

# RESOL DeltaSol<sup>®</sup> BS Plus

**Mounting**

**Connection**

**Operation**

**Fault diagnostics**

**Application examples**



48000500

**Thank you for buying a RESOL product.  
Please read this manual carefully in order to put this controller to the best possible use.**

# DeltaSol<sup>®</sup> BS Plus



**manual**

[www.resol.de](http://www.resol.de)

**Contents**

<b>Imprint .....</b>	<b>2</b>	2.1	Adjustment buttons .....	10
<b>Safety regulations.....</b>	<b>2</b>	2.2	System monitoring display .....	10
<b>Technical data and overview of functions .....</b>	<b>3</b>	2.2.1	Channel indication.....	10
<b>1. Installation .....</b>	<b>4</b>	2.2.2	Tool bar .....	10
1.1 Mounting.....	4	2.2.3	System screen.....	11
1.2 Electrical Connection .....	4	2.3	Blinking codes.....	11
1.2.1 Data communication / Bus .....	5	2.3.1	System-Screen Blinking codes.....	11
1.2.2 Standard solar system.....	5	2.3.2	LED blinking codes.....	11
1.2.3 Solar system and heat exchange .....	6	<b>3. Primary commissioning.....</b>	<b>12</b>	
1.2.4 Solar system and afterheating.....	6	<b>4. Control parameter and display channels.....</b>	<b>13</b>	
1.2.5 Solar system and store charge in layers .....	7	4.1 Channel overview.....	13	
1.2.6 2-store-solar system valve logic .....	7	4.1.1-6 Indication channels .....	15	
1.2.7 2-store-Solar system pump logic.....	8	4.1.6-21 Adjustment channels.....	16	
1.2.8 Solar system with 2 collectors .....	8	<b>5. Tips for fault localization.....</b>	<b>21</b>	
1.2.9 Solar system afterheating by solid fuel boiler.....	9	5.1 <b>Various.....</b>	<b>22</b>	
1.2.10 Solar system with heating circuit return flow incr.....	9	<b>6. Accessory .....</b>	<b>24</b>	
<b>2. Operation and function .....</b>	<b>10</b>			

**Safety regulations:**

Please read the following information carefully before installing and operating the controller. The mounting and the operation are to be carried out due to the accepted technical rules. Please pay attention to the accident prevention regulation of the Accident Prevention & Insurance Association. A wrong application as well as inadmissible changes during the mounting will result in an exclusion of liability.

Attention should be paid to following technical rules:

DIN 4757, part 3

Solar heating systems; solar collectors; meanings; safety regulations; testing of standstill temperature

DIN 4757, part 4

Solar thermal systems; solar collectors; determination of efficiency, heat capacity and pressure loss.

In addition to that European standards are worked out:

PrEN 12975-1

Thermal solar systems and their components; collectors, part 1: General demands.

PrEN 12975-2

Thermal solar systems and their components; collectors; part 2: Test processes

PrEN 12976-1

Thermal solar systems and their components; prefabricated systems, part 1: General demands.

PrEN 12976-2

Thermal solar systems and their components; prefabricated systems, part 2: Test processes

PrEN 12977-1

Thermal solar systems and their components; Customer-designed manufactured systems, part 1: General demands.

PrEN 12977-2

Thermal solar systems and their components; Customer-designed manufactured systems, part 2: Test processes

PrEN 12977-3

Thermal solar systems and their components; Customer-designed manufactured systems, part 3: Performance test of hot water stores.

**Imprint:**

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Editor: RESOL - Elektronische Regelungen GmbH

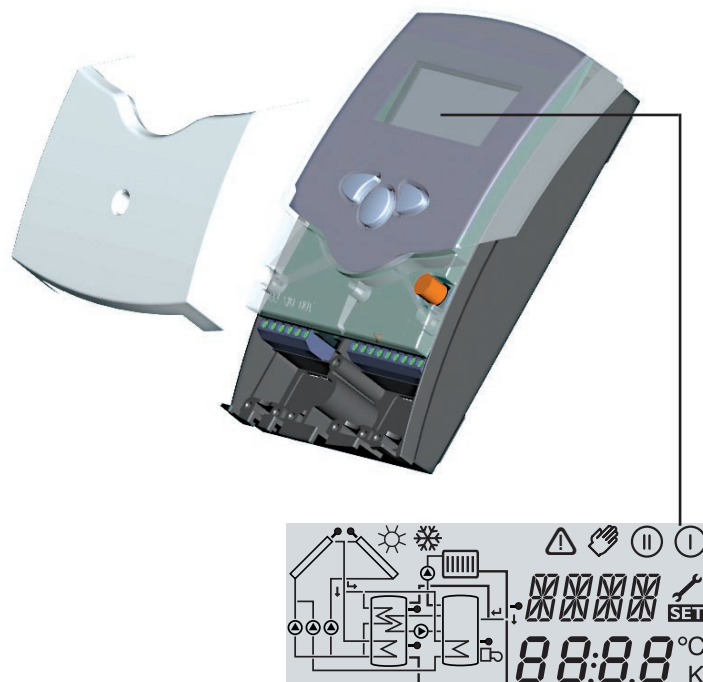
**Important notice:**

All descriptions and drawings contained in this manual have been prepared to the best of our knowledge and belief. The drawings in this manual are for the purpose of example and should be used at your own risk. We cannot be held responsible for any errors. Please note:

It is the responsibility of the installer to ensure current standards and industry best practices are followed.

Subject to change without notice. Errors excepted.

- System-monitoring-display
- Up to 4 temperature sensors Pt1000
- 2 semi-conductor relays for pump speed control
- 9 basic systems selectable
- Heat balancing
- RESOL VBus®
- Function control
- Thermostat function (time controlled)
- Parameterisation and control of the system by RESOL Service Center; Software is possible
- User-friendly operation by simple handling
- Housing in outstanding design and compact dimensions, easy to install

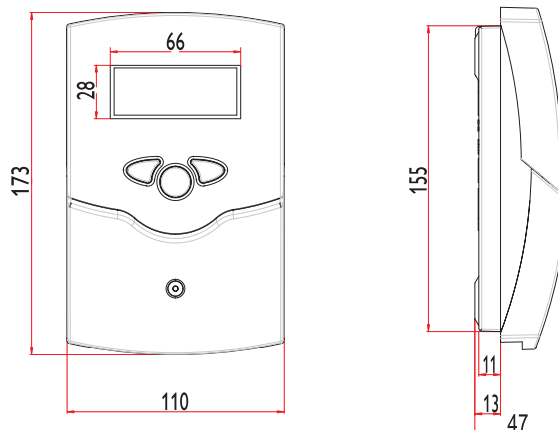


#### Scope of delivery:

- 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 condenser 4,7 nF

Additionally enclosed 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 in the front of the housing

**Functions:** Differential temperature controller with optional add-on system functions. Function control according to BAW-standards, operating hours counter for solar pump, tube collector special function, pump speed control, thermostat function and heat quantity balancing.

**Inputs:** for 4 temperature sensors Pt1000

**Outputs:** 2 semi-conductor relays

**Bus:** RESOL VBus®

**Power supply:**

220 ... 240V~

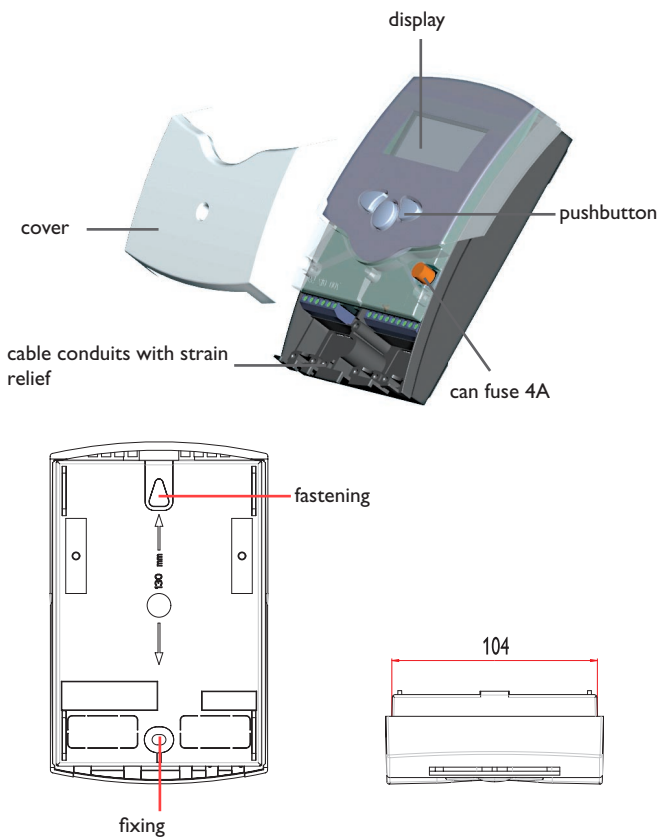
**Switching capacities:**

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

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

## 1. Installation

### 1.1 Mounting

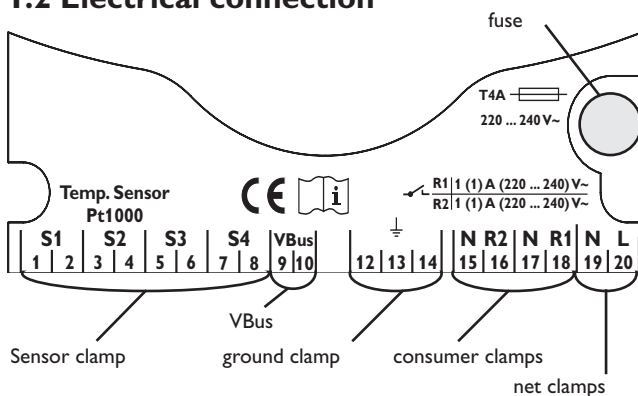


**Warning!**  
Switch-off power supply before opening the housing.

This unit must only be located internally. It is not suitable for installation in hazardous locations and should not be sited near to any electromagnetic field. The controller must additionally be equipped with an all-polar gap of at least 3 mm or with a gap according to the valid installation regulations, e.g. LS-switches or fuses. Please ensure sensor cables and ac power supply are separated.

