

RESOL DeltaSol[®] BS Plus

Mounting

Connection

Operation

Troubleshooting

Application examples



DeltaSol[®] BS Plus

EN
Manual

www.resol.de



48000500

**Thank you for buying this RESOL product.
Read this manual carefully to get the best performance from this unit.**

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 local regulations
- respective valid standards and directives

These instructions are exclusively addressed to authorised skilled personnel.

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

Table of contents

Safety advice 2

Description of symbols 2

Disposal 2

Information about the product..... 2

Technical data and overview of functions 3

1. Installation 4

1.1 Wall mounting 4

1.2 Electrical connection..... 4

1.2.1 Data communication / Bus 5

1.2.2-10 Terminal allocations for different solar systems 5

2. Operation and function 10

2.1 Adjustment buttons 10

2.2 System monitoring display 10

2.2.1 Display channels 10

2.2.2 Tool bar 10

2.2.3 System screen..... 11

2.3 Flashing codes..... 11

2.3.1 System-Screen flashing codes 11

2.3.2 LED flashing codes..... 11

3. Commissioning..... 12

4. Control parameters and display channels 13

4.1 Overview 13

4.1.1-6 Display channels 15

4.1.6-21 Adjustment channels..... 16

5. Troubleshooting..... 21

5.1 Various 22

6. Accessory 24

Imprint 24

Subject to change. Errors excepted.

Description of symbols



WARNING!
Warnings are indicated with a warning triangle!

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

- **Warning** means that injuries or even danger of life can occur.



Note
Notes are indicated with an information symbol.

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 environmentally-friendly disposal of the devices.

Information about the product

Appropriate usage

This product is to be used in solar thermal and heating systems in compliance with the technical data specified in these instructions.

Improper use excludes all liability claims.

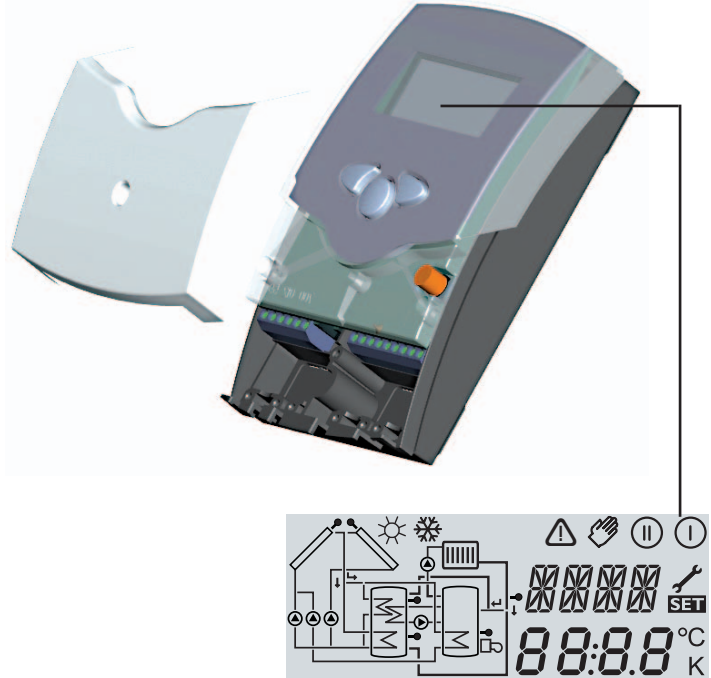
Declaration of conformity

The product complies with the relevant directives and is therefore labelled with the CE mark. The Declaration of Conformity is available upon request, please contact RESOL.



Technical data and overview of functions

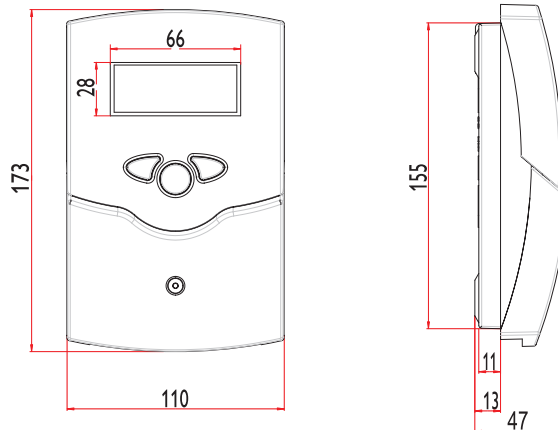
- System-monitoring display
- Up to 4 temperature sensors Pt1000
- 2 semiconductor relays for pump speed control
- 9 basic systems to choose from
- Heat quantity measurement
- RESOLVBus®
- Function control
- Thermostat function (time-controlled)
- Parametrisation and monitoring of the system via RESOL Service Center Software are possible
- User-friendly operation
- Easy-to-mount housing with outstanding design



Included:

- 1 x DeltaSol® BS Plus
- 1 x accessory bag
 - 1 x spare fuse T4A
 - 2 x screws and dowels
 - 4 x strain relief and screws
 - 1 x capacitor 4,7 nF

Additionally included in the full kit:
 2 x sensor FKP6
 2 x sensor FRP6



Technical data

Housing:

plastic, PC-ABS and PMMA

Protection type: IP 20 / DIN 40050

Ambient temp.: 0 ... 40 °C

Size: 172 x 110 x 46 mm

Mounting: wall mounting, mounting into patch-panels is possible

Display: System screen for system visualisation, 16-segment display, 7-segment display, 8 symbols for system status and operating control lamp

Operation: by 3 pushbuttons at the front of the housing

Functions: Differential temperature controller with optional add-on system functions. Function control, operating hours counter for solar pump, tube collector function, pump speed control, thermostat function and heat quantity measurement.

Inputs:

for 4 temperature sensors Pt1000

Outputs: 2 semiconductor relays

Bus: RESOLVBus®

Power supply:

220 ... 240V~

Switching capacities:

1 (1) A 220 ... 240V~
(semiconductor relay)

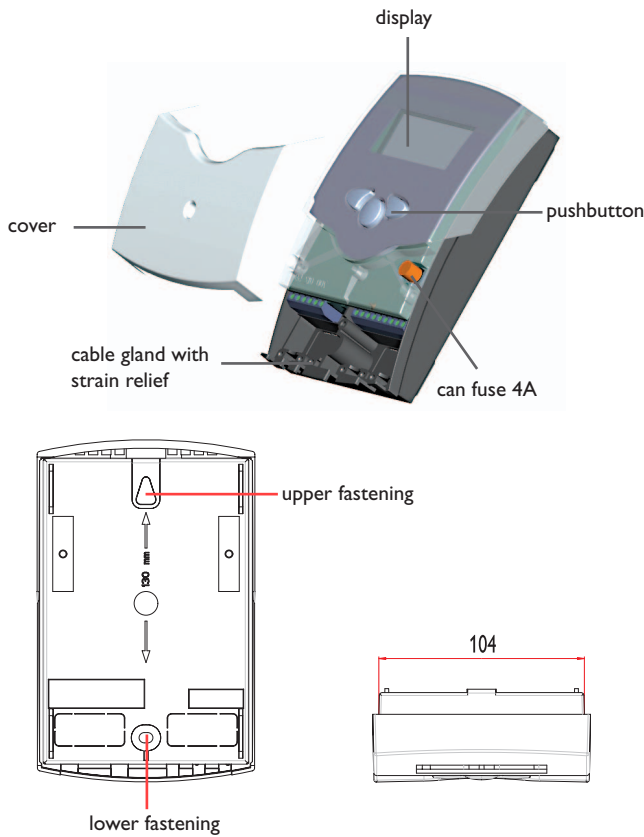
1 (1) A 220 ... 240V~
(semiconductor relay)

1. Installation

1.1 Wall mounting



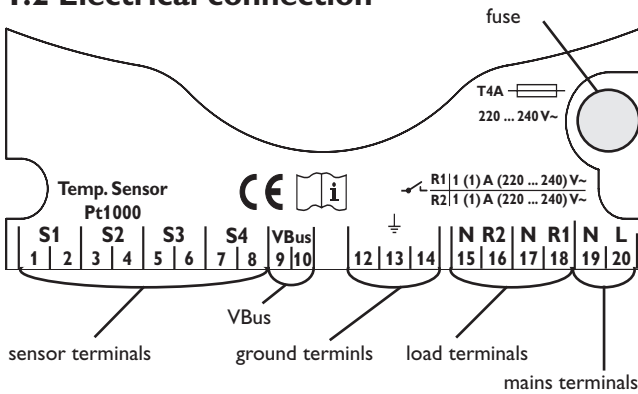
WARNING!
Always switch off power supply and disconnect the controller from the mains before opening the housing!



The unit must only be located in dry interior locations. It is not suitable for installation in hazardous locations and should not be placed close to any electromagnetic fields. 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 mains cables.

1. Unscrew the cross-head screw from the cover and remove it along with the cover from the housing.
2. Mark the upper fastening point on the wall and drill and fasten the enclosed wall plug and screw leaving the head protruding.
3. Hang the housing from the upper fastening point and mark the lower fastening point through the hole in the terminal box (centres 130 mm). Drill and insert the lower wall plug
4. Fasten the housing to the wall with lower fastening screw and tighten.

1.2 Electrical connection



The power supply to the controller must be carried out via an external power switch (last step!) and the supply voltage must be 220 ... 240V~ (50 ... 60 Hz). Flexible cables must be attached to the housing with the enclosed strain relief and the corresponding screws.

The controller is equipped with 2 standard relays, to which the **loads** e.g. pumps, valves etc. can be connected:

- Relay 1
18 = conductor R1
17 = neutral conductor N
13 = ground clamp
- Relay 2
16 = conductor R2
15 = neutral conductor N
14 = ground clamp

The **temperature sensors** (S1 up to S4) have to be connected to the following terminals (either polarity):

- 1 / 2 = Sensor 1 (e.g. Sensor collector 1)
- 3 / 4 = Sensor 2 (e.g. Sensor store 1)
- 5 / 6 = Sensor 3 (e.g. Sensor collector 2)
- 7 / 8 = Sensor 4 (e.g. Sensor store 2)

The **mains supply** is carried out at the following terminals:

- 19 = neutral conductor N
- 20 = conductor L
- 12 = ground clamp



Please note:

The relays are semiconductor relays for pump speed control - a minimum load of 20W (power consumption of the load) is required for faultless function. The capacitor from the accessory bag must be connected in parallel to the respective relay output if it feeds auxiliary relays, motor valves, etc to prevent interference. The minimum pump speed must be set to 100% when auxiliary relays or valves are connected.

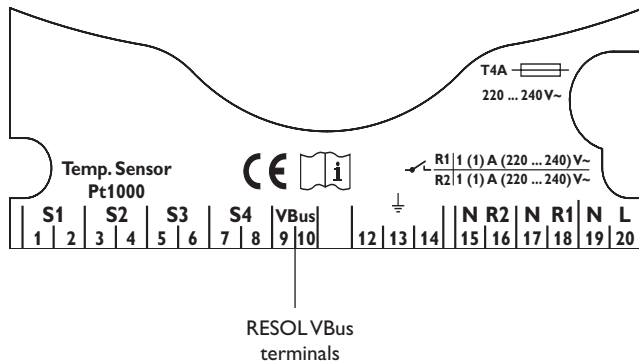


Dangerous voltage on contact!



