RESOL DeltaSol® C/1

Mounting

Connection

Operation

Troubleshooting

Examples

48002911

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

DeltaSol® C/1

en

Manuel

www.resol.com

Safety advice

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

Appropriate usage

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

Improper use excludes all liability claims

Instructions:

Attention should be paid to

- valid local regulations
- the statutory provisions for prevention of industrial accidents,
- the statutory provisions for environmental protection,
- the Health and Safety at Work Act 1974
- Part P of the Building Regulations 2005
- BS7671 Requirements for electrical installations and relevant safety regulations of DIN, EN, DVGW, TRGI, TRF and VDE.

These instructions are exclusively addressed to authorised skilled personnel.

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

Table of comtents

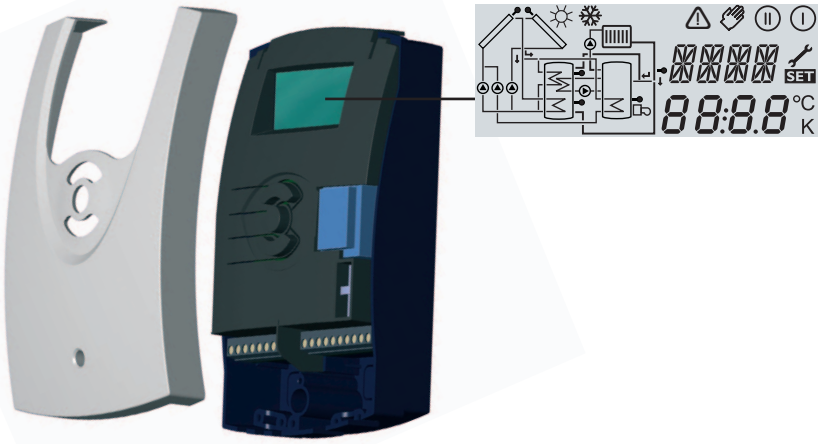
Subject to change without prior notice. Errors excepted

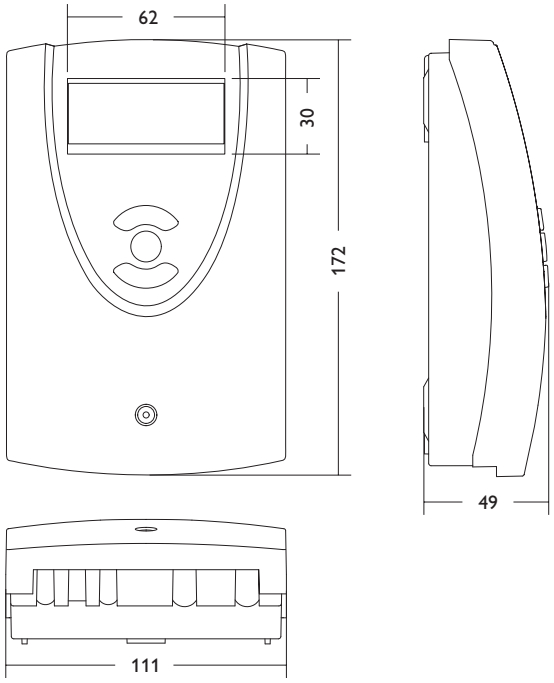
CE-Declaration of conformity

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.

Overview of functions

- **System-Monitoring display**
- **up to 4 temperature sensors Pt1000**
- **heat quantity balancing**
- **function control**
- **user-friendly operation through easy handling**
- **easy-to-mount housing in outstanding design**
- **RESOL VBus®**





Scope of delivery:

1 x DeltaSol® C/1

1 x accessory bag
- 1 x spare fuse T2A
- 2 x screws and dowels
- 4 x strain relief and screw

Additionally contained in the full kit
- 1 x sensor FKP6
- 1 x sensor FRP6

Technical Data

Housing: plastic, PC-ABS and PMMA

Protection type: IP 20 / DIN 40050

Ambiant temp.: 0 ... 40 °C

Dimensions: 172 x 110 x 46 mm

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

Display: System-Monitor for system visualisation, 16-segment display, 7-segment display, pictograms

