DeltaSol® CS Plus

RESOL®

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.

11202673

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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.

Instructions

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

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.

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.

Note
Notes are indicated with an information symbol.

➔ Arrows indicate instruction steps that should be carried out.

Information about the product

Proper usage

The solar controller is designed for use in solar thermal systems and heating systems in compliance with the technical data specified in this manual.

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 the manufacturer.

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.

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.

Subject to technical change. Errors excepted.

Contents

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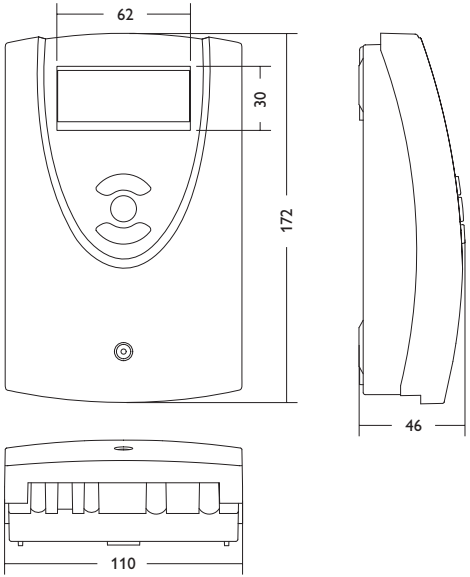
Overview

- **System-Monitoring-Display**
- **Up to 4 Pt1000 temperature sensors**
- **2 semiconductor relays for pump speed control**
- **10 basic system layouts to choose from**
- **1 input for a VFD Grundfos Direct Sensor™**
- **Heat quantity measurement**
- **VBus®**
- **Function control**
- **Thermostat function (time-controlled)**
- **Control of the system by ServiceCenter software possible**
- **User-friendly operation**
- **Housing with outstanding design**
- **Extra-low power consumption**
- **HE pump control**
- **Drainback option**



Technical data

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

Outputs: 2 semiconductor relays, 2 PWM outputs

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

Total switching capacity: 2 A 240 V~

Power supply: 100 ... 240 V~ (50 ... 60 Hz)

Supply connection: type Y attachment

Power consumption: < 1 W (standby)

Mode of operation: type 1.C.Y action

Rated impulse voltage: 2.5 kV

Data interface: RESOL VBus®

VBus® current supply: 35 mA

Functions: function control, operating hours counter, tube collector function, thermostat function, speed control 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 push buttons at the front

Ingress protection: IP 20 / EN 60529

Protection class: I

Ambient temperature: 0 ... 40 °C

Pollution degree: 2

Dimensions: 172 x 110 x 46 mm

1 Installation

1.1 Mounting

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. 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)

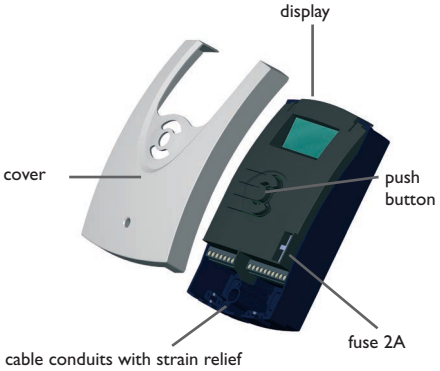
➔ Drill and insert the lower wall plug

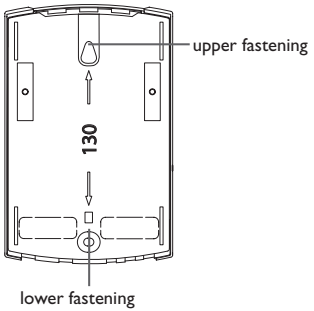
➔ Fasten the housing to the wall with lower fastening screw and tighten

➔ Complete wiring connections in accordance with terminal allocations, see chap. 2.2 “Electrical connection”

➔ Place the cover back onto the housing

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





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!**

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1.2 Electrical connection

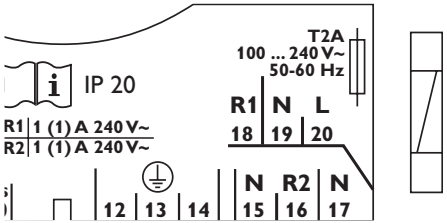
WARNING! **ESD damage!**

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!**

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

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



PE and load terminals

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.

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

Relay 1
18 = conductor R1
17 = neutral conductor N
13 = protective conductor

Relay 2
16 = conductor R2
15 = neutral conductor N
14 = protective conductor

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

19 = neutral conductor N

20 = conductor L

12 = protective conductor

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 1)

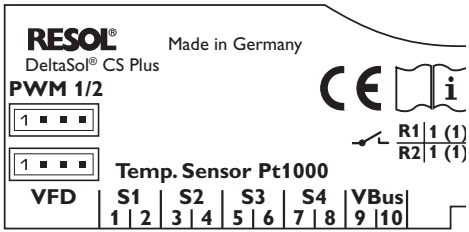
3 / 4 = Sensor 2 (e.g. Sensor store 1)

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

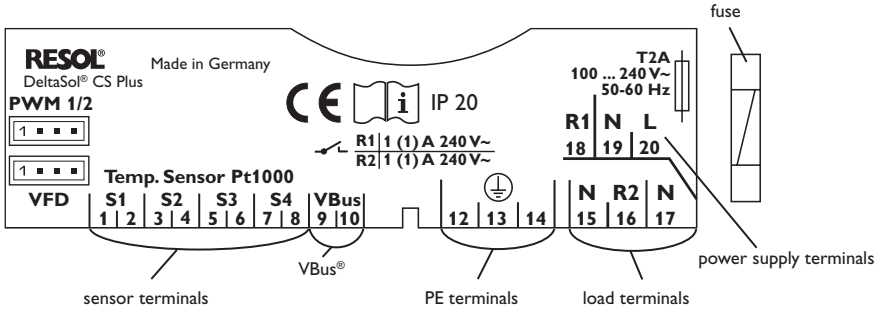
7 / 8 = Sensor 4 (e.g. Sensor return)

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.



Sensor terminals S1 ... S4



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1.3 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 (bottom left).

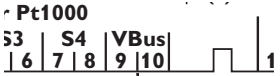
1.4 PWM outputs

The speed of a HE pump is adjusted through a PWM signal. In addition to connection to the relay, the pump must be connected to one of the PWM outputs of the controller.

Power is supplied to the HE pump by switching the corresponding relay on or off.

The terminals marked „PWM 1/2“ are control outputs for pumps with PWM control input.

1.5 Data communication / Bus



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
- DL3 Datalogger
- DL2 Datalogger
- VBus®/USB or VBus®/LAN interface adapter
- AM1 Alarm Module
- WMZ calorimeter module

By means of a Datalogger or an interface adapter, the controller can be connected to a PC or a computer network. Different solutions for visualisation and remote parameterisation are availabe on the RESOL website www.resol.com.

1.6 Terminal allocation in the different system layouts

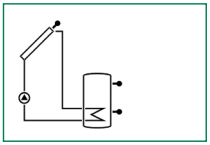
System layout 1

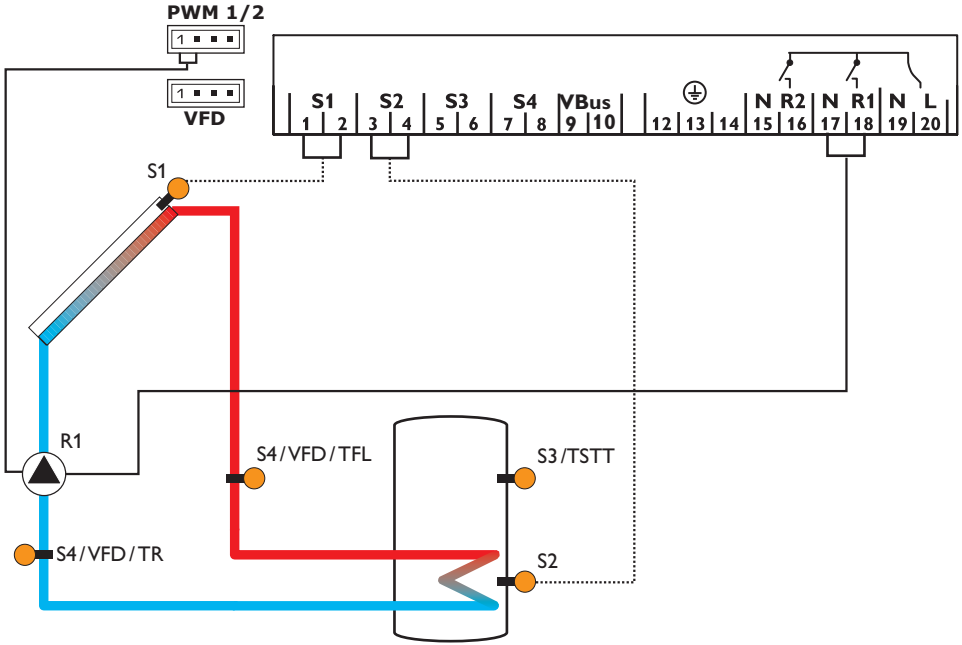
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference (DT O), the solar pump will be operated by relay 1, and the store will be loaded until the switch-off temperature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

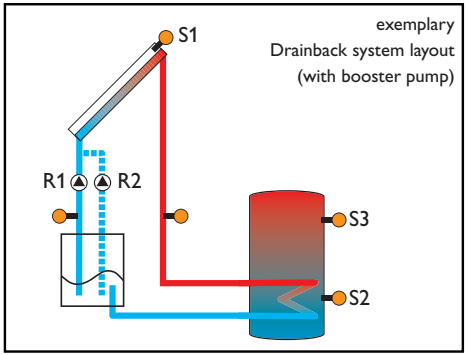
Sensors S3 and S4 can optionally be connected for measurement purposes. S3 can optionally be used as reference sensor for the store emergency shutdown option (OSEM).

If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.

If the drainback option (ODB) is activated, relay 2 can be used to operate a booster pump by activating the booster function (OBST).







Display Channels				
Channel		Description	Terminal	Page
INIT	x*	ODB initialisation active	-	48
FLL	x*	ODB filling time active	-	48
STAB	x*	ODB stabilisation in progress	-	48
COL	x	Temperature collector	S1	48
TST	x	Temperature store	S2	48
S3	x	Temperature sensor 3	S3	48
TSTT	x*	Temperatur store at the top	S3	48
S4	x	Temperature sensor 4	S4	48
TFL	x*	Temperature flow sensor	S1 / S4 / VFD	48
TR	x*	Temperature return sensor	S4 / VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
n%	x	Pump speed R1	R1	49
hP	x	Operating hours R1	R1	50
hP1	x*	Operating hours R1 (if OBST is activated)	R1	50
hP2	x*	Operating hours R2 (if OBST is activated)	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	1	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
PUM1	x	Pump control type	PSOL	51
RIS	x	Rise control R1	2 K [4 °Ra]	51
nMX	x	Maximum pump speed	100%	51
nMN	x	Minimum pump speed	30%	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
		Emergency temperature collector if ODB is activated:	95 °C [200 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53

Adjustment Channels				
Channel		Description	Factory setting	Page
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
FMAX	x*	Maximum flow	6.0 l/min	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
ODB	x	Drainback option	OFF	58
tDTO	x*	ODB switch-on condition - time period	60 s	58
tFLL	x*	ODB filling time	5.0 min	58
tSTB	x*	ODB stabilisation time	2.0 min	58
OBST	s*	Option booster function	OFF	58
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

Legend:

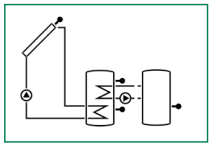
Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

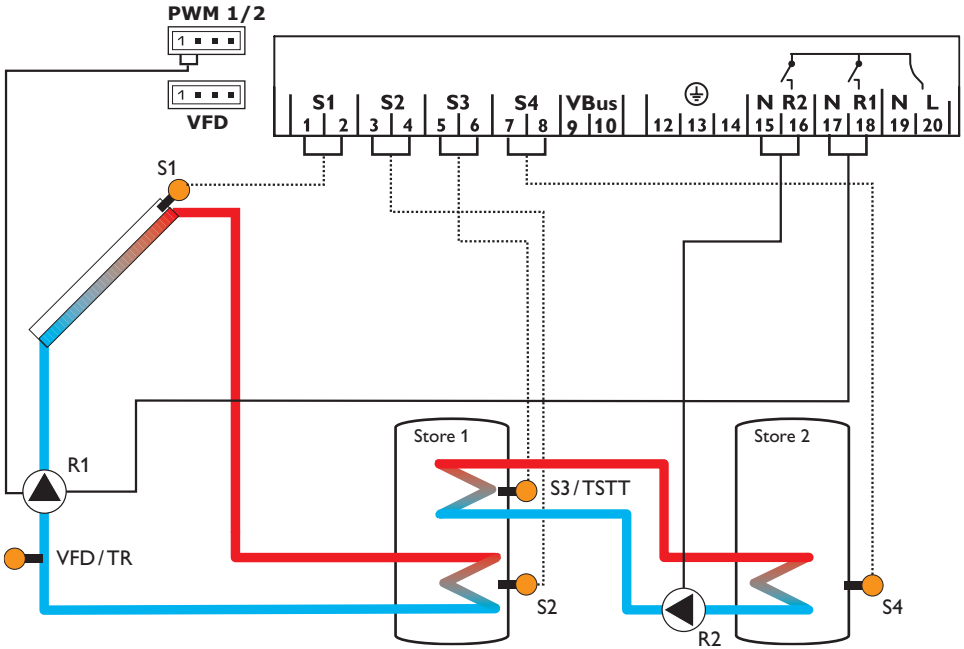
System layout 2

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 relay 1, and the store will be loaded until the switch-off temperature difference (DT F) or the maximum store temperature (S MX) is reached.

