RESOL DeltaSol® DB3-F

Mounting

Connection

Operation

Troubleshooting

Examples

48004710

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

DeltaSol® DB3-F

en-US/CA

Manual

www.resol.com

Table of contents

General

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!

Equipment to be installed and used in accordance with the rules of the National Electrical Code (NEC) or with Canadian Electrical Code (CEC), Part I.

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.

Disposal

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

Target group

These instructions are exclusively addressed to authorised skilled personnel.

- Only qualified electricians should carry out electrical works.
- Initial installation must be effected by qualified personnel named by the manufacturer.

Information about the product

Proper usage

The controller is to be used in drainback solar thermal systems in compliance with the technical data specified in these instructions.

Improper use excludes all liability claims.

CE

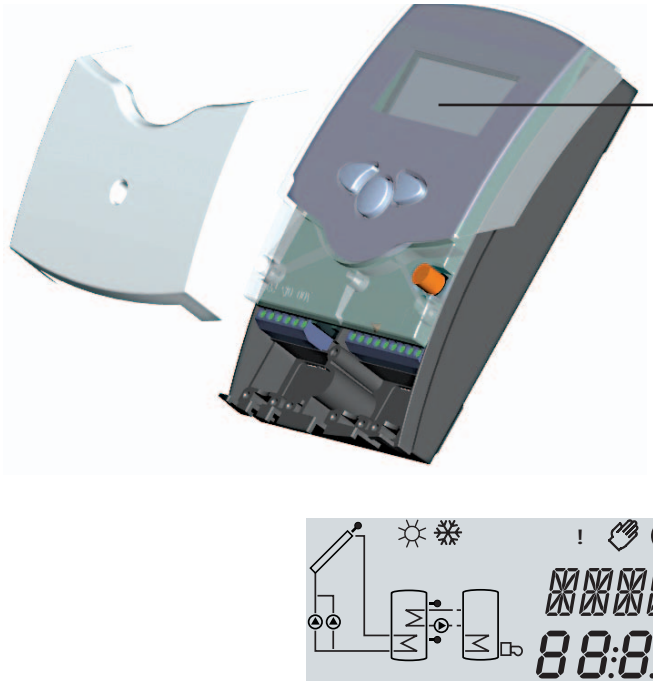
Note
Strong electromagnetic fields can impair the function of the controller.

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

Subject to technical change. Errors excepted.

Controller especially developed for solar drainback systems

- **System-Monitoring-Display**
- **Up to 4 temperature sensors Pt1000**
- **Energy metering**
- **RESOL VBus®**
- **Function control**
- **User-friendly operation**
- **Easy-to-mount housing with outstanding design**
- **operating hours counter and thermostat function**

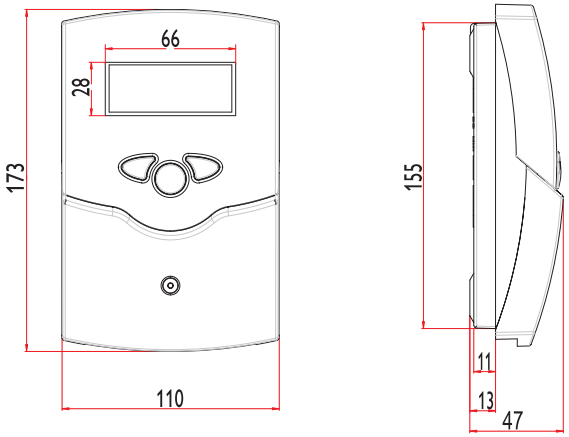


Delivery scope:

1 x DeltaSol® DB3-F

1 x accessory bag
- 1 x spare fuse T4A
- 2 x screw and dowel
- 4 x strain reflief and screw

Additionnally included in the accesory bag:
1 x sensor FKP6
2 x sensor FRP6



Housing:
plastic, PC-ABS and PMMA

Protection type: IP 20 / DIN 40050

Ambient temp.: 32 ... 104 °F

Dimensions: 172 x 110 x 46 mm

Mounting: wall mounting, mounting into patch-panels is possible

Display: System screen for systems visualisation, 16-segment display, 7-segment display, 8 symbols for system status and operating control lamp

Operation: 3 push buttons at the front of the housing

Functions: Differential temperature controller with optional system functions. Function control, operating hours counter for solar pump and energy metering.

Inputs:
for 4 temperature sensors Pt1000

Outputs: 2 standard relays

Bus: RESOL VBus®

Power supply:
115 V~, 50 ... 60 Hz

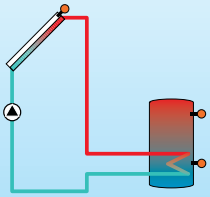
Total switching capacity:
4 (2) A (115) V~

Mode of operation:
Type 1.b

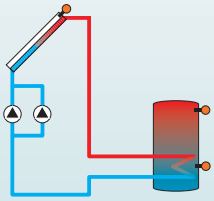
Switching capacity:
electromechanical relay:
2 (1) A (115) V~

