RESOL DeltaSol® BS/2 (Version 2)

Mounting

Connection

Application examples

Operation

Troubleshooting

Thank you for buying this RESOL product.
Read this manual carefully to get the best perfomance from this unit.
Please keep this manual carefully.

DeltaSol® BS/2

DeltaSol® BS/2

Contents

Safety advice

Please pay attention to:

- safety advice in order to avoid danger and damage to people and property.

- the valid local standards, regulations and directives!

Description of symbols

WARNING!	Warnings are indicated with a warning triangle!
⚠️	They contain information on how to avoid the danger described.

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

WARNING means that injury, possibly life-threatening injury, can occur.

ATTENTION means that damage to the appliance can occur.

ℹ️ Note
Notes are indicated with an information symbol.

➔ Arrows indicate instruction steps that should be carried out.

Disposal

Dispose of the packaging in an environmentally sound manner.

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

Target group

These instructions are exclusively addressed to authorised skilled personnel.

Only qualified electricians should carry out electrical works.

Initial installation must be effected by qualified personnel named by the manufacturer.

Information about the product

Proper usage

The solar controller is designed for use in solar thermal and heating systems in compliance with the technical data specified in these instructions.
Improper use excludes all liability claims.

CE-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.

CE

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

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

**Subject to technical change. Errors excepted.**

DeltaSol® BS/2

Overview

- **System-Monitoring-Display**
- **Up to 4 Pt1000 temperature sensors**
- **Semiconductor relay for pump speed control**
- **Heat quantity measurement**
- **VBus®**
- **Function control**
- **Control of the system by ServiceCenter software possible**
- **User-friendly operation**
- **Housing with outstanding design**
- **Extra-low power consumption**
- **HE pump control via adapter**

Included with the BS/2:

1 × DeltaSol® BS/2

1 × accessory bag
    1 × spare fuse T4A
    2 × screws and wall plugs
    4 × strain relief and screws
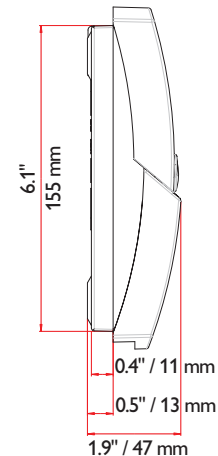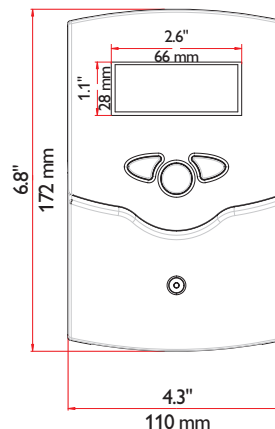
Technical data

Housing: plastic, PC-ABS and PMMA

Protection type: IP 20 / EN 60529

Ambient temp.:
0 ... 40 °C
[32 ... 104 °F]

Size:
172 × 110 × 47 mm
6.8" × 4.3" × 1.9"

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 push buttons at the front of the housing

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

Inputs:
for 4 Pt1000 temperature sensors

Output: 1 semiconductor relay

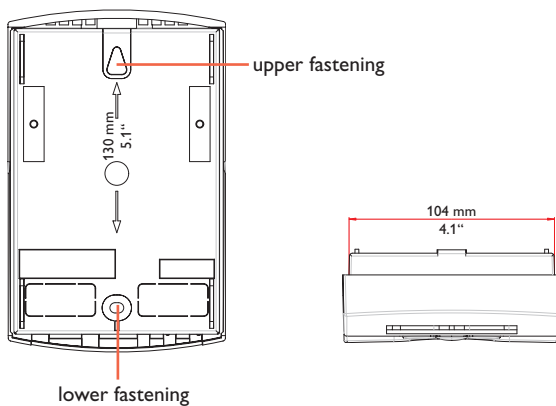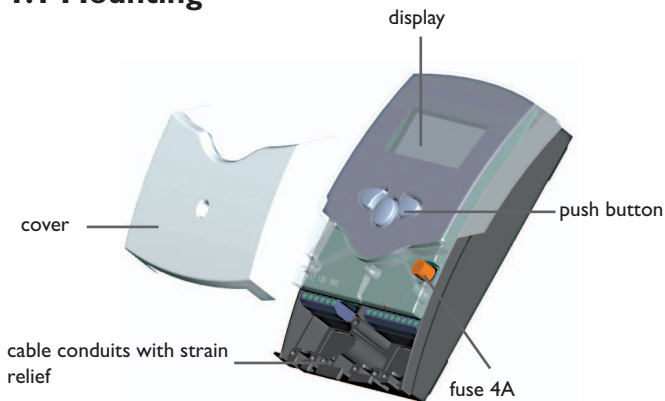**Bus:** VBus®

Power supply: 100 ... 240 V~

Standby power consumption: < 1 W

Switching capacities:
R1: 1 (1) A 100 ... 240 V~ (semiconductor relay)

1. Installation
1.1 Mounting

display
cover
push button
cable conduits with strain relief
fuse 4A

upper fastening
130 mm 5.1"
104 mm 4.1"
lower fastening

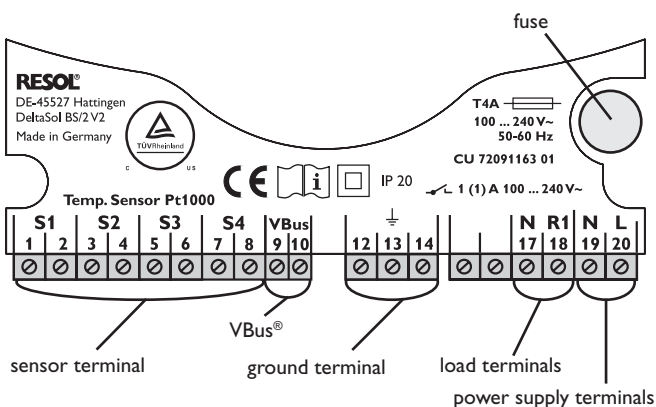| WARNING!	Electric shock!
⚠	**Opening the housing will expose live parts!** ➔ **Switch off power supply and disconnect the device from power supply before opening the housing!**

The unit must only be installed
- in a dry interior location
- in a non-hazardous location
- away from electromagnetic fields

The controller must additionally be supplied from a double-pole switch with contact gap of at least 3 mm [0.12"].

Route sensor cables and power supply cables separately.

➔ Unscrew the cross-head screw from the cover and remove it along with the cover from the housing

➔ Mark the upper fastening point on the wall and drill

➔ Fasten the enclosed wall plug and screw leaving the head protruding

➔ Hang the housing from the upper fastening point and mark the lower fastening point through the hole in the terminal box (centers 130 mm [5.1"])

➔ Drill and insert the lower wall plug

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

➔ Complete wiring connections in accordance with terminal allocations, see chap. 1.2 "Electrical connection"

➔ Place the cover back onto the housing

➔ Fasten the cover by means of the cross-head screw

1.2 Electrical connection

fuse
RESOL®
DE-45527 Hattingen
DeltaSol BS/2 V2
Made in Germany
TÜVRheinland
T4A 100 ... 240 V~ 50-60 Hz
CU 72091163 01
CE
IP 20
1 (1) A 100 ... 240 V~
Temp. Sensor Pt1000
S1 | S2 | S3 | S4 | VBus | | | N | R1 | N | L
1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 13 | 14 | 17 | 18 | 19 | 20
VBus®
sensor terminal
ground terminal
load terminals
power supply terminals

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

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

Connecting the device to the mains supply must always be the last step of the installation!

