

RESOL DELTA Sol

Universal temperature differential regulator for solar- and heating systems
Mounting instructions

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- universal temperature differential regulator for application in solar- and heating systems
- plastic housing with easy mounting and compact dimensions
- digital temperature display
- user-friendly handling
- function variety with different versions
- function control



Technical data RESOL DELTA Sol

Housing:
plug-in plastic housing

Size:
150 x 102 x 52 mm

Protection type:
IP30 / DIN 40050

Display:
3½digit LCD

Breakover points:
 ΔT : 2 ... 11 K (adjustable)
Hysteresis: 1,0 K

Control range:
-40°C...+200°C

Temperature limitation (according to version):
(Tmax): 20°C ... 90°C,
optionally 20°C ... 40°C
(e. g. for swimming pools)
(Tmin): 20°C...90°C

Ambient temperature:
0 ... 40 °C

DELTA Sol

The temperature differential regulator of the serie RESOL DELTA is used in solar-, heating- and air conditioning systems. In general, the regulator compares the temperatures T1 and T2, measured by 2 temperature sensors and compares the temperature difference with a preadjusted temperature difference ΔT . The regulator switches ON if the temperature difference ΔT is reached or exceeded. The regulator switches OFF if this difference is underrun by the adjusted hysteresis.

In designing this regulator great importance has been attached to enclosing the essential components. The simple concept gives the user the confidence to use the regulator without affecting any of the essential operational functions.

This version is equipped with 2 standard relay outputs, 3 sensor inputs for Pt1000-temperature sensors, store temperature limitation and a manual switch. The large display in combination with the selector switch and control lamps enables reliable function control.

By add-on connection of optional system functions by means of a DIP-switch and adjustment potentiometer inside the housing, the regulator can be adapted to individual demands. Collector cooling- and recooling functions as well as security switch-off and switch-off-delay and a thermostat function are problem easily possible.

The regulator DELTA Sol is also available as individual OEM-version so that additional adaptations to the system are possible.

(to be continued next page)



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No responsibility can be accepted for any errors or technical changes.

deltasol_montage.p65

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Universal temperature differential
regulator for solar- and heating systems
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(continued from page 1)

Technical data RESOL DELTA Sol

Inputs:

3 sensor inputs Pt1000

Outputs:

2 relay outputs, total power
supply max. 4 A

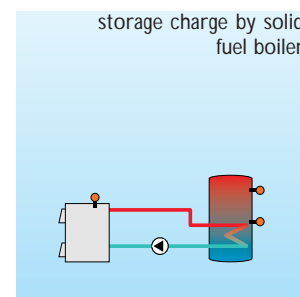
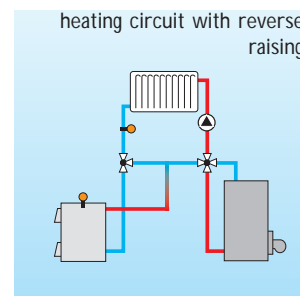
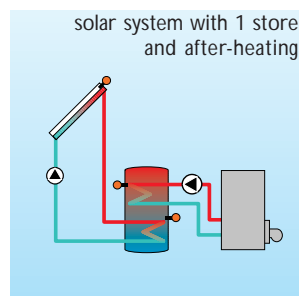
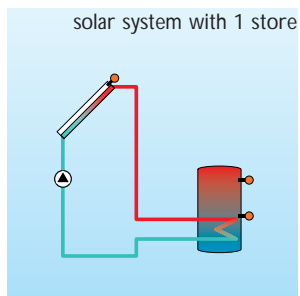
Power supply:

230 Volt AC, $\pm 10\%$

Power consumption:

appr. 2 VA

Examples DELTA Sol



The shown icons should only be used for illustration;
they only represent a choice of the possible applications.

Order indications

RESOL DELTA Sol

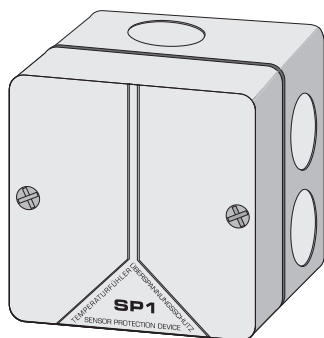
RESOL DELTA Sol - complete package -

incl. 3 temperature sensors Pt1000 (1 x FKP6, 2 x FRP6)

Article-No.