Examples DeltaSol® DB3-F

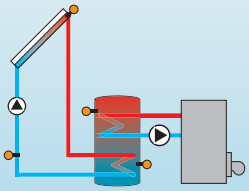
Standard drain back systems



Drain back systems with booster function



Drainback systems with backup-heating



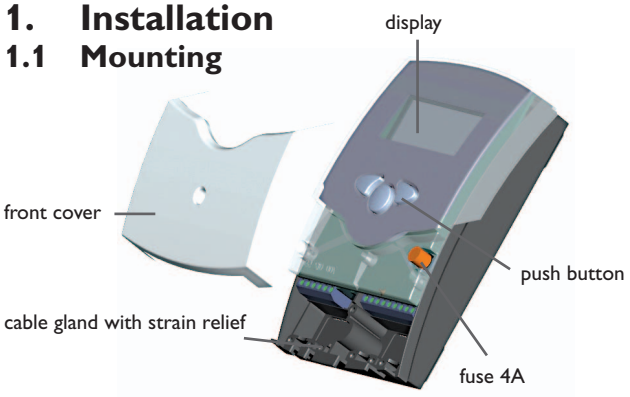
For further information on electrical connection, please see chapter 1.

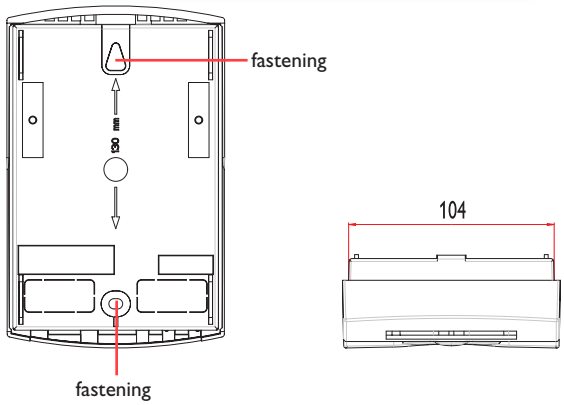
Order note

- **DB3: 2 standard relay, thermostat or booster function, operating hours counter**
  RESOL DeltaSol® DB / 3 **115 426 07**
  RESOL DeltaSol® DB / 3 - full kit
  incl. 3 temperature sensors Pt1000 (1 x FKP6, 2 x FRP6) **115 426 17**

1. Installation

1.1 Mounting



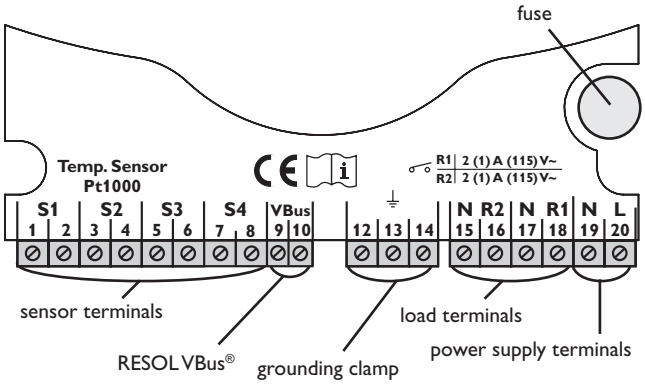


WARNING!	Electric shock! Opening the housing will expose live parts! ➔ Switch off power supply and disconnect the device from power supply before opening the housing!

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

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

1.2 Electrical connection



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

The power supply to the controller must be carried out via an external power switch (last step!) and the supply voltage must be 115 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 2 relays to which **loads** such as pumps, valves, etc. can be connected:

- Relay 1
  18 = conductor R1
  17 = neutral conductor N
  13 = grounding clamp ⏚
- Relay 2
  16 = conductor R2
  15 = neutral conductor N
  14 = grounding clamp ⏚

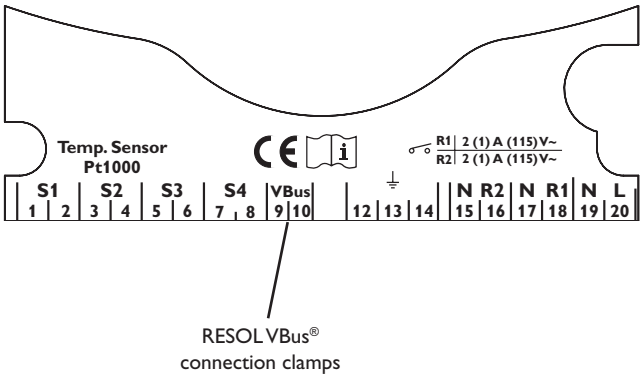
Temperature sensors (S1 to S4) have to be connected to the following terminals (either polarity):

1 / 2 = sensor 1 (e.g. sensor collector 1)
3 / 4 = sensor 2 (e.g. sensor tank 1)
5 / 6 = sensor 3 (e.g. tank top sensor)
7 / 8 = sensor 4 (e.g. return temperature sensor)

The **power supply connection** has to be carried out at the following terminals:

