DeltaSol® CS/2

RESOL®

Solar controller

Manual for the
specialised craftsman

Installation
Operation
Functions and options
Troubleshooting

11204303

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

en

Manual

www.resol.com

Safety advice

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

Danger of electric shock:

- When carrying out works, the device must first of all be disconnected from the mains.
- It must be possible to disconnect the device from the mains at any time.
- Do not use the device if it is visibly damaged.

The device must not be used by children or persons with reduced physical, sensory or mental abilities or without any experience and knowledge. Make sure that children do not play with the device!

Only connect accessories authorised by the manufacturer to the device.

Make sure that the housing is properly closed before commissioning the device.

Target group

These instructions are exclusively addressed to authorised skilled personnel.

Only qualified electricians are allowed to carry out electrical works.

Initial commissioning must be effected by authorised skilled personnel.
Authorised skilled personnel are persons who have theoretical knowledge and experience with the installation, commissioning, operation, maintenance, etc. of electric/electronic devices and hydraulic systems and who have knowledge of relevant standards and directives.

Instructions

Attention must be paid to the valid local standards, regulations and directives!

Information about the product

Proper usage

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

Any use beyond this is considered improper.

Proper usage also includes compliance with the specifications given in this manual.

Improper use excludes all liability claims.

Note

Strong electromagnetic fields can impair the function of the device.

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

EU 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 the manufacturer.

Scope of delivery

The scope of delivery of this product is indicated on the packaging label.

Storage and transport

Store the product at an ambient temperature of 0 … 40 °C and in dry interior rooms only.

Transport the product in its original packaging only.

Cleaning

Clean the product with a dry cloth. Do not use aggressive cleaning fluids.

Decommissioning

1. Disconnect the device from the power supply.
2. Dismount the device.

Subject to technical change. Errors excepted.

Disposal

- Dispose of the packaging in an environmentally sound manner.
- At the end of its working life, the product must not be disposed of as urban waste. Old appliances must be disposed of by an authorised body 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.

Description of symbols

Warnings are indicated with a warning symbol!

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

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

➔ It is indicated how to avoid the danger described.

ATTENTION **means that damage to the appliance can occur.**

➔ It is indicated how to avoid the danger described.

Note

Notes are indicated with an information symbol.

➔ Texts marked with an arrow indicate one single instruction step to be carried out

1. Texts marked with numbers indicate several successive instruction steps to be carried out.

Solar controller DeltaSol® CS/2

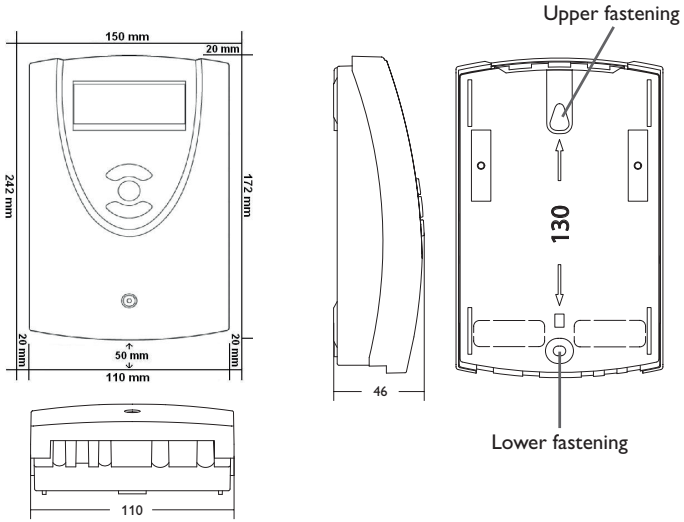
The DeltaSol® CS/2 controller is used for the speed control of a HE pump in small standard solar thermal and heating systems.
It is equipped with a PWM output and an additional input for a VFD Grundfos Direct Sensor™ that enables a precise heat quantity measurement.

Contents

1 Overview

- **Especially designed for the speed control of high-efficiency pumps**
- **1 input for a VFD Grundfos Direct Sensor™**
- **System-Monitoring-Display**
- **Up to 4 Pt1000 temperature sensors**
- **Semiconductor relay for pump speed control**
- **HE pump control**
- **Heat quantity measurement**
- **Commissioning menu**
- **Function control**
- **Drainback option**
- **Unit °F and °C selectable**

Dimensions and minimum distances



Technical data

Inputs: 4 Pt1000 temperature sensors, 1 VFD Grundfos Direct Sensor™

Outputs: 1 semiconductor relays, 1 PWM output

PWM frequency: 512 Hz

PWM voltage: 10.5 V

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

Total switching capacity: 1 A 240 V~

Power supply: 100–240 V~ (50–60 Hz)

Supply connection: type X attachment

Standby: 0.58 W

Mode of operation: type 1.C.Y action

Rated impulse voltage: 2.5 kV

Data interface: VBus®

VBus® current supply: 35 mA

Functions: function control, operating hours counter, speed control, drainback option and heat quantity measurement

Housing: plastic, PC-ABS and PMMA

Mounting: wall mounting, mounting into patch panels is possible

Indication / Display: System-Monitoring-Display for visualisation of systems, 16-segment and 7-segment display, 8 symbols for indication of system status

Operation: 3 buttons

Ingress protection: IP 20 / EN 60529

Protection class: I

Ambient temperature: 0 … 40 °C

Pollution degree: 2

Fuse: T2A

Maximum altitude: 2000 m above MSL

Dimensions: 172 x 110 x 46 mm

2 Installation

2.1 Mounting

WARNING! **Electric shock!**

Upon opening the housing, live parts are exposed!