Operation: 3 push buttons at the front of the housing

Functions: Temperature differential controller with optional add-on functions. function control according to BAW-guidelines, operating hours counter, tube collector function, and heat quantity measurement

Inputs: for 4 temperature sensors Pt1000

Output: 1 standard relay

Bus: RESOL VBus®

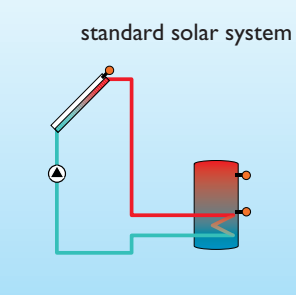
Power supply: 100 ... 220V~

Total switching capacity:
2 (1) A (100 ... 240) V~

Mode of operation:
Type 1.b

Switching capacity per relay:
Electromechanical relay:
2 (1) A (100 ... 240) V~

Example DeltaSol® C/1

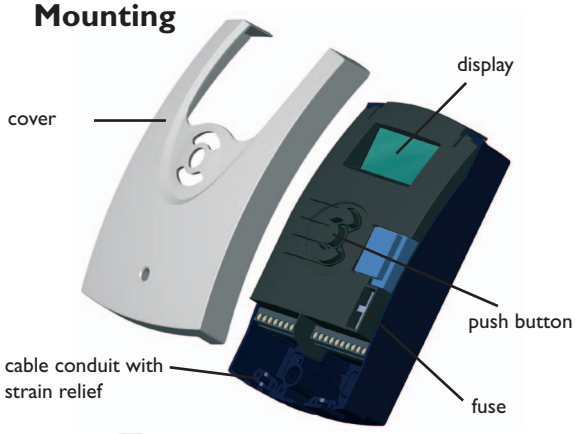


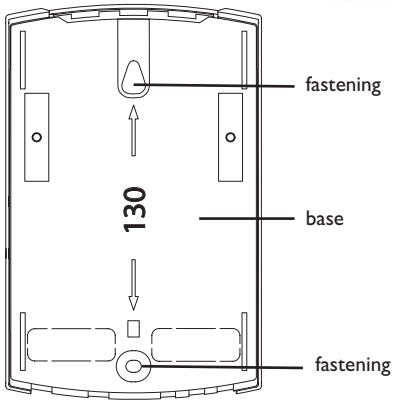
Order notes

RESOL DeltaSol® C/1
RESOL DeltaSol® C/1 - Full kit
incl. 2 temperature sensors Pt1000 (1 x FKP6, 1 x FRP6)

1. Installation

1.1 Mounting



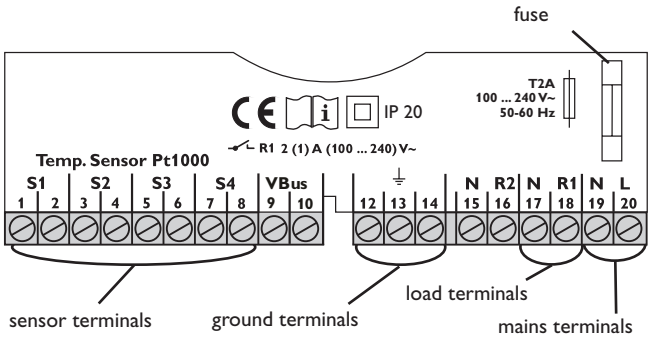


WARNING!
Always disconnect the controller from power supply before opening the housing!

The unit must only be located in dry interior locations. It is not suitable for installation in hazardous locations and should not be placed close to any electromagnetic fields. The controller must additionally be supplied from a double pole switch with contact gap of at least 3 mm. Please pay attention to separate routing of sensor cables and mains cables.

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

1.2 Electrical connection



Electrostatic discharge can cause damage of electronic components!

High-voltage components!

The power supply to the controller must be carried out via an external power switch (last step!) and 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.