19 = neutral conductor N
20 = conductor L
12 = grounding clamp ⏚

1.2.1 Data communication / Bus



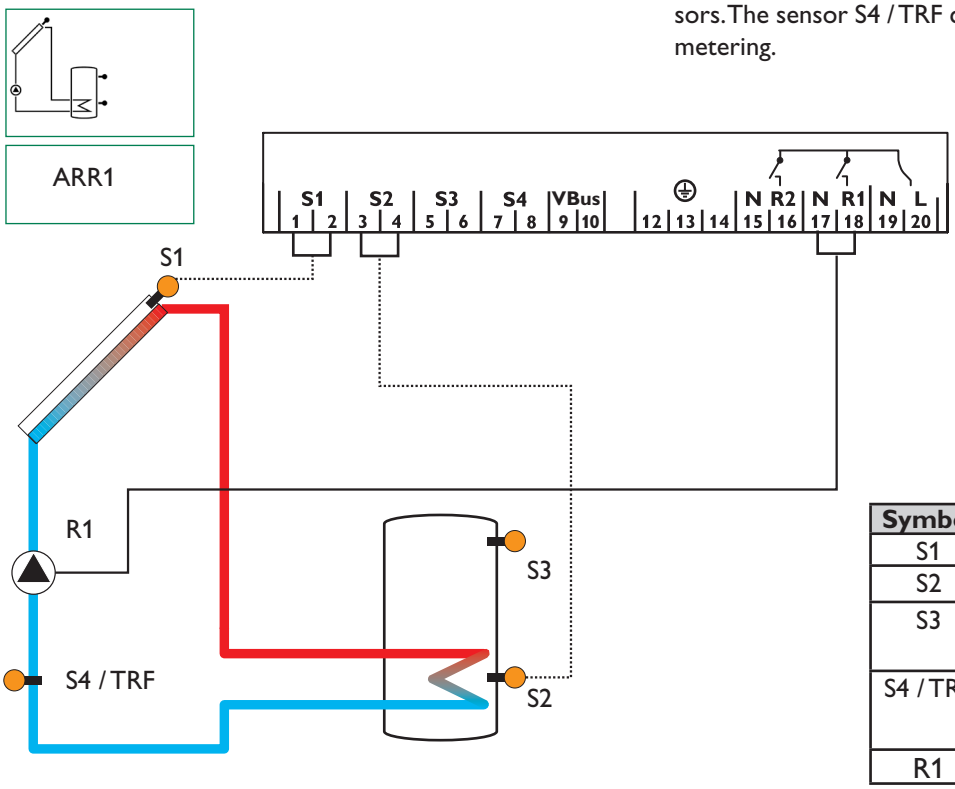
The controller comes with a RESOL **VBus®** for data communication and energy supply of external modules. The connection is effected with optional polarity at the clamps marked with „VBus". Via this data Bus you can install one or more RESOL VBus® modules, e.g.:

- RESOL large display GA3 / Smart display SD3
- RESOL Datalogger, DL2

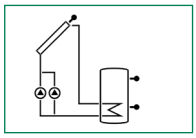
Additionaly, the controller can be connected to the PC with the help of a RESOL RS-COM adapter. With the RESOL ServiceCenter Software (RSC) the controller parameters can be changed, measurements can be read out, processed and visualised. The software enables an easy function control and adjustment of the system. The software can be downloaded from www.resol.com free of charge.

1.2.2 Terminal allocation Arrangement 1

Standard solar system with 1 tank, 1 pump and 3 sensors. The sensor S4 / TRF can be optionally used for energy metering.

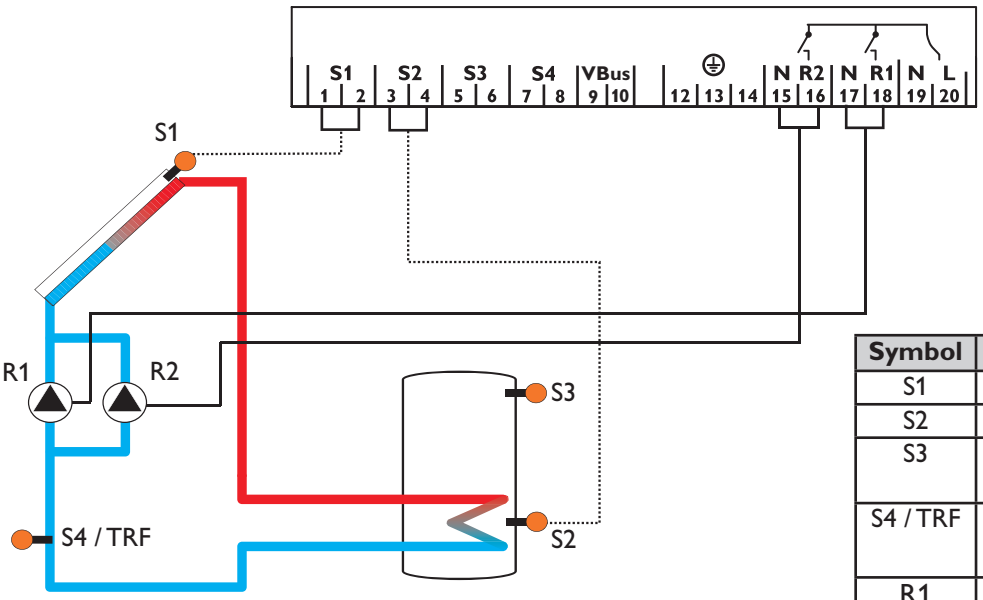


Symbol	Description
S1	collector sensor
S2	tank sensor bottom
S3	tank sensor top (optional)
S4 / TRL	sensor for energy metering (optional)
R1	solar pump



ARR1
with booster

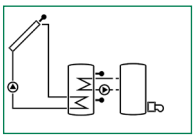
Standard solar system with booster function option with 1 tank, 2 pumps and 3 sensors. The sensor S4 / TRF can be optionally used for energy metering.