115 322 80

115 323 00



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).

Order indication

RESOL SP1

Article-No.: 180 110 10

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Safety regulations:

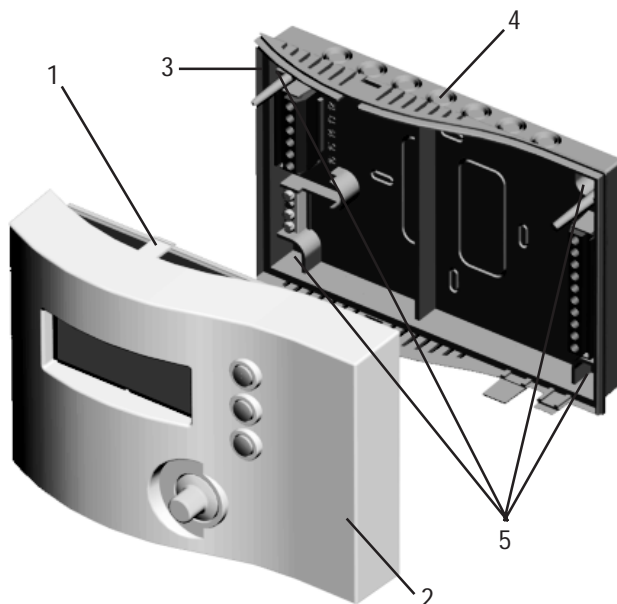
Please read the following information carefully before installing and operating the regulator. In this way damage to the regulator or the solar system will be avoided. All electrical wiring must comply with the latest IEE regulations.

1. Mounting



Warning:

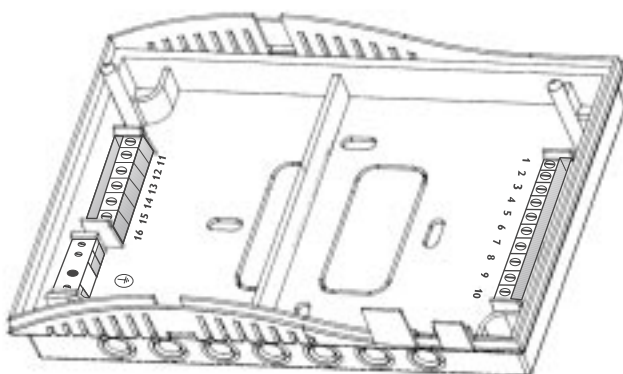
**Switch of power supply
before opening the housing !**



Please unlock both snap connections (1) at the top and at the bottom of the housing by means of a pointed item. The housing (2) can now be removed from the base (3). The required openings and cable feed-throughs (4) must be broken through and deburred. The positions for the 4 fastening screws (5) must be marked and the base may be attached by means of the enclosed screws and dowels. The electrical connection can be made now.

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 fields.

1.1 Electrical connection



The power supply to the regulator must only be made by an external power supply switch (last step of mounting!) and the line voltage must be 230 Volt \pm 10 % (50..60 Hz).

Pumps, valves, ... can be connected to the **consumer-outputs R1** and **R2** of the terminals at the base:

12 = conductor R2

14 = conductor R1

11, 13 = neutral conductor N

ground clamp = protective earth conductor \oplus

The **power supply** is connected to the terminals:

15 = neutral conductor N

16 = conductor L

ground clamp = protective earth clamp \oplus

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

1 / 2 = sensor for heat source (e. g. collector sensor)

3 / 4 = sensor for heat sink (e. g. store sensor)

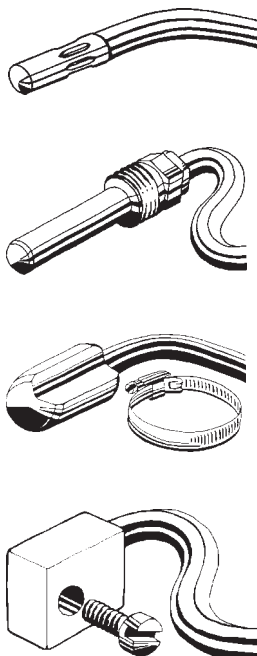
5 / 6 = additional sensor, for measurement purposes or for thermostat function



2. Sensor types

Precision-platin-temperature sensors Pt1000 (**FKP** and **FRP**) are used for the RESOL DELTA Sol.