The controller is equipped with 1 relay to which **loads** such as pumps, valves etc. can be connected:

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

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

1 / 2 = sensor 1 (e. g. sensor collector 1)
3 / 4 = sensor 2 (e. g. sensor store 1)
5 / 6 = Sensor 3 (temperature sensor S3)
7 / 8 = sensor 4 (e. g. sensor store TRF)

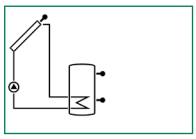
The **mains connection** is at the terminals:

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

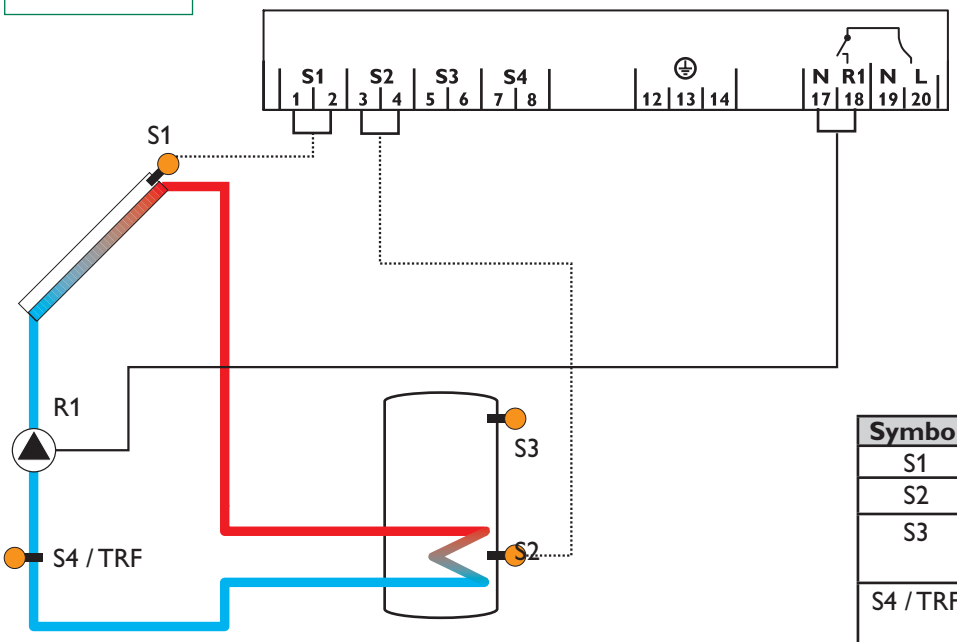
The controller is equipped with the **RESOL VBus®** for data transfer with and energy supply to external modules. The connection is carried out at the two terminals 9 and 10 marked "VBus®" (either polarity). One or more RESOL VBus® modules can be connected via this data bus:

- RESOL calorimeter
- RESOL large display / Smart Display
- RESOL Datalogger

1.2.1 Terminal allocation



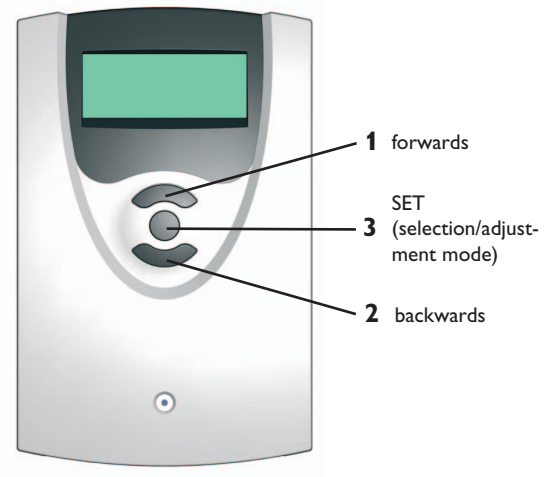
Standard solar system with 1 store, 1 pump and 3 sensors. Sensor S4 / TRF can optionnally be used for heat quantity measurement.