The power supply to the controller must be carried out via an external power switch (last step!). The supply voltage must be 100 ... 240 V~ (50 ... 60 Hz). Flexible cables must be attached to the housing with the enclosed strain relief and the corresponding screws.

R1 1 (1) A (100 ... 240) V~

12	13	14		N	R1	N	L
				17	18	19	20

Grounding and load terminals

**Temp. Sensor
Pt1000**

S1		S2		S3		S4	
1	2	3	4	5	6	7	8

Sensor terminals S1 ... S4

The controller is equipped with a semiconductor relay, to which a **load** such as a pump, a valve etc. can be connected:

- Relay 1
  18 = conductor R1
  17 = neutral conductor N
  13 = ground conductor

The **mains supply** is to be carried out at the terminals:

19 = neutral conductor N
20 = conductor L
12 = ground terminal

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

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

All Pt1000 temperature sensors are equipped with a platinum measuring element in their tip. The electrical resistance of the measuring element changes in relation to the temperature (see table in chap. 5).

The difference between **FKP** and **FRP** type sensors only lies in the cable insulation material. The insulation material of FKP type sensor cables resists a higher temperature, so that FKP type sensors should be used as collector sensors. FRP type sensors are best used as reference sensors in stores or pipes.

1.3 Data communication/ Bus

S4		VBus				
7	8	9	10		12	13

VBus®
connection terminals

The controller is equipped 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, such as

- GA3 Large Display, SD3 Smart Display
- DL2 Datalogger
- VBus®/USB or VBus®/LAN interface adapter
- VBus®/PWM interface adapter
- AM1 Alarm module
- WMZ calorimeter module

By means of a DL2 datalogger or an interface adapter, the controller can be connected to a PC or a computer network. With the RESOL ServiceCenter Software (RSC) the controller measurements can be read out, processed and visualised. The software allows easy function control of the system.

1.4 Terminal allocation

The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference (DT O), the solar pump will be operated by R1, and the store will be loaded until the switch-off temperature difference (DT F) or the maximum store temperature (S MX) is reached.

Sensors S3 and S4 can optionally be connected for measurement purposes. S3 can optionally be used as reference sensor for the store emergency shutdown option (OSEM). If heat quantity measurement (OHQM) is activated, sensor S4 has to be connected as return sensor.

exemplary Drainback system layout
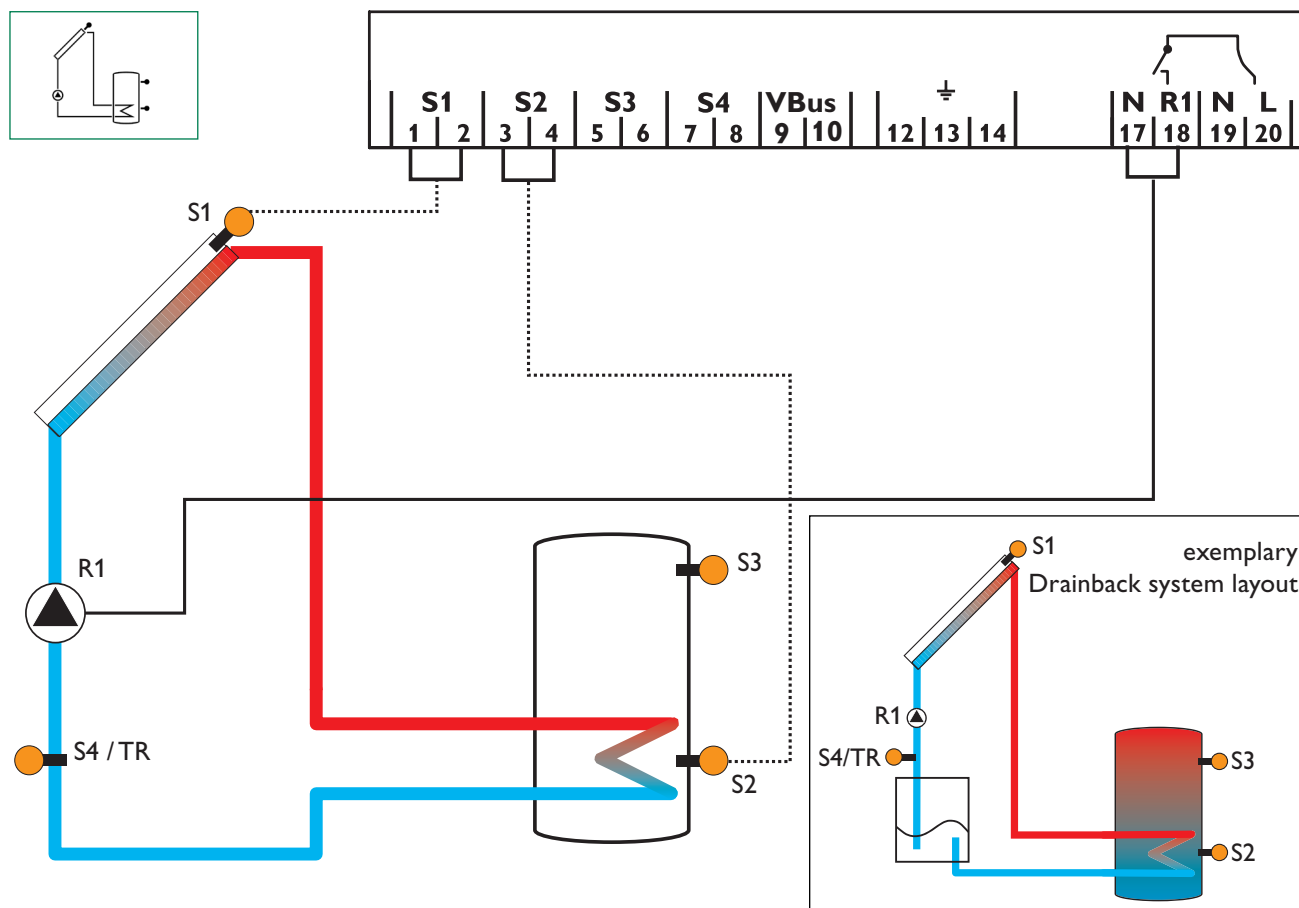
Display Channels				
Channel		Description	Terminal	Page
INIT	x*	ODB initialisation active	-	12
FLL	x*	ODB filling time active	-	12
STAB	x*	ODB stabilisation in progress	-	12
COL	x	Temperature collector	S1	12
TST	x	Temperature store	S2	12
S3	x	Temperature sensor 3	S3	12
TSTT	x*	Temperature store at the top	S3	12
S4	x	Temperature sensor 4	S4	12
TR	x*	Temperature return sensor	S4	12
n %	x	Pump speed R1	R1	13
hP	x	Operating hours R1	R1	13
kWh	x*	Heat quantity kWh	-	13
MWh	x*	Heat quantity MWh	-	13