➔ **Always disconnect the device from power supply before opening the housing!**

Note

Strong electromagnetic fields can impair the function of the device.

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

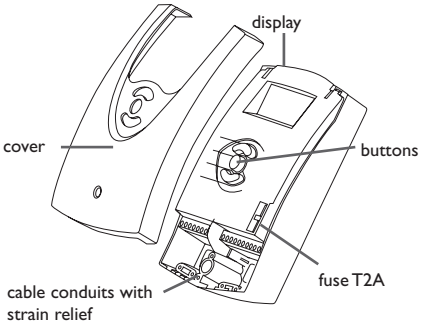
The unit must only be located in dry interior rooms.

If the device is not equipped with a mains connection cable and a plug, the device 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.

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

1. Unscrew the crosshead screw from the cover and remove it along with the cover from the housing.
2. Mark the upper fastening point on the wall. 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 (centres 130 mm).
4. Insert lower wall plug.
5. Fasten the housing to the wall with the lower fastening screw and tighten.
6. Carry out the electrical wiring in accordance with the terminal allocation (see chapter 2.2).
7. Put the cover on the housing.
8. Attach with the fastening screw.



2.2 Electrical connection

WARNING! **Electric shock!**

Upon opening the housing, live parts are exposed!

➔ **Always disconnect the device from power supply before opening the housing!**

ATTENTION! **ESD damage!**

Electrostatic discharge can lead to damage to electronic components!

➔ **Take care to discharge properly before touching the inside of the device!**

Note

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

Note

The mains connection must be carried out with the common ground of the building to which the pipework of the solar circuit is connected.

Note

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

Note

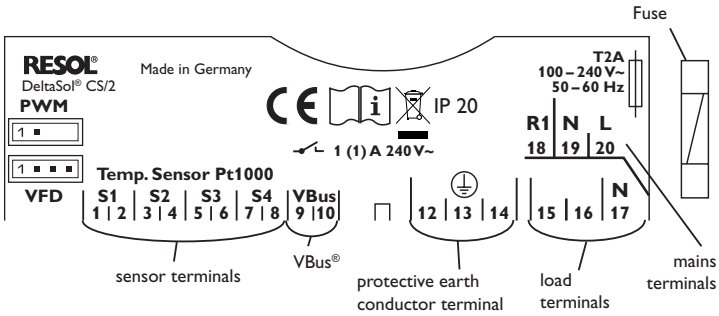
It must be possible to disconnect the device from the mains at any time.

➔ Install the mains plug such that it is accessible at any time.

➔ If this is not possible, install a switch that can be accessed.

If the mains cable is damaged, it must be replaced by a special connection cable which is available from the manufacturer or its customer service.

Do not use the device if it is visibly damaged!



The power supply of the device must be 100 … 240 V~ (50 … 60 Hz). Attach flexible cables to the housing with the enclosed strain relief and the corresponding screws.

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

Relay 1

18 = Conductor R1

17 = Neutral conductor N

13 = Protective earth conductor ⏚

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

19 = Neutral conductor N

20 = Conductor L

12 = Protective earth conductor ⏚

Connect the **temperature sensors** (S1 to S4) to the corresponding terminals with either polarity:

1 / 2 = Sensor 1 (e. g. collector sensor)

3 / 4 = Sensor 2 (e. g. store sensor)

5 / 6 = Sensor 3 (e. g. store sensor top)

7 / 8 = Sensor 4 (e. g. return sensor)

The cables carry low voltage and must not run together in a cable conduit with cables carrying a voltage higher than 50 V (please pay attention to the valid local regulations). The cable lentghs depend on the cross sectional area.

Example: up to 100 m at 1.5 mm², up to 50 m at 0.75 mm². The cables can be extended with a two-wire cable.

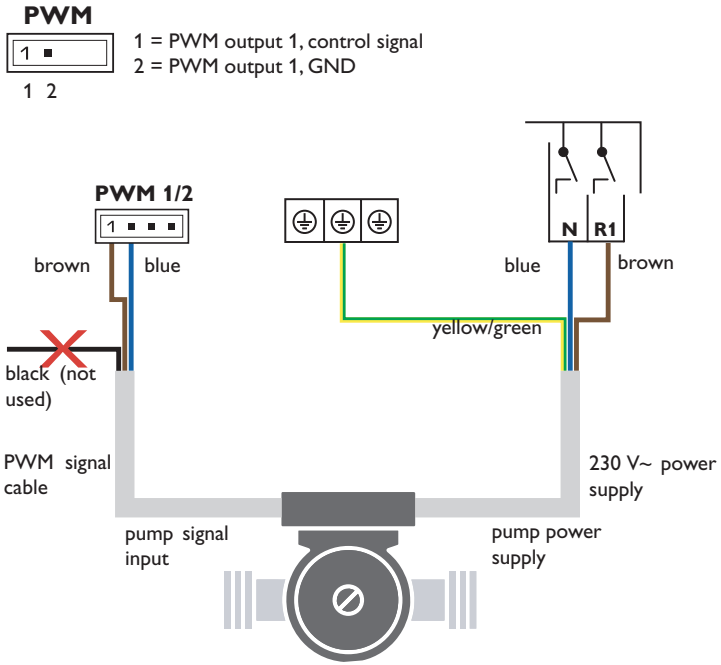
2.3 VFD Grundfos Direct Sensor™

The controller is equipped with 1 input for a digital VFD Grundfos Direct Sensor™ for measuring the flow rate and the temperature. Connection is made at the VFD terminal.

2.4 PWM output

Speed control of a HE pump is possible via a PWM signal. The pump has to be connected to the relay as well as to the PWM output of the controller. Power is supplied to the HE pump by switching the corresponding relay on or off.