Symbol	Description
S1	collector sensor
S2	store base sensor
S3	store top sensor (optional)
S4 / TRF	Sensor for heat quantity measurement (optional)
R1	solar pump

2. Operation and function

2.1 Commissioning and buttons for adjustment



Connect the controller to the mains. The controller is in an initialisation phase. After this phase, the controller is in automatic operation with factory settings.

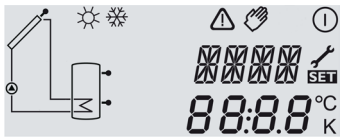
The controller is then ready for operation and normally the factory settings will give close to optimum operation.

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

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

— Press buttons 1 and 2 in order to select a channel
— Briefly press button 3, SET appears (flashing) (SET-mode)
— adjust the requested value by pressing the buttons 1 and 2
— Briefly press button 3, so that SET permanently appears, the adjusted value will be saved.

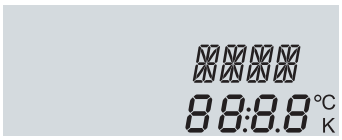
2.2 System-Monitoring display



System Monitoring-Display

The system monitoring display consists of 3 ranges : The **channel display**, the **toolbar** and the **system-screen** (active arrangement).

2.2.1 Channel display



Channel display

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 and temperature differences are indicated in °C or K .

2.2.2 Toolbar

Toolbar

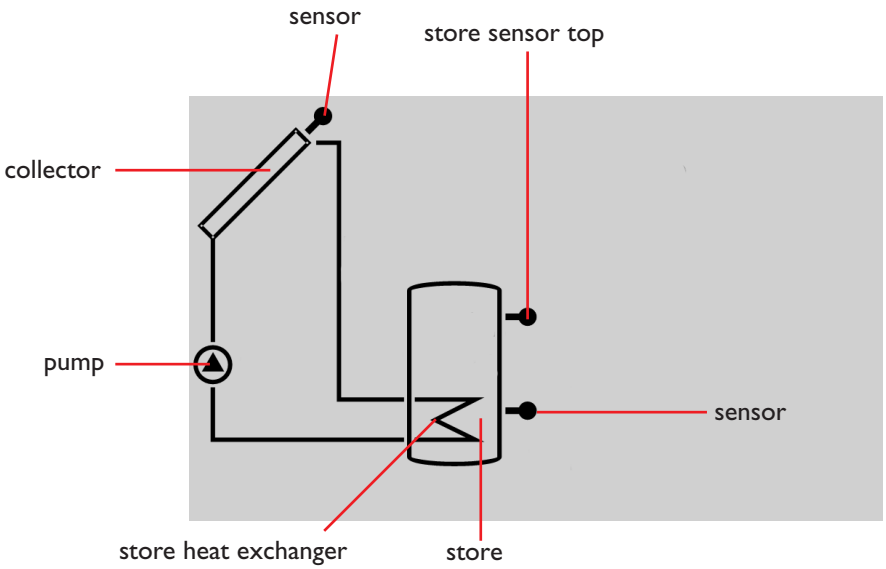
The additional symbols in the **toolbar** indicate the actual system status.

Symbol	normal	flashing
⏻	relay 1 active	
☼	store maximum limitation active / maximum store temperature exceeded	collector cooling function active recooling function active
❄	antifreeze function active	collector minimum limitation active antifreeze function active
⚠		Kollektornotabschaltung aktiv oder Speichernotabschaltung
⚠+🔧		sensor fault
⚠+✋		manual mode
SET		change of adjustment channel SET-mode

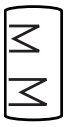
2.2.3 System-Screen

System screen

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



collector
with collector sensor



store
with heat exchanger

temperature sensor

pump

2.3 Flashing codes

- Pump symbols are flashing during the initialisation phase
- Sensor symbols are flashing when the corresponding sensor display channel is selected.
- Sensor symbols are flashing in the case of a sensor fault.