Heat exchange from store 1 to store 2 will be operated by relay 2, if the temperature difference between sensors S3 and S4 is larger than or identical to the adjusted switch-on temperature difference (DT3O), until the adjusted minimum (MN3O) and maximum (MX3O) temperature thresholds of the respective stores are reached. S3 can optionally be used as reference sensor for the store emergency shutdown option (OSEM).

If heat quantity measurement (OHQM) is activated, S1and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
INIT	x*	ODB initialisation active	-	48
FLL	x*	ODB filling time active	-	48
STAB	x*	ODB stabilisation in progress	-	48
COL	x	Temperature collector	S1	48
TST1	x	Temperature store 1 base	S2	48
TSTT	x	Temperature store 1 at the top	S3	48
TST2	x	Temperature store 2 base	S4	48
TFL	x*	Temperature flow sensor	S1	48
TR	x*	Temperature return sensor	VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
n1%	x	Pump speed R1	R1	49
n2%	x	Pump speed R2	R2	49
h P1	x	Operating hours R1	R1	50
h P2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	2	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
RIS	x	Rise control R1	2 K [4 °Ra]	51
PUM1	x	Pump control type R1	PSOL	51
n1MN	x	Minimum pump speed R1	30%	51
n1MX	x	Maximum pump speed R1	100%	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
PUM2	x	Pump control type R2	OnOF	51
n2MN	x*	Minimum pump speed R2	30%	51
n2MX	x*	Maximum pump speed R2	100%	51
EM	x	Emergency temperature collector	130 °C [270 °F]	52
		Emergency temperature collector if ODB is activated:	95 °C [200 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53

Adjustment Channels				
Channel		Description	Factory setting	Page
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
OTC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
DT3O	s	Switch-on temperature difference 3	6.0 K [12.0 °Ra]	50
DT3F	s	Switch-off temperature difference 3	4.0 K [8.0 °Ra]	50
DT3S	s	Nominal temperature difference 3	10.0 K [20.0 °Ra]	50
RIS3	s	Rise control R2	2 K [4 °Ra]	51
MX3O	s	Switch-on treshold for maximum temperature	60.0 °C [140.0 °F]	36
MX3F	s	Switch-off treshold for maximum temperature	58.0 °C [136.0 °F]	36
MN3O	s	Switch-on treshold for minimum temperature	5.0 °C [40.0 °F]	36
MN3F	s	Switch-off treshold for minimum temperature	10.0 °C [50.0 °F]	36
ODB	x	Drainback option	OFF	58
tDTO	x*	ODB switch-on condition - time period	60 s	58
tFLL	x*	ODB filling time	5.0 min	58
tSTB	x*	ODB stabilisation time	2.0 min	58
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
########		Version number		

Legend:

Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

System-specific functions

The following adjustments are used for the specific function in system layout 2.

ΔT control for the heat exchange between 2 stores

DT3O:
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]

DT3F:
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]

Reference sensors for this function are S3 and S4.

In system layout 2 the controller is equipped with an additional differential control for heat exchange between two stores. The basic differential function is adjusted using the switch-on (**DT3O**) and switch-off (**DT3F**) temperature differences.

When the temperature difference exceeds the switch-on temperature difference, relay 2 switches on. If the temperature difference then falls below the adjusted switch-off temperature difference, relay 2 switches off.

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

Pump speed control

DT3S:
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]

Note:
For pump speed control of the heat exchange pump, the operation mode of relay 2 (**MAN2**) must be set to Auto.

RIS3:
Rise
Adjustment range: 1 ... 20 K [2 ... 40 °Ra]
in steps of 1 K [2 °Ra]
Factory setting: 2 K [4 °Ra]

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 (**n2MN**).

If the temperature difference reaches the adjusted nominal temperature difference (**DT3S**), 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 **RIS3**.

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

PUM2
Pump control type R2
Selection: OnOF, PULS, PSOL, PHEA
Factory setting: OnOF

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 (pulse packet control via semiconductor relay)

Adjustment for high-efficiency pump (HE pump)

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

Minimum pump speed

n2MN:
Pump speed control
Adjustment range: (10) 30 ... 100 %
in steps of 5 %
Factory setting: 30 %

A relative minimum pump speed can be allocated to the output R2 via the adjustment channel **n2MN.**

Note:
When loads which are not speed-controlled (e. g. valves) are used, the value of the corresponding relay (n1, n2) must be set to 100% or the pump control type must be set to OnOF in order to deactivate pump speed control.

n2MX
Maximum pump speed R2
Adjustment range: (10) 30 ... 100 %
in steps of: 5 %
Factory setting: 100 %

A relative maximum pump speed can be allocated to the output R2 via the adjustment channel n2MX.

Note:
When loads which are not speed-controlled (e. g. valves) are used, the value of the corresponding relay (n1, n2) must be set to 100 % or the pump control type must be set to OnOF in order to deactivate pump speed control.

Maximum temperature limitation

MX3O / MX3F:
Maximum temperature limitation
Adjustment range: 0.0 ... 95.0 °C [30.0 ... 200.0 °F]
in steps of 0.5 °C [1.0 °F]
Factory setting:
MX3O: 60.0 °C [140.0 °F]
MX3F: 58.0 °C [136.0 °F]

Minimum and maximum temperature limits can be set for the heat exchange function.

The maximum temperature limitation uses sensor 4 as reference sensor.

The maximum temperature limitation function provides a maximum temperature setting, usually to reduce scald risk in a storage store. If **MX3O** is exceeded, relay 2 is switched off until the temperature at sensor 4 falls below **MX3F**.

Minimum temperature limitation

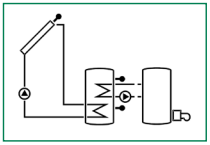
MN3O / MN3F:
Minimum temperature limitation
Adjustment range: 0.0 ... 90.0 °C [30.0 ... 190.0 °F]
in steps of 0.5 °C [1.0 °F]
Factory setting (Arr = 2 only):
MN3O: 5.0 °C [40.0 °F]
MN3F: 10.0 °C [50.0 °F]

The minimum temperature limitation uses sensor 3 as reference sensor.

The minimum temperature limitation function provides a minimum temperature setting for the heat source in system layout 2. If the temperature at sensor 3 falls below **MN3O**, relay 2 is switched off until the temperature at sensor 3 exceeds **MN3F**.

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

System layout 3

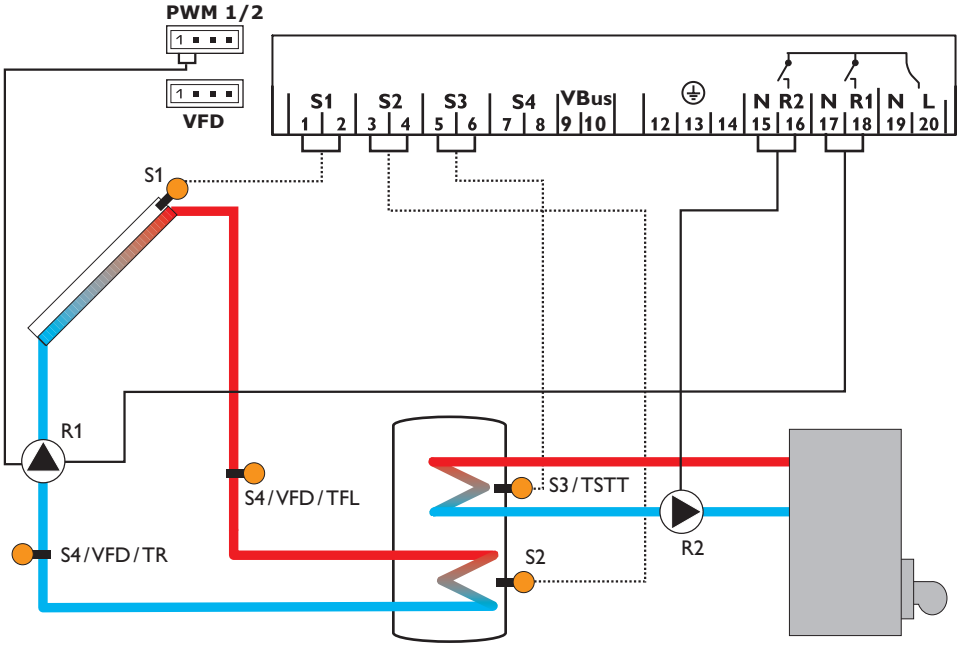


The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference (DT O), the solar pump will be operated by relay 1, and the store will be loaded until the switch-off temperature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

Sensor S3 is used for a thermostatic function, which operates relay 2 for afterheating or heat dump purposes, when the adjusted thermostat switch-on temperature (AH O) is reached. This function can optionally be combined with up to three adjustable time frames.

Sensor S3 can also be optionally used as a reference sensor for the thermal disinfection function OTD or the store emergency shutdown option (OSEM).

Sensor S4 can optionally be connected for measurement purposes. If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.



Display Channels				
Channel		Description	Terminal	Page
INIT	x*	ODB initialisation active	-	48
FLL	x*	ODB filling time active	-	48
STAB	x*	ODB stabilisation in progress	-	48
COL	x	Temperature collector	S1	48
TSTB	x	Temperature store 1 base	S2	48
TSTT	x	Temperature store 1 at the top	S3	48
TDIS	s*	Thermal disinfection temperature	S3	48
S4	x	Temperature sensor 4	S4	48
TFL	x*	Temperature flow sensor	S1 / S4 / VFD	48
TR	x*	Temperature return sensor	S4 / VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
n1 %	x	Pump speed R1	R1	49
h P1	x	Operating hours R1	R1	50
h P2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
CDIS	s*	Countdown of monitoring period	-	49
SDIS	s*	Starting time display	-	49
DDIS	s*	Heating period display	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	3	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
RIS	x	Rise control R1	2 K [4 °Ra]	51
n1MX	x	Maximum pump speed	100 %	51
n1MN	x	Minimum pump speed R1	30 %	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
		Emergency temperature collector if ODB is activated:	95 °C [200 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54

Adjustment Channels				
Channel		Description	Factory setting	Page
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
OTC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
FMAX	x*	Maximum flow	6.0 l/min	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration	45 %	57
AH O	s	Switch-on temp. for thermostat 1	40 °C [110 °F]	18
AH F	s	Switch-off temp. for thermostat 1	45 °C [120 °F]	18
t1 O	s	Switch-on time 1 thermostat	00:00	18
t1 F	s	Switch-off time 1 thermostat	00:00	18
t2 O	s	Switch-on time 2 thermostat	00:00	18
t2 F	s	Switch-off time 2 thermostat	00:00	18
t3 O	s	Switch-on time 3 thermostat	00:00	18
t3 F	s	Switch-off time 3 thermostat	00:00	18
ODB	x	Drainback option	OFF	58
tDTO	x*	ODB switch-on condition - time period	60 s	58
tFLL	x*	ODB filling time	5.0 min	58
tSTB	x*	ODB stabilisation time	2.0 min	58
OTD	s	Option thermal disinfection	OFF	18
PDIS	s*	Monitoring period	01:00	18
DDIS	s*	Heating period	01:00	18
TDIS	s*	Disinfection temperature	60 °C [140 °F]	19
SDIS	s*	Starting time	00:00	19
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

Legend:

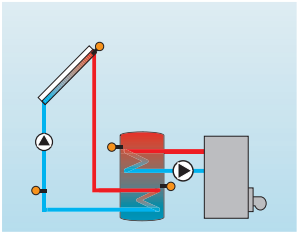
Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

System-specific functions

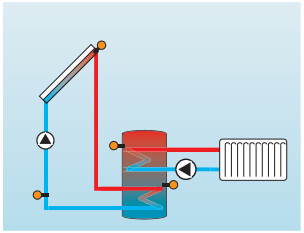
The following functions are exclusively available in system layout 3. The corresponding channels will not be available in any other system layout.

