

# RESOL DeltaSol® B

Mounting

Connection

Operation

Fault location

Examples



*PG 51.02 and PG 53.02*

Thanks for buying a RESOL.

Read this manual carefully to get the best performance from this unit.

RESOL®  
DeltaSol® B

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Editor: RESOL - Elektronische Regelungen GmbH

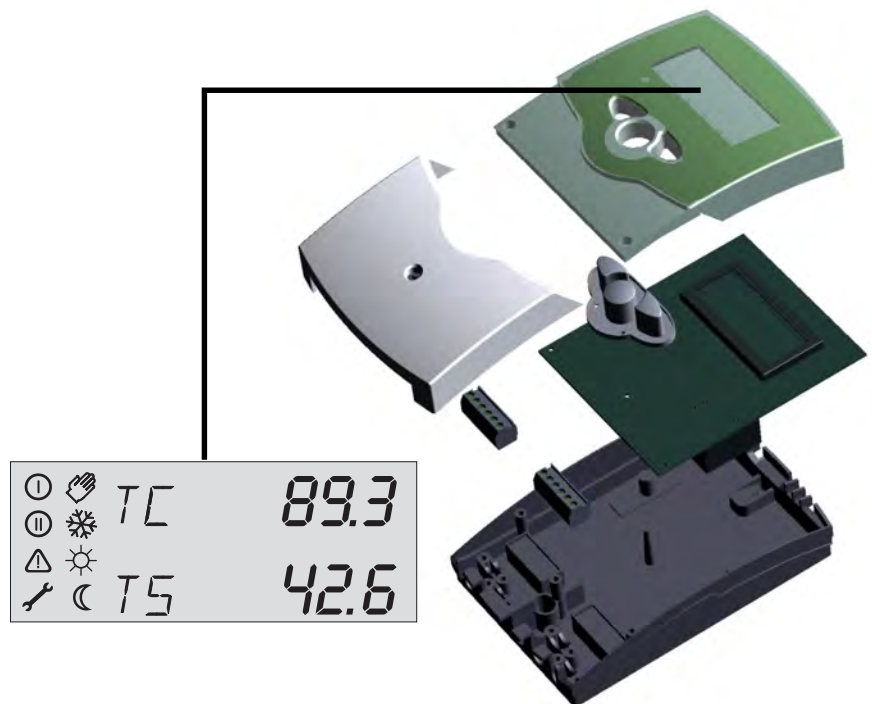
**Important notice:**

We took a lot of care over the texts and drawings of this manual and to the best of our knowledge and consent. As faults can never be excluded, please note:

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

Errors and technical changes excepted

- housing in outstanding design and compact dimensions, easy to install
- multifunctional combined display
- user-friendly operation by simple handling
- intuitive menu mode
- function control



## RESOL DeltaSol B – the next generation of controllers

### DeltaSol® B

The controller RESOL *DeltaSol*® B is used for application in standard solar thermal systems as well as in heating and air conditioning systems and persuades by its clear operation concept.

A newly developed, multi-functional display enables the user to simultaneously request two temperatures (e.g. collector and store temperature). No annoying switching-over, no guessing but easy pictograms give the user clear information on function and operating status of the controller and the system.

The version PG 53.02 is equipped with 2 standard relay outputs, the version PG 51.02 is equipped with 1 standard relay output as well as 3 sensor inputs for Pt1000-sensors, store temperature limitation and manual switch. The central element is the 3-key-field below the display. The newly developed combined LC-display enables an intuitive and reliable controller configuration as well as a comprehensive visualisation of the system status. Collector cooling- and recooling function as well as security switch-off, but also a thermostat function can be easily realised.

The controller *DeltaSol* B is also available as individual OEM-version, so that further system adaptations are possible.

### Technical data

**Housing:** plastic, PC-ABS and PMMA

**Protection type:** IP 40 / DIN 40050

**Size:** 172 x 110 x 46 mm

**Installation:** wall mounting, mounting into patch panels is possible

**Display:** LCD, multi-functional combined display with 8 pictograms, two 2-digit text fields and two 4-digit 7-segment displays as well as one 2-coloured luminescent diode

**Operation:** by three pushbuttons in the front of the housing

**Functions:** standard solar controller with adjustable values: minimum-maximum temperature limitation, switch-on and switch-off-temperature difference. Frost protection / cooling function, security switch-off, function control according to BAW-directions

**Inputs:** 3 temperature sensors Pt1000

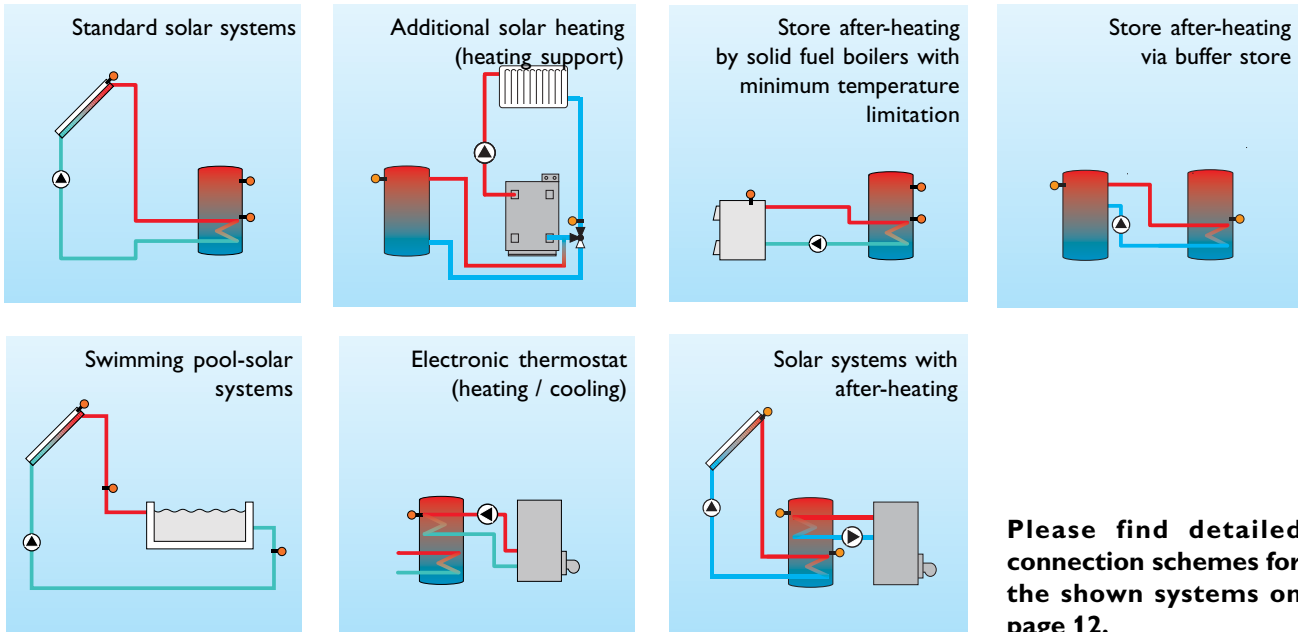
**Output:**  
2 standard-relay outputs (PG 53.02),  
1 standard-relay output (PG 51.02),  
total power supply 4A