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 mm² (or 0,75 mm² 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.

Standard temperature sensors: for installation in existing immersion sleeves (they are included in complete packages)

FKP6 or FRP6: 6 mm, Pt1000

Immersion sensors: available in different length (=immersion depth)

FKP60: 60mm immersion depth, chromium-plated copper

FKP150: 150mm immersion depth, 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

FKP20 or FRP20:

Ensure good thermal contact of the sensor with the pipework 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

FKP8 or FRP8:

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.



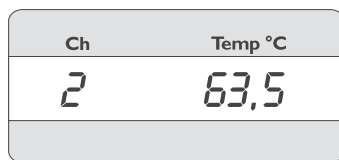
3. Operation:

3.1 Mode switch:

The mode switch is positioned at the lower front side of the housing and enables the following adjustments:

- 0** relay switched-off
- Auto** automatic operation for relay outputs
- I** relays (R1 and R2) switched-on, permanent operation

3.2 Pushbutton / Selector switch / Digital display



By means of the pushbutton at the front side of the regulator, the switchover of the measuring points for the connected temperature sensors can be effected. The code number of the selected temperature sensor is shown in the display at the position „Ch“. The respective sensor temperature is indicated at the position „Temp °C“.

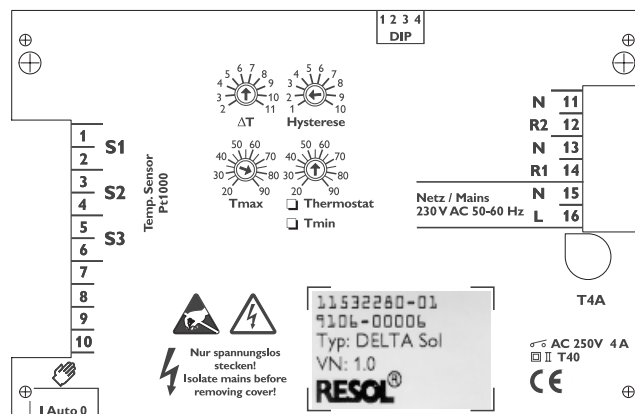
3.3 Control lamps:



3 light emitting diodes with the following symbols are located at the front side of the regulator:

- I** control lamp for relay 1
red: relay 1 OFF
green: relay 1 ON
flashing: activated special function
- II** control lamp for relay 2
red: relay 2 OFF
green: relay 2 ON
- Hand!** control lamp for manual operation and special functions
yellow: mode switch **I** or **0**
flashing: activated special function

3.4 Adjustment potentiometer:



You will find the adjustment potentiometer on the base/ isolation plate (visible in the upper part of the housing of the open regulator).

The regulator is generally equipped with adjustment potentiometer for the temperature difference ΔT , the maximum store temperature T_{max} and the thermostat function.

The regulator can optionally be equipped with a potentiometer for adjustment of an individual hysteresis. The potentiometer for adjustment of the thermostat function can optionally be used also for adjustment of the heat amount minimum temperature T_{min} (particular function is checked off).

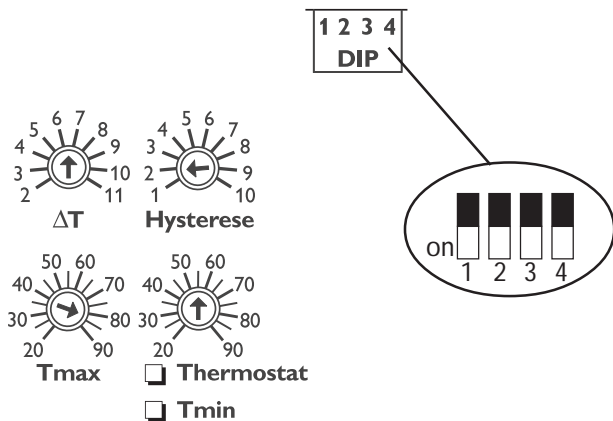
(see also point 3.6.7 - 3.6.9)

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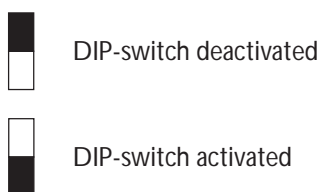


3.5 DIP-switch:



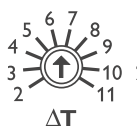
The DIP switch is situated below the base-/isolation plate of the regulator (open housing) at the position marked „DIP“.