Thermostat function

Afterheating



Use of surplus energy



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

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

The symbol ⏸ will be shown on the display if the second relay output is activated.

Reference sensor for the thermostat function is S3!

AH O:
Thermostat switch-on temp.
Adjustment range: 0.0 ... 95.0 °C [30.0 ... 200.0 °F]
in steps of 0.5 °C [1.0 °F]
Factory setting: 40.0 °C [110.0°F]

AH F:
Thermostat switch-off temp.
Adjustment range: 0.0 ... 95.0 °C [30.0 ... 200.0 °F]
in steps of 0.5 °C [1.0 °F]
Factory setting: 45.0 °C [120.0 °F]

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

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

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

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

Thermal disinfection

OtD:
Thermal disinfection function
Adjustment range: ON / OFF
Factory setting: OFF

PDIS:
Monitoring period
Adjustment range: 0 ... 30:0 ... 24 h (dd:hh)
Factory setting: 01:00

DDIS
Heating period
Adjustment range: 00:00 ... 23:59 (hh:mm)
Factory setting: 01:00

TDIS

Disinfection temperature
Adjustment range: 0 ... 95 °C
in steps of 1 K
Factory setting: 60 °C

This function helps to contain the spread of Legionella in DHW stores by systematically activating the afterheating.

Reference sensor for the thermal disinfection function is S3!

For thermal disinfection, the temperature at the reference sensor has to be monitored. This protection is ensured when, during the monitoring period, the disinfection temperature is continuously exceeded for the entire disinfection period.

If the thermal disinfection function is activated, the monitoring period starts as soon as the temperature at the reference sensor falls below the disinfection temperature. When the monitoring period ends, the allocated reference relay activates the afterheating. The disinfection period starts to count as soon as the temperature at the reference sensor exceeds the disinfection temperature.

If the temperature at the reference sensor exceeds the disinfection temperature by more than 5 K, the reference relay switches off until the temperature has fallen below a value of 2 K, above the disinfection temperature.

Thermal disinfection can only be completed when the disinfection temperature is exceeded for the duration of the disinfection period without interruption.

If the disinfection conditions have been fulfilled by solar loading before the monitoring period ends, thermal disinfection is considered complete and a new monitoring period begins.

Due to the flexible control logic, the exact time of thermal disinfection is not predictable. In order to set a fixed time for the disinfection to be run, the starting delay must be used:

Thermal disinfection with starting delay

SDIS

Starting time
Adjustment range: 00:00 ... 24:00 (o'clock)
Factory setting: 00:00

If the starting delay option is activated, a starting time for the thermal disinfection with starting delay can be adjusted. The activation of the afterheating is then delayed until that starting time after the monitoring period has ended.

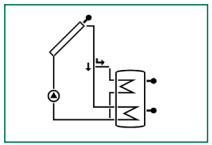
If the monitoring period ends, for example, at 12:00 o'clock, and the starting time has been set to 18:00, the reference relay will be energised with a delay of 6 hours at 18:00 instead of 12:00 o'clock.

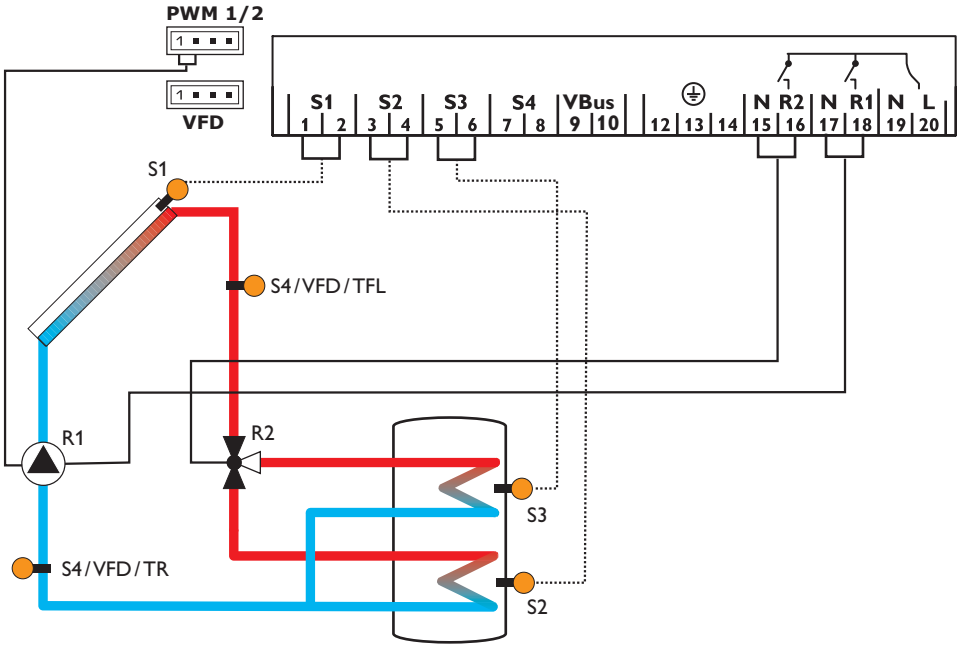
If, during the waiting time, the disinfection conditions are fulfilled by solar loading, thermal disinfection is considered complete and a new monitoring period begins.

System layout 4

The controller calculates the temperature differences between collector sensor S1 and store sensors S2 and S3. If the differences are larger than or identical to the adjusted switch-on temperature differences (DT1O/DT2O), the solar pump will be operated by relay 1, and the respective store zone will be loaded until the switch-off temperature differences (DT1F/DT2F) or the maximum store temperatures (S1MX/S2MX) are reached. The priority logic causes priority loading of the upper zone of the store, if possible. The 3-port valve will be operated by relay 2 then.

If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
COL	x	Temperature collector	S1	48
TSTB	x	Temperature store 1 base	S2	48
TSTT	x	Temperature store 1 at the top	S3	48
S4	x	Temperature sensor 4	S4	48
TFL	x*	Temperature flow sensor	S1 / S4 / VFD	48
TR	x*	Temperature return sensor	S4 / VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
n %	x	Pump speed relay	R1	49
hP1	x	Operating hours R1	R1	50
hP2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	4	50
PUM1	x	Pump control type	PSOL	51
nMN	x	Minimum pump speed	30 %	51
nMX	x	Maximum pump speed	100 %	51
DT1O	x	Switch-on temperature difference 1	6.0 K [12.0 °Ra]	50
DT1F	x	Switch-off temperature difference 1	4.0 K [8.0 °Ra]	50
DT1S	x	Nominal temperature difference 1	10.0 K [20.0 °Ra]	50
RIS1	x	Rise control R1	2 K [4 °Ra]	51
S1 MX	x	Maximum temperature store 1	60 °C [140 °F]	52
DT2O	x	Switch-on temperature difference 2	6.0 K [12.0 °Ra]	50
DT2F	x	Switch-off temperature difference 2	4.0 K [8.0 °Ra]	50
DT2S	x	Nominal temperature difference 2	10.0 K [20.0 °Ra]	50
RIS2	x	Rise control R2	2 K [4 °Ra]	51
S2MX	x	Maximum temperature store 2	60 °C [140 °F]	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53

Adjustment Channels				
Channel		Description	Factory setting	Page
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
PRIO	x	Priority	2	55
tLB	x	Break time	2 min	55
tRUN	x	Circulation runtime	15 min	55
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
FMAX	x*	Maximum flow	6.0 l/min	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

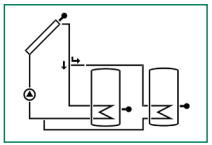
Legend:

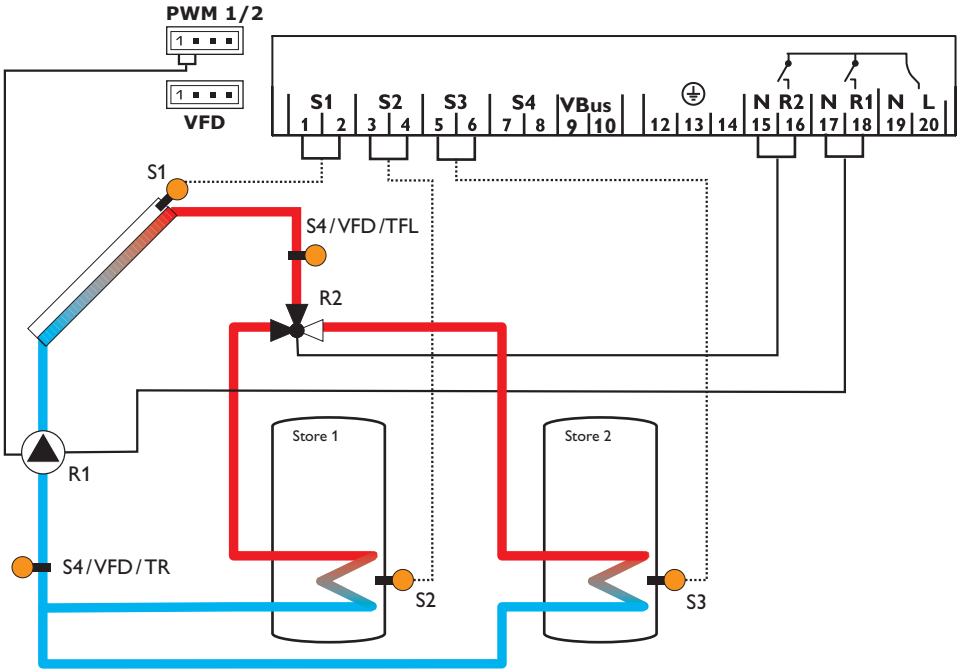
Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

System layout 5

The controller calculates the temperature differences between collector sensor S1 and store sensors S2 and S3. If the differences are larger than or identical to the adjusted switch-on temperature differences (DT1O / DT2O), the solar pump will be operated by relay 1, and the respective store will be loaded until the switch-off temperature differences (DT1F / DT2F) or the maximum store temperatures (S1MX / S2MX) are reached. The priority logic causes priority loading of store 1, if possible. For loading store 2 the 3-port valve will be operated by relay 2.

If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.





Display Channels

Channel		Description	Terminal	Page
COL	x	Temperature collector	S1	48
TST1	x	Temperature store 1 base	S2	48
TST2	x	Temperature store 2 base	S3	48
S4	x	Temperature sensor 4	S4	48
TFL	x*	Temperature flow sensor	S1 / S4 / VFD	48
TR	x*	Temperature return sensor	S4 / VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
n%	x	Pump speed relay	R1	49
hP1	x	Operating hours R1	R1	50
hP2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels

Channel		Description	Factory setting	Page
Arr	x	System	5	50
PUM1	x	Pump control type	PSOL	51
nMN	x	Minimum pump speed	30%	51
nMX	x	Maximum pump speed	100%	51
DT1O	x	Switch-on temperature difference 1	6.0 K [12.0 °Ra]	50
DT1F	x	Switch-off temperature difference 1	4.0 K [8.0 °Ra]	50
DT1S	x	Nominal temperature difference 1	10.0 K [20.0 °Ra]	50
RIS1	x	Rise control R1	2 K [4 °Ra]	51
S1 MX	x	Maximum temperature store 1	60 °C [140 °F]	52
DT2O	x	Switch-on temperature difference 2	6.0 K [12.0 °Ra]	50
DT2F	x	Switch-off temperature difference 2	4.0 K [8.0 °Ra]	50
DT2S	x	Nominal temperature difference 2	10.0 K [20.0 °Ra]	50
RIS2	x	Rise control R2	2 K [4 °Ra]	51
S2MX	x	Maximum temperature store 2	60 °C [140 °F]	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53

Adjustment Channels				
Channel		Description	Factory setting	Page
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
PRIO	x	Priority	1	55
tLB	x	Break time	2 min	55
tRUN	x	Circulation runtime	15 min	55
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
FMAX	x*	Maximum flow	6.0 l/min	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

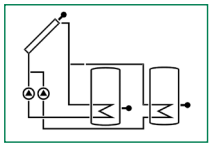
Legend:

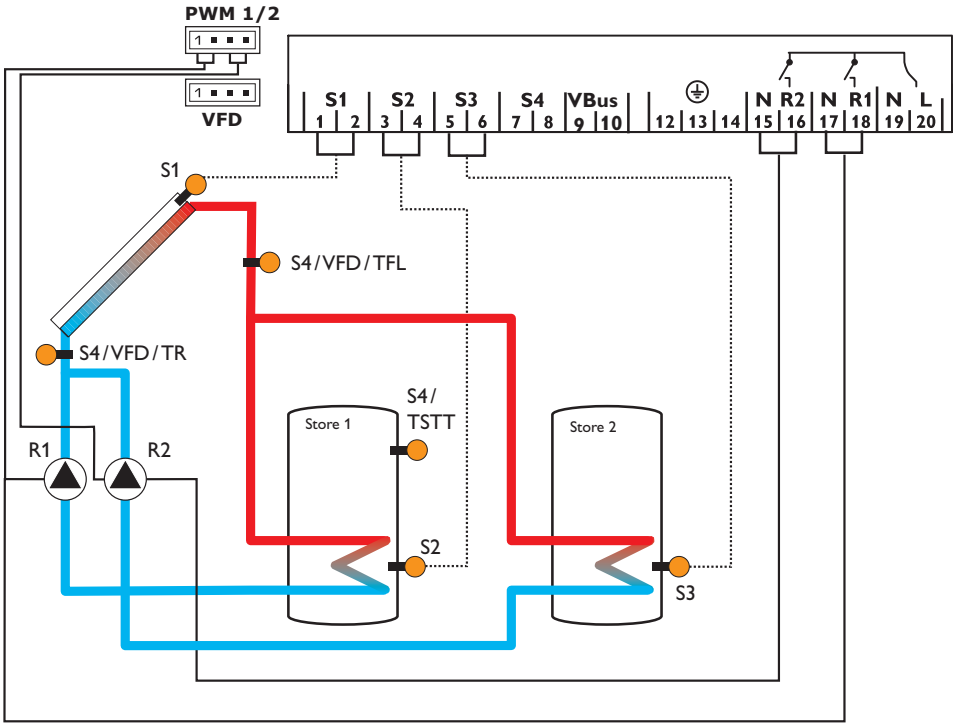
Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

System layout 6

The controller calculates the temperature differences between collector sensor S1 and store sensors S2 and S3. If the differences are larger than or identical to the adjusted switch-on temperature differences (DT1O/DT2O), the solar pumps will be operated by relay 1 and/or relay 2, and the respective store will be loaded until the switch-off temperature differences (DT1F/DT2F) or the maximum store temperatures (S1MX/S2MX) are reached. The priority logic causes priority loading of the selected store (PRIO), if possible. Loading both stores simultaneously is possible as well (PRIO = 0).

Sensor S4 can optionally be used as reference sensor for the store emergency shutdown option (OSEM). If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
COL	x	Temperature collector	S1	48
TST1	x	Temperature store 1 base	S2	48
TST2	x	Temperature store 2 base	S3	48
S4	x	Temperature sensor 4	S4	48
TSTT	x*	Temperature store at the top	S4	48
TFL	x*	Temperature flow sensor	S1 / S4 / VFD	48
TR	x*	Temperature return sensor	S4 / VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
n1%	x	Pump speed R1	R1	49
n2%	x	Pump speed R2	R2	49
h P1	x	Operating hours R1	R1	50
h P2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	6	50
DT1O	x	Switch-on temperature difference 1	6.0 K [12.0 °Ra]	50
DT1F	x	Switch-off temperature difference 1	4.0 K [8.0 °Ra]	50
DT1S	x	Nominal temperature difference 1	10.0 K [20.0 °Ra]	50
RIS1	x	Rise control R1	2 K [4 °Ra]	51
PUM1	x	Pump control type R1	PSOL	51
n1MN	x	Minimum pump speed R1	30%	51
n1MX	x	Maximum pump speed R1	100%	51
S1 MX	x	Maximum temperature store 1	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
DT2O	x	Switch-on temperature difference 2	6.0 K [12.0 °Ra]	50
DT2F	x	Switch-off temperature difference 2	4.0 K [8.0 °Ra]	50
DT2S	x	Nominal temperature difference 2	10.0 K [20.0 °Ra]	50
RIS2	x	Rise control R2	2 K [4 °Ra]	51
PUM2	x	Pump control type R2	OnOF	51
n2MN	x*	Minimum pump speed R2	30%	51
n2MX	x*	Maximum pump speed R2	100%	51
S2MX	x	Maximum temperature store 2	60 °C [140 °F]	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53

Adjustment Channels				
Channel		Description	Factory setting	Page
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
PRIO	x	Priority	1	55
tLB	x	Break time	2 min	55
tRUN	x	Circulation runtime	15 min	55
DTSE	x*	Spread temperature difference	40 K [70 °Ra]	55
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

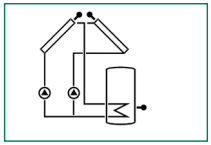
Legend:

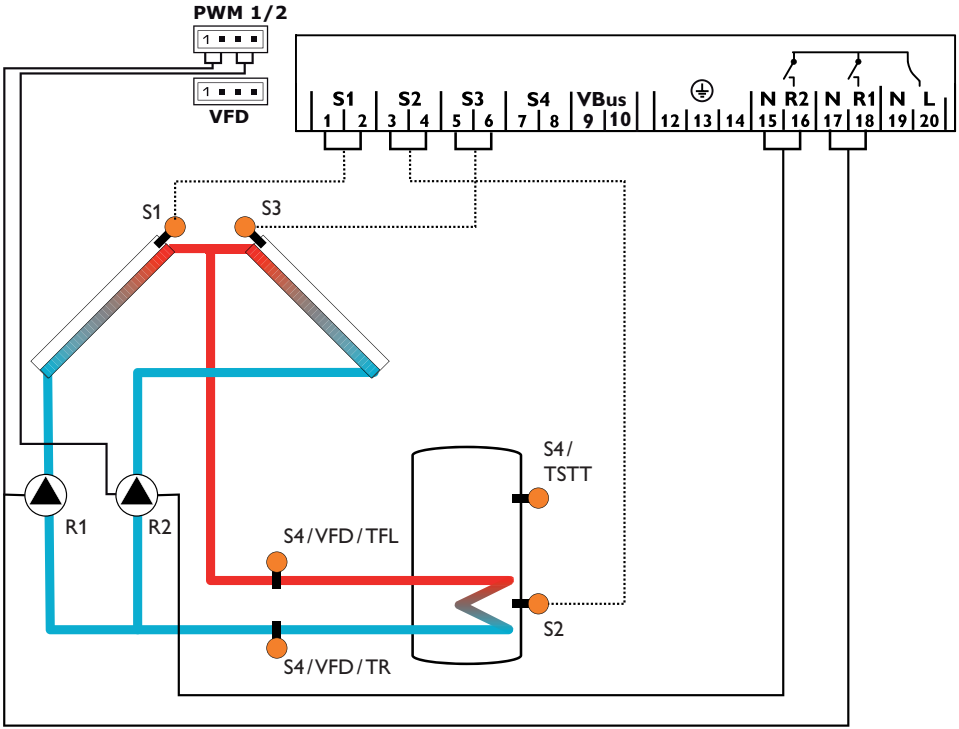
Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

System layout 7

The controller calculates the temperature differences between the collector sensors S1 and S3 and the store sensor S2. If the differences are larger than or identical to the adjusted switch-on temperature difference (DT O), the respective solar pump will be operated by relay 1 and / or relay 2, and the store will be loaded until the switch-off temperature difference (DT F) or the maximum store temperature (S MX) is reached.

Sensor S4 can optionally be used as reference sensor for the store emergency shutdown option (OSEM). If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
COL1	x	Temperature collector 1	S1	48
TST	x	Temperature store	S2	48
COL2	x	Temperature collector 2	S3	48
S4	x	Temperature sensor 4	S4	48
TSTT	x*	Temperature store at the top	S4	48
TFL	x*	Temperatur Vorlaufsensor	S4/VFD	48
TR	x*	Temperatur Rücklaufsensor	S4/VFD	48
VFD	x*	Temperatur Grundfos Direct Sensor™	VFD	48
L/h	x*	Volumenstrom Grundfos Direct Sensor™	VFD	49
n1 %	x	Pump speed R1	R1	49
n2 %	x	Pump speed R2	R2	50
h P1	x	Operating hours R1	R1	50
h P2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	7	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
RIS	x	Rise control R1/R2	2 K [4 °Ra]	51
PUM1	x	Pump control type R1	PSOL	51
n1MN	x	Minimum pump speed R1	30 %	51
n1MX	x	Maximum pump speed R1	100 %	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
PUM2	x	Pump control type R2	OnOF	51
n2MN	x*	Minimum pump speed R2	30 %	51
n2MX	x*	Maximum pump speed R2	100 %	51
EM1	x	Emergency temperature collector	130 °C [270 °F]	52
EM2	x	Emergency temperature collector	130 °C [270 °F]	52
OCC1	x	Option collector cooling collector 1	OFF	53
CMX1	x*	Maximum temperature collector 1	110 °C [230 °F]	53
OCC2	x	Option collector cooling collector 2	OFF	53

Adjustment Channels				
Channel		Description	Factory setting	Page
CMX2	x*	Maximum temperature collector 2	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN1	x	Option minimum limitation collector 1	OFF	54
CMN1	x*	Minimum temperature collector 1	10 °C [50 °F]	54
OCN2	x	Option minimum limitation collector 2	OFF	54
CMN2	x*	Minium temperature collector 2	10 °C [50 °F]	54
OCF1	x	Option antifreeze collector 1	OFF	54
CFR1	x*	Antifreeze temperature collector 1	4.0 °C [40.0 °F]	54
OCF2	x	Option antifreeze collector 2	OFF	54
CFR2	x*	Antifreeze temperature collector 2	4.0 °C [40.0 °F]	54
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

Legend:

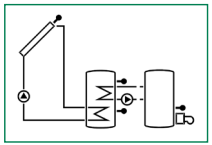
Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

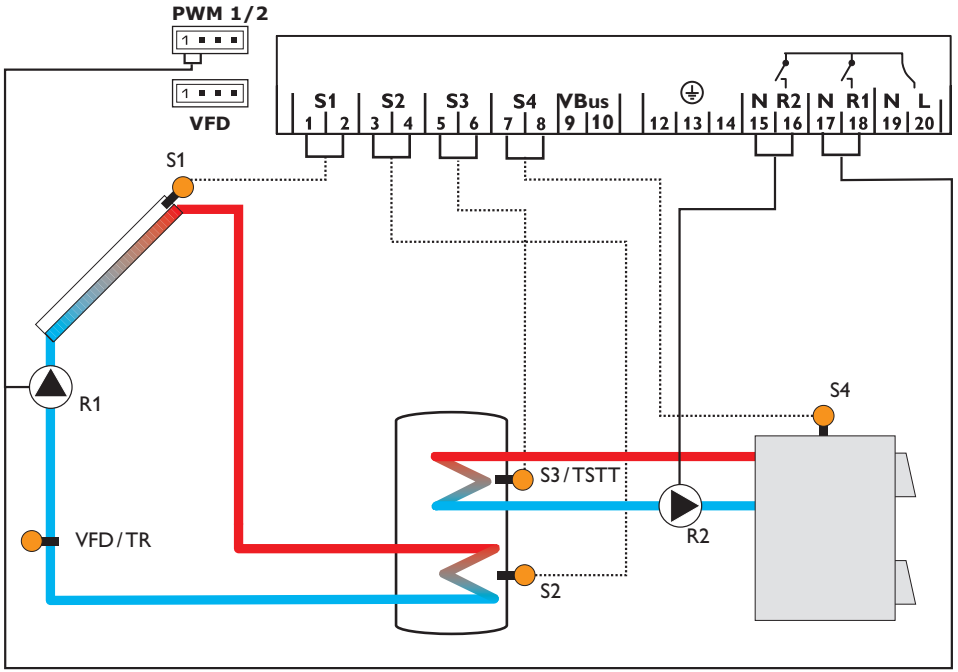
System layout 8

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 relay 1, and the store will be loaded until the switch-off temperature difference (DT F) or the maximum store temperature (S MX) is reached.

A solid fuel boiler will be operated by relay 2, if the temperature difference between sensors S4 and S3 is larger than or identical to the adjusted switch-on temperature difference (DT3O), until the adjusted minimum (MN3O) and maximum (MX3O) temperature thresholds of the fuel boiler and the store are reached. S3 can optionally be used as reference sensor for the store emergency shutdown option (OSEM).