Electrostatic discharge can lead to damage of electronic components!

1.2.1 Data communication / Bus

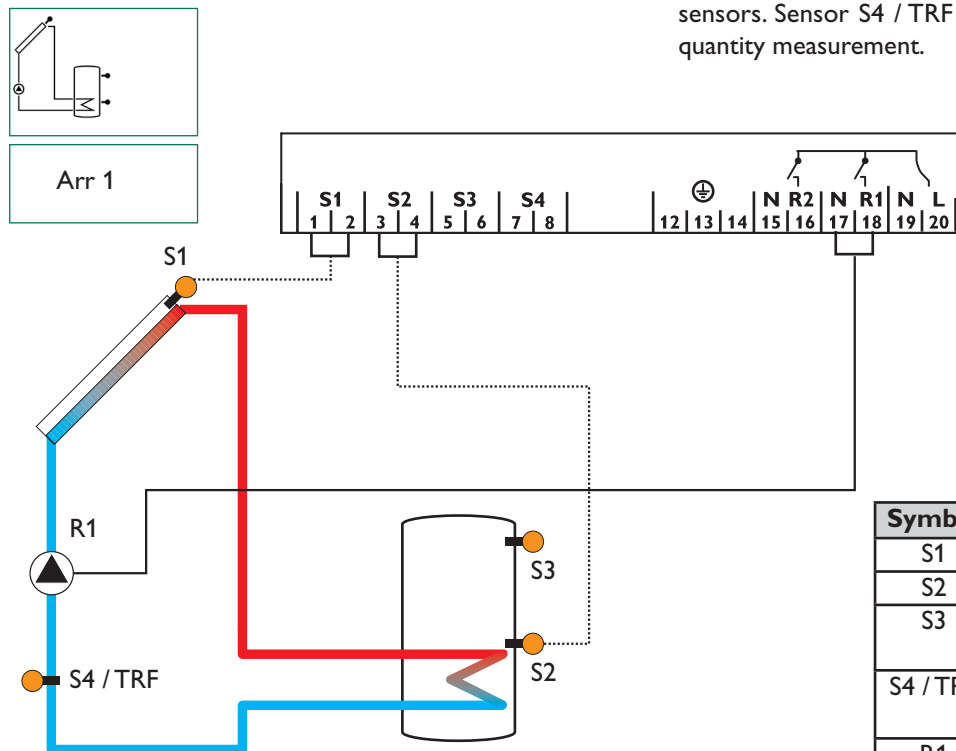


The controller comes with a RESOL VBus® for data transfer with and energy supply to external modules. The connection is carried out at the terminals marked „VBus“ (either polarity). One or more RESOL VBus® modules can be connected via this data bus, e.g.:

- RESOL calorimeter WMZ
- RESOL large display GA3, smart display SD3
- RESOL Data logger, DL2
- RESOL Data remote display

Additionally, the controller can be connected to a PC with a RESOL RS-COM adapter. With the RESOL ServiceCenter Software (RSC) the controller parameters can be changed, measurements can be read out, processed and visualised. The software allows easy function control and adjustment of the system. A light version of the software can be downloaded for free at www.resol.de.

1.2.2 Terminal allocation of system 1

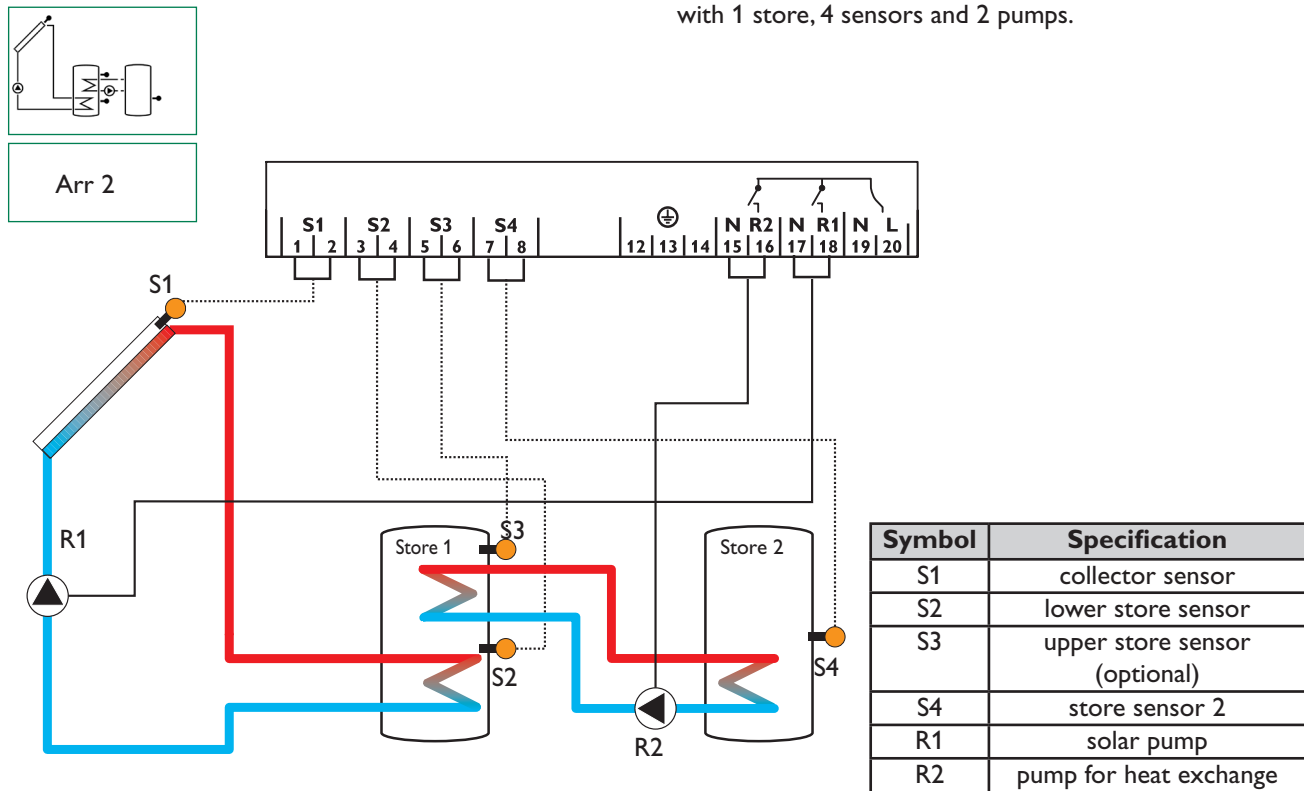


Standard solar system with 1 store, 1 pump and 3 sensors. Sensor S4 / TRF can optionally be used for heat quantity measurement.

Symbol	Specification
S1	collector sensor
S2	lower store sensor
S3	upper store sensor (optional)
S4 / TRF	sensor for heat quantity measurement (optional)
R1	solar pump

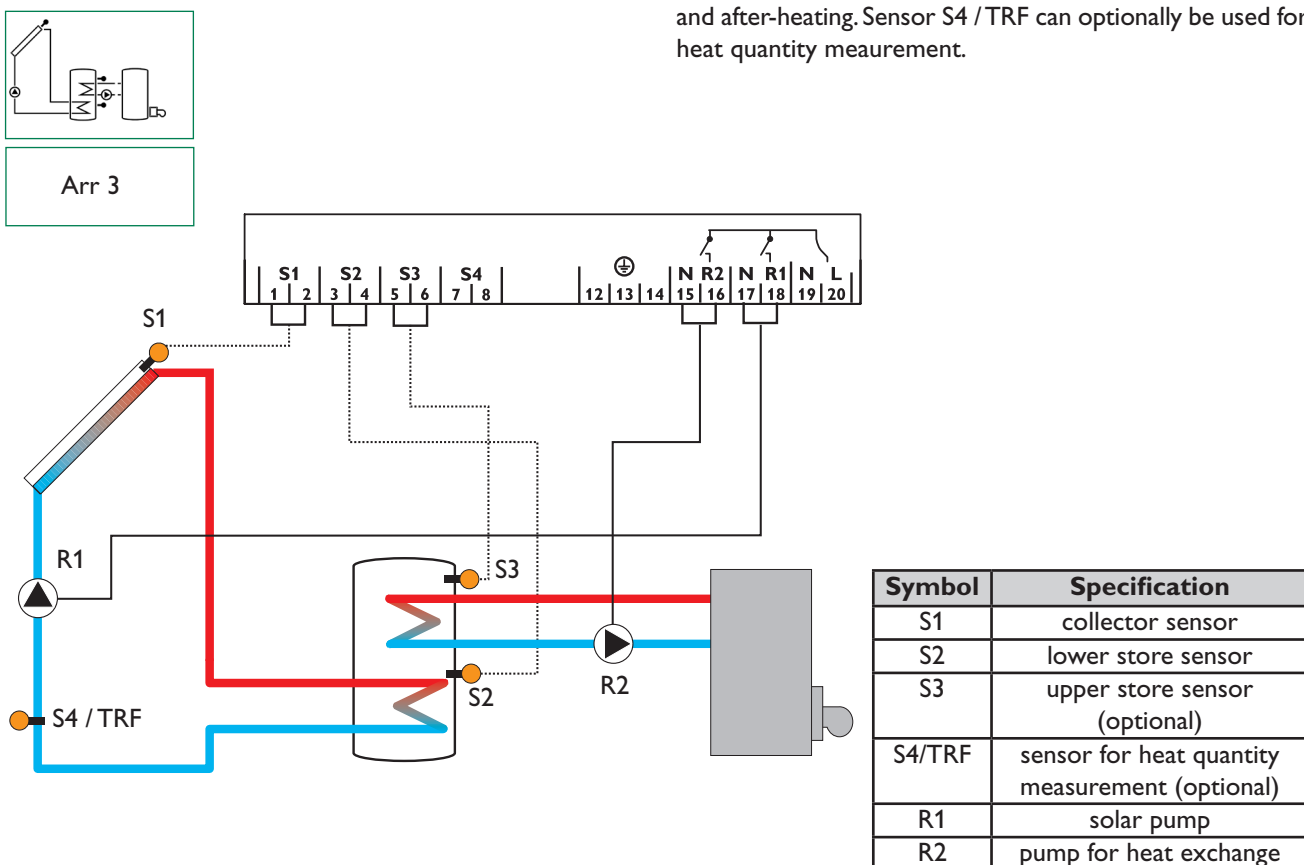
1.2.3 Terminal allocation of system 2

Solar system and heat exchange to existing store with 1 store, 4 sensors and 2 pumps.