The two pins on the left-hand side of the connector marked **PWM** are the control output for a pump with PWM control input. The two pins on the right-hand side are not used.



2.5 Data communication / Bus

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

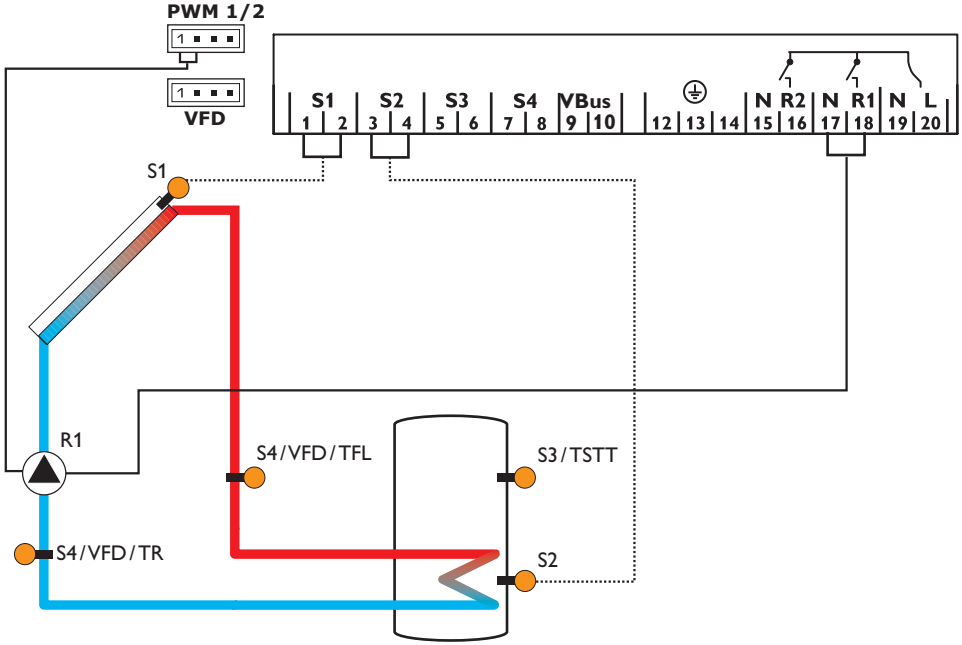
One or more **VBus®** modules can be connected via this data bus.

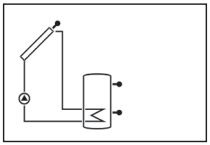
2.6 Terminal allocation

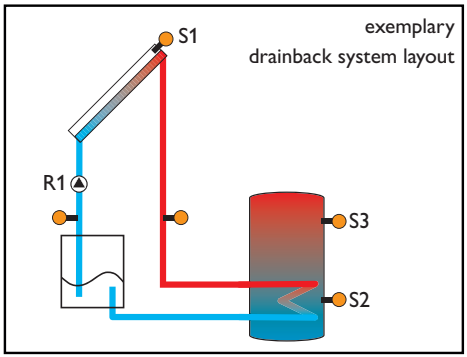
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference (DT O), the solar pump will be activated by relay 1, and the store will be loaded until the switch-off temperature difference (DT F) or the maximum store temperature (SMX) is reached.

Sensors S3 and S4 can optionally be connected. S3 can optionally be used as the reference sensor for the store emergency shutdown option (OSEM).

If heat quantity measurement (OHQM) is activated, S4 and VFD are used as the flow and return sensors.







Display channels

Channel		Description	Connection terminal	Page
INIT	x*	ODB initialisation active	-	15
FLL	x*	ODB filling time active	-	15
STAB	x*	ODB stabilisation in progress	-	15
COL	x	Temperature collector	S1	15
TST	x	Temperature store	S2	15
S3	x	Temperature sensor 3	S3	16
TSTT	x*	Temperature store top	S3	15
S4	x	Temperature sensor 4	S4	16
TFL	x*	Temperature flow sensor	S1/S4/VFD	16
TR	x*	Temperature return sensor	S4/VFD	16
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	16
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	16
n%	x	Speed	R1	16
hP	x	Operating hours	R1	17
kWh	x*	Heat quantity in kWh	-	16
MWh	x*	Heat quantity in MWh	-	16
TIME	x	Time	-	17

Adjustment channels

Channel		Description	Factory setting	Page
DT O	x	Switch-on temperature difference R1	6.0 K [12.0 °Ra]	17
DT F	x	Switch-off temperature difference R1	4.0 K [8.0 °Ra]	17
DT S	x	Set temperature difference R1	10.0 K [20.0 °Ra]	18
RIS	x	Rise R1	2 K [4 °Ra]	18
PUM	x	Pump control type R1	PSOL	18
nMN	x	Minimum speed R1	30%	18
nMX	x	Maximum speed R1	100%	19
S MX	x	Maximum store temperature	60 °C [140 °F]	19
OSEM	x	Store emergency shutdown option	OFF	19
EM	x	Collector emergency temperature	130 °C [270 °F]	19
		Collector emergency temperature if ODB is activated:	95 °C [200 °F]	19
OCC	x	Collector cooling option	OFF	20
CMX	x*	Maximum collector temperature	110 °C [230 °F]	20
OSYC	x	System cooling option	OFF	20