Adjustment Channels

Channel		Description	Factory setting	Page
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	14
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	14
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	14
RIS	x	Rise control	2 K [4 °Ra]	14
nMN	x	Minimum pump speed	30 %	14
S MX	x	Maximum store temperature	60 °C [140 °F]	15
OSEM	x	Option store emergency shutdown	OFF	15
EM	x	Emergency temperature collector	130 °C [270 °F]	15
		Emergency temperature collector if ODB is activated:	95 °C [200 °F]	15
OCC	x	Option collector cooling	OFF	16
CMX	x*	Maximum collector temperature	110 °C [230 °F]	16
OSYC	x	Option system cooling	OFF	16
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	16
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	16
OSTC	x	Option store cooling	OFF	17
OHOL	x*	Option holiday cooling	OFF	17
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	17
OCN	x	Option minimum limitation	OFF	17
CMN	x*	Minimum collector temperature	10 °C [50 °F]	17
OCF	x	Option antifreeze	OFF	17
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	17
OHQM	x	Option heat quantity measurement	OFF	18
FMAX	x*	Maximum flow	6.0 l	18
MEDT	x*	Antifreeze type	1	18
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	18
ODB	x	Drainback option	OFF	19
tDTO	x*	ODB switch-on condition - time period	60 s	19
tFLL	x*	ODB filling time	5.0 min	19
tSTB	x*	ODB stabilisation time	2.0 min	19
MAN1	x	Manual operation R1	Auto	20
ADA1	x	HE pump control	OFF	20
LANG	x	Language	En	20
UNIT	x	Temperature unit	°C	20
RESE	x	Reset - back to factory settings		20
W002####		Version number		

Legend:

Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.

2. Operation and function

2.1 Push buttons

operating control lamp

backward (-)

forward (+)

2 3 1

OK
(selection / adjustment mode)
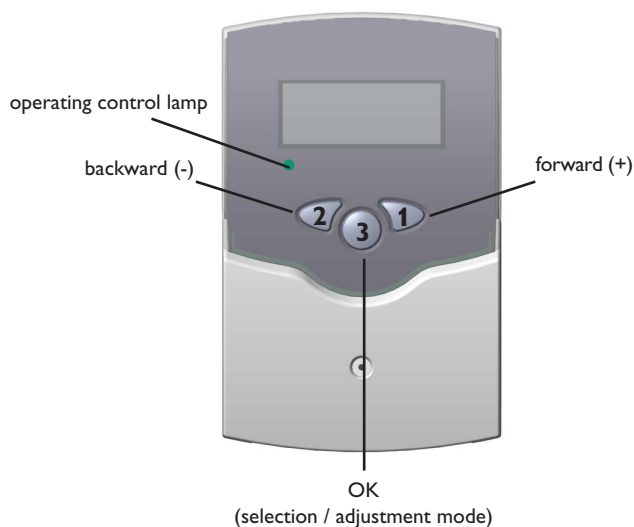
The controller is operated via three push buttons below the display.

Button 1 is used for scrolling forward through the indication menu or to increase the adjustment values. **Button 2** is used for scrolling backward and reducing values. **Button 3** is used for selecting channels and confirming adjustments.

During normal operation, only the display channels are shown.

➔ Scroll through the display channels by pressing buttons 1 and 2

Accessing the adjustment channels:

➔ Scroll forward in the display menu and press button 1 for approx. 2 seconds after you have reached the last display item.
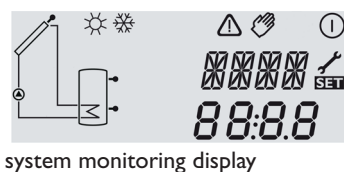
When an **adjustment value** is shown on the display, **SET** is indicated to the right of the channel name.

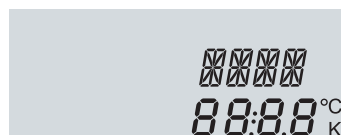➔ Press button 3 in order to access the adjustment mode **SET** starts flashing.

➔ Adjust the value using buttons 1 and 2

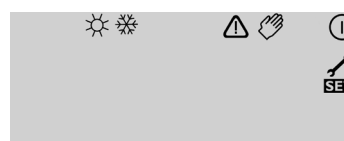➔ Briefly press button 3, **SET** permanently appears, the adjusted value will be saved.

2.2 System-Monitoring-Display

system monitoring display

channel display

tool bar

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

The **channel display** consists of 2 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 are either indicated in °F or °C, whereas temperature differences are indicated in K or °Ra respectively. The additional symbols of the **tool bar** indicate the current system status.

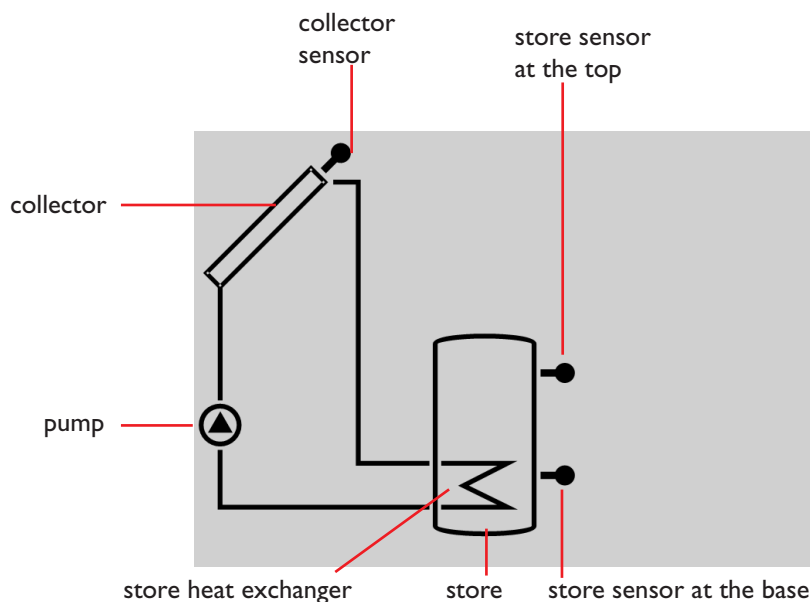| Status	standard	flashing
relay 1 active	ⓘ	
maximum store temperature exceeded	☼	
store emergency shutdown active		⚠ + ☼
collector emergency shutdown active		⚠
collector cooling active	ⓘ	☼
system cooling active	ⓘ	☼
store cooling active	ⓘ + ☼	
holiday cooling function activated	☼	⚠
holiday cooling function active	ⓘ + ☼	⚠
collector minimum limitation active		❄
antifreeze function activated	❄	
antifreeze function active	ⓘ	❄
manual operation relay 1 ON	✋ + ⓘ	⚠
manual operation relay 1 OFF	✋	⚠
sensor defective	🔧	⚠

System screen
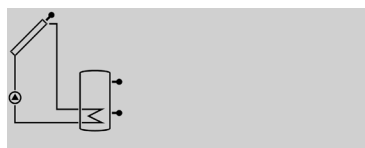
system screen

The system screen shows the solar system. It consists of several system component symbols, which are – depending on the current status of the system – either flashing or permanently shown.

collector sensor

store sensor at the top

collector

pump

store heat exchanger

store

store sensor at the base

Collector
with collector sensor

Store
with heat exchanger

Temperature sensor

Pump

2.3 Flashing codes

**System screen flashing codes**

- Pump is flashing when the relay is active
- Sensor symbols are flashing if the corresponding sensor display channel is selected.
- Sensors are flashing quickly in the case of a sensor fault.

LED flashing codes

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

3. Commissioning

2   3
   (OK)   1
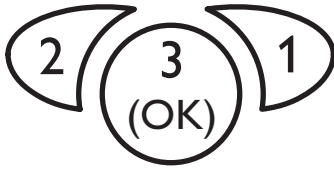
The three push buttons of the BS/2 controller
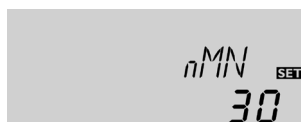
➔ Establish the power supply

During a short initialisation phase, the operating control lamp flashes red and green.