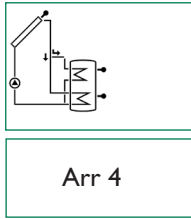


1.2.4 Terminal allocation of system 3

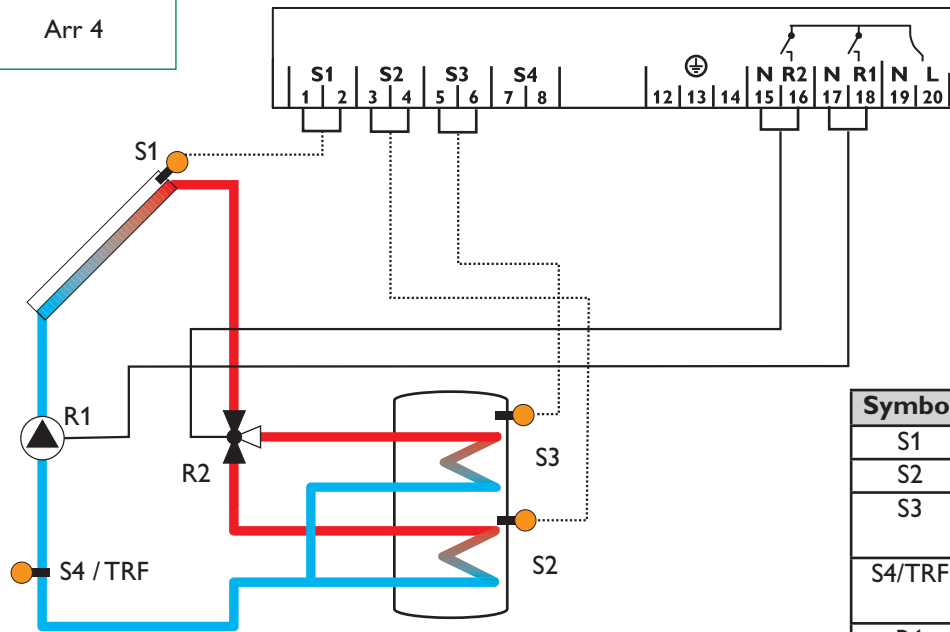
Solar system and after-heating with 1 store, 3 sensors and after-heating. Sensor S4 / TRF can optionally be used for heat quantity measurement.



1.2.5 Terminal allocation of system 4

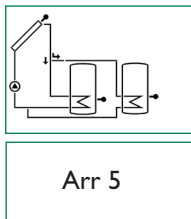


Solar system and store loading in layers with 1 store, 3 sensors, 1 solar pump and 3-port valve for store loading in layers. Sensor S4 / TRF can optionally be used for heat quantity measurement.

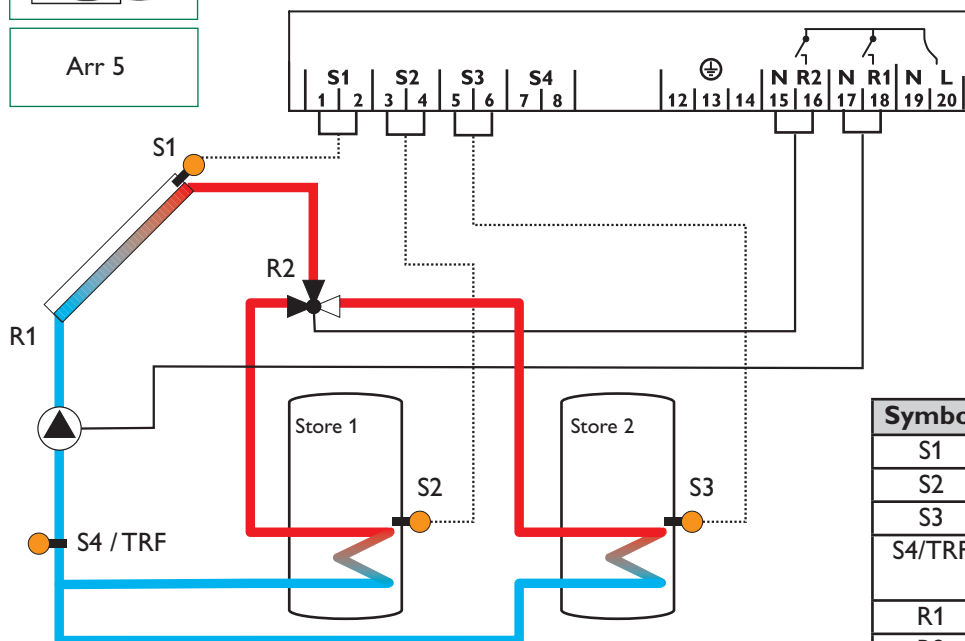


Symbol	Specification
S1	collector sensor
S2	lower store sensor
S3	upper store sensor (optional)
S4/TRF	sensor for heat quantity measurement (optional)
R1	solar pump
R2	3-port valve

1.2.6 Terminal allocation of system 5



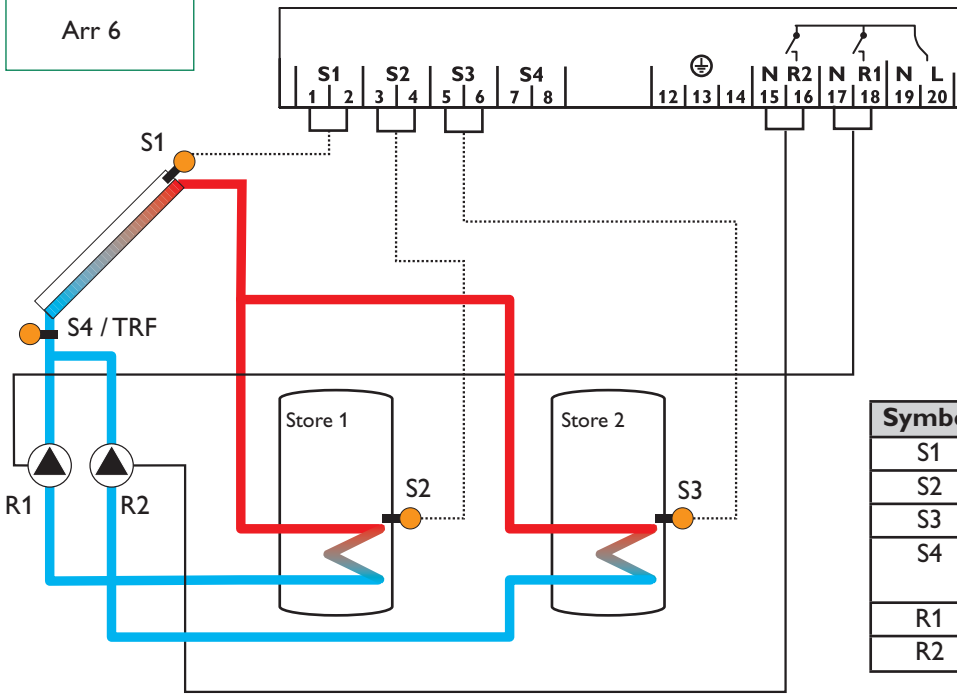
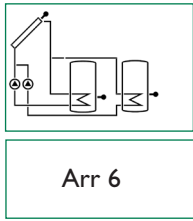
2-store-solar system with valve control with 2 stores, 3 sensors, 1 solar pump and 1 3-port valve. Sensor S4 / TRF can optionally be used for heat quantity measurement.



Symbol	Specification
S1	collector sensor
S2	store sensor 1
S3	store sensor 2
S4/TRF	sensor for heat quantity measurement (optional)
R1	solar pump
R2	3-port valve

1.2.7 Terminal allocation of system 6

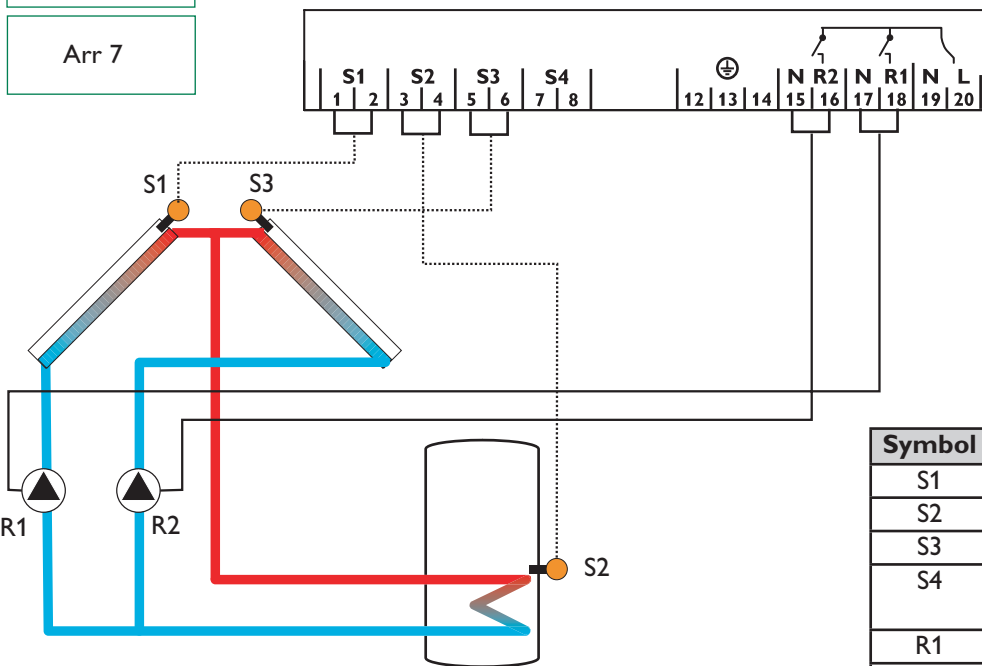
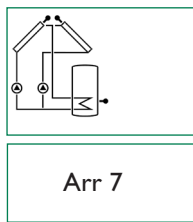
2-store-solar system with pump control with 2 stores, 3 sensors and 2 solar pumps.



Symbol	Specification
S1	collector sensor
S2	store sensor 1
S3	store sensor 2
S4	measuring sensor (optional)
R1	solar pump
R2	solar pump

1.2.8 Terminal allocation of system 7

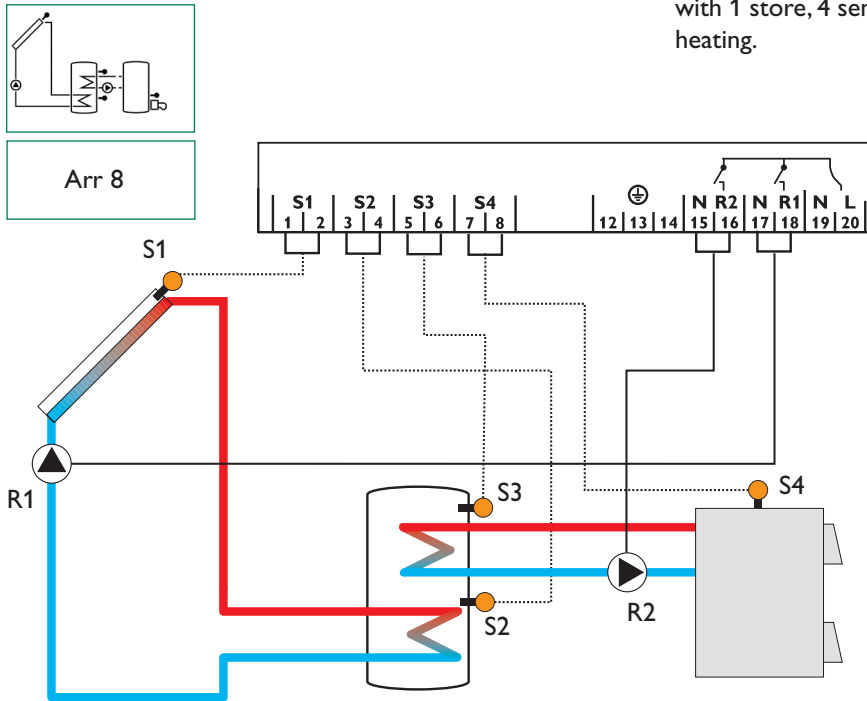
Solar system with east-west collectors, 1 store, 3 sensors and 2 solar pumps.