1. Unscrew the cross-head screw of the cover and remove it from the housing.
2. Mark the upper fastening point on the subsurface and premount the enclosed dowel and screw.
3. Mount the housing to the upper fastening point and mark the lower fastening point on the subsurface (pitch of hole 130 mm), afterwards set the lower dowel.
4. Mount the housing to the top and fix it with the lower fastening screw.

### 1.2 Electrical connection



**Please note:**

The relays are semi-conductor-relays for pump speed control - they need a minimum load of 20 W (power consumption of the consumer) for faultless function. When connecting auxiliary relays, motor valves, etc. are individually to the condenser which is enclosed in the mounting material, must be connected parallelly to the relevant relay output. Attention: for connection of auxiliary relays or valves, the minimum pump speed must be adjusted to 100 %.



Dangerous voltage on contact!



Electrostatic discharge can lead to damages of electronic components!

The power supply to the controller must only be made by an external power supply switch (last step of installation!) and the line voltage must be 220 ... 240 Volt (50...60 Hz). Flexible lines are to be fixed at the housing by enclosed strain relief supports and screws.

The controller is equipped with 2 standard relays, to which the **consumers** 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

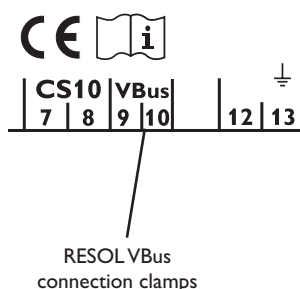
The **temperature sensors** (S1 up to S4) will be connected to the following terminals independently of the polarity:

- 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 **power supply** is effected to the clamps:

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

### 1.2.1 Data communication/ Bus

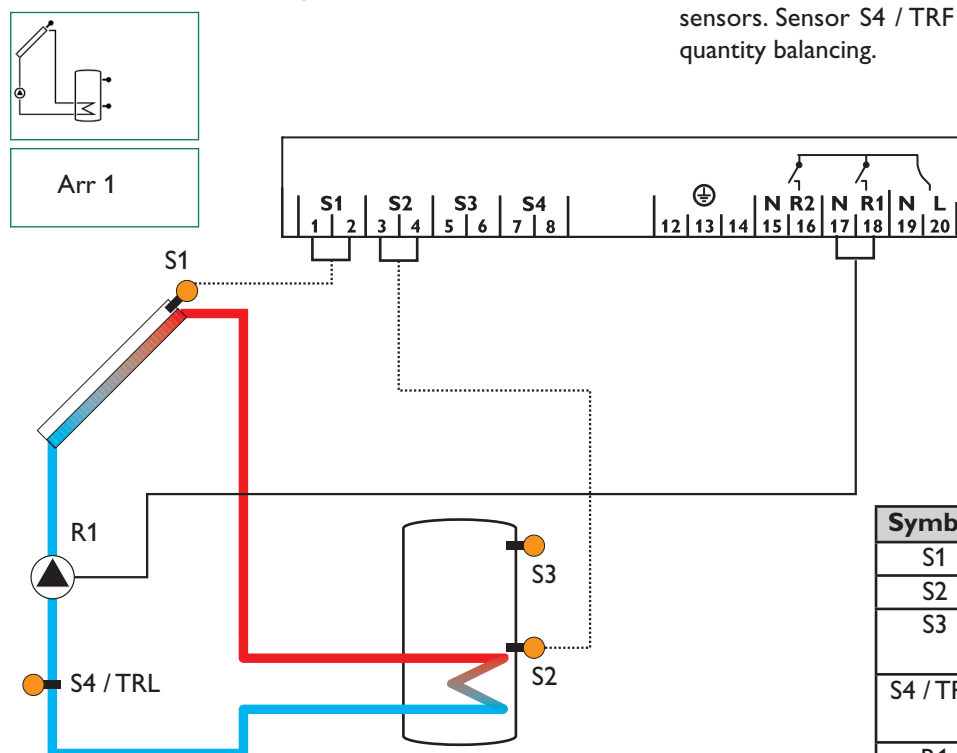


The controller comes with a RESOL VBus® for data communication and energy supply of external modules. The connection is effected with optional polarity at the clamps marked with „VBus“. Via this data Bus you can install one or more RESOL VBus® modules, e.g.:

- RESOL heat quant. measurement module WMZ-M1
- RESOL large display GA3
- RESOL Data logger, DL1
- RESOL Data teleindication, DFA2

Additionally, the controller can be connected to the PC with the help of a RESOL RS-COM adapter. With the **RESOL Service Center Software (RCS)** the controller parameters can be changed, measurements can be read out, processed and visualised. The software enables an easy function control and adjustment of the system. A light Version of the software can be downloaded from [www.resol.de](http://www.resol.de) for free.

### 1.2.2 Allocation of clamps for system 1

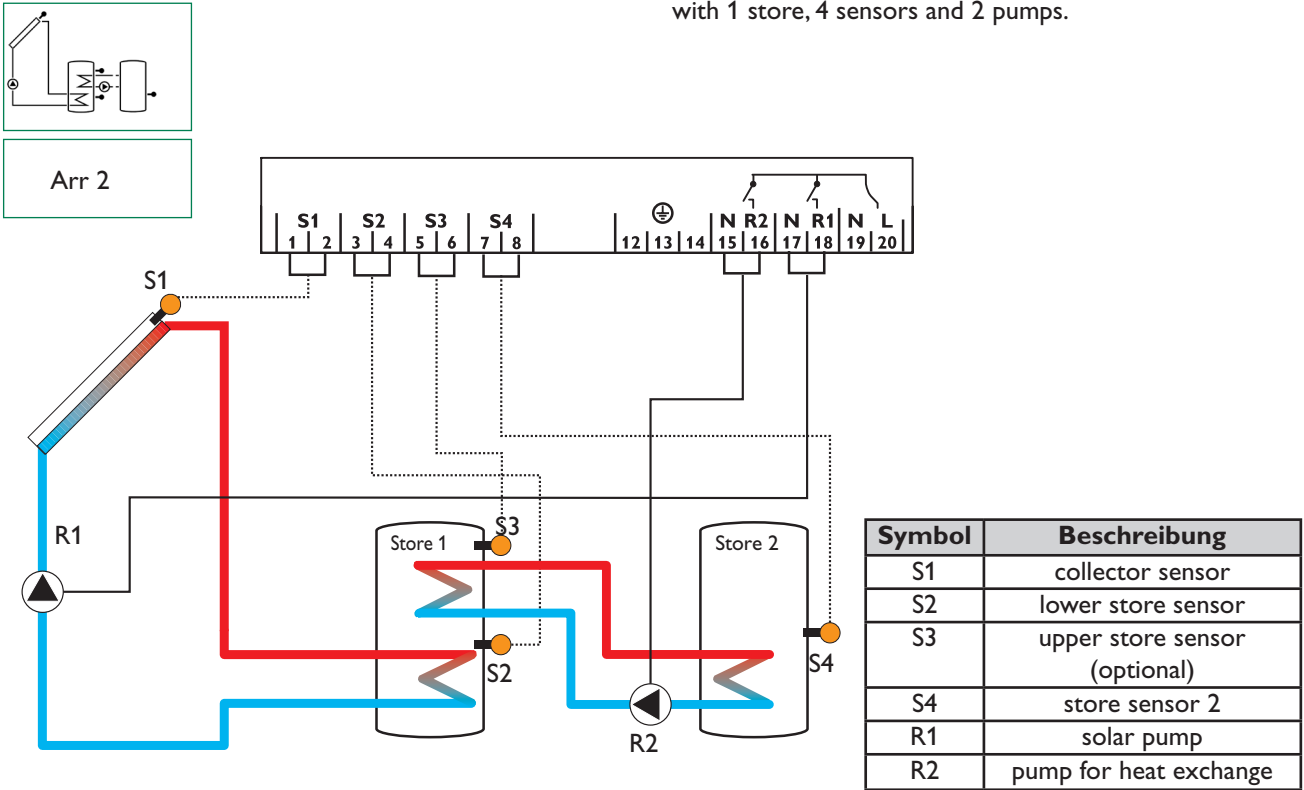


**Standard solar system** with 1 store, 1 pump and 3 sensors. Sensor S4 / TRF can optionally be used for heat quantity balancing.