When the controller is commissioned for the first time or after a reset, it will run a commissioning menu. The commissioning menu leads the user through the most important adjustment channels needed for operating the system.

Operating the commissioning menu:

➔ Enter the channel by pressing button 3

The **SET** symbol flashes.

➔ Adjust the value by pressing buttons 1 and 2

➔ Save the adjustment by pressing button 3 again

The **SET** symbol stops flashing.

➔ Press button 1 or 2 to switch to the next or previous channel

The commissioning menu consists of the following 4 channels:

LANG:
Language selection
Selection: dE, En, Fr
Factory setting: En

LANG SET
En

1. Language

➔ Adjust the desired menu language in this channel

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

UNIT:
Temperature unit selection
Selection: °F, °C
Factory setting: °C

UNIT SET
°C

2. Unit

➔ Adjust the unit in which temperatures and temperature differences shall be displayed

**S MX**:
Maximum store temp.
Adjustment range:
4 ... 95 °C [40 ... 200 °F]
in steps of 1 °C [2 °F]
Factory setting: 60 °C [140 °F]

SM X SET
60

3. Maximum store temperature

➔ Adjust the desired maximum store temperature

i **Note:**
The controller is also equipped with a non-adjustable emergency shutdown function, which will shut the system down if the store reaches 95 °C [200 °F].

nMN:
Pump speed control
Adjustment range: 30 ... 100
in steps of 5 %
Factory setting: 30

nMN SET
30

4. Minimum pump speed

➔ Adjust a minimum speed for the pump

i **Note:**
If a load which is not speed-controlled is used, the value must be set to 100 %.

Confirmation enquiry

OK SET

Completing the commissioning menu

After the last channel of the commissioning menu has been adjusted and confirmed, the controller asks for confirmation of the adjustments.

➔ To confirm the adjustments made in the commissioning menu, press button 3

Now the controller is ready for operation with typical settings to suit the selected system layout.

The settings made in the commissioning menu can be changed later on in the corresponding adjustment channels. Additional functions and options can of course be individually adjusted as well (see chap. 4.2).

4. Channel overview

4.1 Display channels

> **Note:**
> The displayed values and adjustment channels depend on which options and functions have been selected. Only values and adjustment channels available for the individual settings selected will appear in the menu.

Indication of drainback time periods

Initialisation
INIT:
ODB initialisation active

```
INIT
  60
```

Indicates the time adjusted in **tDTO**, running backwards.

Filling time
FLL:
ODB filling time active

```
FLL
05:00
```

Indicates the time adjusted in **tFLL**, running backwards.

Stabilisation
STAB:
Stabilisation

```
STAB
02:00
```

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

Indication of collector temperature

COL:
Collector temperature
Display range:
-40…+260 °C [-40…+500 °F]

```
COL
185.0
```

Indicates the current collector temperature.

Indication of store temperatures

TST:
Store temperatures
Display range:
-40…+260 °C [-40…+500 °F]

```
TST
140.0
```

Indicates the current store temperature.

Indication of sensors 3 and 4
S3, S4:
Sensor temperatures
Display range:
-40…+260 °C [-40…+500 °F]

```
S3
87.5
```

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

• S3 : temperature sensor 3
• S4 : temperature sensor 4

> **Note:**
> S3 and S4 will only be indicated if the temperature sensors are connected.

Indication of return temperature
TR:
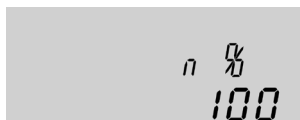Return temperature
Display range:
-40…+260 °C [-40…+500 °F]

```
TR
136.4
```

If heat quantity measurement is active, the temperature at sensor 4 is indicated as TR.

Indication of current pump speed

n %:
Current pump speed
Display range: 30 ... 100 %

```
 n  %
100
```

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

```
KWh   SET
  51
```

Indicates the current pump speed of the solar pump.

Indicates the energy gained in heat quantity – only available if heat quantity measurement (OHQM) is activated.

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 set back to 0. 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 3 for approx. 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.

➔ Confirm the reset with button 3 in order to finish the reset.

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

Operating hours counter

h P:
Operating hours counter
Display channel

```
h P   SET
305
```

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

The accumulated operating hours can be set back to 0. As soon as one operating hours channel is selected, the symbol **SET** is displayed.

➔ In order to access the reset mode of the counter, press button 3 for approx. 2 seconds.

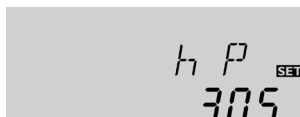The display symbol **SET** will flash and the operating hours will be set to 0.

➔ Confirm the reset with button 3 in order to finish the reset.

In order to interrupt the reset process, do not press a button for about five seconds. The display returns to the display mode.
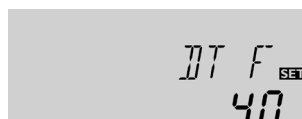
4.2 Adjustment channels

∆T-regulation

DT O:
Switch-on temperature diff.
Adjustment range:
1.0 ... 20.0 K [2.0 ... 40.0°Ra]
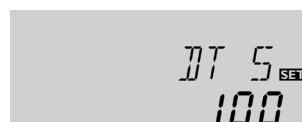in steps of 0.5 K [1 °Ra]
Factory setting:
6.0 K [12.0°Ra]

```
DT O [SET]
     6.0
```

DT F:
Switch-off temperature diff.
Adjustment range:
0.5 ... 19.5 K [1.0 ... 39.0°Ra]
in steps of 0.5 K [1 °Ra]
Factory setting:
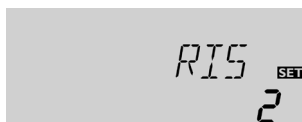4.0 K [8.0°Ra]

```
DT F [SET]
     4.0
```

Pump speed control

DT S:
Nominal temperature difference
Adjustment range:
1.5 ... 30.0 K [3.0 ... 60.0°Ra]
in steps of 0.5 K [1 °Ra]
Factory setting:
10.0 K [20.0°Ra]

```
DT S [SET]
    10.0
```
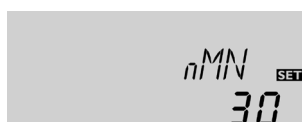
RIS:
Rise
Adjustment range:
1 ... 20 K [2 ... 40°Ra]
in steps of 1 K [2°Ra]
Factory setting:
2 K [4°Ra]

```
RIS [SET]
     2
```

Minimum pump speed

nMN:
Pump speed control
Adjustment range: 30 ... 100 %
in steps of 5 %
Factory setting: 30 %
if ODB is activated: 50 %

```
nMN [SET]
    30
```

The controller works as a standard differential controller. If the switch-on difference is reached, the pump is activated. When the temperature difference falls below the adjusted switch-off temperature difference, the relay switches off.

[i] Note:
The switch-on temperature difference must be at least 0.5 K [1 °Ra] higher than the switch-off temperature difference.

[i] Note:
When the drainback option **ODB** is activated, the temperature differences **DT O**, **DT F** and **DT S** are set to a fixed adjustment:
DT O = 10 K [20 °Ra]
DT F = 4 K [8 °Ra]
DT S = 15 K [30 °Ra]
Previous adjustments made in these channels will be overridden and may have to be entered again if **ODB** is deactivated later on.