Symbol	Specification
S1	collector sensor
S2	store sensor 1
S3	collector sensor 2
S4	measuring sensor (optional)
R1	solar pump collector 1
R2	solar pump collector 2

1.2.9 Terminal allocation of system 8

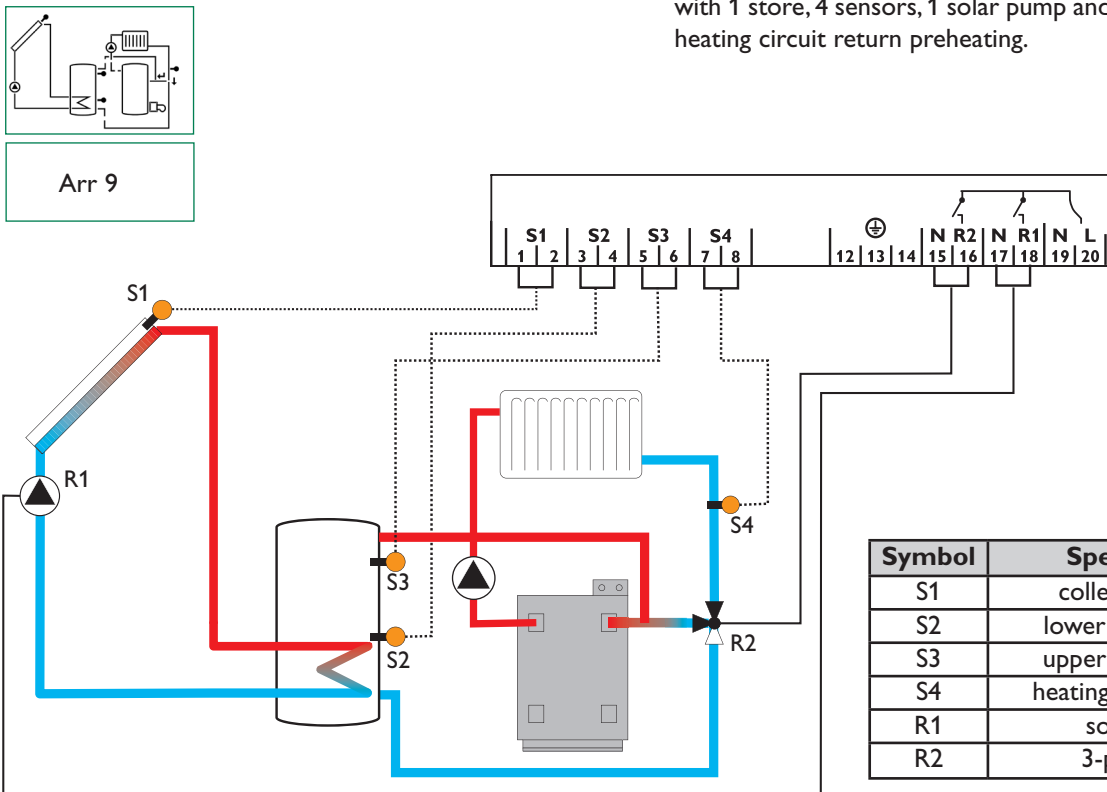
Solar system with after-heating by solid fuel boiler with 1 store, 4 sensors, 1 solar pump and 1 pump for after-heating.



Symbol	Specification
S1	collector sensor
S2	lower store sensor
S3	upper store sensor
S4	sensor for solid fuel boiler
R1	solar pump
R2	pump for solid fuel boiler

1.2.10 Terminal allocation of system 9

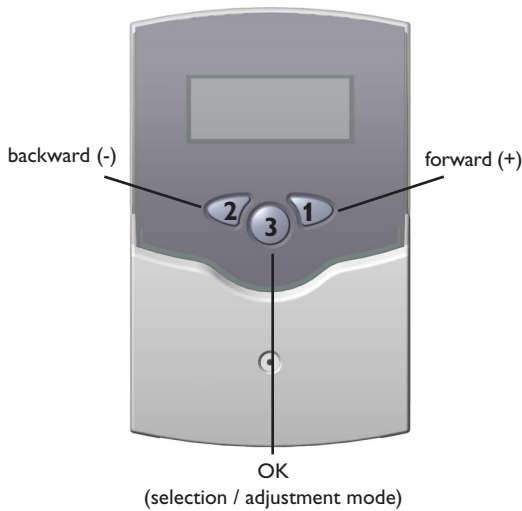
Solar system and heating circuit return preheating with 1 store, 4 sensors, 1 solar pump and 1 3-port valve for heating circuit return preheating.



Symbol	Specification
S1	collector sensor
S2	lower store sensor
S3	upper store sensor
S4	heating circuit return
R1	solar pump
R2	3-port valve

2. Operation and function

2.1 Pushbuttons for adjustment



The controller is operated via the 3 push buttons below the display. The forward-button (1) is used for scrolling forward through the display menu or to increase the adjustment values. The backward-button (2) is similarly used for scrolling backwards and reducing values.

In order to access the adjustment mode, scroll down in the display menu and press the forward button (1) for approx. 2 seconds after you have reached the last display item. If an **adjustment value** is shown on the display, the "SET" icon is displayed. Now, you can access the adjustment mode by using button 3.

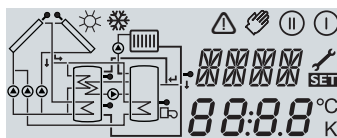
Press buttons 1 and 2 in order to select a channel

Briefly press button 3, „SET“ will flash

Adjust the value by pressing buttons 1 and 2

Briefly press button 3, so that SET permanently appears, the adjusted value will be saved.

2.2 System monitoring display



System-monitoring display

The system monitoring display consists of 3 blocks: **channel display**, **tool bar** and **system screen** (active arrangement).

2.2.1 Channel display



channel display only

The **channel display** consists of two lines. The upper line is an alpha-numeric 16-segment display (text display) for displaying channel names and menu items. In the lower 7-segment display, the channel values and the adjustment parameters are displayed. Temperatures and temperature differences are displayed. Temperatures and temperature differences are indicated in °C or K respectively.

Temperatures and temperature differences are indicated in °C or K respectively.

2.2.2 Tool bar

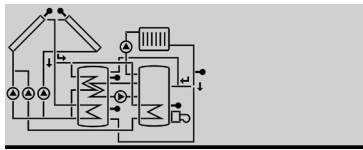


tool bar only

The additional symbols in the **tool bar** indicate the current system status.

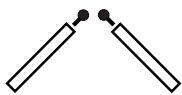
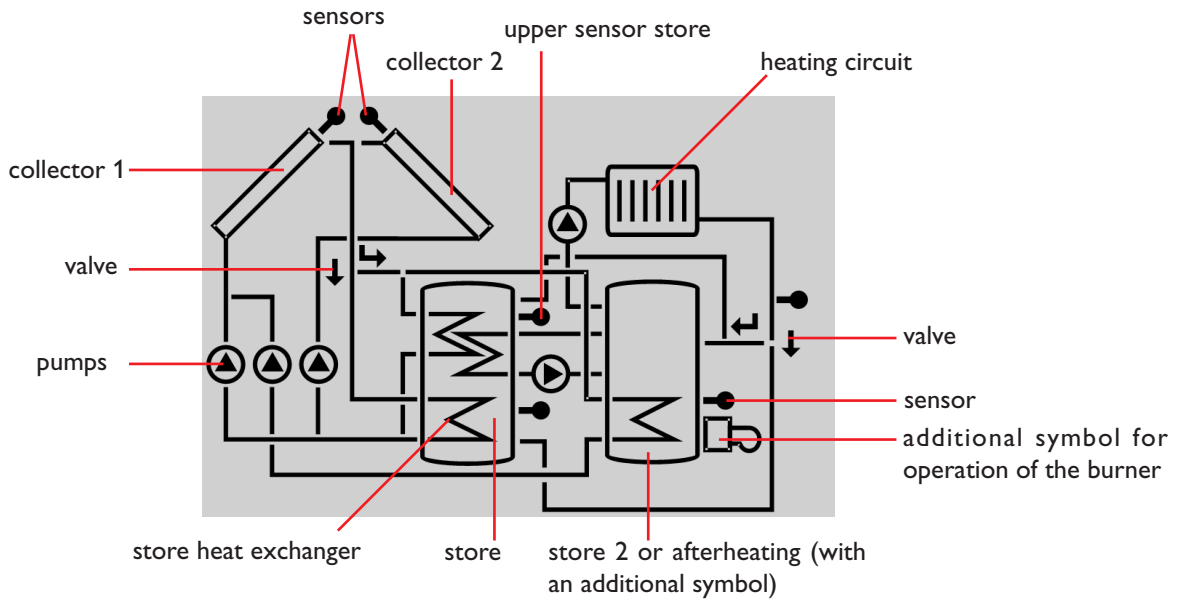
Symbol	normal	flashing
ⓘ	relay 1 active	
Ⓜ	relay 2 active	
☀	maximum store limitation active / maximum store temperature exceeded	collector cooling function active recoiling function active
❄	antifreeze function active	collector minimum limitation active antifreeze function active
⚠		collector emergency shut-down active or store emergency shutdown active
⚠ + 🔧		sensor defective
⚠ + 🧤		manual operation active
SET		SET-mode

2.2.3 System screen

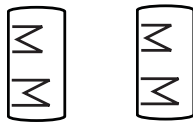


System Screen only

The system screen (active arrangement) shows the scheme which has been selected. The screen consists of several system component symbols, which are - depending on the current status of the system - either flashing, permanently shown or „hidden“.



Collectors
with collector sensor



Stores 1 and 2 with heat-exchanger



3-port valve
The flow direction or the actual switching position is shown.