By means of this DIP-switch the different special functions of the regulator can be activated or deactivated.



3.6 Functions and special functions:

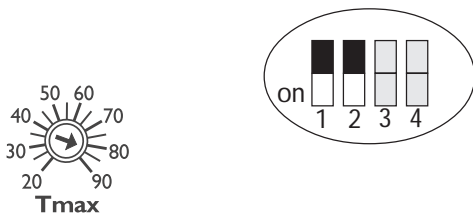
3.6.1 ΔT - regulation:



The temperature differential regulator RESOL DELTA Sol controls the temperature measured by the sensors S1 and S2 and compares the resulting temperature difference with a preadjusted temperature difference ΔT . The regulator switches ON if the measured temperature difference ΔT is higher or identical to the set value preadjusted at the potentiometer in the base plate (adjustment range 2 K ... 11 K [°C]). If this set value is underrun by 1,0 K (hysteresis, set by RESOL, but optionally adjustable) the regulator switches OFF.

The control of the system is effected by 2 relays, to which several motors (pumps) or electrical valves can be connected.

3.6.2 Maximum store temperature

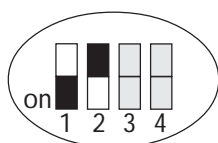


The temperature limitation **Tmax** (maximum store temperature) is adjusted by the potentiometer in the base plate (factory setting: 90°C).

If the adjusted maximum temperature is exceeded, further loading of the store is avoided (control lamps

ⓘ and ⚠ are flashing) so that damaging overheating can be avoided.

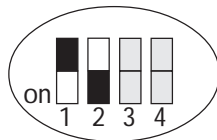
3.6.3 Recooling function



The solar pump remains activated as long as the store is cooled down to the adjusted value by the collector or pipes in the evening or at night if the maximum store temperature is exceeded. The advantage is that the temperature in the solar system remains under 100 °C and even if the water withdrawal is low or during longer heat periods the store temperature increases negligibly above Tmax (factory setting: function is activated).



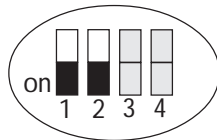
3.6.4 Collector cooling function



If the temperature T1 (collector) increases above the maximum temperature of the heat source (120°C) and the pump is off, the pump (R1) switches on. If the temperature T1 is underrun by 5 K of the adjusted value, the pump (R1) switches off again (in case that the maximum store temperature is reached).

Factory setting: function is deactivated

3.6.5 Security switch-off



The store can be loaded up by the collector cooling function beyond the adjusted maximum temperature, but with the security switch activated only up to 90°C. This function is only effective if $T_{max} < 90^{\circ}C$ (Factory setting: function is deactivated).

3.6.6 Switch-off delay



The switch-off delay can be activated or deactivated by means of the DIP-switch 3. The adjusted delay time of 2 minutes reduces the start frequency of the system. (Factory setting: function is deactivated).

3.6.7 Adjustable hysteresis (optional)

Hysteresis: Difference between switch-on and switch-off temperature for antihunting of the switching characteristics.

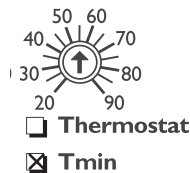


Hysteresis

For optimum adaptation of the hysteresis to existing solar- and heating systems, it can be set from 1 to 10 K at the potentiometer at the bottom of the housing so that the regulation can be optimally adapted to the individual system.

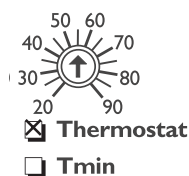
(Attention: The hysteresis must always be set lower than $\Delta T!$)

3.6.8 Minimum temperature of the heat source (optional)



The optional temperature limitation T_{min} prevents as well as the maximum store temperature e. g. a further loading of a store in the event that the preadjusted minimum temperature of the heat source is not reached.