If heat quantity measurement (OHQM) is activated, S4 and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
INIT	x*	ODB initialisation active	-	48
FLL	x*	ODB filling time active	-	48
STAB	x*	ODB stabilisation in progress	-	48
COL	x	Temperature collector	S1	48
TSTB	x	Temperature store 1 base	S2	48
TSTT	x	Temperature store 1 at the top	S3	48
TFL	x*	Temperature flow sensor	S1	48
TR	x*	Temperature return sensor	VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
TSFB	x	Temperature solid fuel boiler	S4	48
n1%	x	Pump speed R1	R1	49
n2%	x	Pump speed R2	R2	49
h P1	x	Operating hours R1	R1	50
h P2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	8	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
RIS	x	Rise control R1	2 K [4 °Ra]	51
PUM1	x	Pump control type R1	PSOL	51
n1MN	x	Minimum pump speed R1	30%	51
n1MX	x	Maximum pump speed R1	100%	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
PUM2	x	Pump control type R2	OnOF	51
n2MN	x*	Minimum pump speed R2	30%	51
n2MX	x*	Maximum pump speed R2	100%	51
EM	x	Emergency temperature collector	130 °C [270 °F]	52
		Emergency temperature collector if ODB is activated:	95 °C [200 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53

Adjustment Channels				
Channel		Description	Factory setting	Page
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
DT3O	s	Switch-on temperature difference 3	6.0 K [12.0 °Ra]	50
DT3F	s	Switch-off temperature difference 3	4.0 K [8.0 °Ra]	50
DT3S	s	Nominal temperature difference 3	10.0 K [20.0 °Ra]	50
RIS3	s	Rise control R2	2 K [4 °Ra]	51
MX3O	s	Switch-on treshold for maximum temperature	60.0 °C [140.0 °F]	36
MX3F	s	Switch-off treshold for maximum temperature	58.0 °C [136.0 °F]	36
MN3O	s	Switch-on treshold for minimum temperature	60.0 °C [140.0 °F]	36
MN3F	s	Switch-off treshold for minimum temperature	65.0 °C [150.0 °F]	36
ODB	x	Drainback option	OFF	58
tDTO	x*	ODB switch-on condition - time period	60 s	58
tFLL	x*	ODB filling time	5.0 min	58
tSTB	x*	ODB stabilisation time	2.0 min	58
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

Legend:

Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

System-specific functions

The following adjustments are used for the specific functions in system layout 8.

ΔT control for afterheating by solid fuel boiler

DT3O:
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]

Reference sensors for this function are S4 and S3.

In system layout 8, the controller is equipped with an additional differential control for heat exchange from a solid fuel boiler (e.g. woodstove). The basic differential function is adjusted using the switch-on (**DT3O**) and switch-off (**DT3F**) temperature differences.

When the switch-on difference is reached, relay 2 switches on. When the temperature difference falls below the adjusted switch-off temperature difference, relay 2 switches off.

DT3F:
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]

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

Pump speed control

DT3S:
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]

Note:
For pump speed control of the solid fuel boiler pump, the operation mode of relay 2 (**MAN2**) must be set to Auto.

RIS3:
Rise
Adjustment range: 1 ... 20 K [2 ... 40 °Ra]
in steps of 1 K [2 °Ra]
Factory setting: 2 K [4 °Ra]

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

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 (**n2MN**).

If the temperature difference reaches the adjusted nominal temperature difference (**DT3S**), 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 **RIS3**.

PUM2
Pump control type R2
Selection: OnOF, PULS, PSOL, PHEA
Factory setting: OnOF

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 (pulse packet control via semiconductor relay)

Adjustment for high efficiency pump (HE pump)

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

Minimum pump speed

n2MN:
Minimum pump speed R2
Adjustment range: (10) 30 ... 100 %
in steps of 5 %
Factory setting: 30 %

A relative minimum pump speed can be allocated to the output R2 via the adjustment channel **n2MN.**

Note:
When loads which are not speed-controlled (e. g. valves) are used, the value of the corresponding relay (n1, n2) must be set to 100 % or the pump control type must be set to OnOF in order to deactivate pump speed control.

Maximaldrehzahl

n2MX
Maximum pump speed R2
Adjustment range: (10) 30 ... 100 %
in steps of: 5 %
Factory setting: 100 %

A relative maximum pump speed can be allocated to the output R2 via the adjustment channel n2MX.

Note:
When loads which are not speed-controlled (e. g. valves) are used, the value of the corresponding relay (n1, n2) must be set to 100 % or the pump control type must be set to OnOF in order to deactivate pump speed control.

Maximum temperature limitation

MX3O / MX3F:
Maximum temperature limitation
Adjustment range: 0.0 ... 95.0 °C [30.0 ... 200.0 °F]
in steps of 0.5 °C [1 °F]
Factory setting:
MX3O: 60.0 °C [140.0 °F]
MX3F: 58.0 °C [136.0 °F]

Minimum and maximum temperature limits can be set for the solid fuel boiler.

The maximum temperature limitation function provides a maximum temperature setting, usually to reduce scald risk in a storage store. If **MX3O** is exceeded, relay 2 is switched off until the sensor falls below **MX3F.** TIn Arr 8, this function uses sensor 3 as reference sensor.

Minimum temperature limitation

MN3O / MN3F:
Minimum temperature limitation
Adjustment range: 0.0 ... 90.0 °C [30.0 ... 190.0 °F]
in steps of 0.5 °C [1 °F]
Factory setting (Arr = 8 only):
MN3O: 60.0 °C [140.0 °F]
MN3F: 65.0 °C [150.0 °F]

The minimum temperature limitation uses sensor 4 as reference sensor.

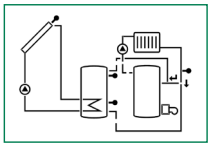
The minimum temperature limitation function provides a minimum temperature setting for the solid fuel boiler in system layout 8. If the temperature at sensor 4 falls below **MN3O**, relay 2 is switched off until the temperature exceeds **MN3F** again.

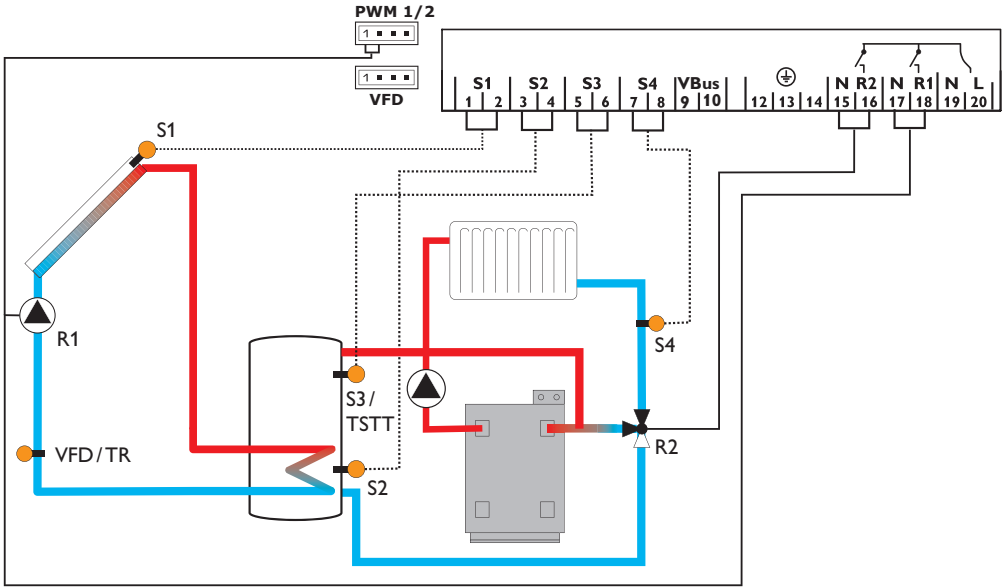
Both switch-on and switch-off temperature differences **DT3O** and **DT3F** are valid for the maximum and minimum temperature limitation.

System layout 9

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 relay 1, and the store will be loaded until the switch-off temperature difference (DT F) or the maximum store temperature (S MX) is reached.

A heating circuit return preheating will be operated by relay 2, if the temperature difference between sensors S3 and S4 is larger than or identical to the adjusted switch-on temperature difference (DT3O). For this purpose, relay 2 will operate the 3-port valve. S3 can optionally be used as reference sensor for the store emergency shutdown option (OSEM). If heat quantity measurement (OHQM) is activated, S1 and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
INIT	x*	ODB initialisation active	-	48
FLL	x*	ODB filling time active	-	48
STAB	x*	ODB stabilisation in progress	-	48
COL	x	Temperature collector	S1	48
TSTB	x	Temperature store 1 base	S2	48
TSTT	x	Temperature store 1 at the top	S3	48
TFL	x*	Temperature flow sensor	S1	48
TR	x*	Temperature return sensor	VFD	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
TRET	x	Temperature heating circuit	S4	48
n%	x	Pump speed relay	R1	49
hP1	x	Operating hours R1	R1	50
hP2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	9	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
RIS	x	Rise control R1	2 K [4 °Ra]	51
PUM1	x	Pump control type R1	PSOL	51
nMN	x	Minimum pump speed	30%	51
nMX	x	Maximum pump speed	100%	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
		Emergency temperature collector if ODB is activated:	95 °C [200 °F]	52
OCC	x	Option collector cooling	OFF	53
CMX	x*	Maximum collector temperature	110 °C [230 °F]	53
OSYC	x	Option system cooling	OFF	53
DTCO	x*	Cooling switch-on temperature difference	20.0 K [40.0 °Ra]	53

Adjustment Channels				
Channel		Description	Factory setting	Page
DTCF	x*	Cooling switch-off temperature difference	15.0 K [30.0 °Ra]	53
OSTC	x	Option store cooling	OFF	53
OHOL	x*	Option holiday cooling	OFF	53
THOL	x*	Holiday cooling temperature	40 °C [110 °F]	54
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45 %	57
DT3O	s	Switch-on temperature difference 3	6.0 K [12.0 °Ra]	50
DT3F	s	Switch-off temperature difference 3	4.0 K [8.0 °Ra]	50
ODB	x	Drainback option	OFF	58
tDTO	x*	ODB switch-on condition - time period	60 s	58
tFLL	x*	ODB filling time	5.0 min	58
tSTB	x*	ODB stabilisation time	2.0 min	58
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

Legend:

Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

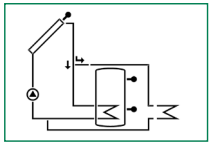
System layout 10

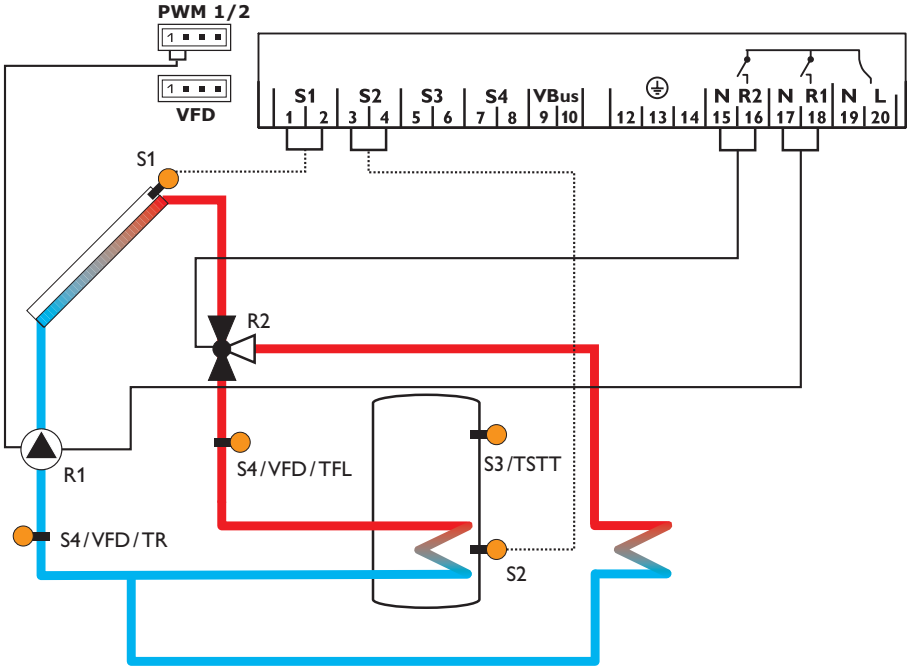
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference (DT O), the solar pump will be operated by relay 1, and the store will be loaded until the switch-off temperature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

If the maximum collector temperature (CMX) is reached, the solar pump will be operated by relay 1 and the 3-port valve will be operated by relay 2 in order to direct the surplus energy to a heat dump. For security purpose this will be carried out only if the store temperature is below the non-adjustable emergency shutdown of 95 °C [200 °F].