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

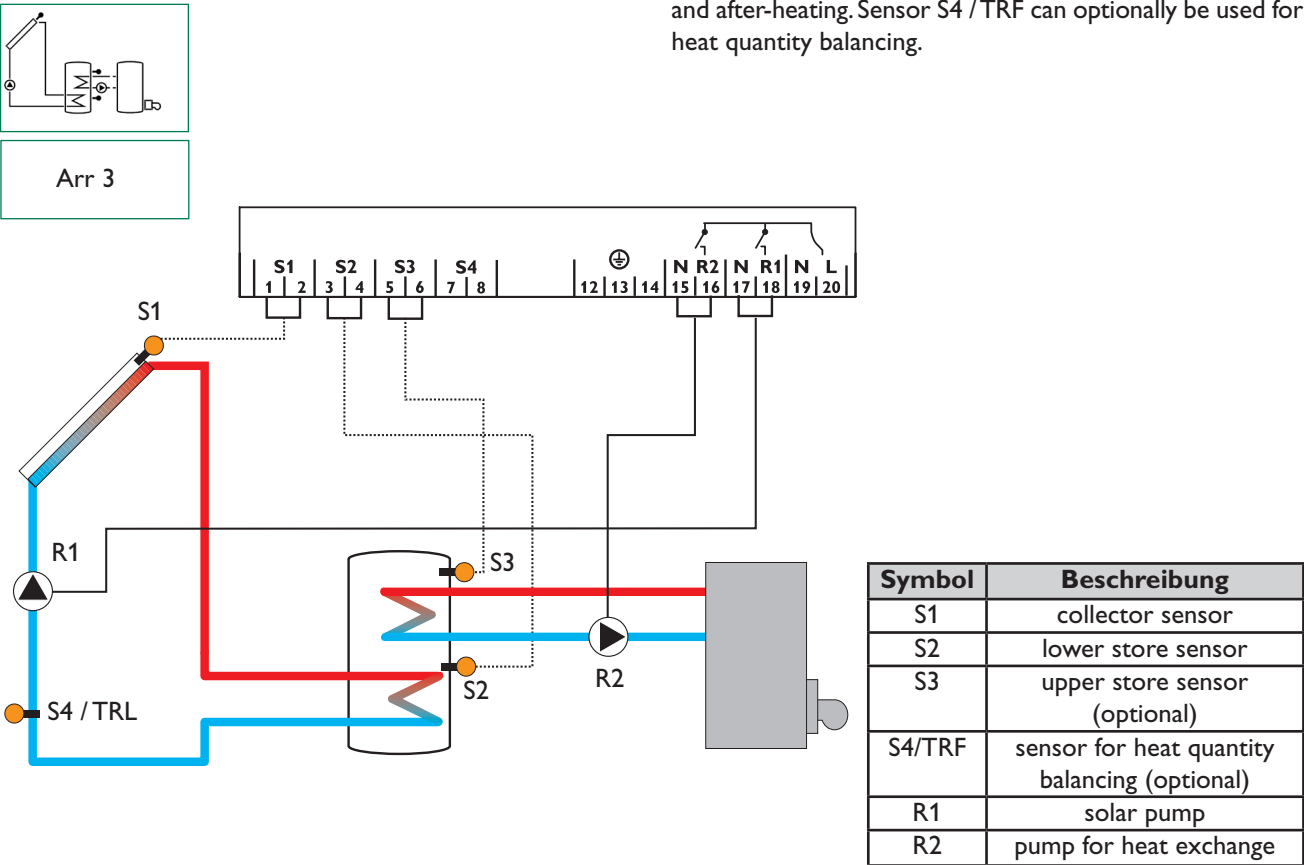
1.2.3 Allocation of clamps for system 2

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

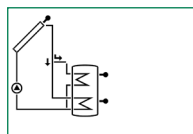


1.2.4 Allocation of clamps for system 3

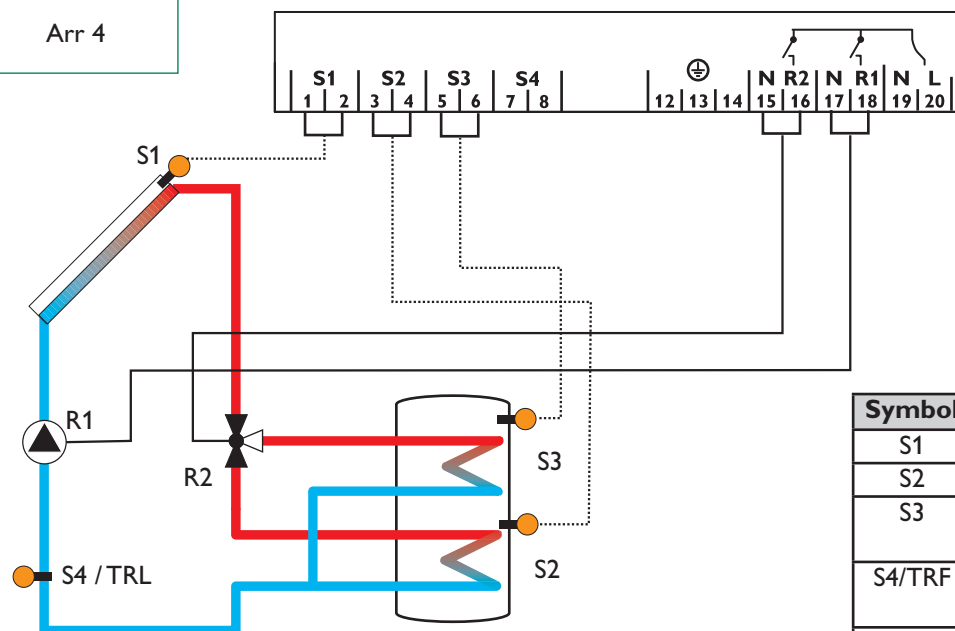
Solar system and after-heating with 1 store, 3 sensors and after-heating. Sensor S4 / TRF can optionally be used for heat quantity balancing.



## 1.2.5 Allocation of clamps for system 4



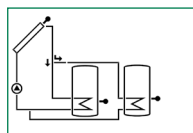
Arr 4



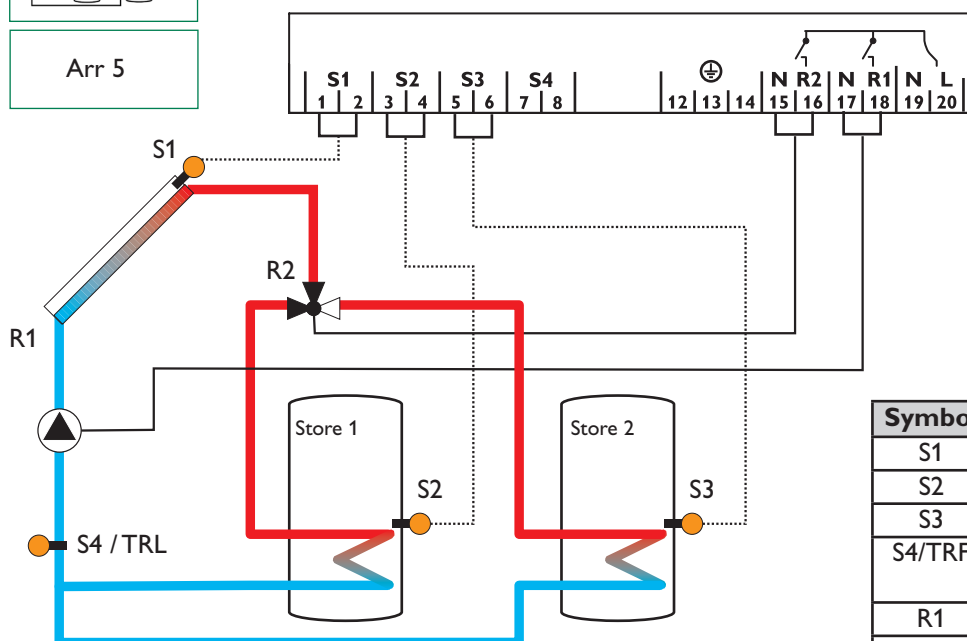
**Solar system and store charge in layers** with 1 store, 3 sensors, 1 solar pump and 3-way-valve for store charge in layers. Sensor S4 / TRF can optionally be used for heat quantity balancing.

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

## 1.2.6 Allocation of clamps for system 5



Arr 5

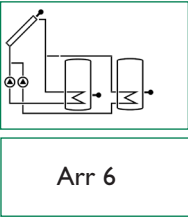


**2-store-solar system with valve logic** with 2 stores, 3 sensors, 1 solar pump and 1 3-way-valve. Sensor S4 / TRF can optionally be used for heat quantity balancing.