**Power supply:**  
210 ... 250V (AC) 50 ... 60 Hz

**Power consumption:** approx. 2 VA



**Examples DeltaSol B**



**Please find detailed connection schemes for the shown systems on page 12.**



**Order indication:**

<b>RESOL DeltaSol® B</b>	<b>115 313 50</b>
<b>RESOL DeltaSol® B - full kit</b>	
incl. 3 temperature sensors Pt1000 (1 x FKP6, 2 x FRP6)	<b>115 313 30</b>

**Accessory**

**Overvoltage protection**

It is highly recommended to connect this RESOL overvoltage protection SP1 to all collector sensors in order to avoid overvoltages (e.g. by lightning).

<b>RESOL SP1</b>	Art.-No.: <b>180 110 10</b>
------------------	-----------------------------



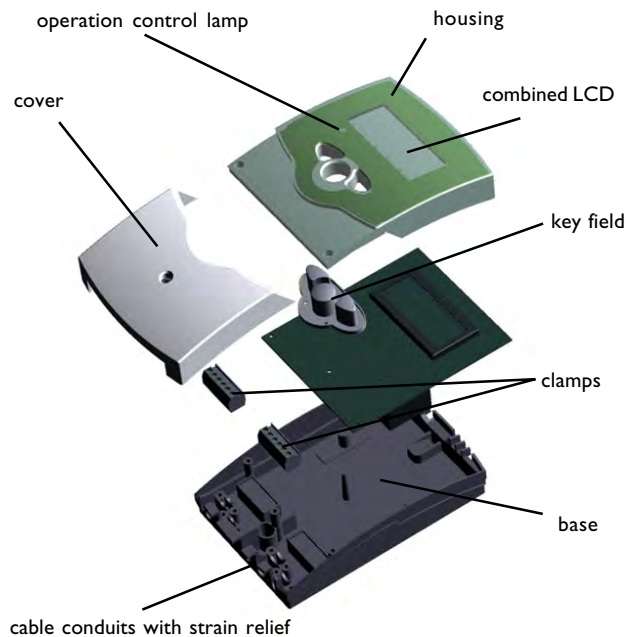
**Safety regulations:**

Please read the following information carefully before installing and operating the controller. In this way damage to the solar system by wrong installation will be avoided. Please observe that the mounting is adapted to the characteristics of the building, that the local regulations are respected and is conform to the technical rules.

- |                      |   |
|----------------------|---|
| TRD 802              | Steamboiler of group III,                                     |
| TRD 402              | Equipment of steamboiler systems with hot water generators of |
| group IV             |   |
| DIN 1988, Teil 1 – 8 | Technical rules for drinking water installation               |
| DIN 4708, Teil 3     | Central warm water heating systems                            |
| DIN 4751, Teil 1 + 2 | Water heating systems   |
| DIN 4753             | Water heater and systems and for drinking water               |
| DIN 4757, Teil 1 – 4 | Solar heating and solar thermal systems                       |
| DIN 18338            | Roofing and roof sealing works                                |
| DIN 18339            | Plumbers works  |
| DIN 18451            | Scaffolding works   |
| VDE 0100             | Set up of electrical operating supplies                       |
| VDE 0185             | General rules for setting up overvoltage protection systems   |
| VDE 0190             | Main potential equalization of electrical systems             |
| DIN 18381            | Gas-, water- and sewage installation systems                  |
| DIN 18382            | Electrical cable- and line systems in housings                |
| HeizAnIV             | Heating system regulation                                     |

## 1. Installation

### 1.1 Mounting

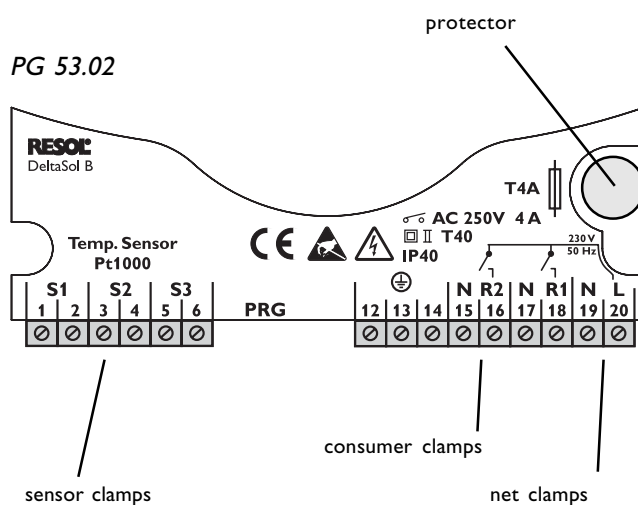


**Warning!**  
Switch-off power supply before opening the housing.

The unit must only be located internally. It is not suitable for installation in hazardous locations and should not be sited near to any electromagnetic field. The controller must additionally be equipped with an all-polar gap of at least 3 mm or with a gap according to the valid installation regulations, e.g. LS-switches or fuses. Please pay attention to a separate laying of the cable lines and installation of ac power supply.

1. Unscrew the cross-recessed screw of the cover and remove it from the housing.
2. Mark the upper fastening point on the underground and pre-mount the enclosed dowel and screw.
3. Hang up the housing at the upper fastening point and mark the lower fastening point on the underground (hole pitch 130 mm), afterwards put the lower dowel.
4. Fasten the housing at the underground.