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, S4 and VFD are to be connected as flow and return sensors respectively.





Display Channels				
Channel		Description	Terminal	Page
COL	x	Temperature collector	S1	48
TST	x	Temperature store	S2	48
S3	x	Temperature sensor 3	S3	48
TSTT	x	Temperature store at the top	S3	48
TFL	x*	Temperature flow sensor	S1 / S4 / VFD	48
S4	x	Temperature sensor 4	S4	48
VFD	x*	Temperature Grundfos Direct Sensor™	VFD	48
L/h	x*	Flow rate Grundfos Direct Sensor™	VFD	49
TR	x*	Temperature return sensor	S4 / VFD	48
n %	x	Pump speed relay	R1	49
h P1	x	Operating hours R1	R1	50
h P2	x	Operating hours R2	R2	50
kWh	x*	Heat quantity kWh	-	49
MWh	x*	Heat quantity MWh	-	49
TIME	x	Time	-	49

Adjustment Channels				
Channel		Description	Factory setting	Page
Arr	x	System	10	50
DT O	x	Switch-on temperature difference	6.0 K [12.0 °Ra]	50
DT F	x	Switch-off temperature difference	4.0 K [8.0 °Ra]	50
DT S	x	Nominal temperature difference	10.0 K [20.0 °Ra]	50
RIS	x	Rise control R1	2 K [4 °Ra]	51
PUM1	x	Pump control type R1	PSOL	51
nMN	x	Minimum pump speed	30 %	51
nMX	x	Maximum pump speed	100 %	51
S MX	x	Maximum store temperature	60 °C [140 °F]	52
OSEM	x	Option store emergency shutdown	OFF	52
EM	x	Emergency temperature collector	130 °C [270 °F]	52
CMX	s	Maximum collector temperature	110 °C [230 °F]	53
OCN	x	Option minimum limitation	OFF	54
CMN	x*	Minimum collector temperature	10 °C [50 °F]	54
OCF	x	Option antifreeze	OFF	54
CFR	x*	Antifreeze temperature	4.0 °C [40.0 °F]	54
O TC	x	Option tube collector	OFF	56
TCST	x*	OTC starting time	07:00	56
TCEN	x*	OTC ending time	19:00	56

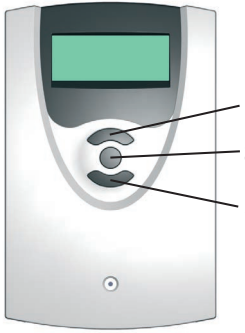
Adjustment Channels				
Channel		Description	Factory setting	Page
TCRU	x*	OTC runtime	30 s	56
TCIN	x*	OTC standstill interval	30 min	56
GFD	x	Grundfos Direct Sensor™	OFF	56
OHQM	x	Option heat quantity measurement	OFF	57
SEN	x*	VFD allocation	2	57
FMAX	x*	Maximum flow	6.0 l/min	57
MEDT	x*	Antifreeze type	1	57
MED%	x*	Antifreeze concentration (only if MEDT = propylene or ethylene)	45%	57
MAN1	x	Manual operation R1	Auto	58
MAN2	x	Manual operation R2	Auto	58
LANG	x	Language	En	58
UNIT	x	Temperature unit	°C	58
RESE	x	Reset - back to factory settings		58
#########		Version number		

Legend:

Symbol	Specification
x	Channel is available
x*	Channel is available if the corresponding option is activated.
s	Channel is specifically available in this system layout
s*	System-specific channel, only available if the corresponding option is activated

2 Operation and function

2.1 Push buttons



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 down in the display menu and press button 1 for approx. two seconds after you have reached the last display item.

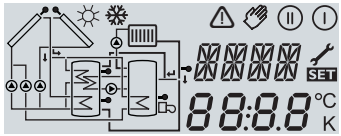
When an **adjustment value** is shown on the display, **SET** is indicated to the right of the channel name.

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

➔ Adjust the value using buttons 1 and 2

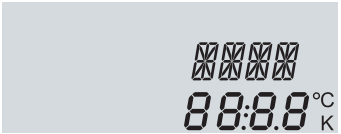
➔ Briefly press button 3, **SET** permanently appears,the adjusted value will be saved.

2.2 System-Monitoring-Display



System-Monitoring-Display

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



channel display

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

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

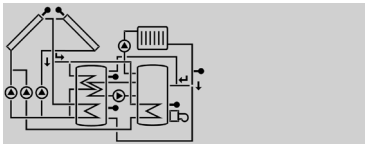
tool bar

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

Status	normal	blinkend
relay 1 active	⏀	
relay 2 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 2 ON	✋ + ⏁	⚠
manual operation relay 1/2 OFF	✋	⚠
sensor defective	🔧	⚠

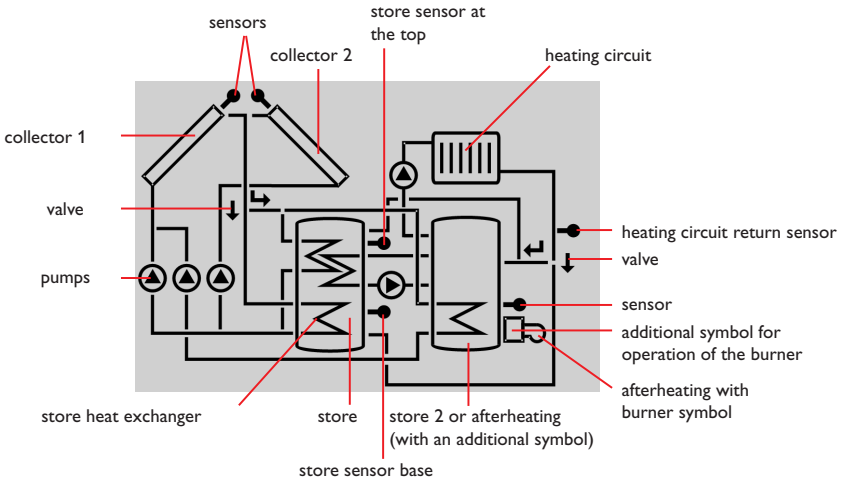
en

System screen

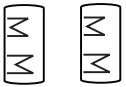


system screen

The system screen (active system layout) shows the system selected on the controller. It consists of several system component symbols, which are – depending on the current status of the system – either flashing, permanently shown or hidden.



Collectors
with collector sensor



Stores 1 and 2
with heat exchanger

3-port valve
the flow direction or the current switching position is shown

Temperature sensor

Heating circuit

Pump

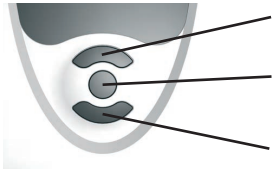
Afterheating
with burner symbol

2.3 Flashing codes

System screen flashing codes

- Pumps are flashing when the corresponding 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
- Burner symbol is flashing if the afterheating is active

3 Commissioning



The three push buttons of the CS Plus controller

➔ Establish the power supply

The controller runs an initialisation phase.

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 8 channels:

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

1. Language

➔ Adjust the desired menu language in this channel

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

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

2. Unit

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

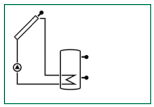
TIME
Real time adjustment

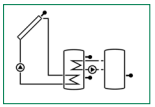
3. Time

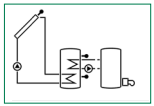
➔ Adjust the current time for the real time clock

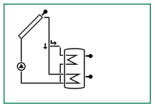
The hours and minutes have to be adjusted separately, first the hours, then the minutes.

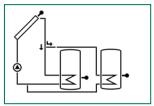
Arr
System layout selection
Adjustment range: 1 ... 10
Factory setting: 1

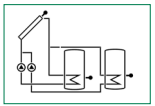

Arr 1

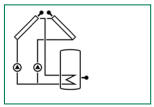

Arr 2

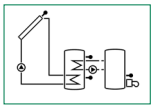

Arr 3

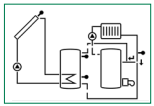

Arr 4

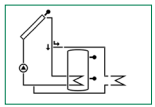

Arr 5


Arr 6


Arr 7


Arr 8


Arr 9


Arr 10

4. System layout

➔ Adjust the desired system layout of your solar thermal system

For a detailed description of the different system layouts selectable, see chapter 1.4.

Overview of system layouts:

Arr 1 : standard solar system layout

Arr 2 : solar system layout with heat exchange

Arr 3 : solar system layout with afterheating

Arr 4 : solar system layout with vertical store charging

Arr 5 : 2-store solar system layout with valve logic

Arr 6 : 2-store solar system layout with pump logic

Arr 7 : solar system layout with 2 collectors and 1 store

Arr 8 : solar system layout with afterheating by solid fuel boiler

Arr 9 : solar system layout with heating circuit return preheating

Arr 10: standard solar system layout with heat dump

If the system layout selection is changed later on, any previous adjustments which have been made in the other channels will be lost. Therefore, changing the system layout is always followed by a security enquiry.

Only confirm the security enquiry if you are sure that you wish to change the system layout selection!

Security enquiry:

➔ To confirm the security enquiry, press button 3

S MX / S1MX / S2MX
Maximum store temp.
Adjustment range: 4 ... 95 °C [40 ... 200 °F]
Arr 10: 4 ... 90 °C [40 ... 190 °F]
in steps of 1 °C [2 °F]
Factory setting: 60 °C [140 °F]

5. Maximum store temperature

➔ Adjust the desired maximum store temperature

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].

PUM1 / PUM2
Pump control type
Selection: OnOF, PULS, PSOL, PHEA
Factory setting: PSOL

6. Pump control type

➔ Adjust the pump control type.

The following types can be selected:

Adjustment for standard pump without speed control

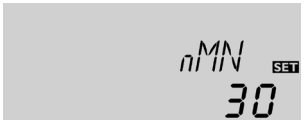
- OnOF (pump on / pump off)

Adjustment for standard pump with speed control

- PULS (pulse packet control via semiconductor relay)

Adjustment for high efficiency pump (HE pump)

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



nMN, n1MN, n2MN
Minimum pump speed
Adjustment range: (10) 30 ... 100 %
in steps of 5 %
Factory setting: 30 %

7. Minimum pump speed

➔ Adjust a minimum speed for the pump

Note:
If loads which are not speed-controlled (e.g. valves) are used, the value must be set to 100 % for the respective relay.

nMX, n1MX, n2MX
Maximum pump speed
Adjustment range: (10) 30 ... 100 %
in steps of: 5 %
Factory setting: 100 %

8. Maximum pump speed

➔ Adjust the maximum pump speed for the corresponding pumps.

Note:
When loads which are not speed-controlled (e. g. valves) are used, the value of the corresponding relay (n1, n2) must be set to 100% or the pump control type must be set to OnOF in order to deactivate pump speed control.

Confirmation enquiry

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.

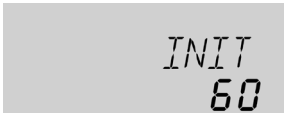
The settings made in the commissioning menu can be changed later on in the corresponding adjustment channels. Additional functions and options can of course be individually adjusted as well (see chap. 4.2).

4 Channel overview

4.1 Display channels

Note:
The displayed values and adjustment channels depend on which system layout, 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
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
Stabilisation
Indicates the time adjusted in **tSTB**, running backwards.

Indication of collector temperatures

COL, COL1, COL2
Collector temperature
Display range: -40 ... +260 °C [-40 ... +500 °F]
Indicates the current collector temperatures.

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

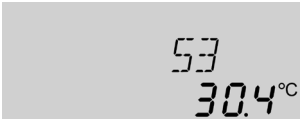
Indication of store temperatures

TST, TSTB, TSTT, TST1, TST2, TDIS
Store temperatures
Display range: -40 ... +260 °C [-40 ... +500 °F]
Indicates the current store temperature.

- TST : store temperature (1-store system)
- TSTB : store temperature base
- TSTT : store temperature top
- TST1 : temperature store 1 (2-store-systems)
- TST2 : temperature store 2 (2-store-systems)
- TDIS : thermal disinfection temperature

(Arr = 3 only; replaces TSTT if, during thermal disinfection, the heating period DDIS is active)

Indication 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 of the corresponding additional sensor (without control function).

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

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

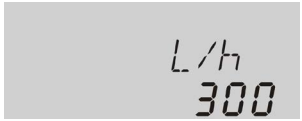
Indication of other temperatures

TSFB, TRET, TFL, TR
Other measured temperatures
Display range: -40 ... +260 °C [-40 ... +500 °F]
Indicates the current temperature of the corresponding sensor.

