant UV-lacquering. The universal VBus® allows the parallel connection of 8 large displays as well as additional VBus® modules.

AM1 Alarm module
The AM1 Alarm module is designed to signal system failures. It is to be connected to the VBus® of the controller and issues an optical signal via the red LED if a failure has occurred. The AM1 also has a relay output, which can e. g. be connected to a building management system (BMS). Thus, a collective error message can be issued in the case of a system failure.

DL2 Datalogger
This additional module enables the acquisition and storage of large amounts of data (such as measuring and balance values of the solar system) over a long period of time. The DL2 can be configured and read-out with a standard Internet browser via its integrated web interface. For transmission of the data stored in the internal memory of the DL2 to a PC, an SD card can be used.
The DL2 is appropriate for all controllers with VBus®. It can be connected directly to a PC or router for remote access and thus enables comfortable system monitoring for yield monitoring or for diagnostics of faults.

DL3 Datalogger
Be it solar thermal, heating or DHW heat exchange controllers – with the DL3 you can easily and conveniently log system data of up to 6 controllers. Get a comprehensive overview of all controllers connected with the large full graphic display. Transfer data with an SD memory card, or use the LAN interface to view and process data on your PC.

VBus.net
The Internet portal for easy and secure access to your system data.
VBus.net is all about the data of your controller. Live data of your system, customized filter settings and much more await you.

11.3 Interface adapters

VBus® / USB & VBus® / LAN interface adapters
The VBus® / USB interface adapter is the interface between the controller and a personal computer. With its standard mini-USB port it enables a fast transmission of system data for processing, visualizing and archiving data via the VBus®. The ServiceCenter software is included.
The VBus® / LAN interface adapter is designed for the direct connection of the controller to a PC or router. It enables easy access to the controller via the local network of the owner. Controller access and data charting can be effected from every workstation of the network by means of the ServiceCenter Software. The VBus® / LAN interface adapter is suitable for all controllers equipped with a VBus®. The ServiceCenter software is included.

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