Adjustment channels

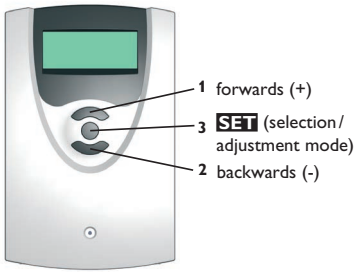
Channel		Description	Factory setting	Page
DTCO	x*	Switch-on temperature difference cooling	20.0 K [40.0 °Ra]	20
DTCF	x*	Switch-off temperature difference cooling	15.0 K [30.0 °Ra]	20
OSTC	x	Store cooling option	OFF	21
OHOL	x*	Holiday cooling option	OFF	21
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	21
OCN	x	Collector minimum limitation option	OFF	21
CMN	x*	Collector minimum temperature	10 °C [50 °F]	21
OCF	x	Antifreeze option	OFF	21
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	21
GFD	x	Grundfos Direct Sensor™	OFF	22
OHQM	x	Heat quantity measurement option	OFF	22
SEN	x*	VFD allocation	2	23
FMAX	x*	Maximum flow rate	6.0 l/min	22
MEDT	x*	Antifreeze type	1	23
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene glycol)	45%	23
ODB	x	Drainback option	OFF	23
tDTO	x*	ODB switch-on condition - time period	60 s	24
tFLL	x*	ODB filling time	5.0 min	24
tSTB	x*	ODB stabilisation time	2.0 min	24
MAN	x	Manual mode R1	Auto	24
LANG	x	Language	dE	24
UNIT	x	Temperature unit	°C	25
RESE	x	Reset - back to factory settings		25
#########		Version number		

Legend:

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

3 Operation and function

3.1 Buttons



The controller is operated via the 3 buttons below the display.

Button 1 (+) is used for scrolling forwards through the menu and increasing adjustment values. **Button 2 (-)** is used for scrolling backwards through the menu and reducing adjustment values. **Button 3 (OK)** is used for selecting channels and confirming adjustments.

During normal operation, display channels will be displayed.

➔ In order to scroll between display channels, press buttons 1 and 2.

Access to adjustment channels:

➔ Use button 1 in order to scroll to the last display channel, then press and hold down button 1 for approx. 2 s.

If an **adjustment channel** is shown on the screen, **SET** will be displayed on the right-hand side next to the channel name.

1. Press button 3 in order to select an adjustment channel.

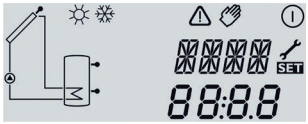
SET starts flashing.

2. Adjust the desired value with buttons 1 and 2.
3. Briefly press button 3.

SET permanently appears, the adjusted value has been saved.

4 System-Monitoring-Display

System-Monitoring-Display



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

Channel display

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

Tool bar

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

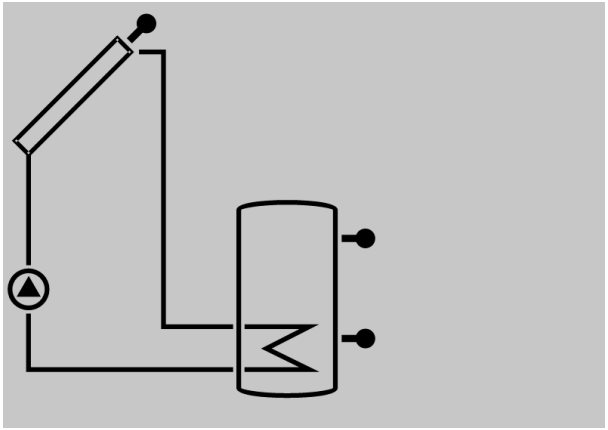
Permanently shown	Flashing	Status indications:
⏻		Relay 1 active
☼		Maximum store temperature exceeded
	⚠ + ☼	Store emergency shutdown active
	⚠	Collector emergency shutdown active
⏻	☼	Collector cooling active
⏻	☼	System cooling active
⏻ + ☼		Store cooling active
☼	⚠	Holiday cooling option activated
⏻ + ☼	⚠	Holiday cooling active
	❄	Collector minimum limitation active
❄		Antifreeze function activated
⏻	❄	Antifreeze function active
✋ + ⏻	⚠	Manual mode relay 1 ON
✋	⚠	Manual mode relay 1 OFF
🔧	⚠	Sensor fault

4.1 Flashing codes

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

System screen

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



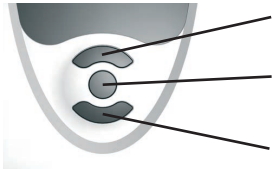
Collector
with collector sensor

Temperature sensor

Store
with heat exchanger

Pump

5 Commissioning

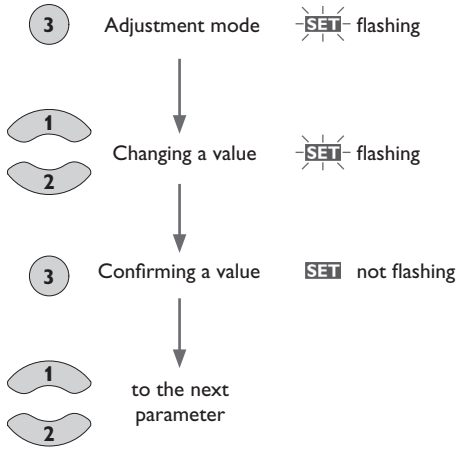


➔ Connect the device to the mains

The controller runs an initialisation phase.

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

Operation



Commissioning

1. Language

➔ Adjust the desired menu language.

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

2. Temperature unit

➔ Adjust the desired unit.