### 1.2 Electrical wiring



The power supply to the controller must only be made by an external power supply switch (last step of installation!) and the line voltage must be 210 ... 250 Volt (50...60 Hz). Flexible lines are to be fixed at the housing by enclosed strain relief supports and screws.

The controller is equipped with an electromechanical relay, to which the **consumers** e.g. pumps, valves, etc. can be connected:

- 18 = conductor R1
- 17 = neutral conductor N
- 13 = ground clamp ⊕

The full version (PG 53.02) is additionally equipped with a second electromechanical relay:

- 16 = conductor R2
- 15 = neutral conductor N
- 14 = ground clamp ⊕

The **temperature sensors** (S1 up to S3) will be connected to the following terminals independently of the polarity:

- 1 / 2 = sensor for heat source (e.g. collector sensor)
- 3 / 4 = sensor for heat sink (e.g. store sensor)
- 5 / 6 = additional sensor, as measuring- or thermostat sensor (only PG 53.02)

The **power supply** is effected to the clamps:

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

## 2. Sensor types

Precision-platin sensors type PT1000 (**FKP** and **FRP**) are used for **DeltaSol B**.

The arrangement of the sensors is of great importance to the total efficiency of the regulator. The collector temperature should be measured in the upper part of the collector. In stores with integral heat exchanger, the sensor must be directly mounted in the upper part of the heat exchanger. When using external heat exchangers, the sensor must be fixed at the bottom of the store. For individual operation systems, our product range contains 3 different types of sensors (sensors for installation in existing immersion sleeves, flatscrew sensors or cylindrical clip-on sensors). The sensor types **FK** and **FR** have the same electrical features and are available in the same models, They only differ in the connecting cable:



FK... : collector sensor

FR... : reference sensor (store sensor)

**FK:** 1,5 m weather- and temperature resistant silicone cable for temperatures between -50 °C ... +180 °C, mostly used for collectors.

**FR:** 2,5 m PVC cable for temperatures between -5 °C ... +80 °C, mostly used for stores.

Make sure that all electrical works are carried out according to the relevant local and IEE-regulations. The sensor cables carry low voltages and they must not run together in a cable conduit with cables carrying higher voltages than 50 Volts. When using longer cables or cable conduits, please use screened cables. The sensor cables can be lengthened up to 100 m, but the cross section must be 1,5 mm<sup>2</sup> (or 0,75 mm<sup>2</sup> up to a cable length of 50m); screened cables should be used preferably. The sensors must not be in direct contact with water, please always use immersion sleeves.

**Immersion sensors:** in different lengths (immersion depth) available

**FK...60:** 60 mm immersion depth, immersion sleeves of chromium-plated brass

**FK...150:** 150 mm immersion depth, immersion sleeve of chromium-plated copper

**Important:** The sensors must be completely pushed into the sleeve and the nut must be slightly tightened.

**Cylindrical clip-on sensors:** for any pipe diameter; cpl. with fastening collar; **FK...21** or **FR...21**

Ensure good thermal contact of the sensor with the pipe work by cleaning the contact area and by applying heat conduction paste between sensor and pipe. In order to protect the sensor cable against outside temperature influences, it is recommended to insulate the pipe..

**Flatscrew sensors:** for installation on flat surfaces

**FK...8** or **FR...8**

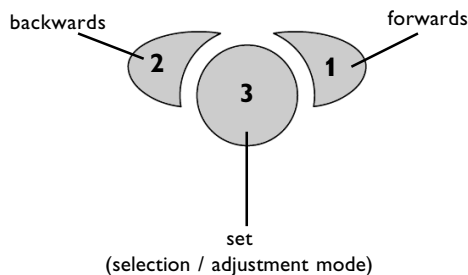
Ensure good thermal contact. Use conduction paste and insulate the sensors against outside temperature influences.

**Indication:**

In order to avoid overvoltage damage at the collector (e.g. by lightning), it is highly recommended to use the overvoltage protection RESOL SP1.

### 3. Operation and function

#### 3.1 Adjustment keys



The controller is only operated by the 3 pushbuttons below the display. The forward-key (1) is used for scrolling forward through the indication menu or to increase the adjustment values. The backwards-key (2) is accordingly used for the reverse function.

The adjustment channels follow the pure indication channels in the display. In order to come to these channels, press the forward key to channel *TT* for 2 sec. If an **adjustment value** is shown on the display, **SEt** is indicated. In this case you can press the key „Set“ (3) in order to change into input mode.

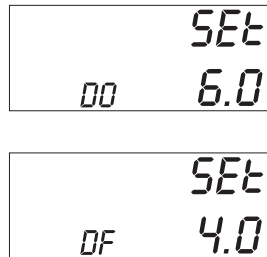
- **Select a channel by keys 1 and 2**
- **Shortly press key 3, so that „SEt“ flashes**
- **Adjust the value by keys 1 and 2**
- **Shortly press key 3, so that „SEt“ permanently appears, the adjusted value is now saved**

#### 3.2 Controller parameter / indication channels

- **TC=TemperatureCollector**
- **TS=TemperatureStorage**
- **TT=Temperature(Thermostat)**
- **DO=TemperatureDifference(On)**
- **DF=TemperaturDifference(OfF)**
- **SX=StorageTemperatur(MaXimum)**
- **CL=CollectorTemperature(Limited)**
- **CX=CollectorTemperature(MaXimum)**
- **CN=CollectorTemperature(MiNimum)**
- **TO=ThermostatTemperature(On)**  
(only PG 53.02)
- **TF=ThermostatTemperature(OfF)**  
(only PG 53.02)
- **FN=FuNction**  
Funktion  
0 : Maximum store temperature deactivated  
1 : Maximum store temperature activated  
2 : Maximum store temperature deactivated, recooling function activated  
3 : Maximum store temperature activated, recooling function activated
- **MM=Mode(Manual) (PG 53.02)**  
manual operation mode  
0 : Operation mode 0, both relays are deactivated  
1 : Operation mode 1, relay 1 is activated, relay 2 is deactivated  
2 : Operation mode 2, relay 1 is deactivated, relay 2 is activated  
3 : Operation mode 3, both relays are activated  
4 : Operation mode 4, automatic operation
- **MM=Mode(Manual) (PG 51.02)**  
manual operation mode  
0 : Operation mode 0, relay is deactivated  
1 : Operation mode 1, relay is activated, relay 2 is deactivated  
2 : Operation mode 2, automatic operation
- **PG=ProGram**  
program number
- **VN=VersionNumber**

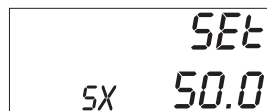
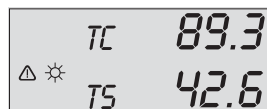
**Please note:** The controller is equipped with a security switch-off of the store, which prevents a further loading of the store at 90 °C store temperature.