- TSFB : temperature solid fuel boiler
- TRET : temperature heating return preheating
- TFL : temperature flow
- TR : temperature return

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

Indication of flow rate



l/h
Flow rate
Display range: depends on the sensor type
Indicates the current flow rate at the VFD flow rate sensor.

The display range depends on the sensor type selected.

Indication of current pump speed

n%, n1%, n2%
Current pump speed
Display range: 30 ... 100%
Indicates the current pump speed of the corresponding pump.

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

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 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 2 s 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 5 s. The display returns to the display mode.

CDIS
Countdown of monitoring period
Display range: 0 ... 30:0 ... 24 (dd:hh)
If the thermal disinfection option (**OTD**) is activated and the monitoring period is in progress, the remaining monitoring time will be displayed as **CDIS** (in days and hours) and counted backwards.

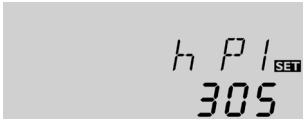
SDIS
Starting time display
Display range: 00:00 ... 24:00 (hh:mm)
If the thermal disinfection option (**OTD**) is activated and a starting delay time has been adjusted, the adjusted delay time is displayed (flashing) in this channel.

DDIS
Heating period display
Display range: 00:00 ... 24:00 (hh:mm)
If the thermal disinfection option (**OTD**) is activated and the heating period is in progress, the remaining time of the heating period is displayed (in hours and minutes) in this channel, counting backwards.

TIME
Indicates the current time.

➔ Press button 3 for 2 s to adjust the hours
➔ Set the hours by pressing buttons 1 and 2
➔ Press button 3 again to adjust the minutes
➔ Set the minutes by pressing buttons 1 and 2
➔ Press button 3 in order to save the adjustments

Operating hours counter



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

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

➔ In order to access the RESET-mode of the counter, press button 3 for approx. two 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 5 s. The display returns to the display mode.

4.2 Adjustment channels

System layout selection

Arr
System layout selection.
Adjustment range: 1 ... 10
Factory setting: 1

In this channel, a pre-defined system layout can be selected. Each system layout has a set of pre-programmed settings that can be individually changed.

If the system layout selection is changed later on, all adjustments made in the other channels will be lost. Therefore, changing the system layout is always followed by a security enquiry.

Only confirm the security enquiry if you are sure that you wish to change the system layout selection!

Security enquiry:

➔ To confirm the security enquiry, press button 3

ΔT control

DT O / DT1O / DT2O / DT3O
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]

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 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 / DT1F / DT2F / DT3F
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]

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.

Pump speed control

DT S / DT1S / DT2S / DT3S
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]

RIS / RIS1 / RIS2 / RIS3
Rise
Adjustment range: 1 ... 20 K [2 ... 40 °Ra]
in steps of 1 K [2 °Ra]
Factory setting: 2 K [4 °Ra]

Note:
For pump speed control, the operation mode of the corresponding relay must be set to Auto (adjustment channel **MAN1** / **MAN2**)

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".

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

PUM1 / PUM2
Pump control type
Selection: OnOF, PULS, PSOL, PHEA
Factory setting: PSOL

With this parameter, the pump control type can be adjusted.

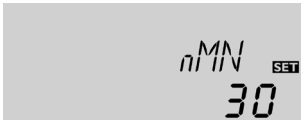
The following types can be selected:

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

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

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

Minimum pump speed



nMN, n1MN, n2MN:
Minimum pump speed
Adjustment range: (10) 30 ... 100 %
in steps of 5 %
Factory setting: 30 %
A relative minimum pump speed can be allocated to the outputs R1 and R2 via the adjustment channels **nMN, n1MN** and **n2MN.**

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

nMX,n1MX, n2MX
Maximum pump speed
Adjustment range: (10) 30 ... 100 %
in steps of: 5 %
Factory setting: 100 %

A relative maximum pump speed can be allocated to the outputs R1 and R2 via the adjustment channel n1(2)MX.

Note:
When loads which are not speed-controlled (e. g. valves) are used, the value of the corresponding relay (n1, n2) must be set to 100% or the pump control type must be set to OnOF in order to deactivate pump speed control.

Maximum store temperature

S MX / S1MX / S2MX
Maximum store temp.
Adjustment range: 4 ... 95 °C [40 ... 200 °F]
Arr 10: 4 ... 90 °C [40 ... 190 °F]
in steps of 1 °C [2 °F]
Factory setting: 60 °C [140 °F]

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 the corresponding sensor exceeds the adjusted maximum store temperature, the ☀ symbol is shown on the display.

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

This option is used for activating the integrated 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 in the system layouts 1, 2, 3, 8, 9 and 10. In the system layouts 6 and 7, sensor S4 is used as the reference sensor.
This option is not available in system layouts 4 and 5, in the system layouts 6 and 7 it will only be available if heat quantity measurement is deactivated.

Collector temperature limitation
Emergency shutdown of the collector

EM / EM1 / EM2
Collector temperature limitation
Adjustment range: 80 ... 200 °C [170 ... 390 °F]
in steps of 1 °C [2 °F]
Factory setting: 130 °C [270 °F]

If the adjusted collector emergency shutdown temperature (**EM / EM1 / EM2**) is exceeded, the controller switches off the solar pump (R1 / R2) in order to protect the system against overheating (collector emergency shutdown). 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.

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 notes are valid for all three cooling functions:

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

Note:
In 2-store-systems, the cooling functions will only affect store 1, respectively the base area of the store (such as in Arr = 4).

Collector cooling function

OCC / OCC1 / OCC2
Option collector cooling
Adjustment range: OFF / ON
Factory setting: OFF

CMX / CMX1 / CMX2
Maximum collector temp.
Adjustment range: 70 ... 160 °C [150 ... 320 °F]
in steps of 1 °C [1 °F]
Factory setting: 110 °C [230 °F]

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.

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

Note:
In system layout 10, the parameter **CMX** is available without the **OCC** function. In system layout 10, **CMX** is used to set the activation temperature for the heat dump function. No other switch-on condition is needed in that case.

System cooling function

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

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 / S1MX**) 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.

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]

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

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

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/S1MX**) 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/S1MX**) 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/S1MX**) 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/OCN1/OCN2
Collector minimum limitation
Adjustment range: OFF/ON
Factory setting: OFF

CMN/CMN1/CMN2
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]

If the collector minimum limitation option is activated, the pump (R1/R2) 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**.

OCF/OCF1/OCF2
Antifreeze function
Adjustment range: OFF/ON
Factory setting: OFF

CFR/CFR1/CFR2
Antifreeze temperature
Adjustment range: -40.0 ... +10.0 °C [-40.0 ... +50.0 °F]
in steps of 0.5 °C [1 °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.

When the antifreeze function is activated, ❄ is shown on the display. If the antifreeze function is active, ⓘ 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.

The DeltaSol® CS Plus priority logic

Note:
Priority logic can be used in multi-store system layouts only (Arr = 4, 5, 6).

PRIO
Loading priority
Adjustment range: SE 1, SE 2, Su 1, Su 2, 0, 1, 2
Factory setting: Arr 4: 2; Arr 5, 6: 1
If a multi-store system layout has been chosen, the priority logic determines how the heat is divided between the stores. Different types of priority logic are adjustable:

- spreaded loading (SE 1 and SE 2)
- successive loading (Su 1 and Su 2)
- parallel loading (0)
- store sequence control (1 and 2)

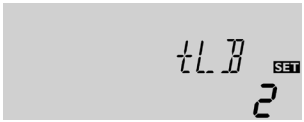
If **priority SE 1** or **SE 2** (only available in Arr 6) is adjusted, the subordinate store will be loaded in parallel if the temperature difference between the collector and the priority store (store 1 for SE 1, store 2 for SE 2) exceeds the adjusted value **DTSE** and the subordinate store has not reached its maximum temperature.
Parallel loading will stop as soon as the temperature difference between the collector and the priority store falls 2 K [4 °Ra] below **DTSE** or the subordinate store reaches its maximum temperature.
If **priority Su 1** or **Su 2** is adjusted, the stores are loaded successively. The subordinate store will only be loaded if the priority store (store 1 for Su 1, store 2 for Su 2) has reached its adjusted maximum temperature (**S1MX** or **S2MX**).
If **priority 0** is adjusted and the switch-on conditions are fulfilled for both stores, the stores are loaded in parallel (Arr 6), resp. in an oscillating loading (Arr 4, 5) beginning with the store with the lowest temperature.
In an oscillating loading, solar loading will switch from one store to the other in steps of 5 K [10 °Ra] temperature difference between the stores.
If **priority 1 / 2** is adjusted, store sequence control will be activated (see below) with the corresponding store as priority store.

Note:
If the priority is set to **Su 1** or **Su 2**, solar loading of the subordinate store will be aborted at once if the temperature in the priority store (store 1 for Su 1, store 2 for Su 2) falls below the adjusted maximum temperature. If, in that case, the temperature difference between the priority store and the collector is not sufficiently high, solar loading will be stopped completely.

Spreaded loading temperature difference
(only available if PRIO is set to SE 1 or SE 2)

DTSE
Spread temperature difference
Adjustment range: 20 ... 90 K [40 ... 160 °Ra]
in steps of 1 K [1 °Ra]
Factory setting: 40 K [70 °Ra]

Store sequence control
(only available if priority is set to SE 1, SE 2, 1 or 2)



tLB
Loading break time
Adjustment range: 1 ... 30 min
Factory setting: 2 min

tRUN
Loading runtime
Adjustment range: 1 ... 30 min
Factory setting: 15 min
Store sequence control will be activated when **PRIO** is set to SE 1, SE 2, 1 or 2.
If the priority store cannot be loaded, the subordinate store is checked. If useful heat can be added, it will be loaded for the "loading runtime time" (**tRUN** - factory setting 15 min.) After this, the loading process stops and the controller monitors the increase in collector temperature during the loading break time **tLB**. If it increases by 2 K [4° Ra], the break time timer starts again to allow the collector to gain more heat. If the collector temperature does not increase sufficiently, the subordinate store will be loaded again for the **tRUN** time as before.
As soon as the switch-on condition of the priority store is fulfilled, it will be loaded. If the switch-on condition of the priority store is not fulfilled, loading of the second store will be continued. If the priority store reaches its maximum temperature, sequence controlled loading will not be carried out.
If store sequence control is active and the system switches to load the priority store, the parameter **tLB** also acts as a stabilisation timer, during which the switch-off condition **DT F** is ignored while the system operation stabilises.

Tube collector function

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

TCST
Tube collector function
starting time
Adjustment range: 00:00 ... 23:45
in steps of 00:15
Factory setting: 07:00

This function helps overcome the disadvantages caused by the non-ideal sensor position with some tube collectors.

This function operates within an adjusted time frame (beginning at **TCST** and ending at **TCEN**). It activates the collector circuit pump for an adjustable runtime (**TCRU**) between adjustable standstill intervals (**TCIN**) in order to compensate for the delayed temperature measurement.

If the runtime **TCRU** is set to more than ten seconds, the pump will be run at 100 % for the first ten seconds of the runtime. For the remaining runtime, the pump will be run at the adjusted minimum speed **nMN**.

If the collector sensor is defective or the collector is blocked, this function is suppressed or switched off.

TCEN
Tube collector function
ending time
Adjustment range: 00:00 ... 23:45
in steps of 00:15
Factory setting: 19:00

TCRU
Tube collector function
runtime
Adjustment range: 5 ... 500 s
in steps of 5 s
Factory setting: 30 s

TCIN
Tube collector function
standstill interval
Adjustment range: 1 ... 60 min
in steps of 1 min
Factory setting: 30 min

In system layout 7 (Arr = 7) both collectors are operated independently from each other by means of this function. If the store is being loaded by one collector, the other one is nevertheless operated after the adjusted standstill time.

Note:
If the drainback option **ODB** is activated, **TCRU** will not be available. In that case, the runtime is determined by the parameters **tFLL** and **tSTB**.

WARNING! **Danger of injury and system damage through pressure surges!**

If a drainback system is filled due to the tube collector function and the heat transfer medium enters very hot collectors, pressure surges can occur.

➔ **If a pressure-less drainback system is used, TCST and TCEN must be adjusted such that the system will not be filled during times of potentially strong irradiation!**

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 / glycol mixture)
40 : VFD 2 - 40
40F : VFD 2 - 40 Fast (water only)

Heat quantity measurement

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

If OHQM is activated, the heat quantity gained can be calculated and displayed.

Heat quantity measurement can be run in 2 different ways (see below): with a fixed flow rate value or with a VFD Grundfos Direct Sensor™.