3.6.9 Thermostat function



After-heating: If the temperature T3 e. g. in the upper part of the store falls by 5 K under the adjusted value, relay 2 switches on until this value is again reached.

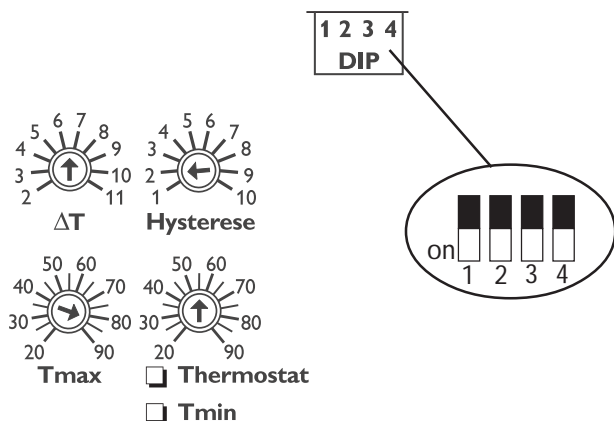


Cooling: If the temperature T3 e. g. in the upper part of the store has reached the adjusted value, relay 2 switches on until this value is again underrun by 5 K.

The after-heating and cooling operation work independently from the solar operation.



4. Adjustments and operation



1. Adjustment of the temperature difference

Please set the required temperature difference at the potentiometer ΔT on the base-/isolation plate of the housing.

(Factory setting: 6 K ... 8 K [$^{\circ}C$])

2. Adjustment of maximum-/minimum temperature

Please set the required maximum temperature (maximum store temperature) at the potentiometer Tmax on the base-/isolation plate of the housing. The required minimum temperature for the regulators in „min“-version can analogously be set at the potentiometer Tmin.

3. Adjustment of special functions

The required special functions can be activated at the DIP-switch by means of a pointed item.

4. Mounting the housing

After having finished the adjustments, the housing must be fitted to socket. The ac power supply is effected by an external switch.

Attention: The snap connections of the housing must clearly lock.

5. Switching

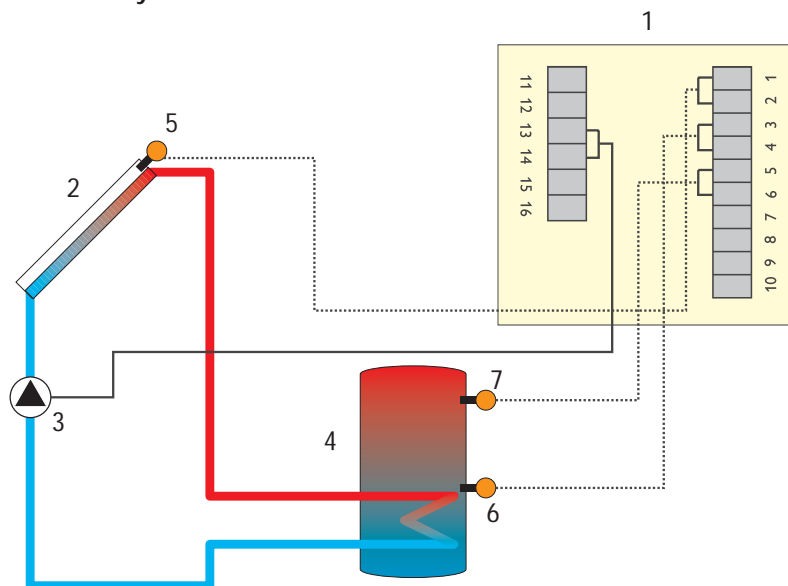
The mode switch of the regulator must be set to **0** before the power connection can be switched on. The yellow control lamp at the front side of the housing ① will flash. If the switch is set to **I**, the green control lamp flashes and the consumer connected to terminals 13/14 is supplied with power.

After having finished this test, the mode switch must be switched to **Auto** for automatic operation .