### 3.2.1 $\Delta T$ -controller (DD, DF)



**Please note:** Switch-on temperature difference DD must be at least 1 K higher than the switch-off temperature difference DF.

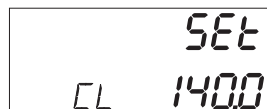
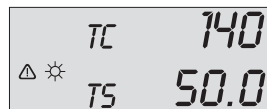
### 3.2.2 Maximum store temperature (SX)



The controller controls the temperatures measured by the two sensors S1 and S2 and compares the resulting temperature difference with the preadjusted switch-on-temperature difference  $\Delta T_{ON}$  (DD). The controller switches ON, when the measured temperature difference  $\Delta T$  is higher than or identical to the preadjusted set value in channel DD. In the display is shown ① and the operating control lamp flashes green. When the adjusted switch-off-temperature-difference  $\Delta T_{OFF}$  (DF) is underrun, the controller switches-OFF. By RESOL, the switch-on temperature difference is set to 6 K and the switch-off temperature difference is set to 4 K.

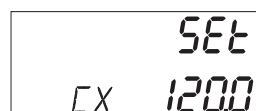
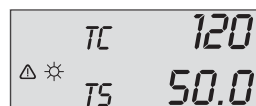
If the adjusted maximum temperature is exceeded, a further loading of the store is stopped so that a damaging overheating can be avoided. The maximum store temperature is activated by factory setting (FN = 3). If the maximum store temperature is exceeded in the display is shown △ and ☀ (flashing), the operating control lamp flashes red. In order to realize a pure maximum temperature limitation and to deactivate the recooling- and/or collector cooling function, FN = 1 must be adjusted.

### 3.2.3 Limit collector temperature (CL)



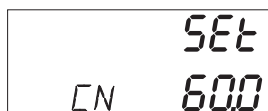
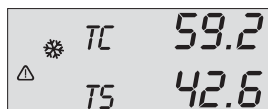
Extremely high collector temperatures are normally intercepted by a properly dimensioned membrane-expansionball. If the preadjusted collector limit temperature (CL) is exceeded, the solar pump (R1) is switched-off in order to avoid a damaging overheating of the solar components (collector safety shutdown). The limit temperature is set to 140 °C by RESOL but it can be changed within the adjustment range of 110 ... 200 °C. In the display is shown △ and ☀ if the maximum collector temperature is exceeded, the operating control lamp flashes red.

### 3.2.3 Maximum collector temperature (CX)



If the collector temperature exceeds the adjusted maximum collector temperature (CX) in standstill of the solar circuit (maximum store temperature is reached), the solar pump (R1) switches-on and cools the collectors by heat transfer via lines and the store (collector cooling function). The store temperature might increase, but only up to 90 °C (safety shutdown of the store). This function guarantees a longer operating time for very hot summer days and ensures a thermal relief for the collectors and the heating medium. The maximum collector temperature is set to 120 °C by RESOL, but it can be changed within the adjustment range of 100 ... 190 °C. In the display is shown ①, △ and ☀ if the maximum collector temperature is exceeded, the operating control lamp flashes green.

**3.2.4 Minimum collector temperature (CN)**

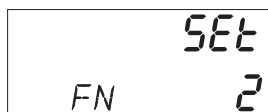
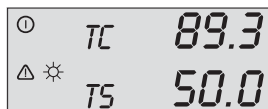


The minimum collector temperature is a minimum switching temperature, which must be exceeded so that the solar pump (R1) is switched-on. The minimum temperature shall avoid a steady starting-up of the solar pump (or solid fuel boiler charging pumps) for low collector temperatures. The minimum temperature is set to 10 °C by RESOL (= deactivated). In the display is shown  $\Delta$  and  $\odot$  if the minimum collector temperature is exceeded, the operating control lamp flashes green. This function analogly is also usable as minimum temperature limitation for solid fuel boilers, recommended adjustment value: 60 °C.

**Please note:**

The minimum collector temperature is used for adjustment of the frost protection function between -10,0 ... 9,9 °C for minimum temperature function between 10,1 ... 100 °C.

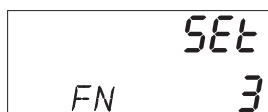
**3.2.5 Recooling function**



**Recooling (FN 2):**

If the adjusted maximum store temperature (5 X) is exceeded, the solar pump remains activated in order to avoid an overheating of the collector. The store temperature may increase - but only up to 90 °C (store safety shutdown). The solar systems remains running in the evening until the store is cooled down to the adjusted maximum store temperature (5 X) by the collector or lines.

**3.2.6 Collector cooling function**

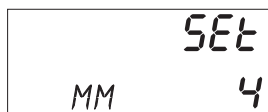


**Collector cooling function (FN 3):**

If the adjusted maximum store temperature is reached, the solar system switches-off. If the collector temperature now raises up to the adjusted maximum collector temperature (CX), the solar pump remains activated until this limit temperature value is again underrun. The store temperature may increase - but only up to 90 °C (store safety shutdown). If the maximum store temperature (SX) is exceeded by the storetemperature and the collector temperature is at least 5K below the store temperature, the solar system remains running until the store is cooled down to the adjusted maximum store temperature (SX) by the collector and the pipes.