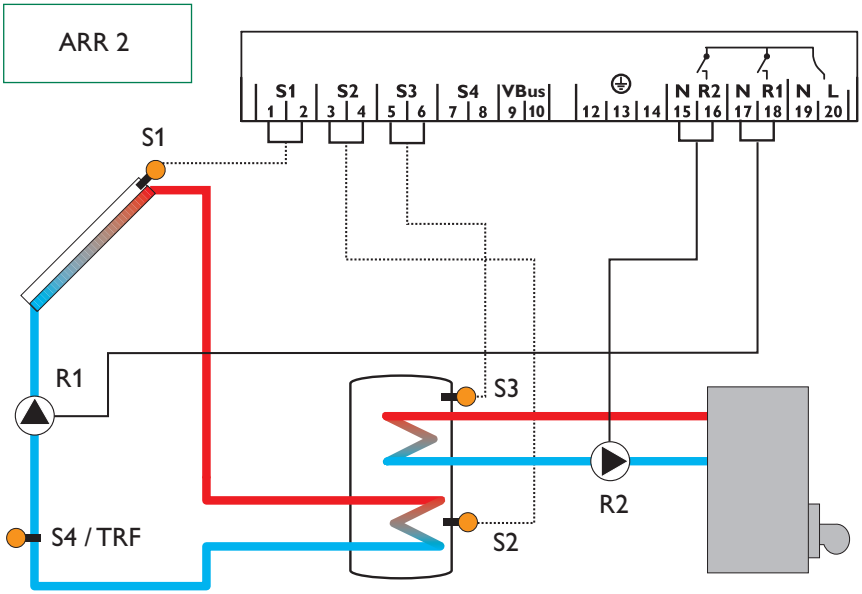
Symbol	Description
S1	collector sensor
S2	tank sensor bottom
S3	tank sensor top / thermostat sensor
S4 / TRF	sensor for energy metering (optional)
R1	solar pump
R2	booster pump

1.2.3 Terminal allocation Arrangement 2

Solar system and backup heating with 1 tank, 3 sensors and backup heating. The sensor S4 / TRF can be optionally used for energy metering.



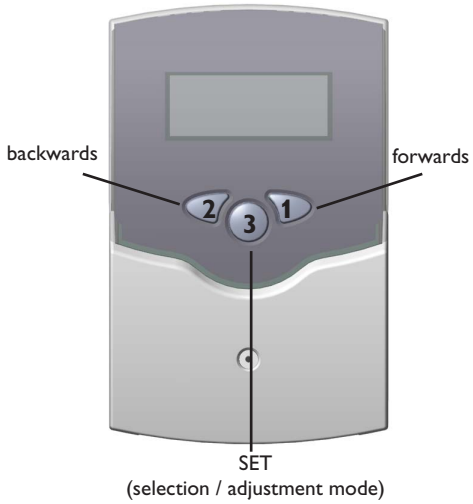
ARR 2



Symbol	Specification
S1	collector sensor
S2	store sensor bottom
S3	store sensor top
S4 / TRF	sensor for heat production measurement (optional)
R1	solar pump
R2	pump for backup heating

2. Operation and function

2.1 Buttons for adjustment

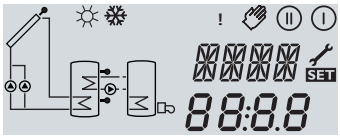


The controller is operated via the 3 push buttons below the display. The forward-button (1) is used for scrolling forward through the display menu or to increase the adjustment values. The backward-button (2) is similarly used for scrolling backwards and reducing values.

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

- Press buttons 1 and 2 in order to select a channel
- Briefly press button 3, „SEt“ will flash
- Adjust the value by pressing buttons 1 and 2
- Briefly press buttons 3, so that „SEt“ permanently appears, the adjusted value will be saved.

2.2 System-Monitoring Display



Complete Monitoring-Display

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

2.2.1 Channel display

channel display

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 indicated in °F whereas temperature differences are indicated in °Ra.

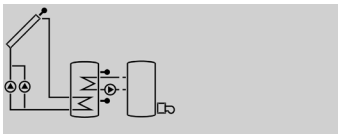
2.2.2 Tool bar

tool bar

The additional symbols in the **tool bar** indicate the actual system status.