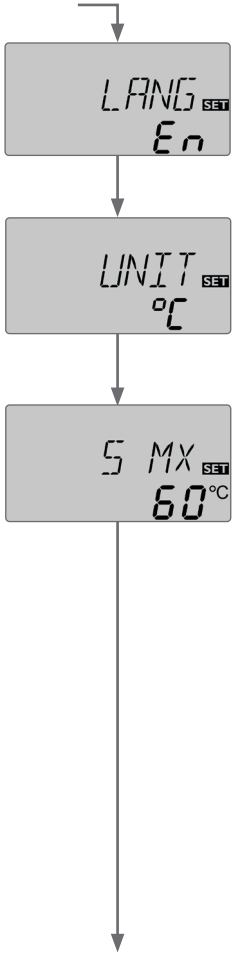
UNIT
Temperature unit
Selection: °F, °C
Factory setting: °C

3. Maximum store temperature

➔ Adjust the desired maximum store temperature.

SMX
Maximum store temperature
Adjustment range: 4 … 95 °C [40 … 200 °F]
Factory setting: 60 °C [140 °F]

Note
The controller is also equipped with a non-adjustable emergency shutdown, deactivating the system if the store reaches 95 °C [200 °F].



6. Pump control type

➔ Adjust the pump control type.

PUM
Pump control type
Selection: OnOF, PULS, PSOL, PHEA
Factory setting: PSOL
The following types can be selected:

Adjustment for standard pump without speed control
- OnOF (pump on / pump off)

Adjustment for standard pump with speed control
- PULS (burst control via semiconductor relay)

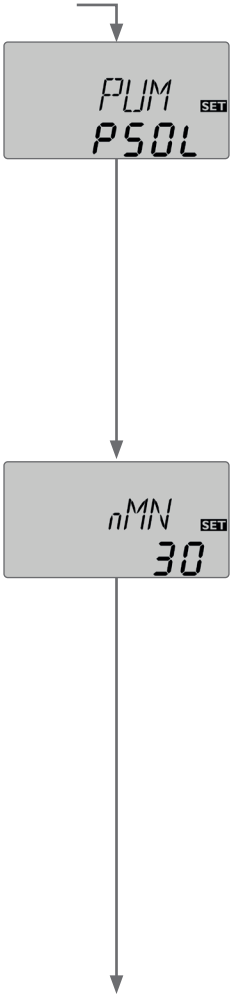
Adjustment for high-efficiency pump (HE pump)
- PSOL (PWM profile for a HE solar pump)
- PHEA (PWM profile for a HE heating pump)

7. Minimum speed

➔ Adjust the minimum speed for the corresponding pump.

nMN
Minimum speed
Adjustment range: (10) 30 … 100 %
Factory setting: 30 %

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



8. Maximum speed

➔ Adjust the maximum speed for the corresponding pump.

nMX
Maximum speed
Adjustment range: (10) 30 … 100 %
Factory setting: 100 %

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

Confirmation

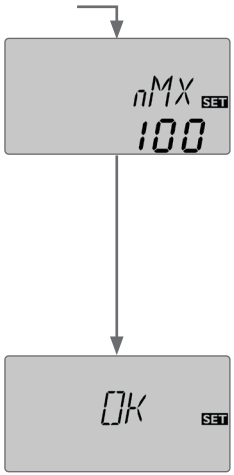
Completing the commissioning menu

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

➔ In order to confirm the adjustments made in the commissioning menu, press button 3.

The controller is then ready for operation with the adjustments made for the system selected .

Note
The adjustments carried out during commissioning can be changed anytime in the corresponding adjustment channel. Additional functions and options can also be activated or deactivated (see page 17).

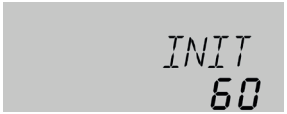


6 Channel overview

6.1 Display channels

Note
The display and adjustment channels as well as the adjustment ranges depend on the system selected, the functions and options as well as on the system components connected to the controller.

Display of drainback time periods
Initialisation



INIT
ODB initialisation active
Indicates the time adjusted in tDTO, running backwards.

Filling time

FLL
ODB filling time active
Indicates the time adjusted in tFLL, running backwards.

Stabilisation

STAB
ODB stabilisation in progress
Indicates the time adjusted in tSTB, running backwards.

Display of collector temperatures

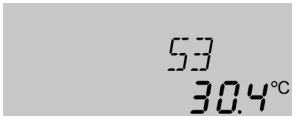
COL
Collector temperature
Display range: -40 … +260 °C [-40 … +500 °F]
Indicates the collector temperatures.

Display of store temperatures

TST,TSTT
Store temperatures
Display range: -40 … +260 °C [-40 … +500 °F]
Indicates the store temperatures.

- TST : Store temperature (1-store system)
- TSTT : Store temperature top

Display of sensors 3, 4 and VFD



S3, S4, VFD
Sensor temperatures
Display range: -40 … +260 °C [-40 … +500 °F]
VFD: 0 … 100 %
Indicates the current temperature at the corresponding additional sensor (without control function).

- S3 : Temperature at sensor 3
- S4 : Temperature at sensor 4
- VFD : Grundfos Direct Sensor™

Note
S3 and S4 will only be indicated if the temperature sensors are connected to the corresponding terminals. VFD will be indicated only if a Grundfos Direct Sensor™ has been connected and registered.

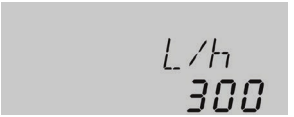
Display of further temperatures

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

- TFL : Temperature flow
- TR : Temperature return

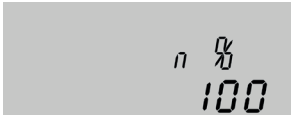
Note
TFL / TR will be indicated only if the heat quantity measurement option (OHQM) has been activated.