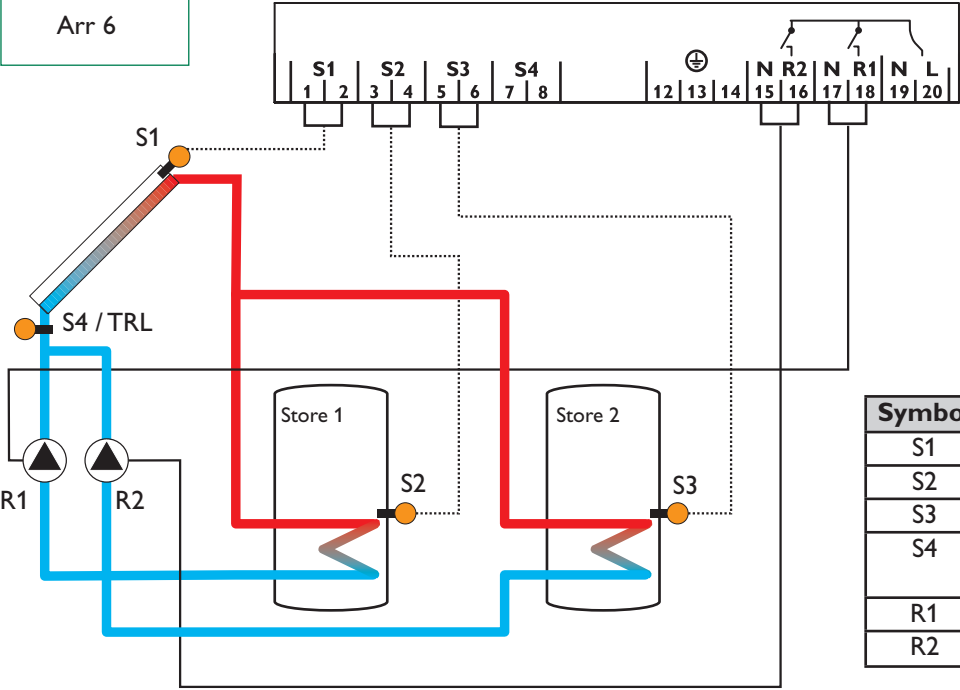
Symbol	Beschreibung
S1	collector sensor
S2	store sensor 1
S3	store sensor 2
S4/TRF	sensor for heat quantity balancing (optional)
R1	solar pump
R2	3-way-valve

1.2.6 Allocation of clamps for system 6

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



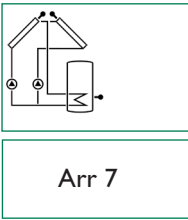
Arr 6



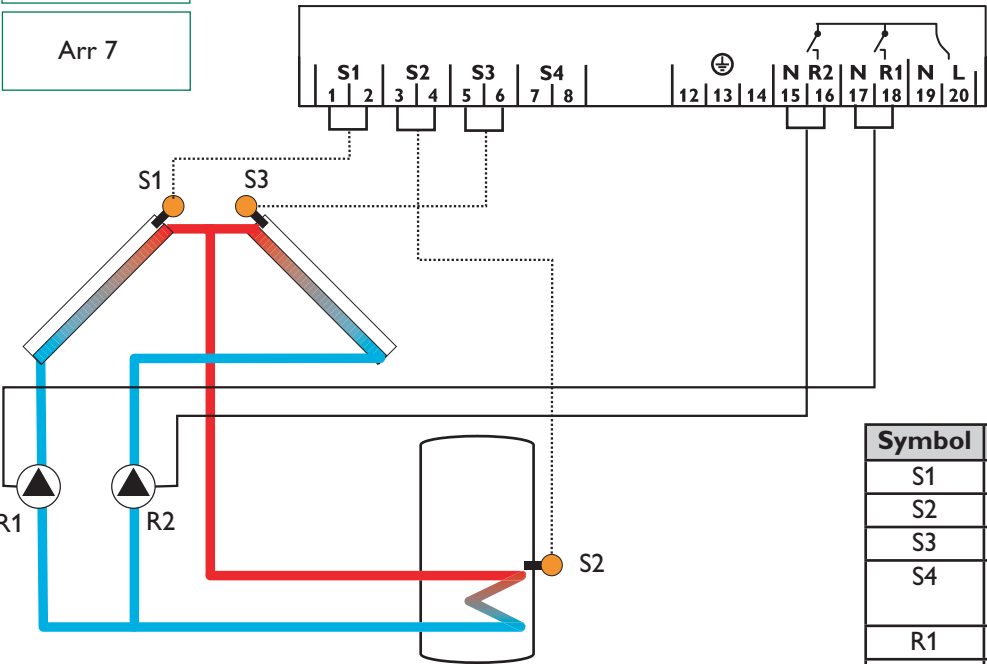
Symbol	Beschreibung
S1	collector sensor
S2	store sensor 1
S3	store sensor 2
S4	measuring sensor (optional)
R1	solar pump
R2	3-way-valve

1.2.7 Connection of system 7

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



Arr 7

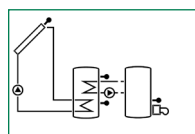


Symbol	Beschreibung
S1	collector sensor
S2	store sensor 1
S3	collector sensor 2
S4	measuring sensor (optional)
R1	solar pump collector 1
R2	solar pump collector 2

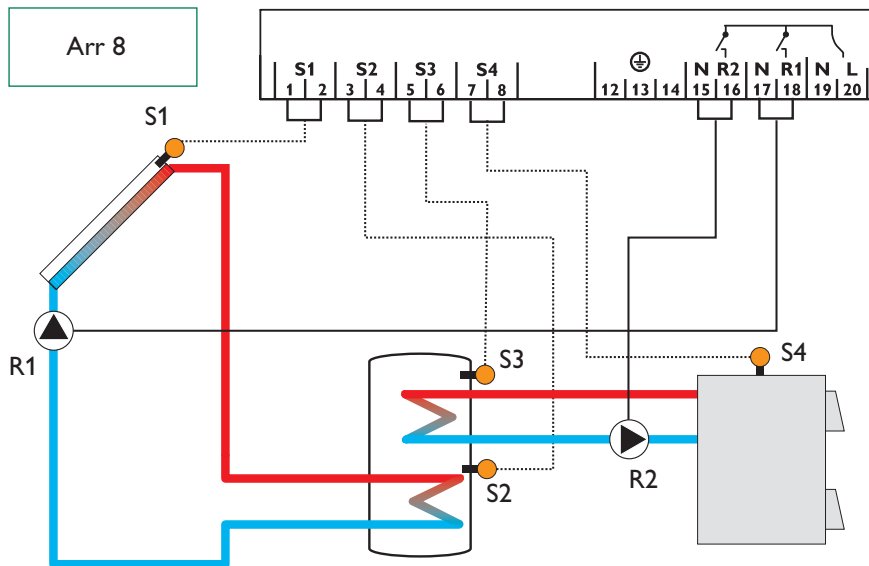


## 1.2.8 Connection of system 8

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



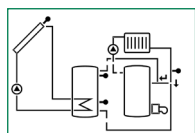
Arr 8



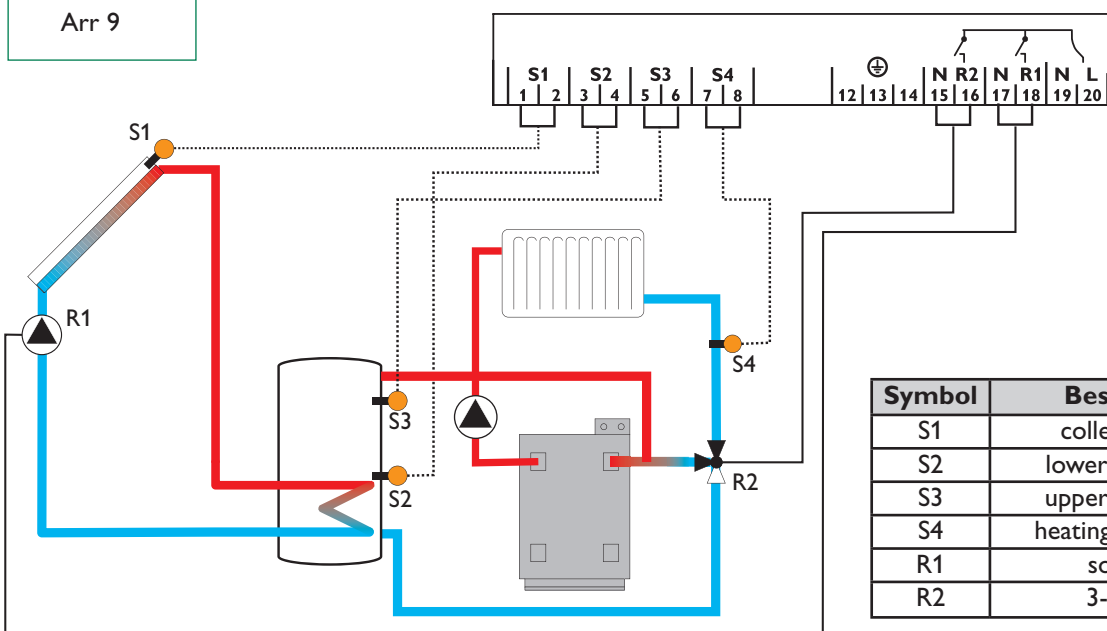
Symbol	Beschreibung
S1	collector sensor
S2	lower store sensor
S3	upper store sensor
S4	sensor for solid fuel boiler
R1	solar pump
R2	pump for solid hot fuel boiler

## 1.2.9 Connection of system 9

**Solar system and heating circuit reverse raising**  
with 1 store, 4 sensors, 1 solar pump and 1 3-way-valve for heating circuit reverse raising.