[i] Note:
For pump speed control, the operation mode of relay 1 must be set to Auto (adjustment channel **MAN**)

When the switch-on temperature difference is reached, the pump is activated at full speed for 10 seconds. Then, the speed is reduced to the minimum pump speed value (factory setting = 30 %).
If the temperature difference reaches the adjusted nominal temperature difference, the pump speed increases by one step (10 %). If the difference increases by the adjustable rise value, 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".

[i] Note:
The nominal temperature difference must be at least 0.5 K [1 °Ra] higher than the switch-on temperature difference.

A relative minimum pump speed can be allocated to the output R1 via the adjustment channel **nMN.**

[i] Note:
When a load which is not speed-controlled is used, the value must be set to 100 % in order to deactivate pump speed control.

Maximum store temperature
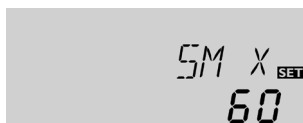
S MX:
Maximum store temp.
Adjustment range:
4 ... 95 °C [40 ... 200 °F]
in steps of a 1 °C [2 °F]
Factory setting:
60 °C [140 °F]

```
SM X SET
   60
```

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. A fixed hysteresis of 2 K [4 °Ra] is set for the maximum store temperature.

When the temperature at sensor 2 exceeds the adjusted maximum store temperature, the ☀ symbol is shown on the display.

> **i** **Note:**
> If the collector cooling or the system cooling function is activated, the adjusted store temperature may be overridden. In order to prevent system damage, the controller is also equipped with an integrated store emergency shutdown if the store reaches 95 °C [200 °F].

Store emergency shutdown option

OSEM:
Store emergency shutdown option
Adjustment range: OFF / ON
Factory setting: OFF

```
OSEM SET
  OFF
```
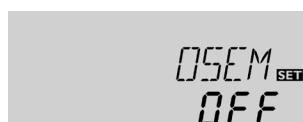
This option is used for activating the integrated store emergency shutdown for an upper store sensor. If the temperature at the reference sensor (S3) exceeds 95 °C, the store will be blocked and loading will be stopped until the temperature falls below 90 °C.

Collector temperature limitation
Emergency shutdown of the collector

EM:
Collector temperature limitation
Adjustment range:
80 ... 200 °C [170 ... 390 °F]
in steps of 1 °C [2 °F]
Factory setting:
130 °C [270 °F]

```
EM    SET
  130
```
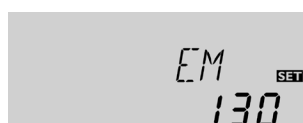
If the adjusted collector emergency shutdown temperature **EM** is exceeded, the controller switches off the solar pump (R1) in order to protect the system against overheating (collector emergency shutdown). A hysteresis of 10 K [20 °Ra] is set for the collector temperature limitation. While the collector is in emergency shutdown, ⚠ (flashing) is shown on the display.

> **i** **Note:**
> If the drainback option **ODB** is activated, the adjustment range of **EM** is changed to 80 ... 120°C [170 ... 250 °F]. The factory setting in that case is 95 °C [200 °F].

WARNING!	**Danger of injury and system damage through pressure surges!**
⚠	If water is used as a heat transfer medium in a pressure-less system, the water will start boiling at 100 °C [212 °F]. ➔ **If a pressure-less drainback system is used with water as a heat transfer medium, do not adjust the collector temperature limitation EM to more than 95 °C [200 °F]!**

Cooling functions

In the following, the three cooling functions – collector cooling, system cooling and store cooling – are described in detail. The following note is valid for all three cooling functions:

> **i** **Note:**
> The cooling functions will not become active as long as solar loading is possible.

Collector cooling function

OCC:
Option collector cooling
Adjustment range: OFF / ON
Factory setting: OFF

```
OCC  SET
  OFF
```

CMX:
Maximum collector temp.
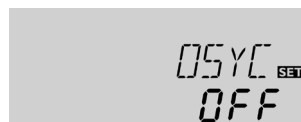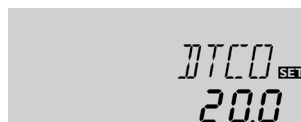Adjustment range:
70 ... 160 °C [150 ... 320 °F]
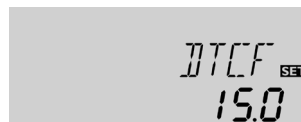in steps of 1 °C [1 °F]
Factory setting:
110 °C [230 °F]

```
CMX  SET
  110
```

When the collector cooling function is activated, the controller aims to keep the collector at an operational temperature.

When the adjusted maximum store temperature is reached, solar loading stops. If the collector temperature increases to the adjusted maximum collector temperature, the solar pump is activated until the collector temperature falls at least 5 K [10 °Ra] below the maximum collector temperature. The store temperature may increase (subordinate active maximum store temperature), but only up to 95 °C [200°F] (emergency shutdown of the store).

If the collector cooling function is active, ⓘ and ☀ (flashing) is shown on the display.

> **i** **Note:**
> This function will only be available if the system cooling function (**OSYC**) is deactivated.

System cooling function

OSYC:
Option system cooling
Adjustment range: OFF / ON
Factory setting: OFF

```
OSYC  SET
  OFF
```

DTCO:
Switch-on temperature diff.
Adjustment range:
1.0 ... 30.0 K [2.0 ... 60.0 °Ra]
in steps of 0.5 K [1 °Ra]
Factory setting:
20.0 K [40.0°Ra]

```
DTCO  SET
  20.0
```

DTCF:
Switch-off temperature diff.
Adjustment range:
0.5 ... 29.5 K [1.0 ... 59.0 °Ra]
in steps of 0.5 K [1 °Ra]
Factory setting:
15.0 K [30.0 °Ra]

```
DTCF  SET
  15.0
```

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

If the store temperature is higher than the maximum store temperature **S MX** and the switch-on temperature difference **DTCO** is reached, the solar system remains activated. Solar loading is continued until either the store temperature reaches 95 °C [200 °F] (emergency shutdown of the store), the temperature difference falls below the adjusted value **DTCF** or the collector emergency shutdown temperature **EM** is reached.

If the system cooling function is active, ⓘ and ☀ (flashing) is shown on the display.

> **i** **Note:**
> This function will only be available if the collector cooling function (**OCC**) is deactivated.

Store cooling function

OSTC:
Store cooling option
Adjustment range: OFF / ON
Factory setting: OFF

```
OSTC  SET
  OFF
```

OHOL:
Holiday cooling option
Adjustment range: OFF / ON
Factory setting: OFF

```
OHOL  SET
  OFF
```

THOL:
Holiday cooling temperature
Adjustment range:
20 ... 80 °C [70 ... 175 °F]
in steps of 1 °C [1 °F]
Factory setting:
40 °C [110 °F]

```
THOL  SET
   40
```

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

If the adjusted maximum store temperature **S MX** is exceeded and the collector temperature falls below the store temperature, the system will be reactivated in order to cool down the store. Cooling will continue until the store temperature has fallen below the adjusted maximum store temperature **S MX** again. A fixed hysteresis of 2 K [4 °Ra] is set for this function.

Reference threshold temperature differences for the store cooling function are **DT O** and **DT F**.

If no DHW consumption is expected for a longer period of time, the additional holiday cooling option **OHOL** can be activated in order to extend the store cooling function. The adjustable temperature **THOL** then replaces the maximum store temperature **S MX** as a switch-off temperature for the store cooling function.