3. Control parameters and display channels

3.1 Overview of channels

Legend:

x

Corresponding channel is available.

x*

Corresponding channel is available when the corresponding option is enabled

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

①

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

②

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

MEDT

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

channel	description	page
COL	temperature collector 1	9
TST	temperature store 1	9
TST	temperature store	9
S3	temperature Sensor 3	9
TRF	temperature return sensor	9
S4	temperature Sensor 4	9
h P	operating hours relay 1	9
kWh	heat quantity kWh	10
MWh	heat quantity MWh	10
DT O	switch-on temperature difference	10
DT F	switch-off temperature difference 1	10
S MX	maximum temperature store 1	11
EM	emergency temperature collector 1	11

channel	**description**	**page**
OCX	option collector cooling collector 1	11
CMX	maximum temperature collector 1	11
OCN	option minimum limitationcollector 1	11
CMN	minimun temperature collector 1	11
OCF	option antifreeze collector 1	12
CFR	antifreeze temperature collector 1	12
OREC	option recooling	12
O TC	pption tube collector	12
OHQM	option heat quantity measurement	12
FMAX	Maximum flowrate	12
MEDT	antifreeze type	12
MED%	antifreeze concentration	12
HND1	Manual operation relay 1	12
LANG	language	12
PROG	program number	
VERS	version number	

3.1.1 Collector temperature

COL:
Collector temperature
Display range: -40 ... +250 °C

Displays the actual collector temperature.

- COL : collector temperature

3.1.2 Store temperatures

TST:
Store temperature
Display range: -40 ... +250 °C

Displays the actual store temperature.

- TST : store temperature

3.1.3 Sensors 3 and 4

S3, S4:
Sensor temperatures
Display range: -40 ... +250 °C

Display of the current temperature at the corresponding additional sensor without control function.

- S3 : temperature Sensor 3
- S4 : temperature Sensor 4

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

3.1.4 Other temperatures

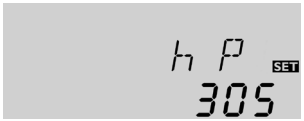
TRF:
Other measured temperatures
Display range: -40 ... +250 °C

Display of the current temperature at the sensor.

- TRF : temperature - return

3.1.5 Operating hours counter

h P: Operating hours counter
Display channel



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

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

3.1.6Heat quantity measurement

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

FMAX: Flow rate in l/min
Adjustment range 0...20,
in 0.1 steps
Factory setting: 6,0

MEDT: Antifreeze type
Adjustment range: 0...3
Factory setting: 1

MED%: Antifreeze concentration in (Vol-) %
When MEDT 0 or 3 is used, the parameter MED% is ‚hidden'.
Adjustment range: 20...70
Factory setting: 45

Heat quantity measurement is possible if a flowmeter is used. For this purpose, the heat quantity measurement option **OHQM** has to be enabled.

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

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

kWh/MWh:Heat quantity kWh / MWh
Display channel

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

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

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

4.1.7 ΔT-regulation

DT O: Switch-on temperature difference
Adjustment range: 1,0 ... 20,0KFactory setting: 6.0

DT A:Switch-off temperature difference
Adjustment range: 0,5 ... 19,5K
Factory setting: 4.0

This function is a standard differential control. If the switch-on differential (**DT O**) is reached, the pump is operated. If the temperature difference falls below the adjusted switch-off temperature difference (**DT F**) the controller switches off.

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

3.1.8 Store maximum temperature

S MX: Maximum store temperature
Adjustment range: 2 ... 95 °C
Factory setting: 60 °C

If the adjusted maximum temperature is exceeded, the store will no longer be loaded in order to avoid damage caused by overheating. If the maximum store temperature is exceeded, ☀ (flashing) is shown on the display.

Note: The controller is equipped with a store emergency shutdown function, which prevents the store from being loaded when the store temperature exceeds 95 °C.