Display of flow rate



l/h
Flow rate
Display range: depending on the sensor type used
Indicates the current flow rate at the VFD flow rate sensor.
The display range depends on the sensor type previously selected.

Display of current pump speed



n %
Current pump speed
Display range: 30 … 100 %
Indicates the current pump speed.

kWh/MWh
Heat quantity in kWh / MWh
Display channel
Indicates the energy gained in heat quantity – only available if heat quantity measurement (**OHQM**) is activated.
The heat quantity measurement can be carried out in 2 different ways (see page 22): with a fixed flow rate value or with a VFD Grundfos Direct Sensor™. 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 zero. As soon as one of the display channels of the heat quantity is selected, the symbol **SET** is displayed.

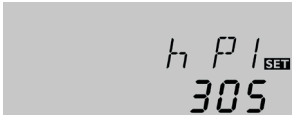
1. In order to access the reset mode of the counter, press button 3 for approx. 2 s.

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

2. In order to finish the reset process, press button 3.

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

Operating hours counter



h P
Operating hours counter
Display channel

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

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

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

SET starts flashing and the operating hours will be set back to zero.

2. In order to finish the reset process, press button 3.

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

6.2 Adjustment channels

ΔT control

DT O
Switch-on temperature difference
Adjustment range: 1.0 … 20.0 K [2.0 … 40.0 °Ra]
Factory setting: 6.0 K [12.0 °Ra]

The controller works as a standard differential controller. If the temperature reaches or exceeds the switch-on temperature difference, the pump switches on.

When the temperature difference reaches or falls below the adjusted switch-off temperature difference, the respective relay switches off.

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

DT F
Switch-off temperature difference
Adjustment range: 0.5 … 19.5 K [1.0 … 39.0 °Ra]
Factory setting: 4.0 K [8.0 °Ra]

Note
If the drainback option **ODB** is activated, the values of the parameters **DT O**, **DT F** and **DT S** will be adapted to values suiting drainback systems:
DT O= 10 K [20 °Ra]
DT F = 4 K [8 °Ra]
DT S = 15 K [30 °Ra]
Adjustments that have been previously made in these channels will be overridden and have to be entered again if **ODB** is deactivated later on.

Speed control

DTS
Set temperature difference
Adjustment range:
1.5 … 30.0 K [3.0 … 60.0 °Ra]
Factory setting: 10.0 K [20.0 °Ra]

RIS
Rise
Adjustment range:
1 … 20 K [2 … 40 °Ra]
Factory setting: 2 K [4 °Ra]

Note
For pump speed control, the operating mode of the corresponding relay must be set to Auto (adjustment channel **MAN**).

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

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

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

PUM
Pump control type
Selection: OnOF, PULS, PSOL, PHEA
Factory setting: PSOL

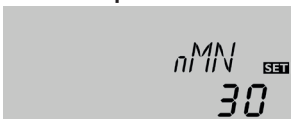
With this parameter, the pump control type can be adjusted. The following types can be selected:

Adjustment for standard pump without speed control
- OnOF (pump on / pump off)

Adjustment for standard pump with speed control
- PULS (burst control via semiconductor relay)

Adjustment for high-efficiency pump (HE pump)
- PSOL (PWM profile for a HE solar pump)
- PHEA (PWM profile for a HE heating pump)

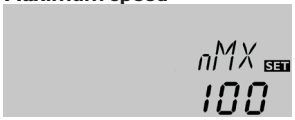
Minimum speed



nMN
Minimum speed
Adjustment range: (10) 30 … 100%
Factory setting: 30%
nMN, n1MN, if ODB is activated: 50%
In the adjustment channel **nMN,** a relative minimum pump speed for a pump connected can be allocated to the output R1.

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

Maximum speed



nMX
Maximum speed
Adjustment range: (10) 30 … 100 %
Factory setting: 100 %

In the adjustment channel **nMX**, a relative maximum speed for a pump connected can be allocated to the output R1.

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

Maximum store temperature

SMX
Maximum store temperature
Adjustment range: 4 … 95 °C [40 … 200 °F]
Arr 10: 4 … 90 °C [40 … 190 °F]
Factory setting: 60 °C [140 °F]

If the store temperature reaches the adjusted maximum temperature, the store will no longer be loaded in order to avoid damage caused by overheating. A non-adjustable hysteresis of 2 K [4 °Ra] is set for the maximum store temperature.

If the maximum store temperature is exceeded, ☼ is displayed.

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

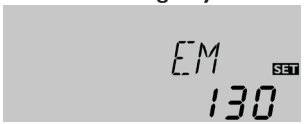
Store emergency shutdown

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

This option is used for activating the internal store emergency shutdown for an upper store sensor. If the temperature at the reference sensor exceeds 95 °C, store 1 will be blocked and loading will be stopped until the temperature falls below 90 °C.

Note
Sensor S3 ist used as the reference sensor.

Collector limit temperature
Collector emergency shutdown



EM
Collector limit temperature
Adjustment range: 80 … 200 °C [170 … 390 °F]
Factory setting: 130 °C [270 °F]

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

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

Cooling functions

In the following the 3 cooling functions – collector cooling, system cooling and store cooling – are described in detail. The following note is valid for all three cooling functions:

Note
The cooling functions will not become active as long as solar loading is possible.

Collector cooling

OCC
Collector cooling option
Adjustment range: OFF / ON
Factory setting: OFF

CMX
Collector maximum temperature
Adjustment range: 70 … 160 °C [150 … 320 °F]
Factory setting: 110 °C [230 °F]

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

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

If the collector cooling function is active, ⏻ and ☼ are displayed (flashing).