When the holiday cooling function is activated, ☀ and ⚠ (flashing) are shown on the display.

While the holiday cooling function is active, ⓘ, ☀ and ⚠ (flashing) are shown on the display.
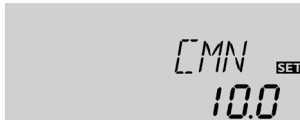
Collector minimum limitation option

OCN:
Collector minimum limitation
Adjustment range: OFF / ON
Factory setting: OFF

`OCN` SET
`OFF`

CMN:
Collector minimum temp.
Adjustment range:
10.0 ... 90.0 °C
[50.0 ... 190.0 °F]
in steps of 0.5 °C [1.0 °F]
Factory setting:
10.0 °C [50.0 °F]

`CMN` SET
`10.0`

If the collector minimum limitation option is activated, the pump (R1) is only switched on if the adjustable collector minimum temperature is exceeded. The minimum temperature prevents the pump from being switched on too often at low collector temperatures. A fixed hysteresis of 5 K [10 °Ra] is set for this function
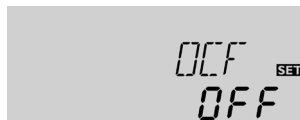
If the collector minimum limitation is active, ❄ (flashing) is shown on the display.

Note:
If **OSTC** or **OCF** is active, the collector minimum function will be overridden. In that case, the collector temperature may fall below **CMN**.

Antifreeze option

OCF:
Antifreeze function
Adjustment range: OFF / ON
Factory setting: OFF

`OCF` SET
`OFF`

CFR:
Antifreeze temperature
Adjustment range:
-40.0 ... +10.0 °C
[-40.0 ... +50.0 °F]
in steps of 0.5 °C [1.0 °F]
Factory setting:
4.0 °C [40.0 °F]

`CFR` SET
`4.0`

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 K [2 °Ra], the loading circuit will be deactivated.

When the antifreeze function is activated, ❄ is shown on the display. If the antifreeze function is active, ① and ❄ (flashing) are shown on the display.

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.
The antifreeze function will be suppressed if the store temperature falls below 5 °C [40 °F] in order to protect the store from frost damage.

Heat quantity measurement

OHQM:
Heat quantity measurement
Adjustment range: OFF / ON
Factory setting: OFF

`OHQM` SET
`OFF`

FMAX: Flow rate in l/min
Adjustment range: 0.5 ...100.0
in steps of 0.5
Factory setting: 6.0

`FMAX` SET
`6.0`

MEDT: Heat transfer fluid
Adjustment range: 0 ...3
Factory setting: 1

`MEDT` SET
`1`

MED%: Antifreeze ratio
in Vol-% (MED% is hidden
when MEDT 0 or 3 is used.)
Adjustment range: 20 ...70 %
in steps of 1 %
Factory setting: 45 %

`MED%` SET
`45`

If OHQM is activated, the heat quantity gained can be calculated and displayed. Heat quantity measurement is possible if a flowmeter is used. To enable heat quantity measurement, proceed as follows:

➔ Read the flow rate (l/min) from the flowmeter at maximum pump speed and adjust it in the **FMAX** channel
➔ Adjust the heat transfer fluid and the concentration of the antifreeze in the channels **MEDT** and **MED%**.
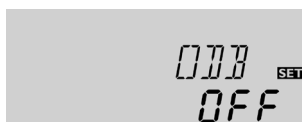
Heat transfer fluid:
0 : Water
1 : Propylene glycol
2 : Ethylene glycol
3 : Tyfocor® LS / G-LS

Drainback option

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

ODB:
Drainback option
Adjustment range: OFF / ON
Factory setting: OFF

$$\boxed{O\ \Box\ B \quad \text{SET}}$$
$$OFF$$

A drainback system permits the heat transfer fluid to drain back into the holding tank when solar energy is not collected. The drainback option will initiate the filling of the system when solar loading begins.

If the drainback option **ODB** is activated, the pump will operate at 100 % speed for the adjusted filling time **tFLL** in order to fill the system with fluid from the holding tank. After **tFLL**, pump speed will go down to the adjusted minimum pump speed **nMn**. The switch-off conditions will then be ignored for the stabilisation time **tSTB** in order to avoid the system from shutting down prematurely.

If the function is activated, the menu items described in the following (**tDTO**, **tFLL** and **tSTB**) have to be adjusted:

Note:
When the drainback option **ODB** is activated, the cooling functions **OCC**, **OSYC** and **OSTC** as well as the antifreeze function **OCF** are not available.
If **OCC**, **OSYC**, **OSTC** or **OCF** have already been activated before, they will be deactivated again as soon as **ODB** is activated. They will remain deactivated, even if **ODB** is deactivated later on.

Note:
When the drainback option **ODB** is activated, the temperature differences **DT O**, **DT F** and **DT S** as well as the minimum speed value **nMN** are set to a fixed adjustment. Additionally, the adjustment range and the factory setting of the collector emergency shutdown temperature **EM** changes (see the corresponding channel descriptions for further information).
Previous adjustments made in these channels will be overridden and have to be entered again if **ODB** is deactivated later on.

Time period – switch-on conditions

tDTO:
Time period - switch-on conditions
Adjustment range: 1 ... 100 s in steps of 1 s
Factory setting: 60 s

$$\boxed{t\ \Box\ T\ O \quad \text{SET}}$$
$$60$$
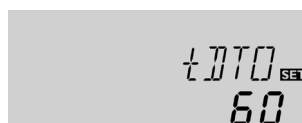
The parameter **tDTO** is used for adjusting the time period during which the switch-on condition **DT O** must be permanently fulfilled.

Filling time

tFLL:
Filling time
Adjustment range:
1.0 ... 30.0 min in steps of 0.5 min
Factory setting: 5.0 min

$$\boxed{t\ F\ L\ L \quad \text{SET}}$$
$$5.0$$
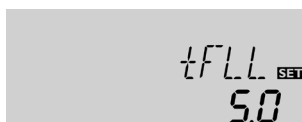
The filling time can be adjusted using the parameter **tFLL**. During this period, the pump runs at 100 % speed.

Stabilisation

tSTB:
Stabilisation
Adjustment range:
1.0 ... 15.0 min in steps of 0.5 min
Factory setting: 2.0 min

$$\boxed{t\ S\ T\ B \quad \text{SET}}$$
$$2.0$$
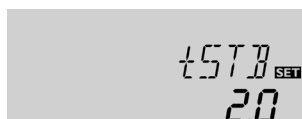
The parameter **tSTB** is used for adjusting the time period during which the switch-off condition **DT F** will be ignored after the filling time has ended.

Operating mode
MAN:
Operating mode
Adjustment range:
OFF, Auto, ON
Factory setting: Auto

```
MAN  SET
Auto
```

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

Operating mode
OFF : relay off ⚠ (flashing) + ✋
Auto : relay in automatic operation
ON : relay on ⚠ (flashing) + ✋ + ①

ℹ **Note:**
Always adjust the operating mode back to "Auto" when the control and service work is completed. Normal operation is not possible in manual mode.