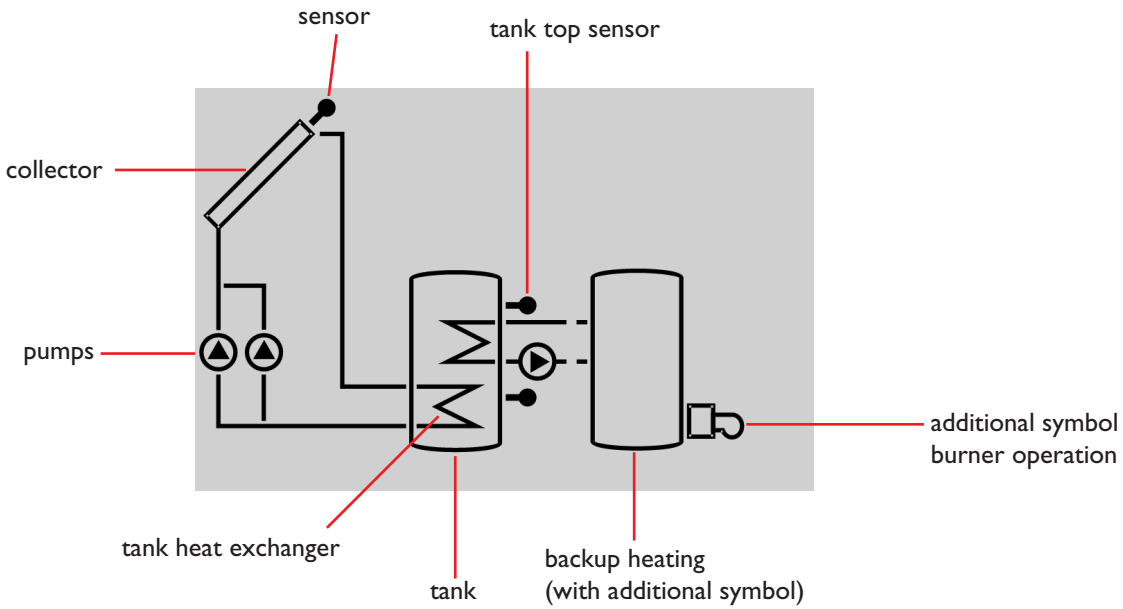
Symbol	standard	flashing
⏽	relay 1 active	
⏾	relay 2 active	
☼	tank maximum limitation active / maximum tank temperature exceeded	collector cooling function or recooling function active
⚠		collector emergency shutdown or tank emergency shutdown active
⚠ + 🔧		sensor defective
⚠ + ✋		manual operation active
SET		SET-mode, change of adjustment value is possible

2.2.3 System-Screen



System-Screen

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

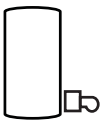


collector
with collector sensor

tank 1
with heat exchanger

temperature sensor

pump



backup-heating
with burner symbol

2.3 Flashing codes

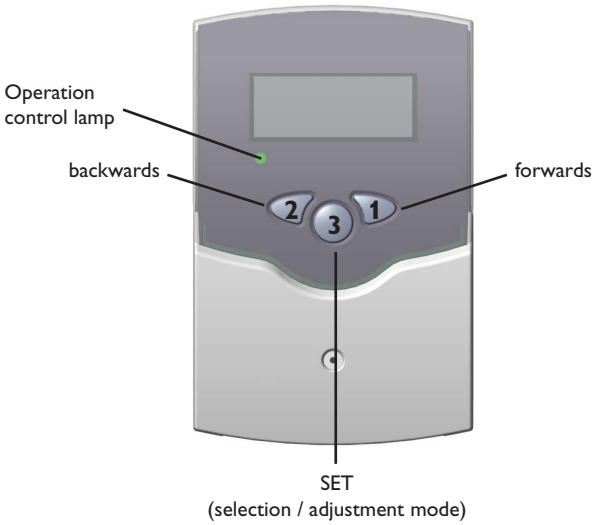
2.3.1 System screen codes

- Pump symbols are flashing during initialization phase
- Sensor symbols are flashing if the corresponding sensor display channel is selected.
- Sensor symbols are flashing in the case of a sensor fault.
- Burner symbol is flashing if the backup heating is active

2.3.2 LED flashing codes

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

3. Commissioning



Note
When the controller is commissioned for the first time, select the system layout (Arr) first! All adjustments will be lost if the system layout selection is changed again.

➔ Establish power supply.
During the initialization phase, the operating control lamp flashes red and green. First, adjust the language in the **LANG** channel.

➔ Change to the SET mode (see 2.1)

➔ Use buttons 1 and 2 to select your language

➔ Press the SET button to save the adjustment

After initialization, the controller is in the automatic mode with typical settings. The pre-programmed system layout is Arr 1.

Select a system layout:

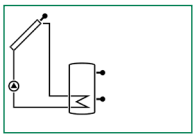
➔ Select the adjustment channel **Arr**

➔ Change to the SET mode (see 2.1)

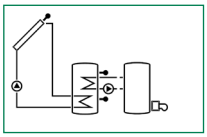
➔ Select the system layout via the Arr-index number

➔ Press the SET button to save the adjustment

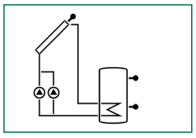
Now the controller is ready for operation with typical settings to suit that system layout and normally the factory settings will give close to optimum operation.