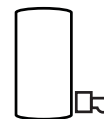
Temperature sensor



Heating circuit



Pump



Afterheating
with burner symbol

2.3 Flashing codes

2.3.1 System screen flashing codes

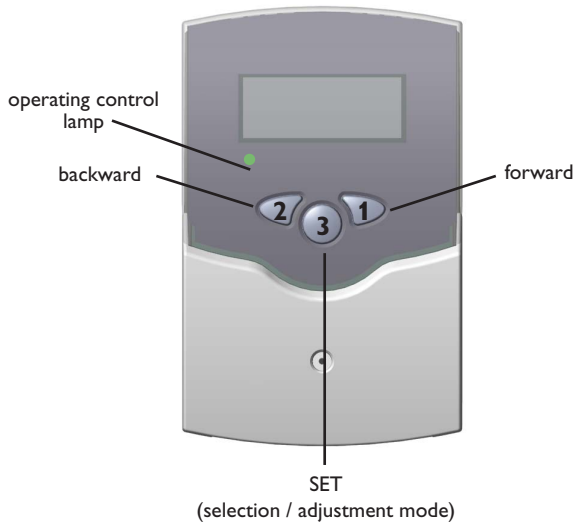
- Pumps are flashing during initialisation phase
- Sensor symbols are flashing if the corresponding sensor display channel is selected.
- Sensors are flashing in the case of a sensor fault.
- Burner symbol is flashing if the after-heating is active

2.3.2 Operating control lamp flashing codes

- | | |
|--------------------|-------------------------------------|
| green: | everything OK |
| red/green flashing | initialisation phase |
| | manual operation |
| red flashing: | sensor fault |
| | (sensor symbol is flashing quickly) |

3. Commissioning

When the controller is commissioned for the first time, the arrangement has to be selected first

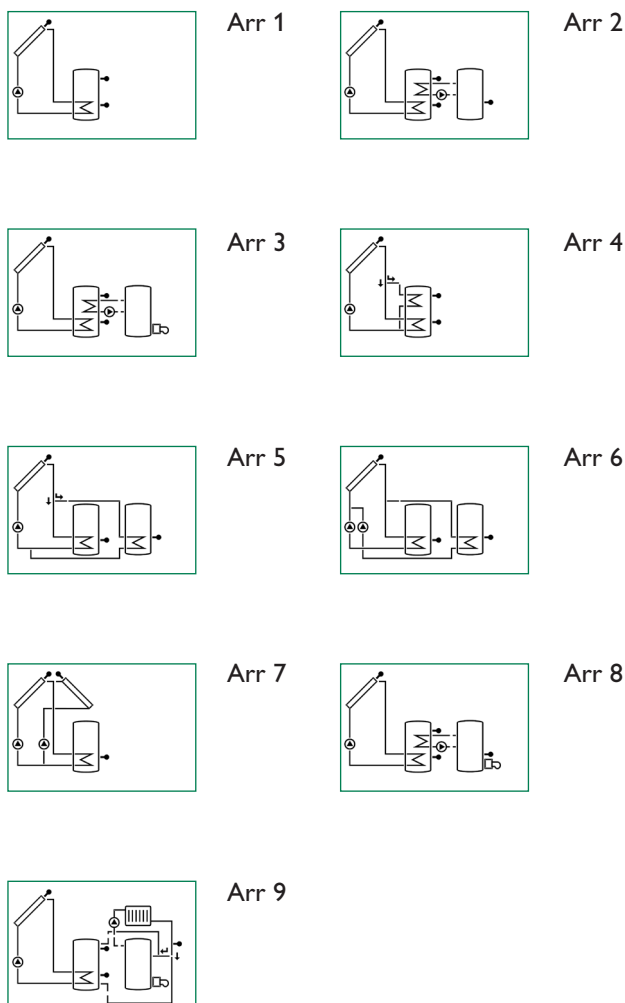


1. Switch on power supply. During the initialisation phase, the operating control lamp flashes red and green. After initialisation, the controller is in the automatic mode with typical settings. The pre-programmed system scheme is Arr 1.

2. Adjust the clock time in the TIME channel. Pressing the **SET** button once for adjusting the hours, and press it once again for adjusting the minutes. The time can be adjusted using buttons 1 and 2 and saved by pressing the **SET** button.

3. - Select the adjustment channel Arr
- Change to the **SET**-mode (see 2.1)
 - Select the arrangement via the Arr-index number
 - Save the adjustment by pressing the **SET** button

Now the controller is ready for operation with typical settings to suit that system and normally the factory settings will give close to optimum operation.



System overview:

- Arr 1 : standard solar system
- Arr 2 : solar system with heat exchange
- Arr 3 : solar system with after-heating
- Arr 4 : solar system with store loading in layers
- Arr 5 : 2-store solar system with valve control
- Arr 6 : 2-store solar system with pump control
- Arr 7 : solar system with 2 collectors and 1 store
- Arr 8 : solar system with after-heating by solid fuel boilers
- Arr 9 : solar system with heating circuit return preheating

4. Control parameters and display channels

4.1 Overview of channels

Legend:

x

Corresponding channel is available.

x*

Corresponding channel is available when the corresponding option is enabled

Please note:

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

①

Only if the option heat quantity measurement is **activated** (OHQM), will the corresponding channel be available.

②

Only if the option heat quantity measurement is **deactivated** (OHQM), will the corresponding channel be available.

MEDT

Only if an antifreeze (MEDT) other than water or **Tyfocon LS / G-LS (MEDT 0 or 3)** is used, will the channel anti-freeze concentration (MED%) be displayed.

channel	Arr									specification	page
	1	2	3	4	5	6	7	8	9		
COL	x	x	x	x	x	x		x	x	Temperature Collector 1	15
COL 1							x			Temperature Collector 1	15
TST	x						x			Temperature Store 1	15
TSTL			x	x				x	x	Temperature Store 1 bottom	15
TST1		x			x	x				Temperature Store 1 bottom	15
TSTU		x	x	x				x	x	Temperature Store 1 top	15
TST2		x			x	x				Temperature Store 2 bottom	15
TFSB								x		Temperature solid fuel boiler	15
TRET									x	Temperature heating circuit	15
COL2							x			Temperature collector 2	15
S3	x									Temperature sensor 3	15
TRF	①		①	①	①					Temperature return sensor	15
S4	②		②	②	②	x	x			Temperature sensor 4	15
n %	x			x	x				x	Pump speed relay 1	15
n1 %		x	x			x	x	x		Pump speed relay 1	15
n2 %		x				x	x	x		Pump speed relay 2	15
hP	x			x	x				x	Operating hours relay 1	16
h P1		x	x			x	x	x		Operating hours relay 1	16
h P2		x	x			x	x	x		Operating hours relay 2	16
kWh	①		①	①	①					Heat quantity kWh	16
MWh	①		①	①	①					Heat quantity MWh	16
time	x									Time	15
Arr	1-9									System	12
DT O	x	x	x				x	x	x	Switch-on temperature diff	17
DT1O				x	x	x				Switch-on temperature diff 1	17
DT F	x	x	x				x	x	x	Switch-off temperature diff 1	17
DT S	x	x	x				x	x	x	Nominal temperature difference	17
RIS	x	x	x				x	x	x	Rise	17
DT1F				x	x	x				Switch-off temperature difference	17
DT1S				x	x	x				Rise 1	17
RIS1				x	x	x				Maximum temperature store 1	17
S MX	x	x	x				x	x	x	Maximum temperature store 1	17
S1 MX				x	x	x				Maximum temperature store 1	17
DT2O				x	x	x				Switch-on temperature difference 2	17
DT2F				x	x	x				Switch-off temperature difference 2	17
DT2S				x	x	x				Nominal temperature difference 2	17
RIS2				x	x	x				Rise2	17
S2MX				x	x	x				Maximum temperature store 2	17
EM	x	x	x	x	x	x		x	x	Emergency temperature collector 1	18
EM1							x			Emergency temperature collector 1	18

channel	Arr									specification	page
	1	2	3	4	5	6	7	8	9		
OCX	x	x	x	x	x	x		x	x	Collector cooling option collector 1	18
OCX1								x		Collector cooling option collector 1	18
CMX	x*	x*	x*	x*	x*	x*		x*	x*	Maximum temperature collector 1	18
CMX1								x*		Maximum temperature collector 1	18
OCN	x	x	x	x	x	x		x	x	Minimum limitation option collector 1	18
OCN1								x		Minimum limitation option collector 1	18
CMN	x*	x*	x*	x*	x*	x*		x*	x*	Minimum temperature collector 1	18
CMN1								x*		Minimum temperature collector 1	18
OCF	x	x	x	x	x	x		x	x	Antifreeze option collector 1	18
OCF1								x		Antifreeze option collector 1	18
CFR	x*	x*	x*	x*	x*	x*		x*	x*	Antifreeze temperature collector 1	18
CFR1								x*		Antifreeze temperature collector 1	18
NOT2								x		Emergency temperature collector 2	18
OCX2								x		Collector cooling option collector 2	18
CMX2								x*		Maximum temperature collector 2	18
OCN2								x		Minimum limitation option collector 2	18
CMN2								x*		Minimum temperature collector 2	18
OCF2								x		Antifreeze option collector 2	18
CFR2								x*		Antifreeze temperature collector 2	18
PRIO				x	x	x				Priority	19
tST				x	x	x				Break time	19
tRUN				x	x	x				Circulation runtime	19
OREC	x	x	x	x	x	x	x	x	x	Recooling option	19
OTC	x	x	x	x	x	x	x	x	x	Tube collector option	19
DT3O		x						x	x	Switch-on temperature difference 3	17
DT3F		x						x	x	Switch-off temperature difference 3	17
DT3S		x						x		Nominal temperature ΔT3	17
RIS3		x						x		Rise ΔT3	17
MX3O		x						x		Switch-on threshold for maximum temp.	17
MX3F		x						x		Switch-off threshold for maximum temp.	17
MN3O		x						x		Switch-on threshold for minimum temp.	17
MN3F		x						x		Switch-off threshold for minimum temp.	17
AH O			x							Switch-on temp. for thermostat 1	20
AH F			x							Switch-off temp. for thermostat 1	20
t1on			x							Switch on time 1 thermostat	20
t1off			x							Switch off time 1 thermostat	20
t2on			x							Switch on time 2 thermostat	20
t2off			x							Switch off time 2 thermostat	20
t3on			x							Switch on time 3 thermostat	20
t3off			x							Switch off time 3 thermostat	20
OHQM	x		x	x	x					Heat quantity measurement option	
FMAX	①		①	①	①					Maximum flow	
MEDT	①		①	①	①					Antifreeze type	
MED%	MEDT		MEDT	MEDT	MEDT					Antifreeze content	20
nMN	x			x	x				x	Minimum pump speed relay 1	20
n1MN		x	x			x	x	x		Minimum pump speed relay 1	20
n2MN		x				x	x	x		Minimum pump speed relay 2	20
HND1	x	x	x	x	x	x	x	x	x	Manual operation relay 1	20
HND2	x	x	x	x	x	x	x	x	x	Manual operation relay 2	20
LANG	x	x	x	x	x	x	x	x	x	Language	20
PROG	XX.XX									Program number	
VERS	X.XX									Version number	

4.1.1 Indication of collector temperatures

COL, COL1, COL2:

Collector temperature
display range: -40...+250 °C



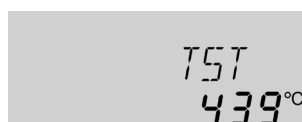
Indicates the actual collector temperature.