**3.2.7 Operating mode (MM)**

MM	R1	R2
0	off	off
1	on	off
2	off	on
3	on	on
4	auto	auto
PG 53.02		



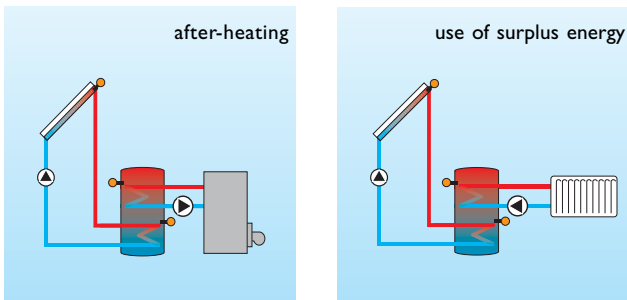
Display: PG 53.02

MM	R1
0	off
1	on
2	auto
PG 51.02	

The operating mode of the controller can manually be set for control- and service works. Choose the adjustment value MM, which allows the following adjustments:

- 0 = both relays are deactivated, operating-control lamp flashes red/green
- 1 = relay 1 is activated, relay 2 is deactivated, operating control lamp flashes red/green
- 2 = relay 2 is activated, relay 1 is deactivated, operating control lamp flashes red/green
- 3 = relays 1 and 2 are activated
- 4 = automatic operation

### 3.2.8 Thermostat function ( $T0$ , $TF$ )



⑩	TS	42.6
	TT	25.4

		SEt
	T0	40.0

		SEt
	TF	45.0

The controller is equipped with a 2nd relay and a 3rd temperature sensor input (S3, e.g. in the upper store part) for thermostat function. The thermostat function works independently from the solar operation and can e.g. be used for use of surplus energy or after-heating. Adjustment by RESOL  $T0 = 40\text{ °C}$ ,  $TF = 45\text{ °C}$

- $T0 = TF$   
the thermostat function is deactivated, in this case relay output R2 is activated if the maximum store temperature is exceeded
- $T0 < TF$   
the thermostat function is used for after-heating
- $T0 > TF$   
the thermostat function is used as use of surplus energy

If the 2nd relay output is activated, in the display is shown ⑩.

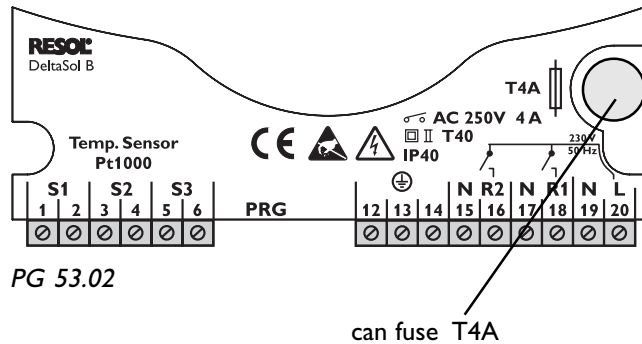
## 4. Commissioning

①	TC	89.3
	TS	42.6

Ac power supply must be activated. The controller passes an initialisation phase in which the operating control lamp flashes red and green. After having finished the initialisation, the controller is in automatic operation, which is the most effective one for most of the systems with the indicated factory settings.

If individual conditions require an adaptation of the parameter, please adjust the values accordingly (see 3.2).

**5. Tips for fault location:**



°C	Ω	°C	Ω
-10	961	55	1213
-5	980	60	1232
0	1000	65	1252
5	1019	70	1271
10	1039	75	1290
15	1058	80	1309
20	1078	85	1328
25	1097	90	1347
30	1117	95	1366
35	1136	100	1385
40	1155	105	1404
45	1175	110	1423
50	1194	115	1442

resistance values of PT1000 sensors

Please check the following points if the controller **RESOL DeltaSol® B** does not work faultlessly:

**1. Power supply**

If the operating control lamp is off, please check the power supply of the controller.

The controller is protected by one can fuse T4 A, which is situated at the base/isolation plate and can be replaced by opening the cover of the housing (spare fuse is enclosed in one of the accessory bags).

**2. Sensor faults**

If there is a malfunction due to a sensor defect, the operating control lamp flashes red and the symbol is shown on the display (T3 is not affected). An error code for the concerned sensor is shown on the display (T $\bar{L}$ , T $\bar{S}$  or T $\bar{T}$ ). The pushbutton key <+> must once be pressed for checking the 3rd temperature sensor (PG 53.02):

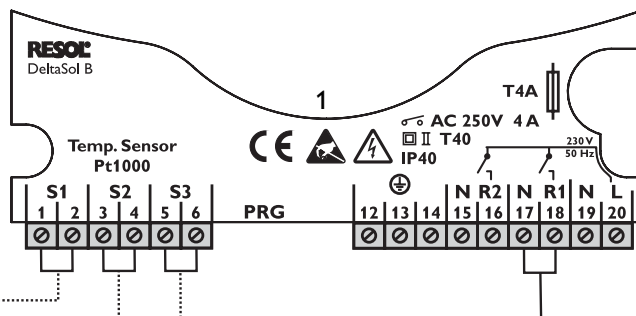
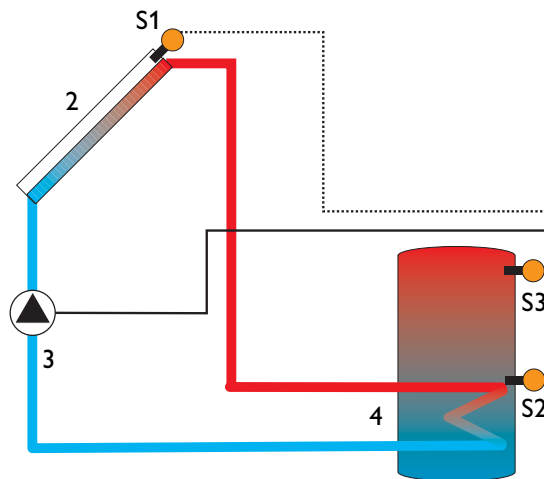
**Short-circuit:** Short-circuit in the sensor wire with indication of the concerned temperature sensor (T $\bar{L}$ , T $\bar{S}$  or T $\bar{T}$ ). The error code - $\bar{B}\bar{B}\bar{B}.\bar{B}$  is shown on the display.

**Line break:** Interruption of the sensor wire with indication of the concerned temperature sensor (T $\bar{L}$ , T $\bar{S}$  or T $\bar{T}$ ). The error code  $\bar{B}\bar{B}\bar{B}.\bar{B}$  is shown on the display for the concerned sensor.

Clamped Pt1000-temperature sensors can be checked by a resistance-measuring device. The measured temperatures can be compared with the resistance values of the table opposite.