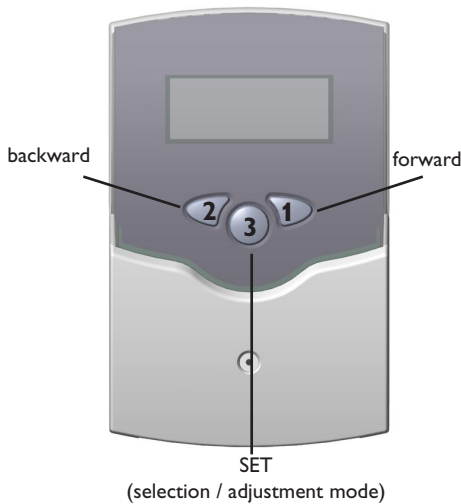
Arr 9



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

2. Opeartion and function

2.1 Pushbuttons for adjustment

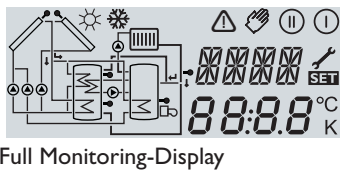


The controller is operated by 3 pushbuttons below the display. The forward-key (1) is used for scrolling forward through the indication menu or to increase the adjustment values. The backwards-key (2) is accordingly used for the reverse function.

For adjustment of last indication channel, keep button 1 pressed for 3 seconds. If an **adjustment value** is shown on the display, **SET** is indicated. In this case you can press the key „Set“ (3) in order to change into input mode.

Select a channel by keys 1 and 2  
Shortly press key 3, so that **SET** is blinking.  
Adjust the value by keys 1 and 2  
Shortly press key 3, so that **SET** permanently appears, the adjusted value is now saved.

2.2 System monitoring display



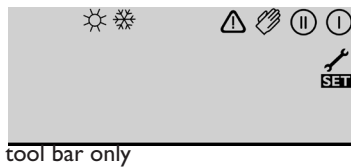
The system monitoring display consists of 3 blocks: **indication of the channel, tool bar** and **system screen** (active system scheme).

2.2.1 Channel indication



The **indication channel** consists of two lines. The upper line is an alphanumeric 16-segment indication in which mainly the channel names / menu items are shown. In the lower 7-segment indication, the channel values and the adjustment parameter are indicated.  
Temperatures and temperature differences are indicated in °C or K.

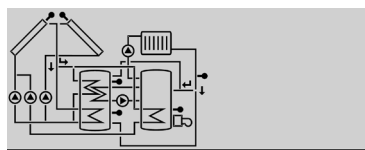
2.2.2 Tool bar



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

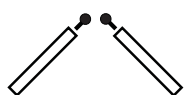
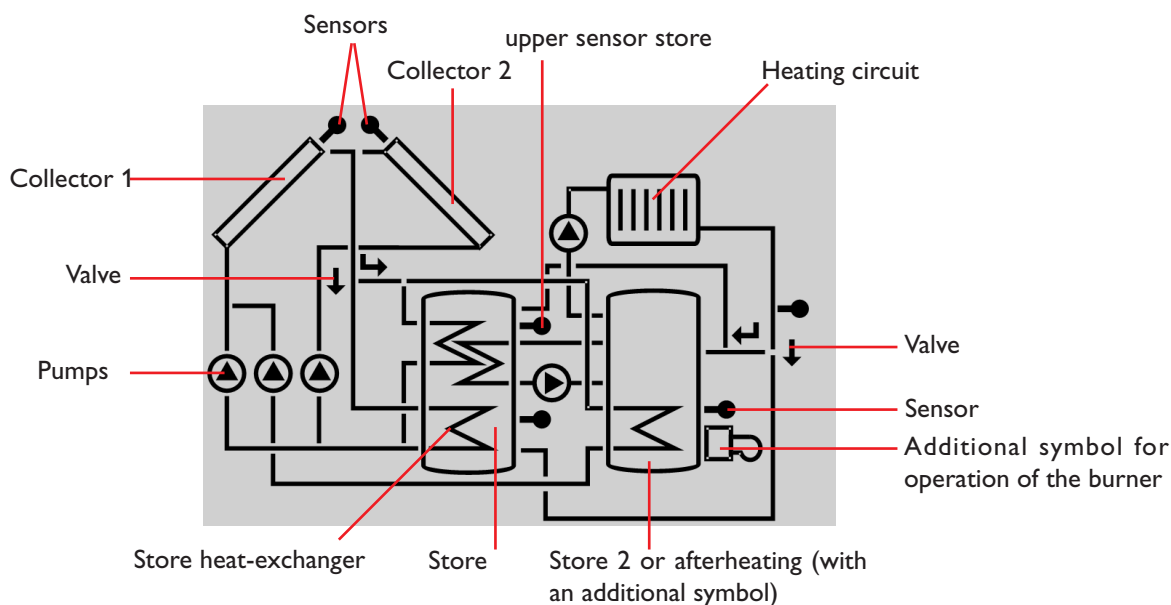
Symbol	normal	blinkend
ⓘ	relay 1 active	
ⓘ	relay 2 active	
☀	maximum store limitation active / maximum store temperature exceeded	collector cooling function active recoiling function active
❄	option antifreeze function active	collector minimum limitation active antifreeze function active
⚠		collector security shutdown active or store securtiy shut-down active
⚠ + 🔧		sensor defect
⚠ + 🖐		manual operation active
SET		SET-mode

### 2.2.3 System screen

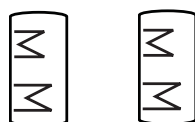


System Screen only

The system screen (active system scheme) shows the schemes selected on the controller. It 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-way-valve**

The flow direction or the current breaking capacity is always shown.



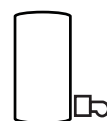
**Temperature sensor**



**Heating circuit**



**Pump**



**Afterheating**  
with burner symbol

## 2.3 Blinking codes

### 2.3.1 System screen blinking codes

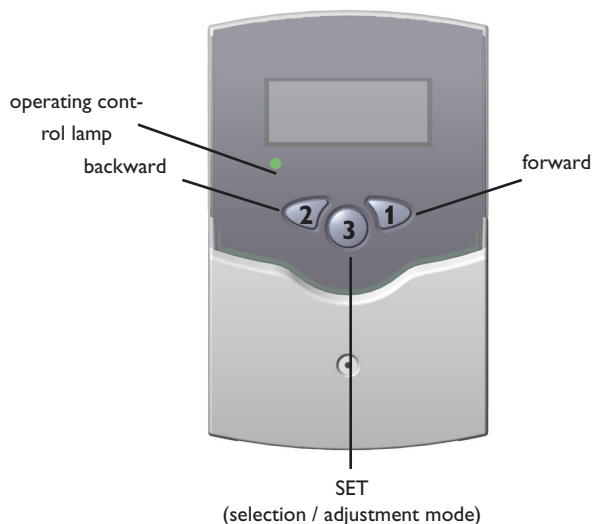
- Pumps are blinking during starting phase
- Sensors are blinking if the respective sensor-indication channel is selected.
- Sensors are quickly blinking in case of sensor defect.
- Burner symbol is blinking if after-heating is activated

### 2.3.2 LED blinking codes

- Constantly green: everything all right  
 Red/green blinking: initialisation phase  
 manual operation  
 Red blinking: sensor defect  
 (sensor symbol is quickly blinking)

### 3. Primary commissioning

For primary commissioning the system scheme has to be adjusted first



1. AC power supply must be activated at first. The controller passes an initialisation phase during which the operating control lamp is blinking red and green. After having finished the initialisation, the controller is in automatic operation with factory settings. The preadjusted system scheme is Arr 1.

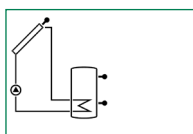
2. Clock time adjustment in channel TIME. By pressing the **SET** button once you can adjust hours, pressing it once again the minutes. The time can be adjusted by buttons 1 and 2 and saved by pressing the **SET** button.

3. - select adjustment channel Arr

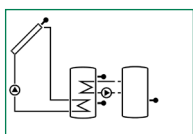
- change into **SET**-mode (see 2.1)

- adjustment are saved by pressing button **SET**

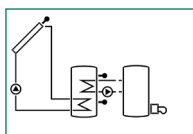
Now the controller is ready for operation and should enable an optimum operation of the solar system with the factory settings.



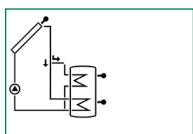
Arr 1



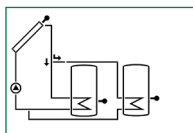
Arr 2



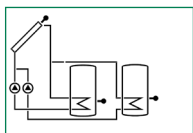
Arr 3



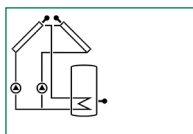
Arr 4



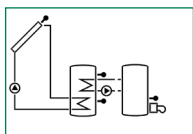
Arr 5



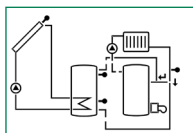
Arr 6



Arr 7



Arr 8



Arr 9

#### System survey:

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 charge in layers

Arr 5 : 2-store solar system with valve logic

Arr 6 : 2-store solar system with pump logic

Arr 7 : solar system with 2 collectors and 1 store

Arr 8 : solar system with after-heating by solid hot fuel boilers

Arr 9 : solar system with heating circuit reverse raising

## 4. Control parameter and indication channels

### 4.1 Channel-overview

#### Legend:

x

Corresponding channel is available.

x\*

Corresponding channel is available if the appropriate option is activated.

#### Please note:

S3 and S4 are only indicated in case of sensors connected

①

Corresponding channel is only available if the option heat quantity measurement is **activated** (OHQM).

②

Corresponding channel is only available if the option heat quantity measurement is **deactivated** (OHQM).