ARR 1



ARR 2



ARR 1
with booster

Overview of system layouts:

ARR 1 : standard solar sytem (with booster function option)
ARR 2 : solar system with backup heating

4. Control parameters and display channels

4.1 Overview of channels

Legend:

x

Corresponding channel is available.

x*

Corresponding channel is available when the corresponding option is enabled

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

①

Only if the option energy metering is **activated** (OHQM), will the corresponding channel be available.

②

Only if the option energy metering is **deactivated** (OHQM), will the corresponding channel be available.

MEDT

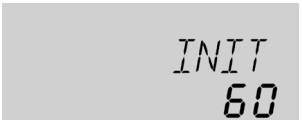
Only if an antifreeze (MEDT) other than **water or Tyfocor LS / G-LS (MEDT 0 or 3)** is used, will the channel antifreeze concentration (MED%) be displayed.

channel	ARR		description	page
	1	2*		
INIT	x	x	time period - switch-on conditions active	12
FLL	x	x	time period - filling time active	12
STAB	x	x	time period - stabilisation active	12
COL	x	x	temperature collector	12
TST	x		Temperature tank	12
TSTL		x	temperature tank base	12
TSTU		x	temperature tank top	12
S3	x		temperature sensor 3	12
TRF	①	①	temperature return sensor	12
S4	②	②	temperature sensor 4	12
h P	x		operating hours relay 1	13
h P1		x	operating hours relay 1	13
h P2		x	operating hours relay 2	13
kWh	①	①	heat quantity kWh	15
MWh	①	①	heat quantity MWh	15
ARR	1-2		Arrangement	
DT O	x	x	Switch-on temperature difference	13
DT F	x	x	Switch-off temperature difference	13
tDTO	x	x	time period - switch-on conditions	13
tFLL	x	x	filling time	13
tSTB	x	x	time period - stabilisation	14
OBST***	x		booster function option	14
S MX	x	x	maximum temperature tank 1	14
EM	x	x	emergency shutdown collector 1	15

channel	ARR		description	page
	1	2		
OCN	x	x	option collector minimum limitation	15
CMN	x	x	minimum collector temperature	15
TH O		x	switch-on temp. thermostat	16
TH F		x	switch-off temp. thermostat	16
OHQM		x	HQM option	14
FMAX	①	①	maximum flow rate	14
MEDT	①	①	antifreeze type	14
MED%	MEDT	MEDT	antifreeze concentration	14
HND	x	x	manual mode relay 1	16
HND1	x	x	manual mode relay 1	16
HND2	x	x	manual mode relay 2	16
LANG	x	x	language	16
Db x	XX.XX			

4.1.1 Initialization

INIT:
Initialization active



Indicates the time adjusted in tDTE, running backwards.

- INIT : Initialization

4.1.2 Filling time

FLL:
Filling time active

Indicates the time adjusted in tFLL, running backwards.

- FLL : filling time

4.1.3 Stabilization

STAB:
Stabilization

Indicates the time adjusted in tSTB, running backwards.

- STAB : Stabilization

4.1.4 Collector temperature

COL:
Collector temperature
Display range: -40 ...+480 °F

Indicates the collector temperature.

- COL : Collector temperature

4.1.5 Tank temperatures

TST TSTL, TSTU:
Tank temperatures
Display range: -40 ...+480 °F

Indicates the tank temperature.

- TST : tank temperature
- TSTL : tank temperature bottom
- TSTU : tank temperature top

4.1.6 Sensor 3 and Sensor 4

S3, S4:
Sensor temperatures
Display range: -40 ...+480 °F

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

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

Please note:
Only if the temperature sensors are connected (displayed), will S3 and S4 be displayed.

4.1.7 Other temperatures

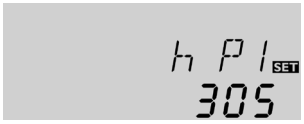
TRF:
Other measured temperatures
Display range: -40 ...+480 °F

Display of the current temperature at the sensor.

- TRF : temperature - return

4.1.8 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** / **hP2**). Full hours are displayed.

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

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

4.1.9 ΔT-regulation

DT O:
Switch-on temperature diff.
Adjustment range: 2.0 ... 40.0
Factory setting: 20.0 °F

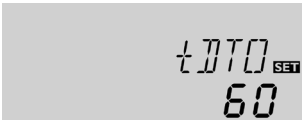
When the switch-on difference (**DT O**) is continuously exceeded during the **t DTO** period, the pump is switched on. When the temperature difference falls below the adjusted switch-off difference (**DT F**), the controller switches off.

DT F:
Switch-off temperature diff.
Adjustment range: 1.0 ... 38.0
Factory setting 8.0

Please note: The switch-on temperature difference must be at least 1 °Ra higher than the switch-off temperature difference.

4.1.10 Time period - switch-on conditions

tDT O:
Time periode -
switch-on conditions
Adjustment range: 1 ... 100 s
Factory setting: 60 s



The parameter **tDTO** is used for adjusting the time period during which the switch-on condition must be permanentely fulfilled.

4.1.11 Filling time

tFLL:
Filling time
Adjustment range: 1 ... 30 min
Factory setting: 5 min

The filling time can be adjusted using the parameter **tFLL**. During this period, the pump runs at 100% speed and the booster pump is additionally switched-on.