- COL : collector temperature (1-collector-system)
- COL1: collector temperature 1
- COL2: collector temperature 2

4.1.2 Indication of store temperatures

TST, TSTL, TSTU, TST1, TST2:

Store temperatures
Display range: -40...+250 °C



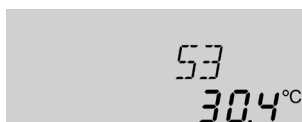
Indicates the actual store temperature.

- TST : store temperature (1-store-system)
- TSTL : store temperature bottom
- TSTU: store temperature top
- TST1 : temperature store 1
- TST2 : temperature store 2

4.1.3 Indication of sensor 3 and sensor 4

S3, S4:

Sensor temperatures
Display range: -40...+250 °C



Indicates the actual temperature of the corresponding additional sensor (without control function).

- S3 : temperature sensor 3
- S4 : temperature sensor 4



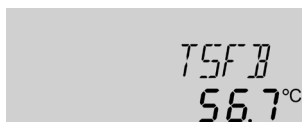
Please note:

Only if the temperature sensors are connected (displayed), will S3 and S4 be displayed.

4.1.4 Indication of other temperatures

TSFB, TRET, TRF:

Other measured temperatures
Display range: -40...+250 °C



Indicates the actual temperature of the corresponding sensor.

- TSFB : temperature - solid fuel boiler
- TRET : temperature - heating return
- TRF : temperature - return

4.1.5 Indication of current pump speed

n %, n1 %, n2 %:

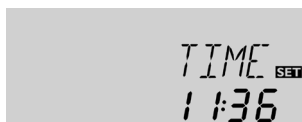
Actual pump speed
Display range: 30...100 %



Indicates the actual pump speed of the corresponding pump.

- n % : actual pump speed (1-pump-system)
- n1 % : actual pump speed pump 1
- n2 % : actual pump speed pump 2

4.1.6 Time



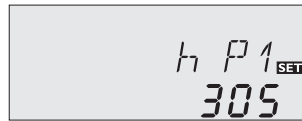
Indicates the actual time.

Press button **SET** for 2 seconds in order to adjust the hours and press it again in order to adjust the minutes (flashing). The time can be set using buttons 1 and 2 and saved by pressing the **SET** button.

4.1.6 Operating hours counter

h P / h P1 / h P2:

Operating hours counter
Display channel



The operating hours counter accumulates the solar operating hours of the respective relay (**h P / h P1 / h P2**). Full hours are displayed.

The accumulated operating hours can be set back to zero. As soon as one operating hours channel is selected, the symbol **SET** is displayed. Press the SET (3) button for approx. 2 seconds in order to access the RESET-mode of the counter. The display symbol **SET** will flash and the operating hours will be set to 0. Confirm the reset with the **SET** button in order to finish the reset.

In order to interrupt the RESET-process, do not press a button for about 5 seconds. The display returns to the display mode.

4.1.7 Heat quantity measurement

OHQM: Heat quantity measurement

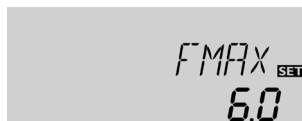
Adjustment range: OFF...ON
Factory setting: OFF



Heat quantity measurement is possible in Arr 1, 3, 4, and 5 if a flowmeter is used. For this purpose, the heat quantity measurement option (**OHQM**) has to be enabled.

FMAX: Flow rate in l/min

Adjustment range 0 ... 20
in 0,1 steps
Factory setting 6,0



The flow rate should be read from the flowmeter (l/min) and has to be adjusted in the channel **FMAX**. Antifreeze type and concentration of the heat transfer medium have to be adjusted in the channels **MEDT** and **MED%**.

MEDT: Antifreeze

Adjustment range 0...3
Factory setting 1



Antifreeze type:

- 0 : water
- 1 : propylene glycol
- 2 : ethylene glycol
- 3 : Tyfocor® LS / G-LS

MED%: Concentration of antifreeze in (Vol-) %

MED% is "hidden" when MEDT 0 or 3 is used.
Adjustment range 20...70
Factory setting 45



kWh/MWh: Heat quantity in kWh / MWh

Display channel



The flow rate as well as the reference sensors S1 (flow) and S4 (return) are used for calculating the heat quantity supplied. It is shown in kWh in the channel **kWh** and in MWh in the channel **MWh**. The overall heat quantity results from the sum of both values.

The accumulated heat quantity can be reset. As soon as one of the display channels of the heat quantity is selected, the **SET** symbol is permanently shown on the display. Press button SET (3) for about 2 seconds in order to access the RESET mode of the counter. The display symbol **SET** will flash and the heat quantity value will be set to 0. In order to finish this process, press the **SET** button to confirm.

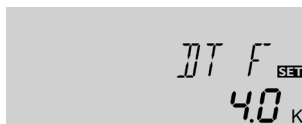
In order to interrupt the RESET process, no button should be pressed for about 5 seconds. The controller automatically returns to the display mode.

4.1.8 Δ T-control**DT O / DT1O / DT2O / DT3O:**

Switch-on temperature diff.
Adjustment range 1,0 ... 20,0 K
Factory setting 6.0

**DT F / DT1F / DT2F / DT3F:**

Switch-off temperature diff.
Adjustment range 0,5 ... 19,5 K

**DT S / DT1S / DT2S / DT3S:**

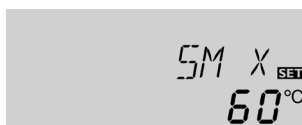
Nominal temperature difference
Adjustment range 1,5 ... 30,0 K
Factory setting 10.0

**RIS / RIS1 / RIS2 / RIS3:**

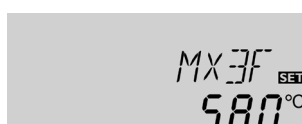
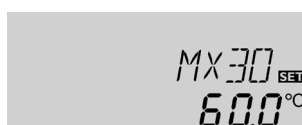
Rise
Adjustment range 1 ... 20 K
Factory setting 2 K

**4.1.9 Maximum store temperature****S MX / S1MX / S2MX:**

Maximum store temp.
Adjustment range 2 ... 95 °C
Factory setting 60 °C

**4.1.10 Δ T-control (solid fuel boiler and heat exchange)****Maximum temperature limitation****MX3O / MX3F:**

Maximum temperature limitation
Adjustment range 0,0 ... 95,0 °C
Factory setting
MX3O 60,0 °C
MX3F 58,0 °C

**Minimum temperature limitation****MN3O / MN3F:**

Minimum temperature limitation
Adjustment range 0,0 ... 90,0 °C
Factory setting:
Arr = 2
MN3O 5,0 °C
MN3F 10,0 °C
Arr = 8
MN3O 60,0 °C
MN3F 65,0 °C



First the controller works as a standard differential controller. If the switch-on difference (**DT O / DT1O / DT2O**) is reached, the pump is activated at full speed for 10 seconds. The speed is then reduced to the minimum pump speed value (nMN / nMN1 / nMN2 = 30 %). If the temperature difference reaches the adjusted set value (**DT S / DT1S / DT2S / DT3S**), the pump speed increases by one step (10%). If the difference increases by 2 K (**RIS / RIS1 / RIS2 / RIS3**), the pump speed increases by 10 % respectively until the maximum pump speed of 100 % is reached. The response of the controller can be adapted via the parameter „Rise“. If the temperature difference falls below the adjusted switch-off temperature difference (**DT F / DT1F / DT2F**), the controller switches off.

DT O and **DT S** are locked against each other. **DT S** must be at least 0,5 K higher than **DT O**.

**Please note:**

The switch-on temperature difference must be at least 1 K higher than the switch-off temperature difference.

Once the adjusted maximum temperature is exceeded, the solar pump is switched off and further loading of the store is prevented to reduce scald risk or system damage. The ☀ symbol is shown on the display.

**Note:**

The controller is also equipped with a non-adjustable emergency switch-off if the store reaches 95 °C. The reference sensor is S2 (or S3 for two store systems).

In arrangements 2 and 8, the controller is equipped with an additional differential control for heat exchange between two stores or from a solid fuel back boiler (e.g. wood-stove). Minimum and maximum temperature limits can be set. The basic differential function is adjusted using the switch on (**DT3 O**) and switch off (**DT3 F**) temperature differences.

The **MX3O / MX3F** function provides a maximum temperature setting, usually to reduce scald risk in a storage tank. If **MX3O** is exceeded, relay 2 is switched off until the sensor falls below **MX3F**. This function uses sensor 3 in Arr. 8 and sensor 4 in Arr.2.

The **MN3O / MN3F** function provides a minimum temperature setting and aims to provide frost protection in Arr.2, and back boiler protection in Arr.8. If the sensor temperature falls below **MN3O**, relay 2 is switched off until the temperature exceeds **MN3F**. This function uses sensor 4 in Arr.8 and sensor 3 in Arr.2.

Both switch-on and switch-off temperature differences **DT3O** and **DT3F** are valid for the maximum and minimum temperature limitation.

4.1.11 Collector temperature limitation Emergency shutdown of the collector

EM / EM1 / EM2:

Collector temperature limitation
Adjustment range 110 ... 200 °C
Factory setting 140 °C



If the adjusted collector emergency shutdown temperature (**EM / EM1 / EM2**) is exceeded, the controller switches off the solar pump (R1 / R2) in order to protect the system against overheating (collector emergency shutdown). The factory setting is 140 °C but it can be changed within the adjustment range of 110 ... 200 °C. Δ (flashing) is shown.

4.1.12 System cooling

OCX / OCX1 / OCX2:

Option System cooling
Adjustment range OFF ... ON
Factory setting OFF



When the adjusted maximum store temperature is reached, the system stagnates. If the collector temperature increases to the adjusted maximum collector temperature (**CMX / CMX1 / CMX2**), the solar pump is activated until the collector temperature falls below the maximum collector temperature. The store temperature may increase (subordinate active maximum store temperature), but only up to 95 °C (emergency shutdown of the store). If the store temperature is higher than the maximum store temperature (**SMX / S1MX / S2MX**) and if the collector temperature is at least 5 K below the store temperature, the solar system remains activated until the store is cooled down below the adjusted maximum temperature (**SMX / S1MX / S2MX**) via the collector and the pipework.

CMX / CMX1 / CMX2:

Collector maximum temperature
Adjustment range 100... 190 °C
Factory setting 120 °C



If the system cooling function is enabled, \star (flashing) is shown on the display. Due to the cooling function, the system will have a longer operation time on hot summer days and guarantees thermal relief of the collector field and the heat transfer fluid.

4.1.13 Collector minimum limitation option

OCN / OCN1 / OCN2:

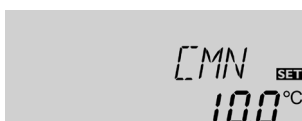
Collector minimum limitation
OFF / ON
Factory setting OFF



The minimum collector temperature is the minimum temperature which must be exceeded for the solar pump (R1 / R2) to switch on. The minimum temperature prevents the pump from being switched on too often at low collector temperatures. If the temperature falls below the minimum temperature, \star (flashing) is shown on the display.