MEDT

The channel antifreeze content (MED%) is only shown if **the antifreeze is not water or Tyfocor LS / G-LS (MEDT 0 or 3)**. Adjustments concerning the antifreeze content will only make sense if the antifreeze is used in the solar circuit.

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 below	15
TST1		x			x	x				Temperature Store 1 below	15
TSTU		x	x	x				x	x	Temperature Store 1 at the top	15
TST2		x			x	x				Temperature Store 2 below	15
TFSB								x		Temperature solid hot fuel boiler	15
TRET									x	Temperature heating circuit	15
COL2							x			Temperature collector 2	15
S3	x									Temperature sensor 3	15
TRF	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	Increase	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				Increase 2	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	option collector cooling collector 1	18
OCX1							x			option collector cooling 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	option minimum limitation collector 1	18
OCN1							x			option minimum limitation 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	option antifreeze collector 1	18
OCF1							x			option antifreeze 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			option collector cooling collector 2	18
CMX2							x*			maximum temperature collector 2	18
OCN2							x			option minimum limitation collector 2	18
CMN2							x*			minimum temperature collector 2	18
OCF2							x			option antifreeze collector 2	18
CFR2							x*			antifreeze temperature collector 2	18
PRIO				x	x	x				priority	19
tST				x	x	x				stop time	19
tRUN				x	x	x				Circulation time	19
OREC	x	x	x	x	x	x	x	x	x	option recolling	19
OTC	x	x	x	x	x	x	x	x	x	option tube collector	19
DT3O		x						x		switch-on temperature difference 3	17
DT3F		x						x		switch-off temperature difference 3	17
DT3S		x						x		nominal temperature $\Delta T_3$	17
RIS3		x						x		Rise $\Delta T_3$	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					option WMZ	
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



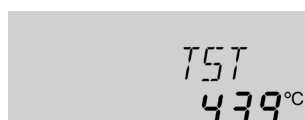
Shows the current collector temperature.

- 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



Shows the current store temperature.

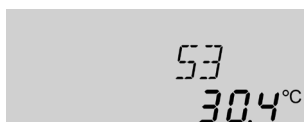
- TST : store temperature (1-store-system)
- TSTL : store temperature lower
- TSTU: store temperature above
- TST1 : temperature store 1
- TST2 : temperature store 2

#### 4.1.3 Indication of sensor 3 and sensor 4

##### S3, S4:

##### S3, S4:

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



Shows the current temperature of the corresponding additional sensor (without control function).

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

##### Please note:

S3 and S4 are only shown if the temperature sensors are connected.

#### 4.1.4 Indication of other temperatures

##### TFSB, TRET, TRF:

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



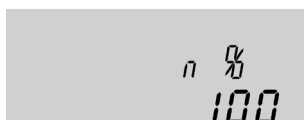
Shows the current temperature of the corresponding sensor.

- TFSB : temperature solid fuel boiler
- TRET : temperature heating reverse raising
- TRF : temperature return flow

#### 4.1.5 Indication of current pump speed

##### n %, n1 %, n2 %:

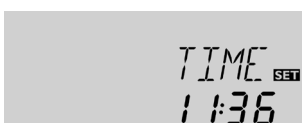
current pump speed  
Display range: 30...100 %



Shows the current pump speed of the corresponding pump.

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

#### 4.1.6 Time

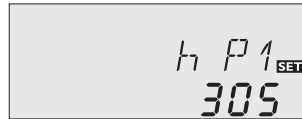


In this channel the current time is indicated.

By pressing button **SET** for 2 seconds the hours, by pressing it again the minutes are displayed blinking. The time can be set by 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  
Indication channel



The operating hours counter adds up the solar operating hours of the respective relay (**h P / h P1 / h P2**). Full hours are shown on the display.

After the operating hours are added up, they can be reset. As soon as one operating hours channel is selected, symbol **SET** is permanently shown on the display. The button SET (3) must be pressed for approx. 2 seconds in order to get back into the RESET-mode of the counter. The display-symbol **SET** is blinking and the operating hours will be set to 0. In order to finish the RESET-procedure, the button **SET** must be pressed in order to confirm the data.

In order to interrupt the RESET-procedure, don't press any button for about 5 seconds. The controller returns automatically into the indication mode.

#### 4.1.7 Heat quantity balancing

**OHQM:** Heat quantity measurement  
Adjustment range: OFF...ON  
Factory setting: OFF



A heat quantity balancing is possible for the basic systems (Arr) 1, 3, 4 and 5 in conjunction with a flowmeter. You just have to activate the option heat quantity balancing in channel **OHQM**.

**FMAX:** Volume flow in l/min  
Adjustment range 0...20 in steps of 0,1  
Factory setting 6,0



The volume flow readable at the flowmeter (l/min) must be adjusted in the channel **FMAX**. Antifreeze type and concentration of the heat transfer medium are indicated on channels **MEDT** and **MED%**.

**MEDT:** antifreeze  
Adjustment range 0...3  
Factory setting 1



##### Type of antifreeze:

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

**MED%:** Concentration of antifreeze in (Vol-) %  
MED% is blinded out by MEDT 0 and 3.  
Adjustment range 20...70  
Factory setting 45



**kWh/MWh:** Heat quantity in kWh / MWh  
Display channel



The heat quantity transported is measured by the indication of the volume flow and the reference sensor of feed flow S1 and return flow T-. It is shown in kWh-parts in the indication channel **kWh** and in MWh-parts in the indication channel **MWh**. The sum of both channels form the total heat output.

The heat quantity added up can be reset. As soon as one of the display channels of the heat quantity is selected, symbol **SET** is permanently shown on the display. The SET (3) button must be pressed for approx. 2 seconds in order to get back into the RESET-mode of the counter. The display-symbol **SET** is blinking and the value for heat quantity will be set to 0. In order to finish the RESET-procedure, the button **SET** must be pressed in order to confirm the data.

In order to interrupt the RESET-procedure, no button should be pressed for about 5 seconds. The controller returns automatically into the indication mode.

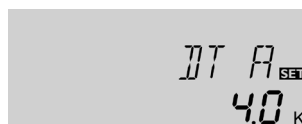


4.1.8  $\Delta T$ -regulation**DT E / DT1E / DT2E / DT3E:**

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

**DT A / DT1A / DT2A / DT3A:**

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



**Please note:** Switch-on temperature difference DO must be at least 1 K higher than the switch-off temperature-difference DF.

**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



First the controller works in the same way as a standard differential controller. If the switch-on difference (**DT E / DT1E / DT2E**) is reached, the pump is activated and after having received a start mpulse (10 s) a minimum pump speed (nMN = 30 %) is run. If the temperature difference reaches the set nominal value (**DT S / DT1S / DT2S / DT3S**), the pump speed is increased by one step (10%). If the difference is increased by 2 K (**ANS / ANS1 / ANS2 / ANS3**), the pump speed is increased by 10 % in each case until the maximum pump speed of 100 % is reached. The response of the controller can be adjusted by means of the parameter „rise“. If the adjusted switch-off temperature is underrun (**DT A / DT1A / DT2A**), the controller switches-off.

**DT E** and **DT S** are locked against each other. **DT S** has to be at least by 0,5 above **DT E**.

## 4.1.9 Store maximum temperature

**S MX / S1MX / S2MX:**

**S MX / S1MX / S2MX:**  
Maximum store temp.  
Adjustment range 2 ... 95 °C  
Factory setting 60 °C



If the adjusted maximum temperature is exceeded, a further loading of the store is stopped so that a damaging overheating can be avoided. If the maximum store temperature is exceeded, symbol ☀ is shown on the display.

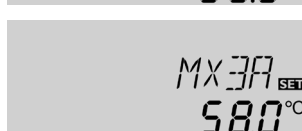
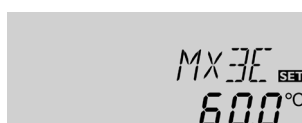
**Please note:** The controller is equipped with a security-switch-off of the store, which avoids a further loading of the store if 95 °C is reached at the store.

4.1.10  $\Delta T$ -controller (solid fuel boiler and heat exchange)

## Maximum temperature limitation

**MX3E / MX3A:**

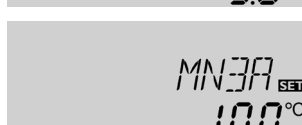
Maximum temperature limitation  
Adjustment range  
0,0 ... 95,0 °C  
Factory setting  
MX3E 60,0 °C  
MX3A 58,0 °C



## Minimum temperature limitation

**MN3E / MN3A:**

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



The controller is equipped with an independent temperature differential regulation for which minimum and maximum temperature limitations as well as corresponding switch-on and -off temperatures can be separately adjusted. Only possible for Arr = 2 and 8 (e.g. for solid fuel boilers or heat exchange regulation).

If the adjusted value **MX3E** is exceeded, relay 2 will be deactivated. When falling below **MX3A**, the relay will be switched on again.

Reference sensor:  
S3 by Arr 8 (TSTU)  
S4 by Arr 2 (TST2)

If the adjusted value **MN3E** underrun relay 2 will be deactivated. By falling below **MN3A**, the relay will be switched on again.

Reference sensor:  
S4 by Arr 8 (TFSB)  
S3 by Arr 2 (TSTU)

Both switch on- and switch off temperature differences **DT3E** and **DT3A** apply parallelly for the maximal- and minimal temperature limit.