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

System cooling

OSYC
System cooling option
Adjustment range: OFF / ON
Factory setting: OFF

DTCO
Switch-on temperature difference
Adjustment range:
1.0 … 30.0 K [2.0 … 60.0 °Ra]
Factory setting: 20.0 K [40.0 °Ra]

The system cooling function 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 adjusted maximum store temperature and the switch-on temperature difference **DTCO** is reached, the solar pump remains switched on or will be switched on. Solar loading is continued until either the temperature difference falls below the adjusted value **DTCF** or the collector limit temperature is reached. If the system cooling function is active, ⏻ and ☼ are displayed (flashing).

DTCF
Switch-off temperature difference
Adjustment range: 0.5 … 29.5 K [1.0 … 59.0 °Ra]
Factory setting: 15.0 K [30.0 °Ra]

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

Store cooling

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

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

THOL
Holiday cooling temperature
Adjustment range: 20 … 80 °C [70 … 175 °F]
Factory setting: 40 °C [110 °F]

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 (**SMX**) 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 (**SMX**) again. A hysteresis of 2 K [4 °Ra] is set for the store cooling function.
Reference threshold temperature differences for the store cooling function are **DTO** and **DTF**.
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 (**SMX**) as the switch-off temperature for the store cooling function.
When the holiday cooling function is activated, ☼ and ⚠ (flashing) are shown on the display.
If the holiday cooling function is active, ⏻, ☼ and ⚠ are displayed (flashing).

Collector minimum limitation

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

CMN
Minimum collector temperature
Adjustment range:
10.0 … 90.0 °C [50.0 … 190.0 °F]
Factory setting: 10.0 °C [50.0 °F]

If the collector minimum limitation option is activated, the pump (R1 / R2) will only be 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 hysteresis of 5 K [10 °Ra] is set for this function. If the collector minimum limitation is active, ❄ is displayed (flashing).

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

Antifreeze function

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

CFR
Antifreeze temperature
Adjustment range:
-40.0 … +10.0 °C [-40.0 … +50.0 °F]
Factory setting: +4.0 °C [+40.0 °F]

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.
If the antifreeze function is activated, ❄ is displayed. If the antifreeze function is active, ⏻ and ❄ are displayed (flashing).

Note
Since this function uses the limited heat quantity of the store, the antifreeze function should only 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.

Grundfos Direct Sensor™ registration

GFD
Grundfos Direct Sensor™ registration
Selection: OFF, 12, 40, 40F
Factory setting: OFF
Registration of a digital flow rate sensor which can be used for heat quantity measurement.
OFF : no Grundfos Direct Sensor™
12 : VFD 1-12 (water-propylene glycol mixture only)
40 : VFD 2-40
40F : VFD 2-40 Fast (water only)

Heat quantity measurement

OHQM
Heat quantity measurement option
Adjustment range: OFF / ON
Factory setting: OFF
If **OHQM** is activated, the heat quantity gained can be calculated and displayed.
The heat quantity measurement can be carried out in 2 different ways (see below): with a fixed flow rate value or with a VFD Grundfos Direct Sensor™.

Heat quantity measurement with fixed flow rate value
The heat quantity balancing (estimation) uses the difference between the flow and return temperatures and the entered flow rate (at 100 % pump speed).
1. Read the flow rate (l/min) and adjust it in the **FMAX** channel.
2. Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

FMAX
Flow rate in l/min
Adjustment range: 0.5 … 100.0
Factory setting: 6.0

Note
The FMAX channel will be available only if the SEN channel has been set to OFF or if no VFD Grundfos Direct Sensor™ is activated.

Heat quantity measurement with a VFD Grundfos Direct Sensor™
Heat quantity measurement with a VFD Grundfos Direct Sensor™ is possible in all system layouts.
In order to use a VFD Grundfos Direct Sensor™ for heat quantity measurement, proceed as follows:
1. Register the VFD Grundfos Direct Sensor™ in the **GFD** channel.
2. Adjust the position of the **VFD** Grundfos Direct Sensor™ in the **SEN** channel.
3. Adjust the type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

SEN
Digital flow rate sensor (only if SEN = 12, 40 or 40F)
Selection: OFF, 1, 2
Factory setting: 2

Flow rate detection type:
OFF : fixed flow rate value (flowmeter)
1 : Grundfos Direct Sensor™ in the flow pipe
2 : Grundfos Direct Sensor™ in the return pipe

Sensor allocation for heat quantity measurement:

SEN = 1		SEN = 2		SEN = OFF	
SFL	SRET	SFL	SRET	SFL	SRET
GFD	S4	S4	GFD	S1	S4

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

MED%
Antifreeze concentration
in Vol-% (MED% is not indicated when MEDT 0 or 3 is used.)
Adjustment range: 20 … 70 %
Factory setting: 45 %

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

Drainback option

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

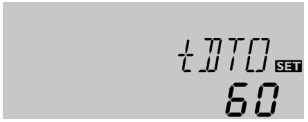
In a drainback system the heat transfer fluid will flow into a holding tank if solar loading does not take place. The drainback option initiates the filling process if solar loading is about to start. If the drainback option is activated, the following adjustment can be made.

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

Note
If the drainback option is activated, the cooling functions and the antifreeze function will not be available. If one or more than one of these functions have 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.

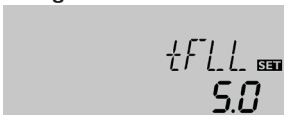
Note
If the drainback option **ODB** is activated, the factory settings of the parameters **nMN**, **DTO**, **DTF** and **DTS** will be adapted to values suiting drainback systems:
Additionally, the adjustment range and the factory setting of the collector emergency shutdown will change. Adjustments previously made in these channels will be overridden and have to be entered again if the drainback option is deactivated later on.