4.1.12 Stabilization

tSTB:
Stabilization
Adjustment range: 1 ... 15 min
Factory setting: 2 min

The parameter **tSTB** is used for adjusting the time period during which the switch-off condition will be ignored after the filling time has ended.

4.1.13 Booster function option

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

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

4.1.14 Maximum tank temperature

S MX:
Maximum tank temperature
Adjustment range:
+40 ... 480 °F

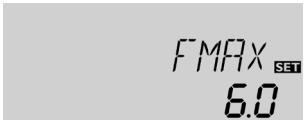
If the adjusted maximum temperature is exceeded, the tank will no longer be loaded in order to avoid damage caused by overheating. If the maximum tank temperature is exceeded, ☀ will be shown.

Please note: The controller is equipped with a tank emergency shutdown function, which prevents the tank from being loaded when the tank temperature exceeds 295 °F.

4.1.15 Energy metering

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

FMAX:
Flow rate in l/min
Adjustment range: 0 ... 20
in 0,1-steps
Factory setting: 6.0



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

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

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

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

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

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

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

Example: 123 kWh + 123 MWh = 123.123 kWh

The accumulated heat quantity can be reset. As soon as one of the display channels of the heat quantity is selected, the symbol SET is permanently shown on the display. Press button SET (3) for about 2 seconds in order to access the RESET mode of the counter. The display symbol SET will flash and the heat quantity value will be set to 0. In order to finish this process, press the SET button to confirm.

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

4.1.16 Collector emergency temperature Collector emergency shutdown

EM:
Collector emergeny shutdown temperature
Adjustment range: 230 ... 400 °F
Factory setting: 285 °F

If the adjusted collector emergency shutdown temperature (**EM**) is exceeded, the controller will switch off the solar pump (R1) in order to protect the system against overheating (collector emergency shutdown). The factoring setting is 285 °F but it can be changed within the adjustment range of 230...400 °F. ⚠ (flashing) is displayed.

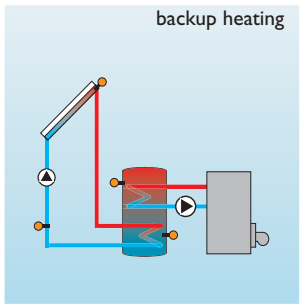
4.1.17 Collector minimum limitation option

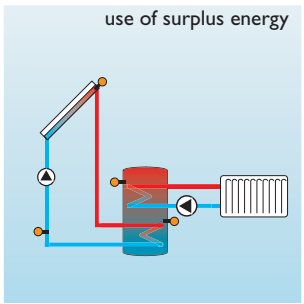
OCN:
Collector minimum limitation
Adjustment range: OFF / ON
Factory setting: OFF

CMN:
Collector minimum temperature
Adjustment range: 210 ... 380 °F
Factory setting: 40 °F

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

4.1.18 Thermostat function (ARR = 2)





TH O:
Thermostat switch-on temperature
Adjustment range:
30...205 °F
Factory setting: 100.0 °F

TH F:
Thermostat switch-off temperature
Adjustment range:
30...205 °F
Factory setting: 110.0 °F

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

- **TH O < TH F**
  thermostat function for backup heating
- **TH O > TH F**
  thermostat function for using surplus energy

When the 2nd relay output is active, ⓘ is displayed.

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 of time, there are 3 time frames t1 ...t3. If the function should be activated only between e.g. 6:00 and 9:00, set **t1 O** to 6:00 and **t1 F** to 09:00. The thermostat function is continuously activated (factory setting).
If all time frames are set to 00:00, the thermostat function is continuously activated (factory setting).

4.1.19 Operating mode

MAN / 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 MAN. The following adjustments can be carried out:

- **MAN**
  Operating mode
  OFF : relay off ⚠ (flashing) + ✋
  AUTO : relay in automatic operation
  ON : relay on ⚠ (flashing) + ✋

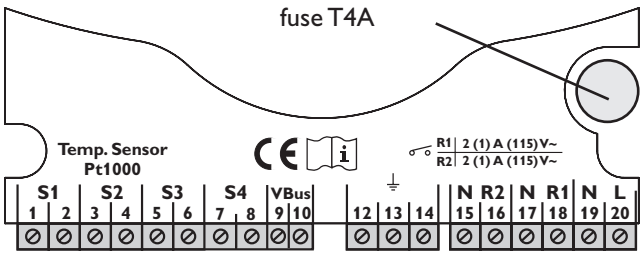
4.1.20 Language (LANG)

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

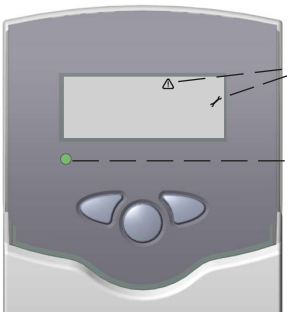
In this channel, different languages are available.

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

5. Troubleshooting



If a malfunction occurs, a message is displayed in the display of the controller:



Operating control lamp flashes red. The symbol and the ⚠ are shown.

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

888.8

Cable is broken. Check the cable.

- 88.8

Short-circuit. Check the cable.