3.1.9 Collector-limit temperature Collector emergency shutdown

EM: Collector emergeny shutdown temperature
Adjustment range: 110 ... 200°C
Factory setting: 140 °C

If the adjusted collector emergency shutdown temperature (**EM**) is exceeded, the controller will switch off the solar pump (R1) in order to protect the system against overheating (collector emergency shutdown). The factoring setting is 140 °C but it can be changed within the adjustment range of 110...200 °C. If the temperature is exceeded, ⚠ (flashing) is shown on the display.

3.1.10 System cooling

OCX: Option system cooling
Adjustment range: OFF ... ON
Factory setting: OFF

CMX: Maximum collector temperature
Adjustment range: 100 ... 190 °C
Factory setting: 120 °C

When the adjusted maximum store temperature is reached, the system stagnates. If the collector temperature increases to the adjusted maximum collector temperature (**CMX**) the solar pump is activated until the collector temperature falls below the maximum collector temperature. The store temperature may increase (subordinate active maximum store temperature), but only up to 95 °C (emergency shutdown of the store).

If OREC is additionnally enabled:

If the store temperature is higher than the maximum store temperature (**S MX**) and if the collector temperature is at least 5 K below the store temperature, the solar system remains activated until the store is cooled down below the adjusted maximum temperature (**S MX**) via the collector and the pipework.
If the system cooling function is enabled, ☀ (flashing) is shown on the display. Due to the cooling function, the system will have a longer operation time on hot summer days and guarantees thermal relief of the collector field and the heat transfer fluid.

3.1.11 Minimum collector function

OCN: Minimum collector function
Adjustment range: OFF / ON
Factory setting: OFF

CMN: Minimum collector temperature
Adjustment range: 10 ... 90 °C
Factory setting: 10 °C

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

3.1.12 Antifreeze function

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

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

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

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.

3.1.13 Recooling function

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

If the adjusted maximum store temperature (S MX) is reached, the controller keeps the solar pump running in order to prevent the collector from being overheated. The store temperature may increase, but only up to 95 °C (emergency shutdown of the store).
The solar pump is switched on as soon as possible (depending on weather conditions). It is switched off when the store is cooled down to the adjusted maximum temperature via the collector and the pipework.

3.1.14 Tube collector function

O TC: Tube collector function
Adjustment range: OFF ... ON
Factory setting: OFF

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

3.1.15 Operating mode

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

For control and service work, the operating mode of the controller can be manually adjusted. For this purpose, select the adjustment value HND1. The following adjustments can be carried out:

OFF : relay off ⚠ (flashing) + ✋
AUTO: relay in automatic operation
ON : relay on ⚠ (blinkend) + ✋

3.1.16 Language (LAN)

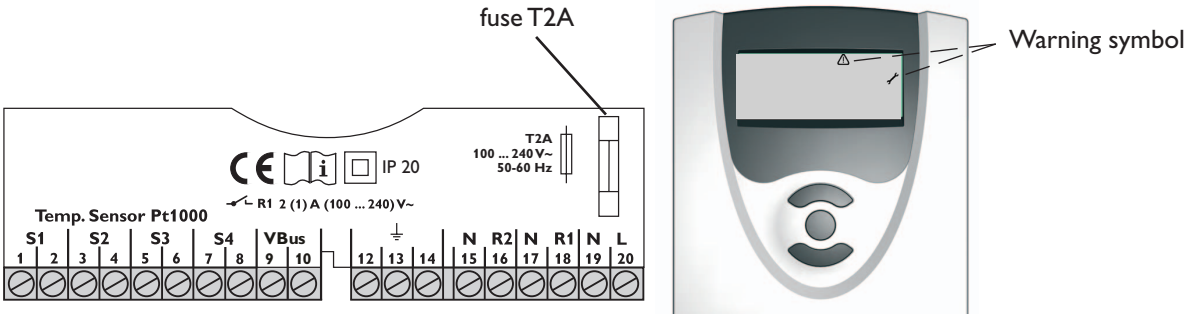
LANG:
Language choice
Adjustment range:
dE, En, It, Fr
Factory setting: En

In this channel, different languages are available.