HE pump control
ADA1:
HE pump control
Adjustment range: ON / OFF
Factory setting: OFF

```
ADA1  SET
OFF
```
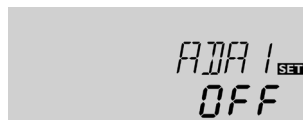
This option is used for controlling a high-efficiency pump via a VBus® / PWM adapter. The power supply of the pump takes place via the semiconductor relay (R1). For pump speed control with activated ADA1 option, the relay is switched on or off (no pulse packets). Temperature dependent speed information is transmitted via the VBus®. The relay will remain deactivated for 1 hour after its switch-off conditions have been fulfilled (pump protection).

Language
LANG:
Language selection
Selection: dE, En, Fr
Factory setting: En

```
LANG  SET
En
```

The menu language can be adjusted in this channel.
- dE : German
- En : English
- Fr : French

Unit
UNIT:
Temperature unit selection
Selection: °F, °C
Factory setting: °C

```
UNIT  SET
°C
```

In this adjustment channel, the display unit for temperatures and temperature differences can be chosen. The unit can be switched between °C / K and °F / °Ra during operation. Temperatures and temperature differences in °F and °Ra are displayed without units. If the indication is set to °C, the units are displayed with the values.

Reset
RESE
Reset function

```
RESE  SET
```

By using the reset function, all adjustments will be set back to the factory settings.

➔ To initiate a reset, press button 3

Any previous adjustments will be lost. Therefore, initiating the reset function is always followed by a security enquiry.

Only confirm the security enquiry if you are sure that you wish to reset all adjustments to the factory settings!

Security enquiry:

```
SAVE  SET
YES
```

➔ To confirm the security enquiry, press button 3

ℹ **Note:**
Whenever a reset has been completed, the controller runs the commissioning menu again (see chap. 3).

5. Troubleshooting

fuse

RESOL®
DE-45527 Hattingen
DeltaSol BS/2 V2
Made in Germany

T4A
100 ... 240 V~
50-60 Hz
CU 72091163 01

1 (1) A 100 ... 240 V~

IP 20

Temp. Sensor Pt1000

S1		S2		S3		S4		VBus						N	R1	N	L
1	2	3	4	5	6	7	8	9	10	12	13	14		17	18	19	20

sensor terminals

VBus® terminals

ground terminals

load terminals

power supply terminals
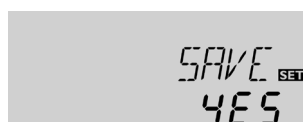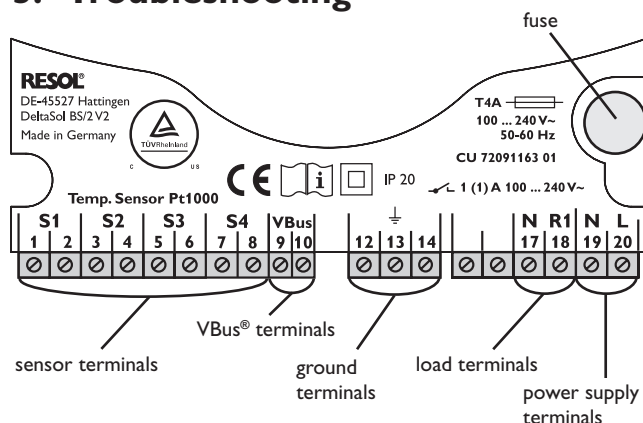
In the case of an error, a message is shown on the display of the controller:

Warning symbols

Operating control lamp
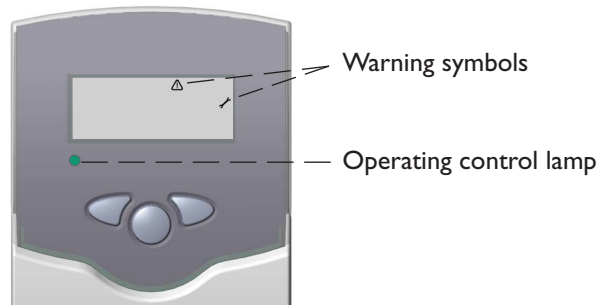
Operating control lamp flashes red. On the display the symbols ✎ and ⚠ appear.

Sensor defect. An error code instead of a temperature is displayed in the sensor display channel.

888.8	- 88.8

Cable broken. Check cable.

Short circuit. Check cable.

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

°C	°F	Ω	°C	°F	Ω
-10	14	961	55	131	1213
-5	23	980	60	140	1232
0	32	1000	65	149	1252
5	41	1019	70	158	1271
10	50	1039	75	167	1290
15	59	1058	80	176	1309
20	68	1078	85	185	1328
25	77	1097	90	194	1347
30	86	1117	95	203	1366
35	95	1136	100	212	1385
40	104	1155	105	221	1404
45	113	1175	110	230	1423
50	122	1194	115	239	1442
Resistance values of the Pt1000-sensors					

Operating control lamp off.

Check the power supply. Is it disconnected?

no	yes

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).

Check the supply line and reconnect it.

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 air / gas bubbles in the lines.

Air in the system?

no | **yes**

Air in the system; increase the system pressure to at least static primary pressure plus 7. 25 psi (0.5 bar); if necessary continue to increase pressure; switch the pump off and on for a short time.

Is the collector circuit blocked at the dirt trap?

yes

Clean the dirt trap

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

Temperature difference at the controller too small?

no | **yes**

Change ΔTon and ΔToff correspondingly. Problem solved?

no | **yes**

o.k.

Wrong position of collector sensors?

no | **yes**

Mount the collector sensor at solar flow (warmest collector output); use sensor well of the respective collector.

Plausibility control of the option tube collector special function

---

Pump starts up very late

Switch-on temperature difference Ton to large?

no | **yes**

Change ΔTon and ΔToff correspondingly.

Non-ideal position of the collector sensor (e.g. flatscrew sensor instead of sensor in sensor wells)?

yes

Activate tube collector function if necessary.

o.k.

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

Collector circuit pump defective?

no | **yes**

Check / replace it

Heat exchanger calcified?

no | **yes**

Decalcify it

Heat exchanger blocked?

no | **yes**

Clean it

Heat exchanger too small?

yes

Replace with correctly sized one.

Stores cool down at night

Collector circuit pump runs during the night?
- no
- yes → **Check controller: Manual operation active? Tube collector function active? Store cooling or antifreeze function active?**

Collector temperature is at night higher than the outdoor temperature
- no
- yes → **Check the check valve in the flow and the return pipe with regard to the functional efficiency.**

Sufficient store insulation?
- yes
- no → **Increase insulation.**

Insulation close enough to the store?
- yes
- no → **Replace insulation or increase it.**

Are the store connections insulated?
- yes
- no → **Insulate the connections.**

Warm water outflow upwards?
- no
- yes → **Change connection and let the water flow horizontally or through a siphon (downwards); less store losses now ?**
  - no
  - yes → **o.k.**

Does the warm water circulation run for a very long time?
- no
- yes → **Use the circulation pump with timer and switch-off thermostat (energy efficient circulation).**