6. Examples

6.1 Solar system with 1 collector and 1 store:

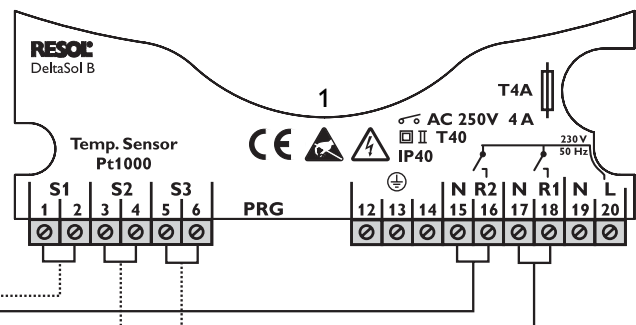
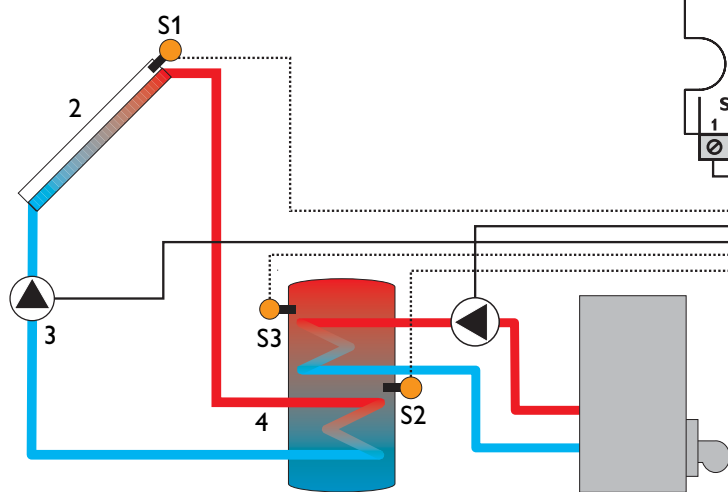


Solar irradiation transfers heat, which is made utilizable by the heat exchanger of the store (4), via collector (2) to the system. The controller (1) measures the temperature difference between collector sensor S1 and store S2. As soon as this difference is higher or identical to the adjusted value ( $\Delta D$ ), the pump (3) is started and the store is loaded

up. If the switch-off temperature difference ( $\Delta F$ ) is underrun by this difference, the pump is stopped.

The 3rd temperature sensor S3 is an additional sensor for measuring purpose, e.g. for measuring the upper store temperature.

6.2 Solar system with 1 collector, 1 store and after heating (only PG 53.02):



Solar irradiation transfers heat which is made utilizable by the heat exchanger of the store (4) via collector (2) to the system (2). The controller (1) measures the temperature difference between collector sensor S1 and store sensor S2. As soon as this difference is higher or identical to the adjusted value ( $\Delta D$ ), the pump (3) is started and the store is loaded up. If the switch-off temperature difference ( $\Delta F$ ) is underrun by this difference, the pump is stopped.

adjustment channels. Depending on your adjustment, the thermostat function works in after-heating or cooling operation.

Necessary adjustments for store after-heating:

$T_D = 40\text{ }^\circ\text{C}$

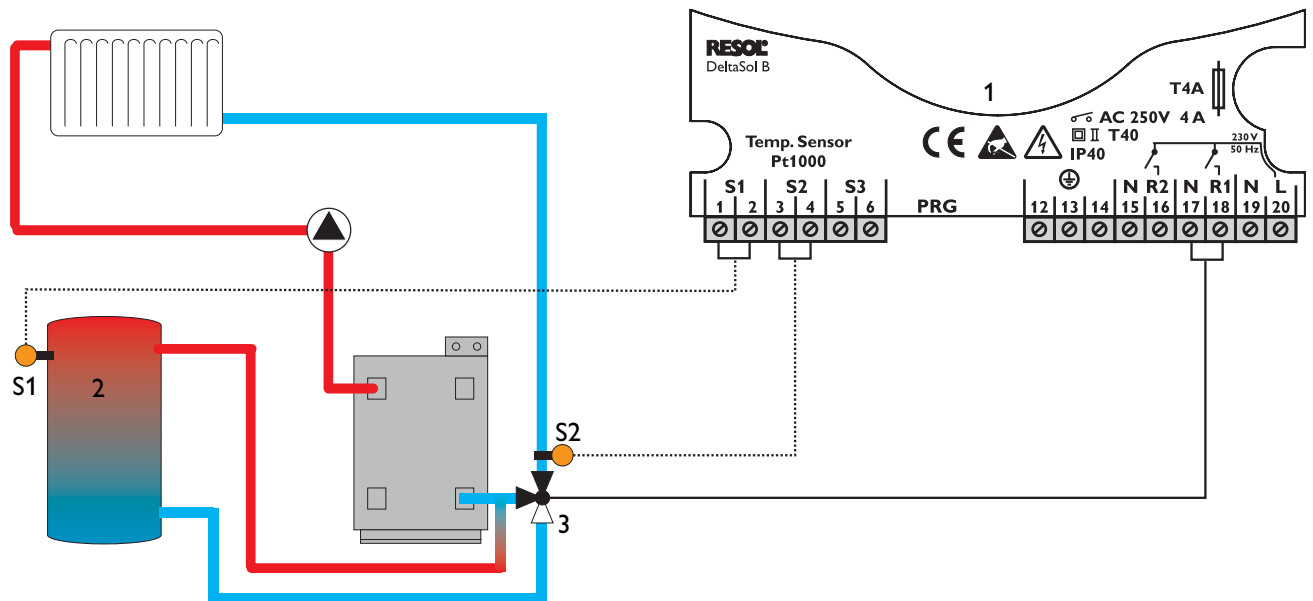
$T_F = 45\text{ }^\circ\text{C}$

(adjusted by RESOL)

The adjustments can be adapted to the individual system conditions.