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

4. Troubleshooting

If a malfunction occurs, a notification is given on the display of the controller:



On the display appears the symbol and the symbol ⚠.

Sensor defect. An error code is shown on the relevant sensor indication channel instead of a temperature.

888.8 — Line break. Check the line.

- 88.8 — Short-circuit. Check the line.

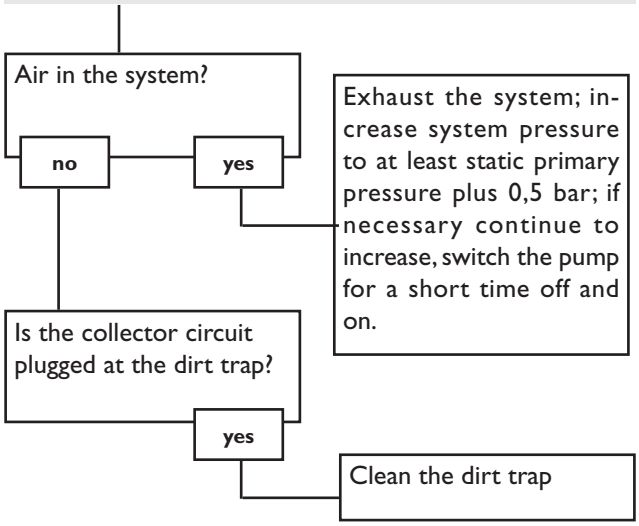
Pt1000-temperature sensors pinched off can be checked with an ohmmeter. In the following the resistance values corresponding to different temperatures are listed.

°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

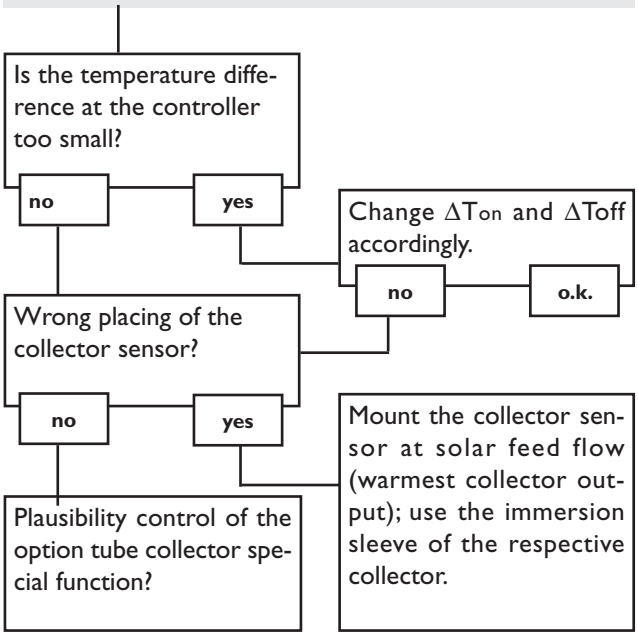
Resistance values of the Pt1000-sensors

5.1 Various:

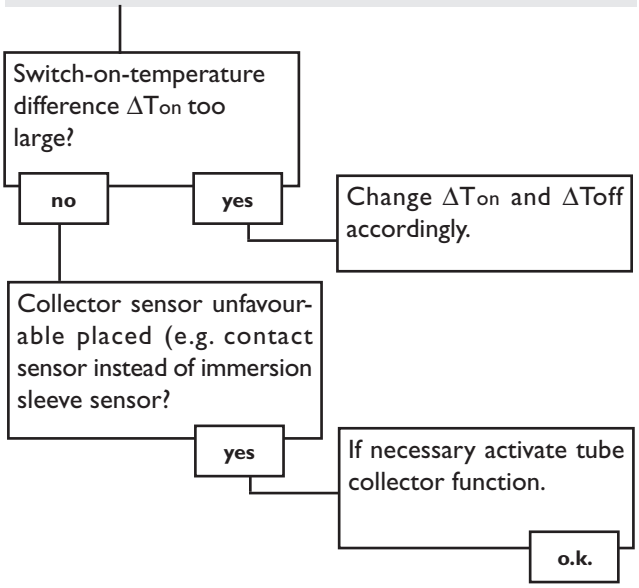
Pump is overheated, but no heat transfer from collector to the store, feed flow and return flow are equally warm, perhaps also bubble in the lines.