#### 4.1.11 Collector temperature limitation Emergency shut down of the collector

##### EM / EM1 / EM2:

temperature limitation corrector

Adjustment range

110 ... 200 °C,

Factory setting 140 °C



If the adjusted collector limit temperature (**EM** / **EM1** / **EM2**) is exceeded the solar pump (R1/R2) is deactivated in order to avoid a damaging overheating of the solar components (collector emergency shutdown). The factory setting for the temperature limitation is 140 °C - it can be changed within the adjustment range of 110...200 °C. Symbol  $\triangle$  is shown on the display (blinking).

#### 4.1.12 System cooling

##### OCX / OCX1 / OCX2:

Option System cooling

Adjustment range OFF

... ON

Factory

setting OFF



##### CMX / CMX1 / CMX2:

collector maximum temperature

Adjustment range 100...

190 °C

Factory setting 120 °C



If the adjusted maximum store temperature is reached, the solar system switches-off. If now the collector temperature rises to the adjusted maximum collector temperature (**CMX** / **CMX1** / **CMX2**), the solar pump remains activated until this temperature limitation value is again underrun. The store temperature might continue to rise (subordinated 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 the collector temperature is by at least 5K lower than the store temperature, the solar system remains activated until the store is cooled down again by the collector and the tubes below the adjusted maximum temperature (**SMX** / **S1MX** / **S2MX**) (only by activated **OREC** function).

In case of an activated system  $\star$  is shown on the display (blinking). Due to the cooling function, the solar system can be kept operable for a longer period on hot summer days and a thermal release of the collector and the heat transfer medium is ensured as well.

#### 4.1.13 Option collector minimum limitation

##### OCN / OCN1 / OCN2: collector minimum limitation

OFF / ON

Factory setting OFF

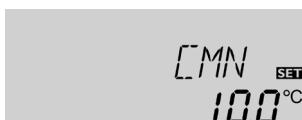


##### CMN / CMN1 / CMN2:

col. minimum temperature

Adjustment range 10 ... 90 °C

Factory setting 10 °C



The minimum collector temperature is a minimum switching temperature which must be exceeded so that the solar pump (R1/R2) is switched-on. The minimum temperature shall avoid a steady starting-up of the solar pump (or solid fuel boiler charging pumps) for low collector temperatures. If the minimum temperature is underrun,  $\star$  is shown on the display (blinking).

#### 4.1.14 Option antifreeze

##### OCF / OCF1 / OCF2:

antifreeze function

Adjustment range OFF / ON

Factory setting OFF



##### CFR / CFR1 / CFR2:

antifreeze temperature

Adjustment range -10 ... 10 °C

Factory setting 4,0 °C



The antifreeze function activates the loading circuit between collector and store if the adjusted antifreeze function is underrun in order to protect the medium against freezing or „thickening“. If the adjusted frost protection temperature is exceeded by 1 °C, the loading circuit will be deactivated.

##### Please note:

As there is only a limited heat quantity of the store available for this function, the antifreeze function should only be used in regions with few days of temperatures around freezing point.

#### 4.1.15 Oscillating charge

Respective adjustment values:

priority [PRIO]

oscillating break-time [tSP]

oscillating charge-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.

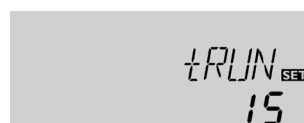
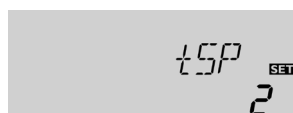
Die DeltaSol® BS Plus priority logic

priority:



The above-mentioned options and parameters only have a meaning in multi-store systems (system Arr = 4, 5, 6). If **priority 0** is adjusted, the stores which show a temperature difference to wards the collector are loaded in numerical order (store 1 or store 2). Usually only one store is loaded at this point. For Arr= 5, 6 parallel loading is also possible.

Oscillating break time / oscillating charge time / collector rising temperature



The controller checks the stores regarding loading facilities (switch-on difference). If the priority store cannot be loaded, the lower-ranking store is checked. If the lower-ranking store can be charged this is effected by the so-called „oscilating charge time“ (**tRUN**).When the oscillating charge time is over the loading is stopped. The controller regulates the increase of the collector temperature. If it increases by the collector rising temperature ( $\Delta T_{Col}$  2 K, fixed software value), the expired break time is again reset to zero and the oscillating break time starts again. If the switch-on conditions of the priority store are not reached, the loading of the lower-ranking store is continued. If the priority switch has reached its maximum temperature, the oscillating charge is not effected.

#### 4.1.16 Recooling function

**OREC:**

option recooling

adjustment range

OFF...ON

Factory setting: OFF



If the adjustem maximum store temperaute (**S MX, S1MX, S2MX**) is reached, the solar pump remains activated in order to avoid an overheating of the collector. The store temperature might continue to increase but only up to 95 °C (emergency shutdown of the store).

In the evening the solar system continues running until the store is cooled down to the adjusted maximum store temperature via collector and pipes.

#### 4.1.17 Tube collector special function

**OTC:**

Tube collector special function

Adjustment range:

OFF...ON

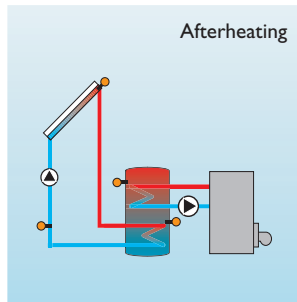
Factory setting: OFF



If the controller measures an increase of 2 K compared to the collector temperature stored at last, the solar pump is switched-on to 100 % for about 30 seconds. After the expiration of the solar pump runtime the current collector temperature is stored as a new reference value. If the measured temperature (new reference value) is again exceeded by 2 K, the solar pump again switches-on for 30 seconds. If the switch-on difference between collector and store is again exceeded during the runtime of the solar pump or the standstill of the system, the controller automatically switches over to solar charging.

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

## 4.1.18 Thermostat function (Arr = 3)



AH O SET  
40.0 °C

**H O:**

Thermostat-switch-on temperature

Adjustment range:

0,0 ... 95,0 °C

Factory setting: 40,0 °C

t1 E SET  
00:00

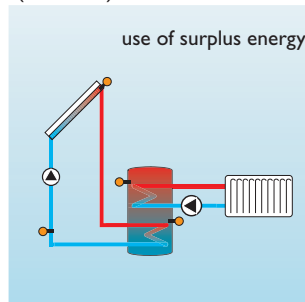
**t1 E, t2 E, t3 E:**

Thermostat switch-on time

Adjustment range:

00:00 ... 23:45

Factory setting: 00:00



AH F SET  
45.0 °C

**AH F:**

Thermostat-switch-off temperature

Adjustment range:

0,0 ... 95,0 °C

Factory setting: 45,0 °C

t1 A SET  
00:00

**t1 A, t2 A, t3 A:**

Thermostat switch-off time

Adjustment range:

00:00 ... 23:45

Factory setting: 00:00

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

- **AH O < AH F**  
the thermostat function is used for after-heating
- **AH O > AH F**  
the thermostat function is used for use of surplus energy

Symbol ② will be shown on the display if the second relay output is activated.

In order to block the thermostat function for a certain time span, there are 3 time frames t1 ...t3. If the function should be activated only between e.g. 6:00 and 9:00, 6:00 should be set for **t1 E** and 9:00 should be set for **t1 A**. The factory setting for the thermostat function is in continuous operation.

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

## 4.1.19 Pump speed control

**nMN, n1MN, n2MN:**

Pump speed control

Adjustment range:

30 ... 100

Factory setting: 30

nMN SET  
30

A relative minimum pump speed is specified for pumps connected at the outputs R1 and R2 via adjustment channels **nMN, n1MN** and **n2MN**.

**Attention:**

**When using consumers (e.g. valves) which are not pump speed controlled, the value must be set to 100 % in order to deactivate the pump speed control.**

## 4.1.20 4.1.20 Operating mode

**HND1/HND2:**

Operating mode

Adjustment range:

OFF/AUTO, ON

Factory setting: AUTO

HND1 SET  
Auto

HND2 SET  
Auto

For control- and service works the operating mode of the controller can be manually adjusted by selecting the adjustment value MM in which the following adjustments can be made:

• **HND1 / HND2**

Operating mode

OFF : relay off ⚠ (blinking) + 🖐

AUTO : relay in automatic operation

ON : relay on ⚠ (blinking) + 🖐

## 4.1.21 Language (LG)

**LANG:**

Adjustment of language

Adjustment range: dE, En

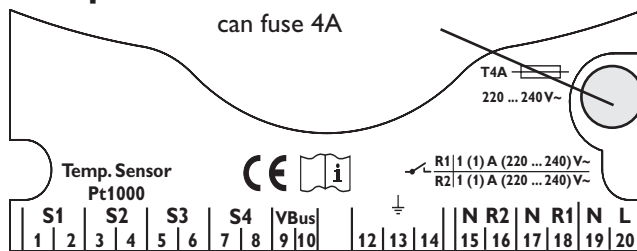
Factory setting: En

LANG SET  
En

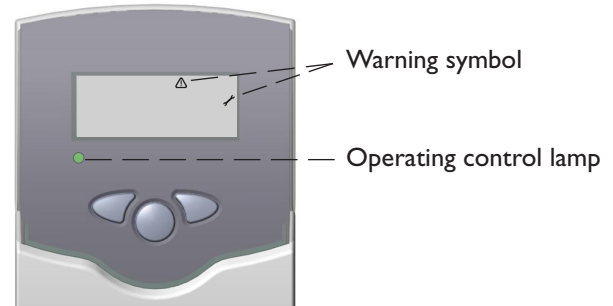
The menu language can be adjusted in this channel.