CMN / CMN1 / CMN2:

Collector minimum temp.
Adjustment range 10 ... 90 °C
Factory setting 10 °C



4.1.14 Antifreeze option

OCF / OCF1 / OCF2:

Antifreeze function
Adjustment range OFF / ON
Factory setting OFF



The antifreeze function activates the loading circuit between the collector and the store when the temperature falls below the adjusted antifreeze temperature. This will protect the fluid against freezing or coagulating. If the adjusted antifreeze temperature is exceeded by 1 °C, the loading circuit will be deactivated.

CFR / CFR1 / CFR2:

Antifreeze temperature
Adjustment range -10 ... 10 °C
Factory setting 4,0 °C



Note:

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

4.1.15 Store sequence control

Corresponding adjustment values:

Priority [PRIO]

Oscillating break-time [tST]

Oscillating loading time [tRUN]

Factory setting

(1 / Arr 5,6) (2 / Arr 4)

2 min.

15 min.

Adjustment range

0-2

1-30 min.

1-30 min.

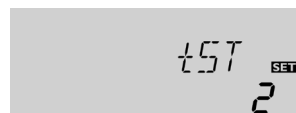
The DeltaSol® BS Plus priority logic

Priority:



The above-mentioned options and parameters are used in multi-store systems only (system Arr = 4, 5, 6). If **priority 0** is adjusted, the stores with a temperature difference to the collector are loaded in numerical order (store 1 or store 2). Usually the stores are loaded one after the other. **Parallel loading** is also possible in Arr = 5, 6.

Loading break time / store sequence control / collector rise temperature



This function aims to extract the maximum solar gain in 2 store systems. If the first priority store cannot be loaded, the second priority is checked. If useful heat can be added, it will be loaded for the „oscillating loading time“ („t-run“ - factory default 15 min.) After this, the loading process stops and the controller monitors the increase in collector temperature during the break time „t-st“. If it increases by 2°C, the break time timer starts again to allow the collector to gain more heat. If it does not, but useful heat can be added to the second priority store, the second store will be loaded again for the „t-run“ time as before.

As soon as the switch-on condition of the priority store is fulfilled, it will be loaded. If the switch-on condition of the priority store is not fulfilled, loading of the second store will be continued. If the priority store reaches its maximum temperature, oscillating loading will not be carried out.

4.1.16 Recooling function

OREC:

Recooling option
adjustment range

OFF...ON

Factory setting: OFF



If the adjusted maximum store temperature (**S MX / S1MX / S2MX**) is reached, the controller keeps the solar pump running in order to prevent the collector from being overheated. The store temperature may increase but only up to 95 °C (emergency shutdown of the store).

In the evening, the solar thermal system remains switched on until the store is cooled down to the adjusted maximum temperature via the collector and the pipework.

4.1.17 Tube collector function

OTC:

Tube collector function

Adjustment range:

OFF...ON

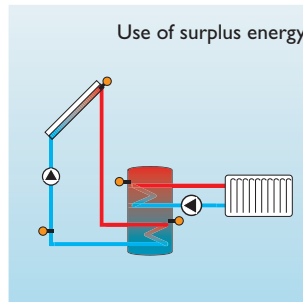
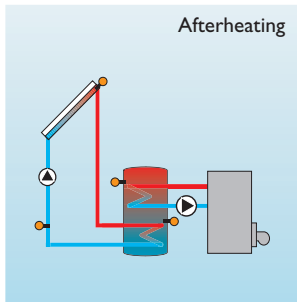
Factory setting: OFF



If the controller detects an increase in collector temperature by 2 K compared to the previously stored collector temperature, the solar pump will be switched-on at 100 % for about 30 seconds in order to detect the fluid temperature. The current collector temperature will be saved as a new reference value. If the measured temperature (new reference value) is exceeded by 2 K, the solar pump will run for 30 seconds. If the switch-on difference between the collector and the store is exceeded during the runtime of the solar pump or the standstill of the system, the controller will automatically switch to solar loading.

If the collector temperature decreases by 2 K during standstill, the switch-on value for the tube collector function will be recalculated.

4.1.18 Thermostat function (Arr = 3)



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

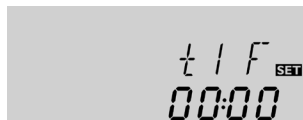
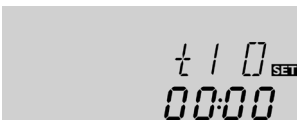
- **AH O** < **AH F**
thermostat function for after-heating
- **AH O** > **AH F**
thermostat function for using surplus energy

Symbol will be shown on the display if the second relay output is activated.



AH O:
Thermostat switch-on temperature
Adjustment range:
0,0...95,0 °C
Factory setting: 40,0 °C

AH F:
Thermostat switch-off temperature
Adjustment range:
0,0...95,0 °C
Factory setting: 45,0 °C



t1 O, t2 O, t3 O:
Thermostat switch-on time
Adjustment range:
00:00...23:45
Factory setting: 00:00

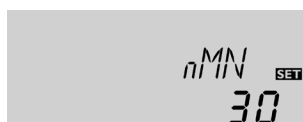
t1 F, t2 F, t3 F:
Thermostat switch-off time
Adjustment range:
00:00...23:45
Factory setting: 00:00

In order to block the thermostat function for a certain period, there are 3 time frames t1 ... t3. If the function should be active between 6:00 and 9:00, set **t1 O** to 6:00 and **t1 F** to 9:00. The thermostat function is factory set to continuous operation.

If all time frames stop at 00:00 o'clock, the thermostat function is continuously activated (factory setting).

4.1.19 Pump speed control

nMN, n1MN, n2MN:
Pump speed control
Adjustment range:
30...100
Factory setting: 30



A relative minimum pump speed for pumps can be allocated to the outputs R1 and R2 via the adjustment channels **nMN**, **n1MN** and **n2MN**.

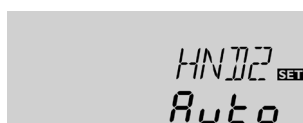
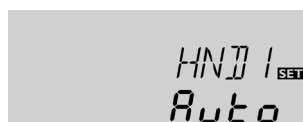


Note:

When loads which are not speed-controlled (e.g. valves) are used, the value must be changed to 100 % in order to deactivate pump speed control.

4.1.20 Operating mode

HND1/HND2:
Operating mode
Adjustment range:
OFF, AUTO, ON
Factory setting: AUTO



For control and service work, the operating mode of the controller can be manually adjusted. For this purpose, select the adjustment value **HND**, **HND1**, **HND2** in which the following adjustments can be made:

- **HND / HND1 / HND2**
Operating mode
OFF : relay off (flashing) +
AUTO : relay in automatic operation
ON : relay on (flashing) +

4.1.21 Language (LANG)

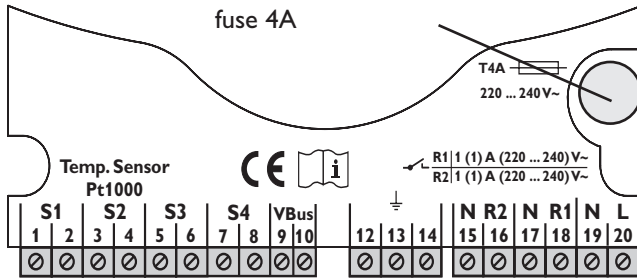
LANG:
Language choice
Adjustment range: dE, En, It, Fr
Factory setting: En



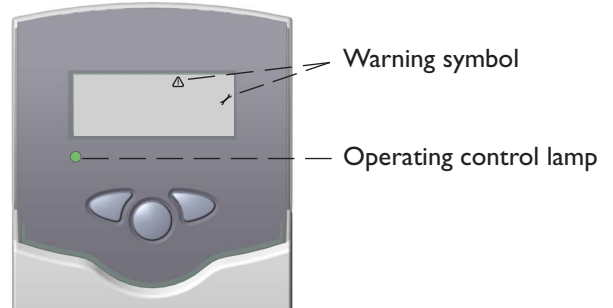
The menu language can be adjusted in this channel.

- dE : German
- En : English
- It : Italian
- Fr : French

5. Troubleshooting



If a malfunction occurs, it will be indicated on the display of the controller:



Operating control lamp flashes red. The symbol and the are shown.

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

888.8

- 88.8

Cable is broken. Check the cable.

Short-circuit. Check the cable.

Disconnected Pt1000 temperature sensors can be checked with an ohmmeter. In the following table, the resistance values corresponding to different temperatures are listed.

°C	Ω	°C	Ω
-10	961	55	1213
-5	980	60	1232
0	1000	65	1252
5	1019	70	1271
10	1039	75	1290
15	1058	80	1309
20	1078	85	1328
25	1097	90	1347
30	1117	95	1366
35	1136	100	1385
40	1155	105	1404
45	1175	110	1423
50	1194	115	1442

Resistance values of the Pt1000-sensors

Operating control lamp off

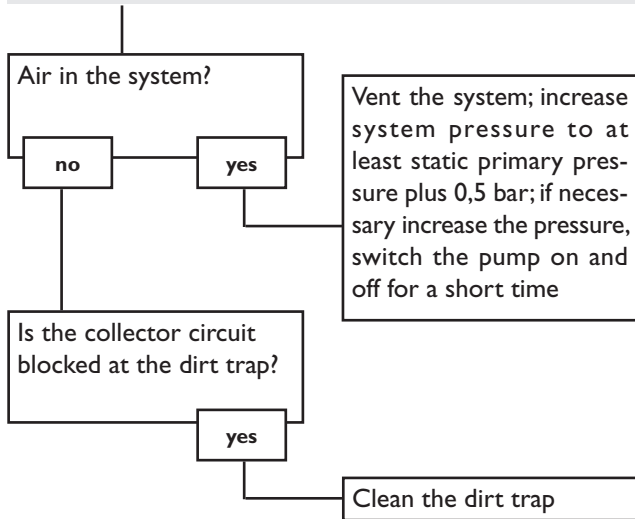
Check the power supply

o.k.

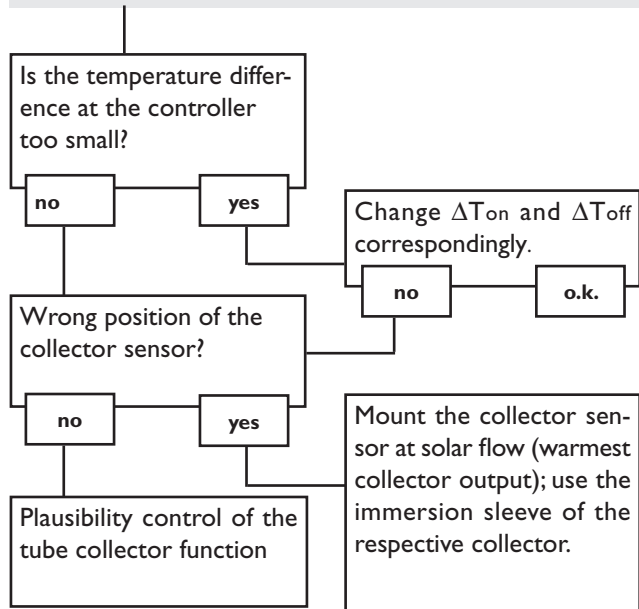
The fuse of the controller could be blown. It can be replaced after the front cover has been removed (spare fuse is enclosed in the accessory bag).