➔ Activate the heat quantity measurement option in the OHQM channel

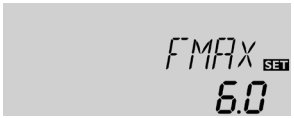
➔ Select the flow rate detection type in the SEN channel

Heat quantity measurement with a fixed flow rate value

Heat quantity measurement is possible on Arr. 1, 3, 4, 5 and 10 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%**.



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

Note:
The FMAX channel will be available only if the SEN channel has been set to OFF.

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:

➔ Register the VFD Grundfos Direct Sensor™ in the GFD channel.

➔ Adjust the position of the VFD Grundfos Direct Sensor™ in the SEN channel.

➔ Adjust the type and ratio of the heat transfer fluid in the channels MEDT and MED%.

SEN
Digital flow rate sensor (only if SEN = 1 or 2)
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		2		OFF	
Arr	SFL	SRET	SFL	SRET	SFL	SRET
1	GFD	S4	S4	GFD	S1	S4
2	---	---	S1	GFD	---	---
3	GFD	S4	S4	GFD	S1	S4
4	GFD	S4	S4	GFD	S1	S4
5	GFD	S4	S4	GFD	S1	S4
6	GFD	S4	S4	GFD	---	---
7	GFD	S4	S4	GFD	---	---
8	---	---	S1	GFD	---	---
9	---	---	S1	GFD	---	---
10	GFD	S4	S4	GFD	S1	S4

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

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

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 %

Note:
If the system layout 10 has been selected and **OHQM** is activated, heat quantity measurement will be interrupted when the 3-port valve switches to the heat dump. Heat quantity measurement with a VFD Grundfos Direct Sensor™ will continue independently.

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.

Note:
The drainback option is only available in system layouts with one store and one collector (Arr 1, 2, 3, 8 and 9).

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:

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

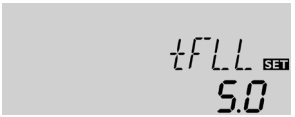
Note:
When the drainback option **ODB** is activated, the cooling functions **OCC**, **OSYC** and **OSTC** as well as the antifreeze function **OCF** are not available.
If **OCC**, **OSYC**, **OSTC** or **OCF** have already been activated before, they will be deactivated again as soon as **ODB** is activated. 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 values **nMN / n1MN** 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

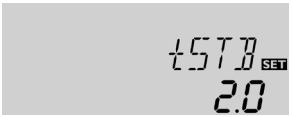
tDTO
Time period - switch-on conditions
Adjustment range: 1 ... 100 s
in steps of 1 s
Factory setting: 60 s
The parameter **tDTO** is used for adjusting the time period during which the switch-on condition **DT O** must be permanentely fulfilled.

Filling time



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

Booster function option

OBST
Booster function
Adjustment range: ON / OFF
Factory setting: OFF

This function is used for switching on a second pump when filling the solar system. When solar loading starts, R2 is energised in parallel to R1. After the filling time (**tFLL**) has ended, R2 is switched off.

Note:
The booster function is available in system layout 1 (Arr = 1) only.
The booster function will only be available if the drainback option has been activated.

Operating mode

MAN1 / MAN2
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 **MAN1, MAN2** in which the following adjustments can be made:

- **MAN1 / MAN2**
  Operating mode
  OFF : relay off ⚠ (flashing) + ✋
  Auto : relay in automatic operation
  ON : relay on ⚠ (flashing) + ✋ + Ⅰ / Ⅱ

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
Factory setting: En

The menu language can be adjusted in this channel.

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

Unit

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

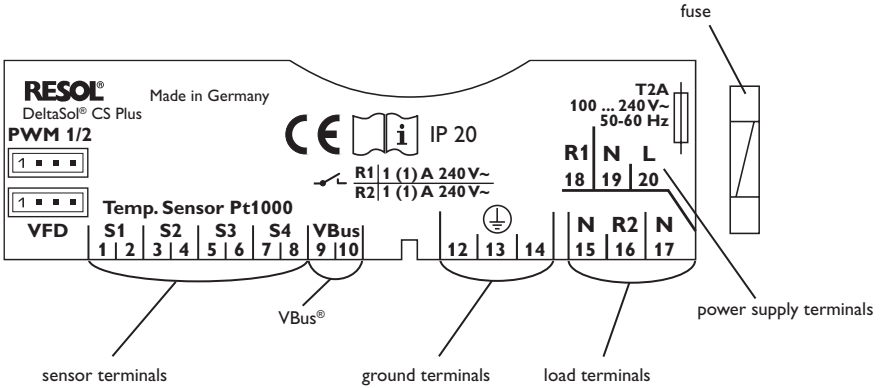
Only confirm the security enquiry if you are sure that you wish to reset all adjustments to the factory settings!

Security enquiry

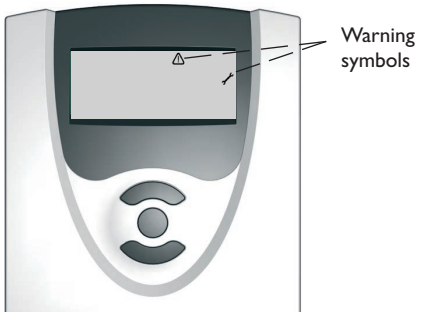
➔ To confirm the security enquiry, press button 3

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

5 Troubleshooting



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



en

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 — Cable broken. Check cable.

- 88.8 — 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

Display off.

Check the power supply. Is it disconnected?

no — 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).

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 air / gas bubbles in the lines.

- Air in the system?
  - 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.
  - no → Is the collector circuit blocked at the dirt trap?
    - yes → Clean the dirt trap

Pump starts up very late

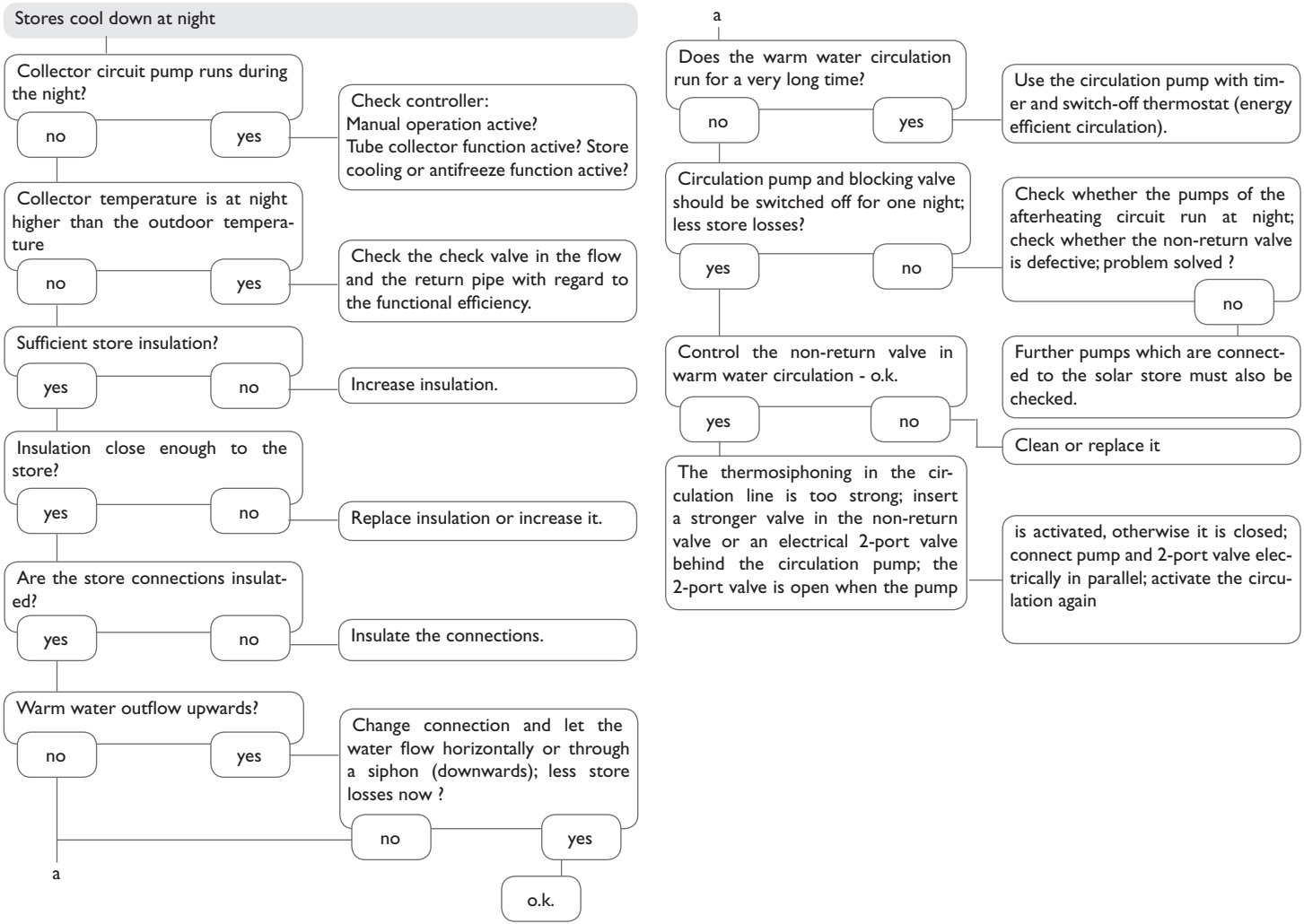
- Switch-on temperature difference ΔTon to large?
  - yes → Change ΔTon and ΔToff correspondingly.
  - no → Non-ideal position of the collector sensor (e.g. flatscrew sensor instead of sensor in sensor wells)?
    - yes → Activate tube collector function if necessary.
      - o.k.
    - no → Minimum temperature limitation active

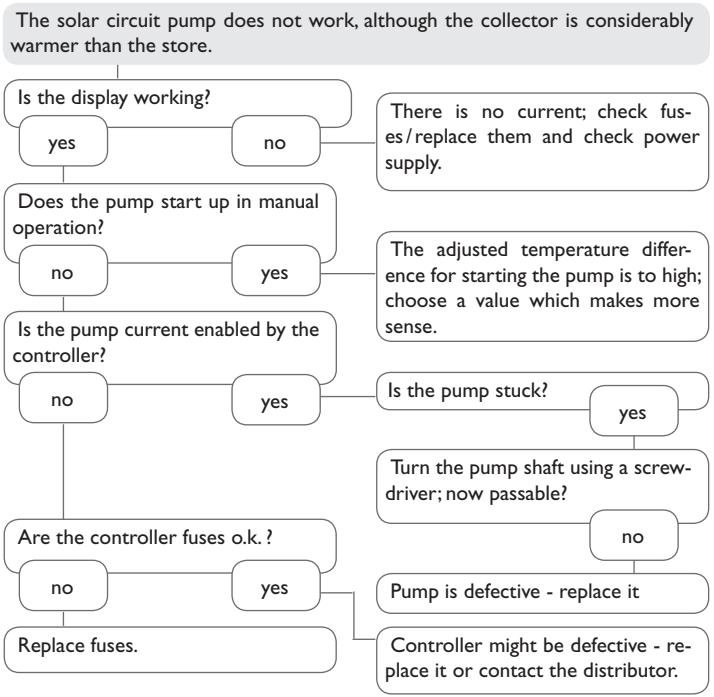
Pump starts for a short moment, switches off, switches on again, etc.

- Temperature difference at the controller too small?
  - yes → Change ΔTon and ΔToff correspondingly. Problem solved?
    - no → o.k.
  - no → Wrong position of collector sensors?
    - yes → Mount the collector sensor at solar flow (warmest collector output); use sensor well 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.


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

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**

VFD Grundfos Direct Sensors™

The VFD Grundfos Direct Sensor™ is a digital sensor that measures both temperature and flow rate.

VFD 1-12 digital Article no.: **130 000 80**

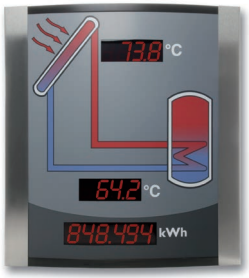
VFD 2-40 digital Article no.: **130 001 00**

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 even in poor visibility conditions and from a larger distance. 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**

DL3 Datalogger

Be it solar thermal, heating or DHW heat exchange controllers – with the DL3 you can easily and conveniently log system data of up to 6 RESOL controllers.

Get a comprehensive overview of all controllers connected with the large full graphic display. Transfer data with an SD memory card or use the LAN interface to view and process data on your PC.

RESOL DL3 Article no.: **180 009 90**

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 new 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**

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**

Notes

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Important note

The texts and drawings of 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.

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