- dE : German
- En : English

## 5. Tips for fault localization



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



Operating control lamp is blinking red. Symbol and symbol appear on the display.

Line break. Check the line.

888.8

- 88.8

Line break. Check the line.

Short-circuit. Check the line.

Pt1000-temperature sensors pinched off can be checked with an ohmmeter. In the following 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  
Pt1000 Sensors

Operating control lamp is permanently extinct .

If the control lam is extinct the power supply of the controller has to be checkedThe power supply of the controller has to be checked.

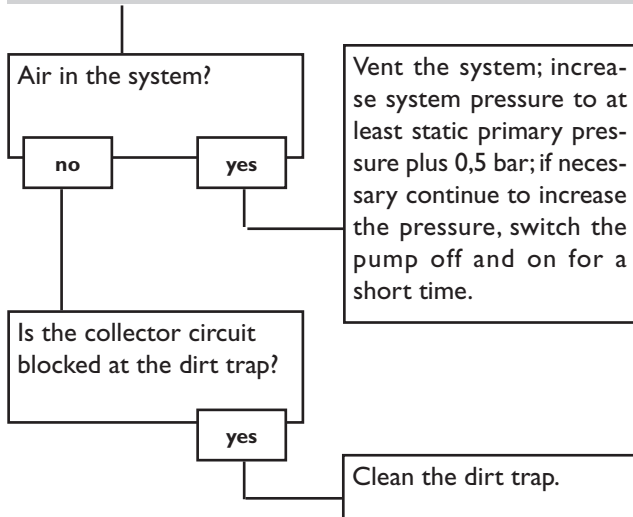
no

o.k.

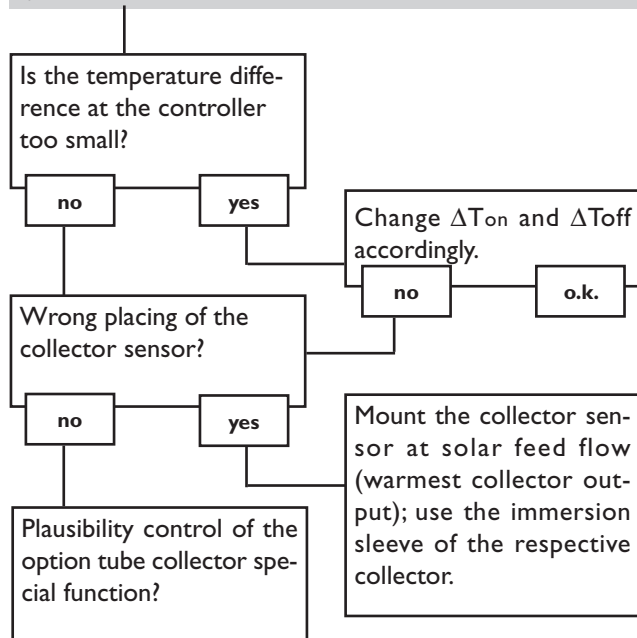
The can fuse of the controller is defective. It is accessible after having removed the cover and can then be replaced (a spare fuse accessory bag).

## 5.1 Various

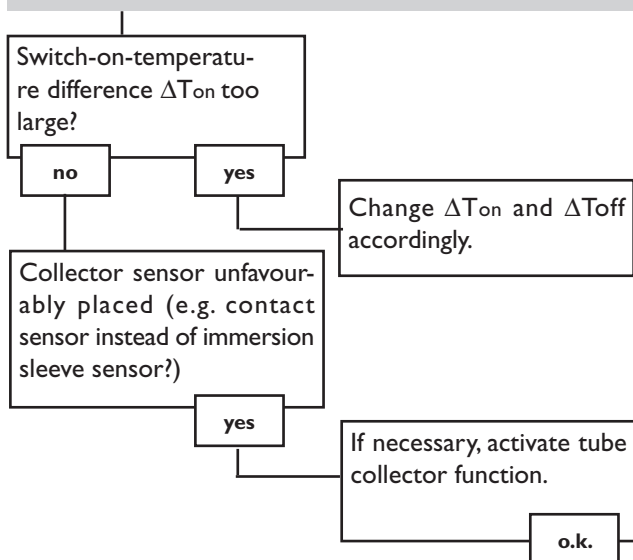
Pump is overheated, but no heat transfer from collector to the store, feed flow and return flow are equally warm, perhaps also „bubble“ in the lines.



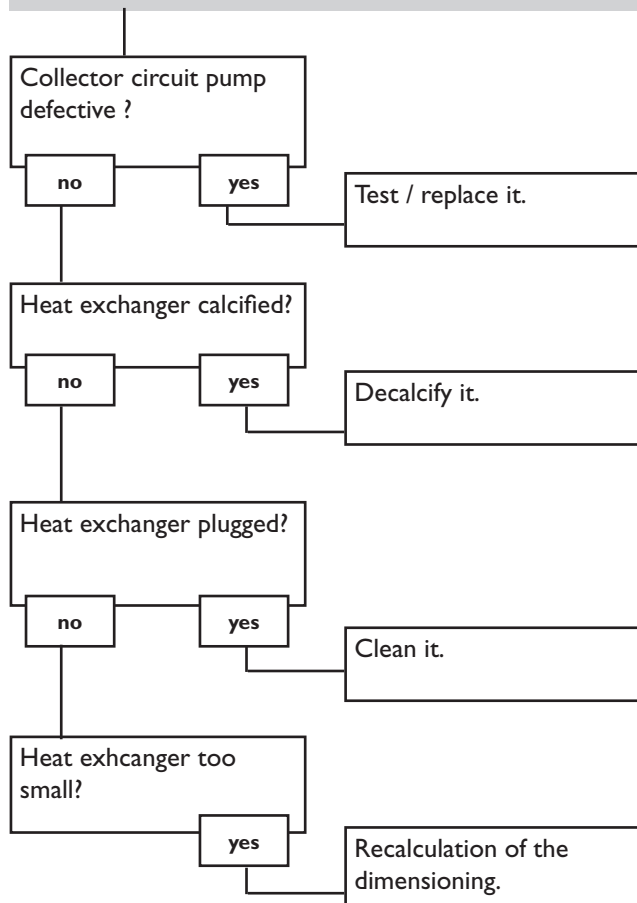
Pump starts for a short moment, switches-off, switches-on again, etc. („controller after-running“).



Pump starts up very late and stops working soon.



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



Stores are cooled during the night.

Does collector circuit pump run during the night?

no

yes

Check the controller functions.

Collector temperature is at night higher than ambient temperature.

no

yes

Check the return flow preventer in feed flow and return flow with regard to the functional efficiency.

Is store insulation sufficient?

yes

no

Intensify the insulation.

Is the insulation close enough to the store?

yes

no

Replace or intensify the insulation.

Are the store connections insulated?

yes

no

Insulate connections.

Warm water outflow upwards?

no

yes

Change connection and let the water flow side-wards or through a siphon (downwards elbow pipe); less store losses now?

no

yes

o.k.

Does warm water circulation run for a very long time?

no

yes

Use the circulation pump with timer and switch-off thermostat (energy efficient circulation)

Switch-off the circulation pump and the blocking valve for 1 night; less store losses?

yes

no

Check the pumps of the after-heating circuit according to nightly run and defective return flow preventer; problem solved?

no

a

Control the return flow preventer in warm water circulation- o.k.?

yes

no

The gravitation circulation in the circulation line is too strong; insert a stronger return flow preventer or an electric 2-way valve behind the circulation pump; the 2-way valve is open in pump operation, otherwise it is closed, connect-pump and 2-way

b

Please also check further pumps connected to the solar store.

Clean or replace it.

valve parallelly; activate the circulation again! The speed control has to be deactivated again!

The solar circuit pump does not work although the collector is obviously warmer than the store.

Is the control LED illuminated?

yes

no

There is no current; check fuses / replace them and check power supply.

Does the pump start up in manual operation?

no

yes

The adjusted temperature difference for starting the pump is too high; choose a more reasonable value.

Is the current of the pump released by the controller?

no

yes

Is the pump stuck?

yes

Put the pump into operation by means of a screwdriver; is it passable now?

no

Is the pump defective - replace it.

Are the fuses of the controller o.k.?

no

yes

replace the fuses

controller seems to be defective - replace it.

a

b



## 6. Accessory

### Sensors

Our product range comprises high-precision platin temperature sensors, flatscrew sensors, ambient temperature sensors, indoor temperature sensors, cylindrical clip-on sensors and irradiation sensors, also to be used as complete sensors with sensor pocket.



### Overvoltage protection

We highly recommend to install the RESOL overvoltage protection in order to avoid overvoltage damages at the collector (e.g. by lightning).



### Flowmeter

In order to effect a heat quantity balancing, you need a flowmeter for measuring the volume flow in your system.



### RS-COM Adapter

By means of a RS-COM Adapters the controller can be connected to a PC.



### RESOL Service Center Software

The controller can be visualized and configured comfortably by PC with the RESOL Service Center Software.

A light version of the software can be downloaded from [www.resol.de](http://www.resol.de) for free.

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