5.1 Various:

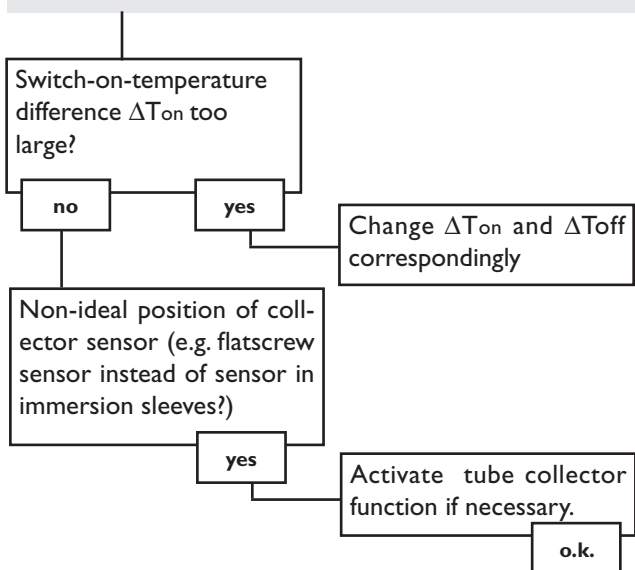
Pump is overheated, but no heat transfer from the collector to the store, flow and return have the same temperature; perhaps also bubble in the lines



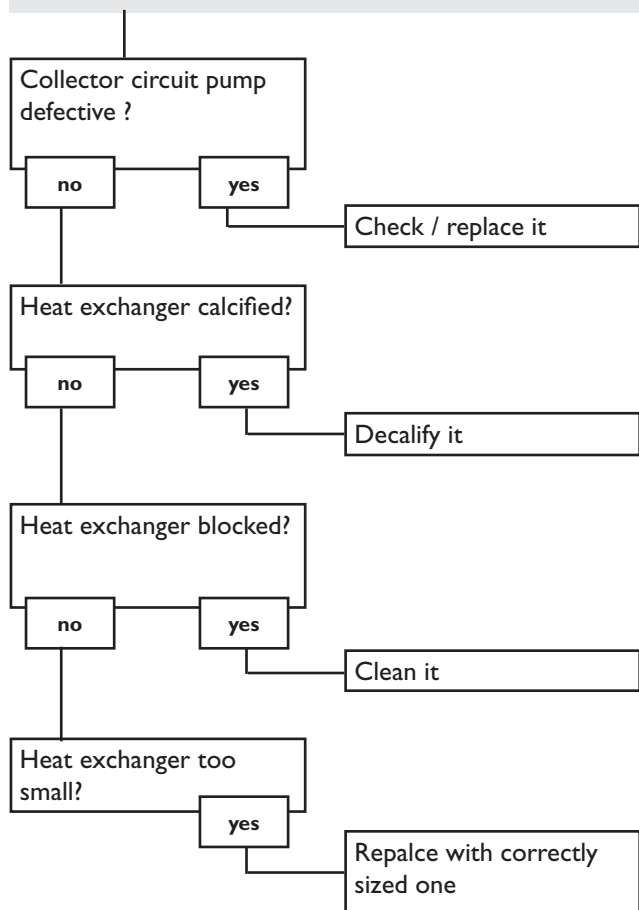
Pump starts for a short moment, switches-on/off again, etc.

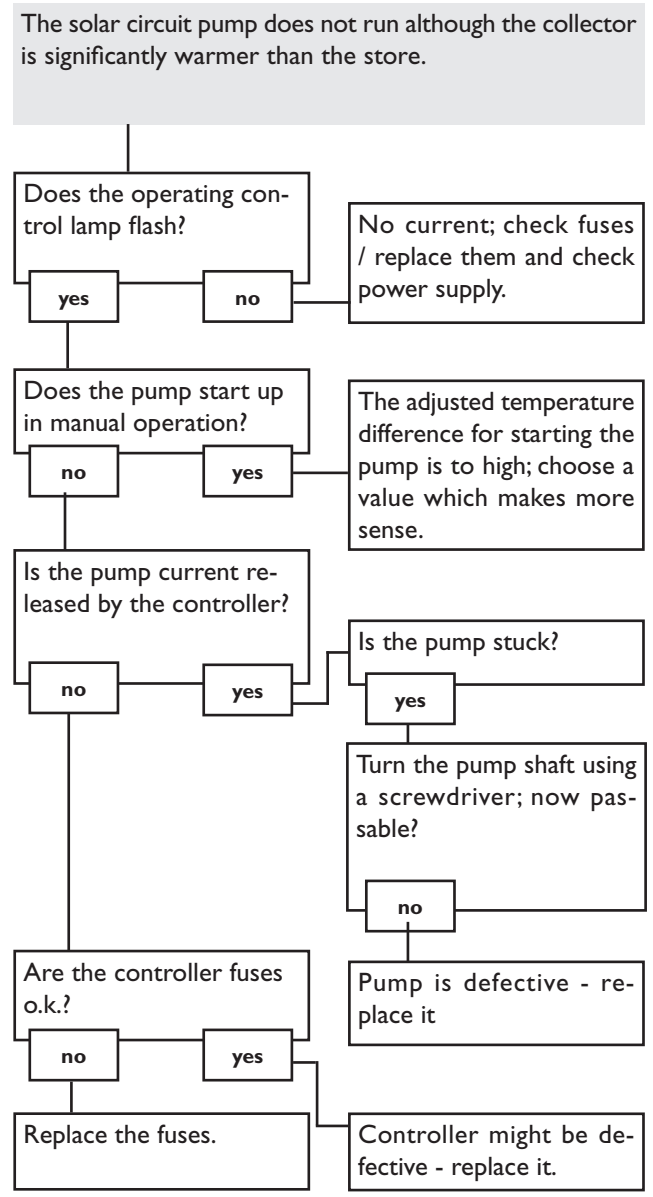
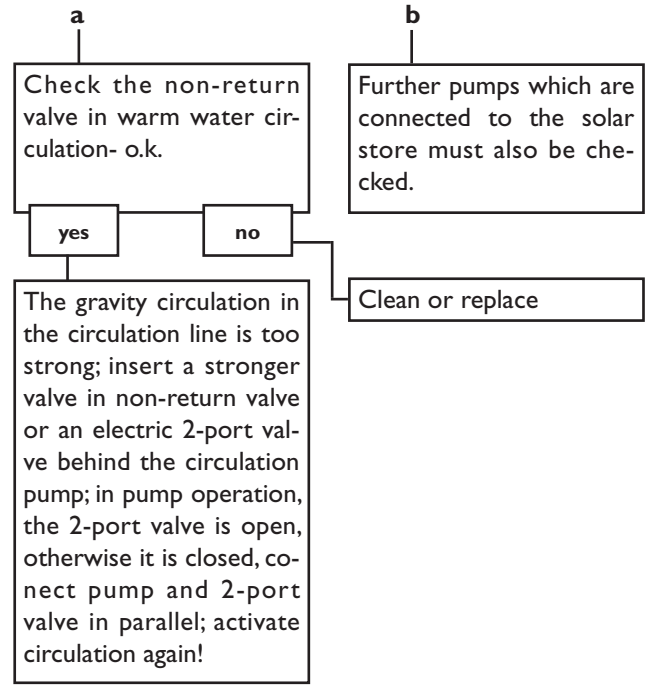
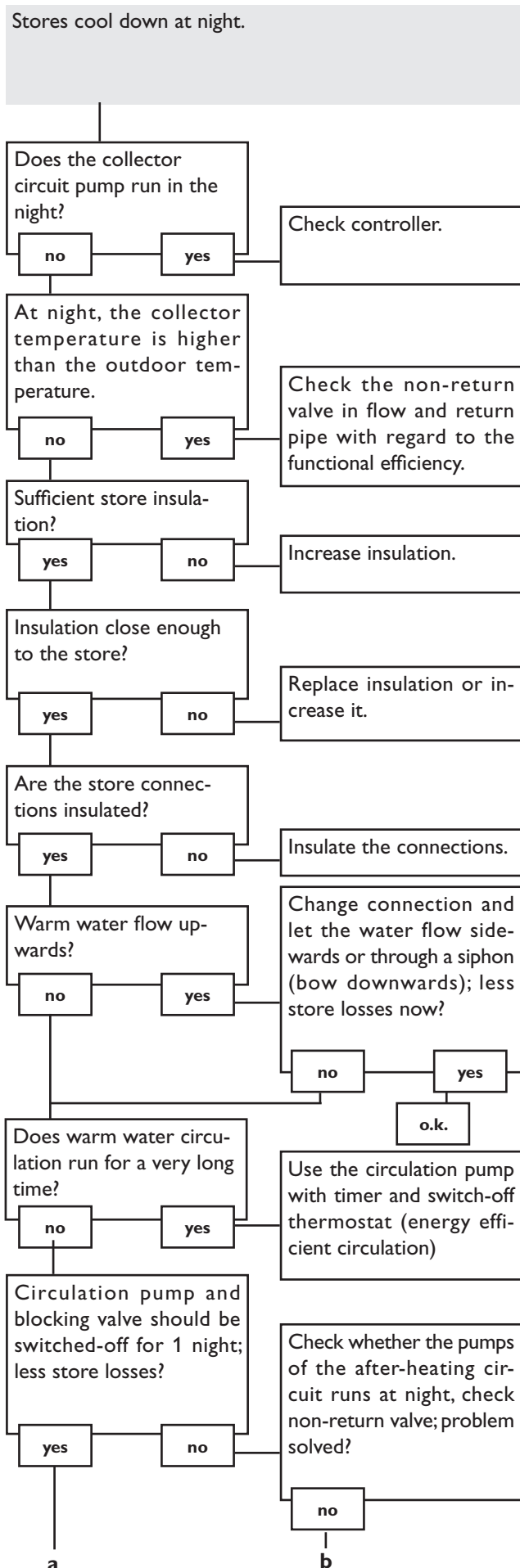


Pump starts up very late..



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





6. Accessory

Sensors

Our product range includes high-precision platinum temperature sensors, flatscrew sensors, outdoor temperature sensors, indoor temperature sensors, cylindrical clip-on sensors and irradiation 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 overvoltage protection RESOL SP1



Flowmeter

If you wish to carry out a heat quantity measurement, you need a flowmeter for measuring the flow rate in your system.



RS-COM Adapter

The controller can be connected to a PC by means of the RS-COM adapter.



RESOL ServiceCenter Software

The controller data can be read out for visualising and monitoring the system state. The light version of the software is available for free download at www.resol.de.

The full version additionally allows easy configuration of the control parameters with a PC.

Distributed by:

RESOL - Elektronische Regelungen GmbH

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Fax: +49 (0) 23 24 / 96 48 - 755
www.resol.de
info@resol.de

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