5. Examples

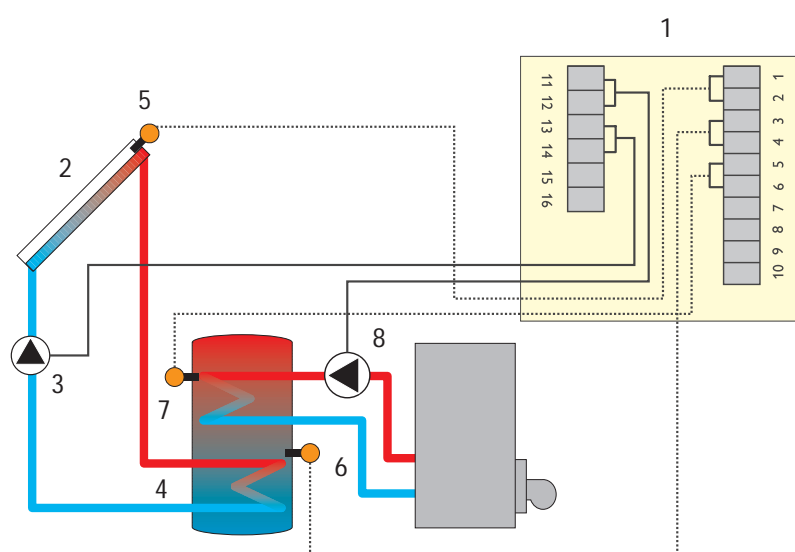
5.1 Solar system with 1 collector and 1 store:



The system is supplied with heat via collector (2) by solar irradiation; the heat is utilized by the heat exchanger of the store (4). The regulator (1) determines the temperature difference between collector sensor T1 (5) and store sensor T2 (6). As soon as the difference is higher or identical to the adjusted value (ΔT), the pump (3) is activated and the store is loaded.

The 3rd temperature sensor (7) can additionally be used for measuring purposes (e.g. for measuring the temperature in the upper part of the store).

5.2 Solar system with 1 collector, 1 store and after-heating:

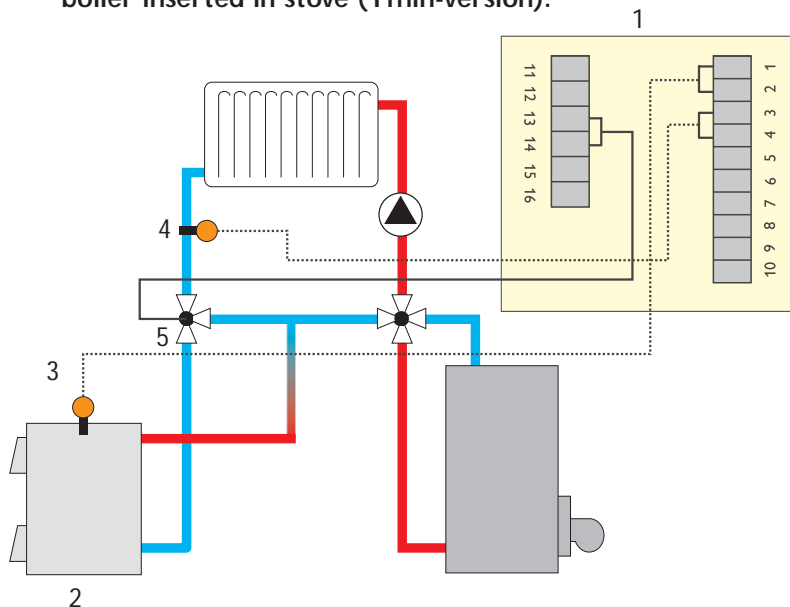


The system is supplied with heat via collector (2) by solar irradiation; the heat is utilized by the heat exchanger of the store (4). The regulator (1) determines the temperature difference between collector sensor T1 (5) and store sensor T2 (6). As soon as the difference is higher or identical to the adjusted value (ΔT), the pump (3) is activated and the store is loaded. If the adjusted value at the potentiometer (T_{max}) is exceeded at the sensor T2 (6), relay 1 is switched OFF by the regulator.

The 3. temperature sensor (7) can be used for the thermostat function. According to the selected DIP-switch position, the thermostat function operates as after-heating- or cooling function (see S.7).