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

°F	Ω	°F	Ω
14	961	131	1213
23	980	140	1232
32	1000	149	1252
41	1019	158	1271
50	1039	167	1290
59	1058	176	1309
68	1078	185	1328
77	1097	194	1347
86	1117	203	1366
95	1136	212	1385
104	1155	221	1404
113	1175	230	1423
122	1194	239	1442

Resistance values of the Pt1000-sensors

Control lamp off

Check the power supply. Is it disconnected?

no

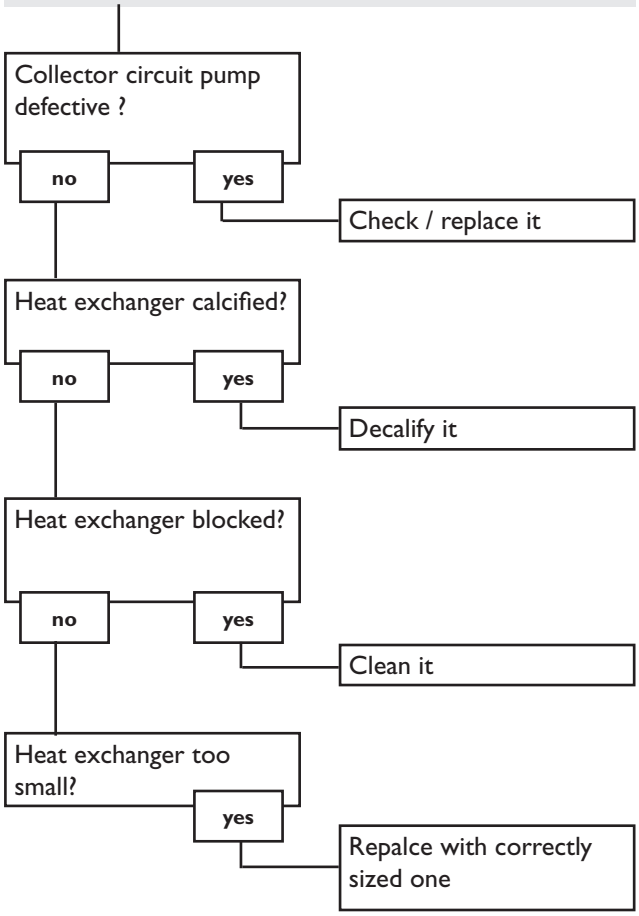
The fuse of the controller could be blown. It can be replaced after the front cover has been removed (spare fuse is enclosed in the fuse holder).

yes

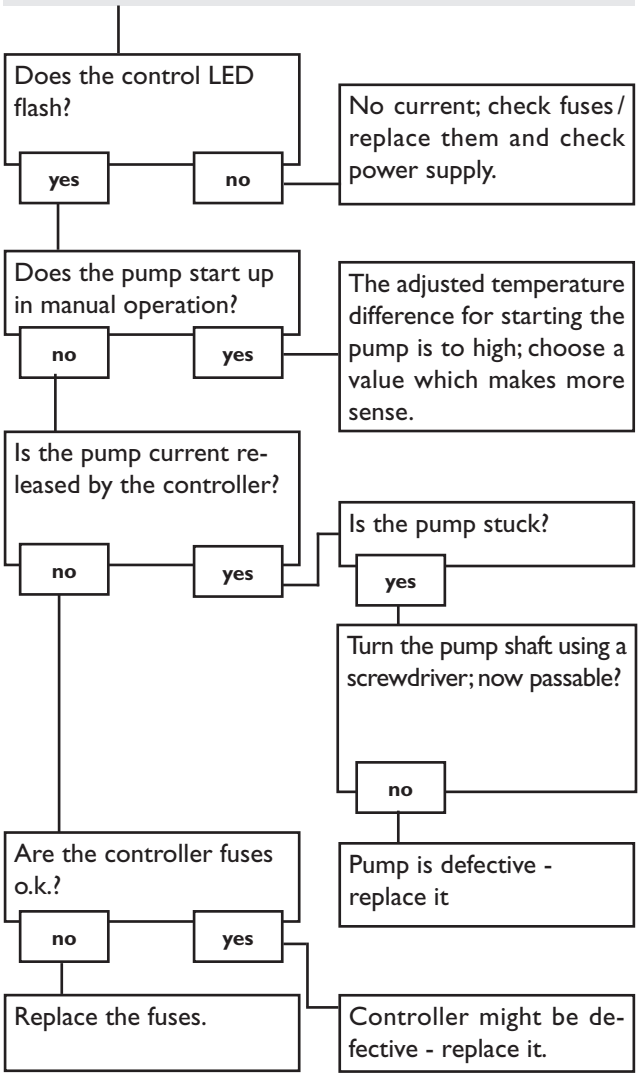
Check the supply line and reconnect it.

5.1 Various:

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



The solar circuit pump does not run although the collector is significantly warmer than the tank.



Notes

6. Accessories

Sensors

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

Overvoltage protection device

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

Distributed by:

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Fax: +49 (0) 23 24 / 96 48 - 755
www.resol.com
info@resol.com

Important notice:
The text and drawings in this manual are correct to the best of our knowledge. As faults can never be excluded, please note: Your own calculations and plans, under consideration of the current standards and directives 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 any resulting damages.

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