The 3rd temperature sensor S3 can be used for thermostat function. The thermostat switch-on temperature ( $T_D$ ) and the switch-off temperature ( $T_F$ ) must be adjusted in the

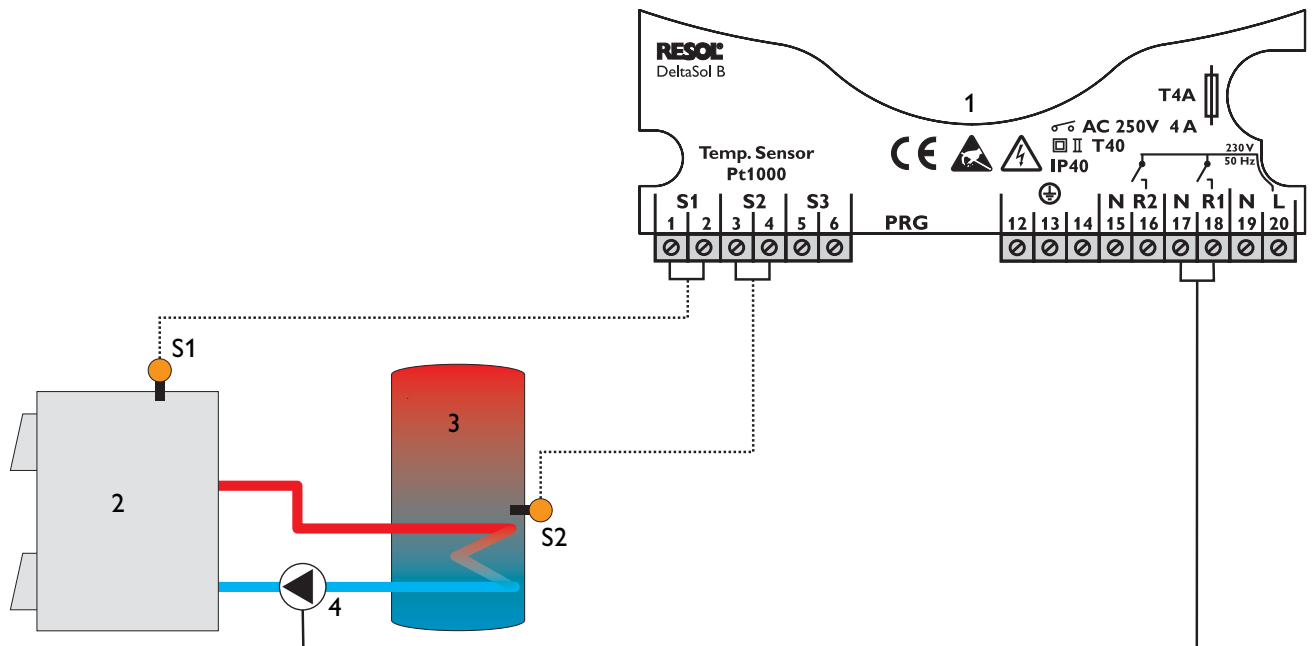
6.3 Reverse raising of the heating circuit:



The controller (1) compares the temperature measured by sensor S1 at the buffer store (2) with the reverse temperature at measuring sensor S2. If the measured temperature difference is higher or identical to the adjusted

value  $\Delta T$ , the reverse temperature is increased by the warmth of the buffer store when connecting the 3-way valve (3)(heating support).

6.4 Loading of the store by solid fuel boiler or chimney boiler:



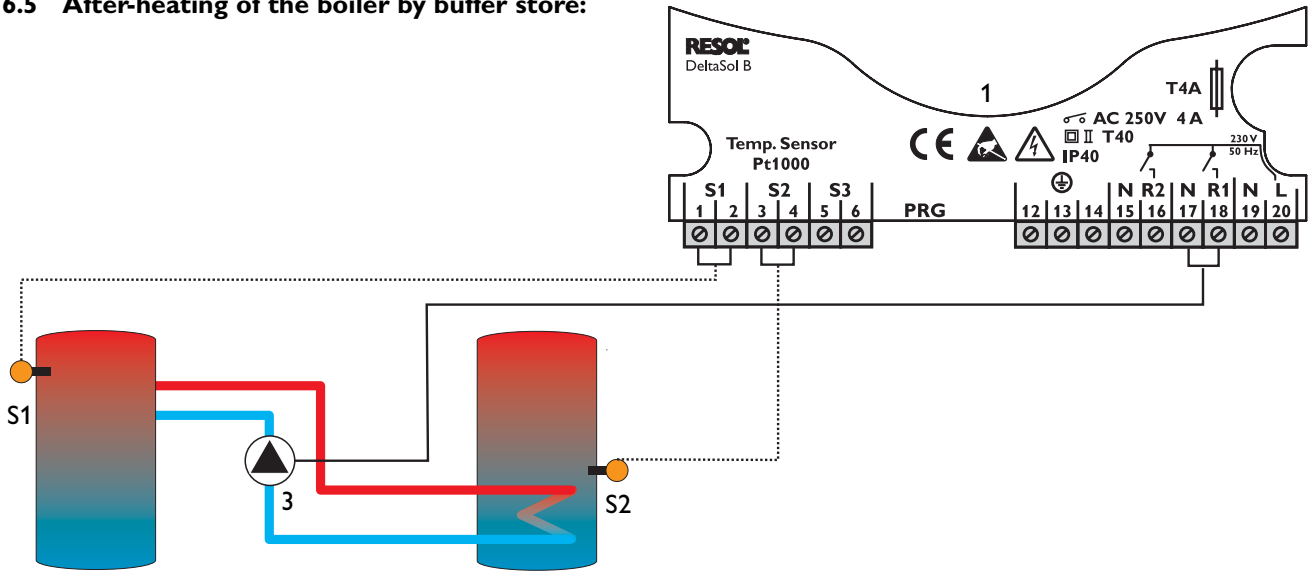
The controller (1) compares the temperatures measured by sensor S1 in the boiler or chimney boiler (2) with the temperature measured by sensor S2 in the store (3). If the measured temperature difference is higher or identical to the adjusted value  $\Delta T$  (switch-on temperature difference), the pump (4) is activated, if the adjusted minimum temperature ( $\Delta N$ , adjustment range 10,1 ...100 °C) is simultaneously reached or exceeded. If the switch-off

temperature difference  $\Delta T$  or the minimum temperature is underrun, the pump switches-off.