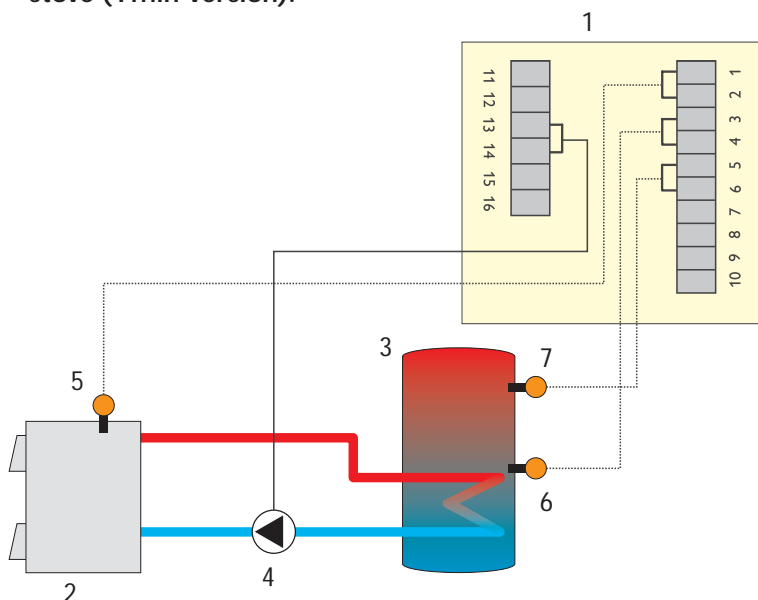


5.3 Reverse raising of a heating circuit by a solid fuel boiler or boiler inserted in stove (Tmin-version):



The regulator (1) compares the temperature T1 measured at the sensor (3) of the solid fuel boiler- or boiler inserted in stove (2) with the return temperature (T2) measured at the sensor (4). If this temperature difference is higher or identical to the adjusted value ΔT , the return temperature is increased by using the heat of the solid fuel boiler by switching a 3-way-valve (5). The regulator controls simultaneously if a preadjusted minimum temperature is reached or exceeded (avoidance of flue gas condensation).

5.4 Store charge by a solid fuel boiler- or boiler inserted in stove (Tmin-version):



The regulator (1) compares the temperature T1 at the sensor (5) of the solid fuel boiler or boiler inserted in stove (2) with the temperature T2 at the sensor (6) of the store (3). If the measured temperature difference is higher or identical to the adjusted value ΔT , the pump (4) is activated if the adjusted minimum temperature is simultaneously reached or exceeded.

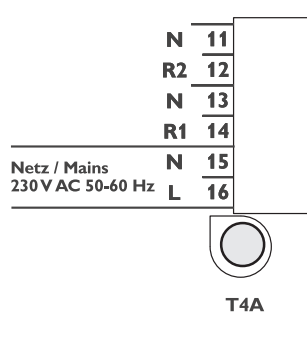
The 3. temperature sensor (7) can be additionally used for measuring purposes, e.g. for measurement of the temperature in the upper part of the store.



6. Test aid:

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

resistance values of
the Pt1000 sensors



Please check the following items if the regulator
RESOL DELTA Sol does not work faultlessly:

1. Power supply

The power supply is guaranteed if at least one control lamp
lights up.

2. Temperature sensors

The regulator will not switch off if there is a contact link
between sensor terminals 3 and 4 or in the event of a mis-
sing contact at terminals 1 or 2, on the other side.

The regulator will not switch on if there is a short circuit
or contact link between terminals 1 and 2 or if the other
sensor is not connected to terminals 3 and 4.

Please check the connections and sensor cable extensions
if the above malfunctions occur. The sensors and connecting
leads can be checked by measuring their resistance values.

In case of an interruption of the sensor lead, in the display
is shown *I*; in case of a short-circuit of the sensor lead - *I*
is shown for the concerned sensor.

3. Relays

Please check the fuses if the solar pump is not activated by
the regulator in spite of an existing line voltage and mode
switch position to I. The relay output of the regulator is
protected by 2 can fuses T1,6 A which are accessible on the
base/isolation plate after removing the housing and can be
changed now (spare fuses are enclosed).