Circulation pump and blocking valve should be switched off for one night; less store losses?
- yes
- no → **Check whether the pumps of the afterheating circuit run at night; check whether the non-return valve is defective; problem solved ?**
  - no
  - yes → **o.k.**

a

b

---

a

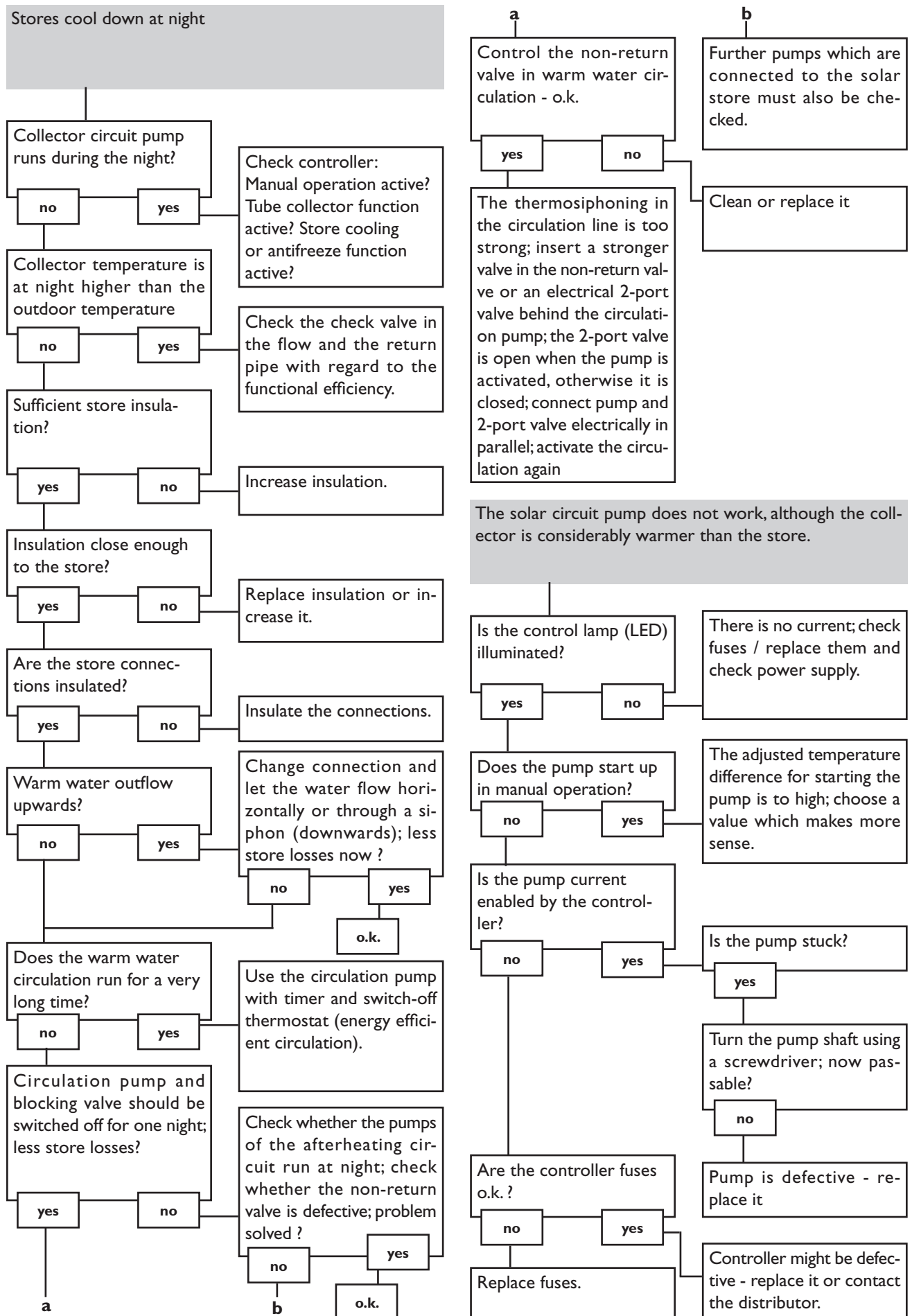**Control the non-return valve in warm water circulation - o.k.**
- yes
- no → **Further pumps which are connected to the solar store must also be checked.** → **Clean or replace it**

b
Further pumps which are connected to the solar store must also be checked.

The thermosiphoning in the circulation line is too strong; insert a stronger valve in the non-return valve or an electrical 2-port valve behind the circulation pump; the 2-port valve is open when the pump is activated, otherwise it is closed; connect pump and 2-port valve electrically in parallel; activate the circulation again

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

Is the control lamp (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 to high; choose a value which makes more sense.**

Is the pump current enabled by the controller?
- no
- yes → **Is the pump stuck?**
  - yes → **Turn the pump shaft using a screwdriver; now passable?**
    - no → **Pump is defective - replace it**

Are the controller fuses o.k. ?
- no → **Replace fuses.**
- yes → **Controller might be defective - replace it or contact the distributor.**

RESOL®

6. Accessories

Sensors

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

For more information, see our catalogue and price list.

Overvoltage protection device

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

RESOL SP10   Article no.: **180 110 70**

Smart Display SD3

The RESOL Smart Display is designed for simple connection to RESOL controllers with RESOL VBus®. It is used for visualizing data issued by the controller: collector temperature, storage temperature and energy yield of the solar thermal system. The use of high-efficient LEDs and filter glass assures a high optical brilliance and good readability. An additional power supply is not required.

RESOL SD3 (unit °C)   Article no.: **180 004 90**
RESOL SD3 (unit °F)   Article no.: **180 007 77**

Large Display GA3

The RESOL Large Display GA3 is designed for simple connection to RESOL controllers via the RESOL VBus®. It is used for visualizing the data issued by the controller: collector and store temperature as well as heat quantity produced in the solar system.
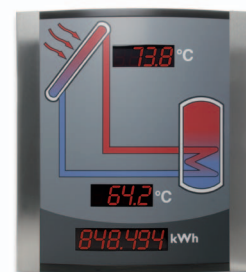
The use of high-efficient LEDs and antireflective filter glass assures a high optical brilliance and good readability - even in poor lighting conditions and at a larger distance.

RESOL GA3 (unit °C)   Article no.: **180 006 50**
RESOL GA3 (unit °F)   Article no.: **180 007 87**

RESOL®

DL2 Datalogger

This additional module enables the acquisition and storage of large amounts of data (such as measuring and balance values of the solar system) over a long period of time. The DL2 can be configured and read-out with a standard internet browser via its integrated web interface. For transmission of the data stored in the internal memory of the DL2 to a PC, an SD card can be used.

The DL2 is appropriate for all controllers with RESOL VBus®. It can be connected directly to a PC or router for remote access and thus enables comfortable system monitoring for yield monitoring or for diagnostics of faults.

RESOL DL2   Article no.: **180 007 10**

VBus® / USB interface adapter

The VBus® / USB interface adapter is the interface between the controller and a personal computer. With its standard mini-USB port it enables a fast transmission of system data via the VBus® for processing, visualizing and archiving. A full version of the RESOL ServiceCenter software is included.

RESOL VBus® / USB interface adapter   Article no.: **180 008 50**

VBus® / LAN interface adapter

The VBus® / LAN interface adapter is designed for the direct connection of the controller to a PC network or router. It enables easy access to the controller via the local network of the owner. Thus, controller access and data charting can be effected from every workstation of the network. A full version of the RESOL ServiceCenter software is included.

RESOL VBus® / LAN interface adapter   Article no.: **180 008 80**

VBus® / PWM interface adapter

The VBus® / PWM interface adapter is used for the speed control of a pump via a PWM or 0-10 V signal. Via the VBus®, the adapter receives information from the controller about the necessary pump speed. The speed is converted into a PWM or direct voltage signal and put out to the corresponding terminals.

RESOL VBus® / PWM interface adapter   Article no.: **180 008 60**

AM1 Alarm module

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

RESOL AM1 Alarm module   Article no.: **180 008 70**

RESOL®

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