Necessary adjustment for minimum temperature limitation (to avoid flue gas condensation):

$\Delta N = 60 \text{ °C}$  (recommended)

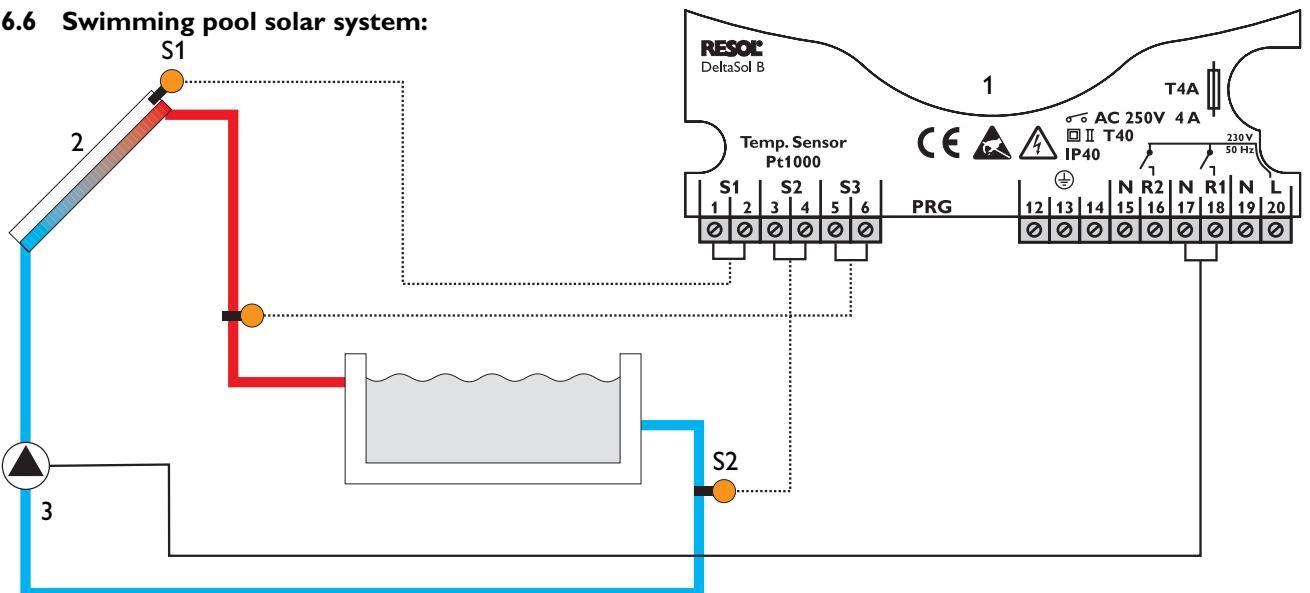
6.5 After-heating of the boiler by buffer store:



The controller(1) measures the temperature difference between buffer store sensor S1 and store sensor S2. As soon as the difference is higher or identical to the adjusted value (DD), the pump (3) is activated and the store is loaded up. If the switch-off difference (DF) is underrun by the measured difference, the pump is again deactivated.

The 3rd temperature sensor S3 is an additional sensor for measuring purpose, e.g. for measuring the upper store temperature.

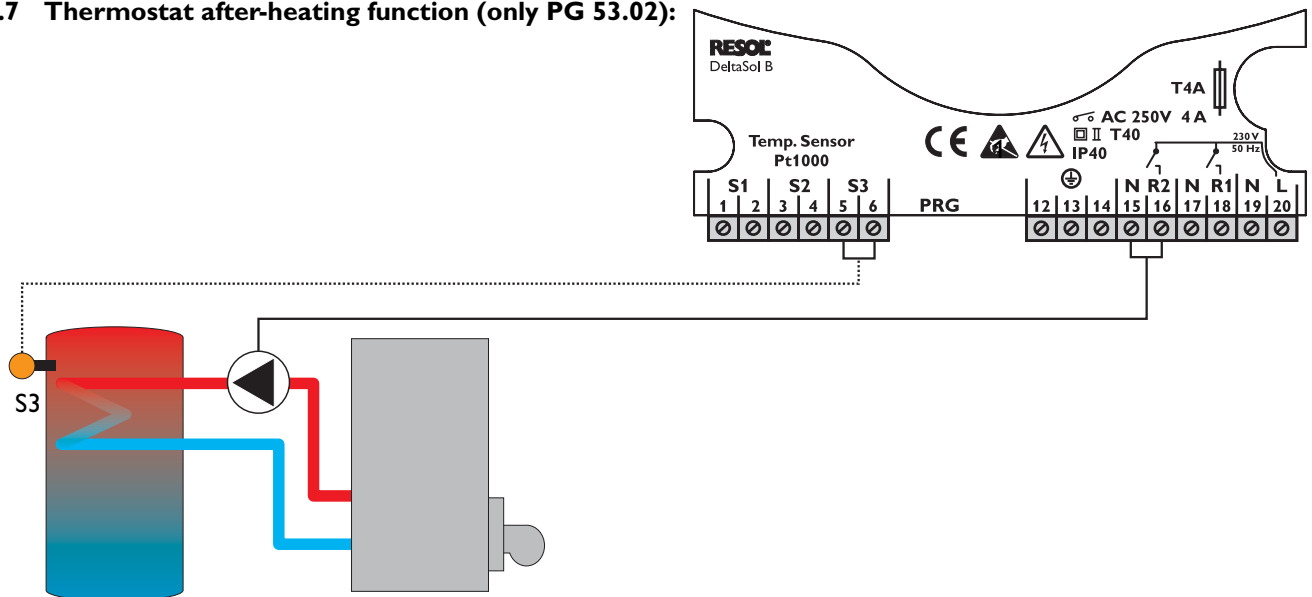
6.6 Swimming pool solar system:



The controller (1) measures the temperature difference between collector sensor S1 and swimming pool reverse sensor S2. As soon as the difference is higher or identical to the adjusted value (DD), the pump (3) is activated so that the water in the pool is heated up. If the switch-off difference (DF) is underrun by the measured difference, the pump is again deactivated.

The 3rd temperature sensor S3 is an additional sensor for measuring purpose, e.g. for measuring the upper store temperature.

## 6.7 Thermostat after-heating function (only PG 53.02):



The third temperature sensor S3 can be used for the thermostat function. The thermostat switch-on temperature  $T_D$  and the thermostat switch-off temperature  $T_F$  must be adjusted in the adjustment channels. Depending on the adjustment, the thermostat function works in after-heating or cooling operation.

Factory setting:  $T_D = 40\text{ °C}$ ,  $T_F = 45\text{ °C}$

- $T_D = T_F$   
the thermostat function is deactivated, that means that relay output R2 is activated if the maximum store temperature is exceeded
- $T_D < T_F$   
the thermostat function is used as after-heating
- $T_D > T_F$   
the thermostat function is used as surplus energy

**Your wholesaler:**

**Notes**

Design and specifications are subject to change without notice.  
Illustrations may differ slightly from production models.