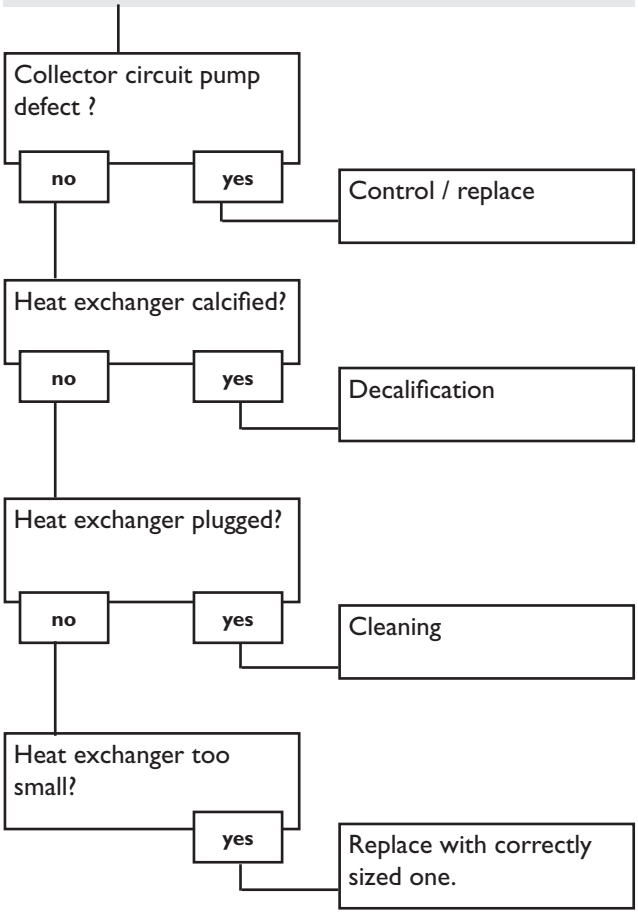
Pump starts for a short moment, switches-off, switches-on again, etc. („controller hunting“)



Pump starts up very late and soon 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 → Check the controller functions
- yes →

Collector temperature is at night higher than ambient temperature.
- no → Check the return flow preventer in feed flow and return flow with regard to the functional efficiency.
- yes →

Is store insulation sufficient?
- yes → Intensify the insulation.
- no →

Is store insulation close enough to the store?
- yes → Replace or intensify the insulation.
- no →

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

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

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

Switch-off the circulation pump and the blocking valve for 1 night; less store losses?
- yes → a
- no → Check the pumps of the after-heating circuit according to nightly run and defect return flow preventer; problem solved?
  - no → b

a

Control the return flow preventer in warm water circulation- o.k.
- yes → The gravitation circulation in the circulation line is too strong; insert a stronger return flow preventer or an electrical 2-way valve behind the circulation pump; the 2-way valve is open in pump operation, otherwise it is closed, conect pump and 2-way valve in parallel; activate the circulation again!
- no → Cleaning or replacement.

b

Please also check further pumps which are connected to the solar store.

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

Does the pump start up in manual operation?
- no → Is the current of the pump released by the controller?
  - no → Are the fuses of the controller o.k.?
    - no → Replace the fuses.
    - yes → Controller might be defective - replace it.
  - yes → Is the pump stuck?
    - yes → Turn the pump shaft using a screwdriver; is it passable now ?
      - no → Is the pump defective - replace it.
- yes → The adjusted temperature difference for starting the pump is too high; choose an matching setting

5. Accessory

Sensors

Our product range includes 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 full 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 lightening).

Distributed by:

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Please note:
The design and the specifications are to be changed without notice.
The illustrations may differ from the original product.