Time period – switch-on condition



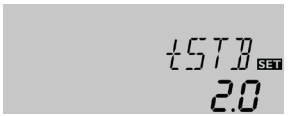
tDTO
Time period – switch-on condition
Adjustment range: 1 … 100 s
Factory setting: 60 s
The parameter **tDTO** is used for adjusting the time period during which the switch-on condition must be permanently fulfilled.

Filling time



tFLL
Filling time
Adjustment range: 1.0 … 30.0 min
Factory setting: 5.0 min
The parameter **tFLL** is used for adjusting the filling time. During this period, the pump runs at 100 % speed.

Stabilisation



tSTB
Stabilisation
Adjustment range: 1.0 … 15.0 min
Factory setting: 2.0 min
The parameter **tSTB** is used for adjusting the time period during which the switch-off condition will be ignored after the filling time has ended.

Operating mode

MAN
Operating mode
Adjustment range: OFF, Auto, On
Factory setting: Auto
For control and service work, the operating mode of the relays can be manually adjusted. For this purpose, select the adjustment value **MAN** in which the following adjustments can be made:

- **MAN**
  Operating mode
  OFF : Relay off ⚠ (flashing) + ✋
  Auto : Relay in automatic operation
  ON : Relay on ⚠ (flashing) + ✋ + ⏻/⏸

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.

Language

LANG
Language selection
Selection: dE, En, Fr, ES, It
Factory setting: dE
In this adjustment channel the menu language can be selected.

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

Unit

UNIT
Temperature unit selection
Selection: °F, °C
Factory setting: °C
In this adjustment channel, the display unit for temperatures and temperature differences can be selected. 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
By means of the reset function, all adjustments can be set back to their factory settings.
➔ In order to carry out a reset, press button 3
All adjustments that have previously been made will be lost! For this reason, a security enquiry will appear after the reset function has been selected.
Only confirm the security enquiry if you are sure you want to set back all adjustment to the factory setting.

Security enquiry
➔ In order to confirm the security enquiry, press button 3

Note
After a reset, the commissioning menu will start again (see page 13).

7 Troubleshooting

If a malfunction occurs, the display symbols will indicate an error code:

The symbol is indicated on the display and the symbol ⚠ is flashing.

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

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

Disconnected Pt1000 temperature sensors can be checked with an ohmmeter. Please check the resistance values correspond with the table.

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

Resistance values of Pt1000 sensors

WARNING! **Electric shock!**

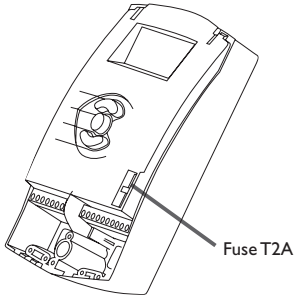
Upon opening the housing, live parts are exposed!

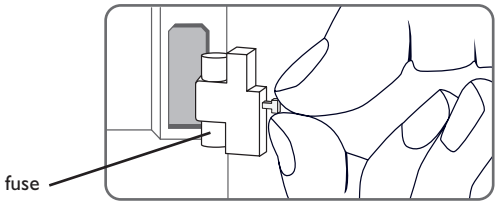
➔ **Always disconnect the device from power supply before opening the housing!**

The display is permanently off.

If the display is off, check the power supply of the controller. Is it disconnected?

- no: The fuse of the controller could be blown. The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.
- yes: Check the supply line and reconnect it.





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

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

Pump starts up very late.

- Switch-on temperature difference ΔTon too large?
  - yes → Change ΔTon and ΔToff correspondingly.
  - no → Non-ideal position of the collector sensor (e. g. flatscrew sensor instead of sensor in immersion sleeves).
    - yes → Put the solar pump (R1) into the manual mode On for a short time during irradiation. Check whether the collector temperature significantly increases.

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

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

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

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

Note
For answers to frequently asked questions (FAQ) see www.resol.com.

Store cool down at night

Collector circuit pump runs during the night?
- no → Check controller
- yes

Collector temperature at night is higher than the outdoor temperature.
- no → Check the non-return valves in the flow and the return pipe for functional efficiency.
- yes

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 sidewards or through a siphon (downwards); less store losses now?
  - no → o.k.
  - yes

Does the DHW 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 1 night; less store losses?
- yes → a
- no → Check whether the pumps of the after-heating circuit run at night; check whether the non-return valve is defective; problem solved?
  - no → b

a

Check the non-return valve in warm water circulation - o.k.
- yes → The gravitation circulation in the circulation line is too strong; insert a stronger valve in the non-return valve or an electrical 2-port valve behind the circulation pump; the 2-port valve is open when the pump is activated, otherwise it is closed; connect pump and 2-port valve electrically in parallel; activate the circulation again. Deactivate pump speed control!
- no → Clean or replace it.

b

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

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

Is the display working?
- 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.

Controller fuse ok?
- no → Replace fuse
- yes → Controller might be defective - replace it.

8 Index

Software License Information (Firmware Version 3.00)

Optionales Zubehör | Optional accessories | Accessoires optionnels | Accesorios opcionales | Accessori opzionali:
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Important note

The texts and drawings in this manual are correct to the best of our knowledge. As faults can never be excluded, please note:

Your own calculations and plans, under consideration of the current standards and directions should only be basis for your projects. We do not offer a guarantee for the completeness of the drawings and texts of this manual - they only represent some examples. They can only be used at your own risk. No liability is assumed for incorrect, incomplete or false information and / or the resulting damages.

Note

The design and the specifications can be changed without notice.

The illustrations may differ from the original product.

Imprint