

Hamworthy Trigon  
**DeltaSol M Solar Controller**  
**Installation, Commissioning &  
Operating Instructions**

**IMPORTANT NOTE**

**THESE INSTRUCTIONS MUST BE READ  
AND UNDERSTOOD BEFORE INSTALLING,  
COMMISSIONING, OPERATING OR  
SERVICING EQUIPMENT**



Heating *at work.*

# Customer After Sales Services

Telephone: **01202 662555** E-mail: **service@hamworthy-heating.com** Fax: **01202 662522**

## **Technical Enquiries**

To supplement the detailed technical brochures, technical advice on the application and use of products in the Hamworthy Heating range is available from our technical team in Poole and our accredited agents.

## **Site Assembly**

Hamworthy offer a service of site assembly for many of our products where plant room access is restricted. Using our trained staff we offer a higher quality of build and assurance of a boiler built and tested by the manufacturer.

## **Commissioning**

Commissioning of equipment by our own engineers, accredited agents or specialist sub-contractors will ensure the equipment is operating safely and efficiently.

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THE TRIGON DELTASOL M SOLAR CONTROLLER COMPLIES WITH ALL RELEVANT EUROPEAN DIRECTIVES.

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# Hamworthy Trigon

## Advanced DeltaSol<sup>®</sup> M Controller

**Mounting**

**Connection**

**Commissioning**

**Troubleshooting**



49011030  
00DNO0206-A

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

## Table of contents

<b>Safety advice</b> .....	2	<b>3. Commissioning</b> .....	12
<b>Technical data and overview of functions</b> .....	3	<b>3.1 Commissioning the controller</b> .....	12
<b>1. Installation</b> .....	4	<b>3.2 Basic systems and hydraulic variants</b> .....	12
<b>1.1 Mounting</b> .....	4	<b>3.3 Function blocks</b> .....	14
<b>1.2 Electrical connection</b> .....	5	<b>3.4 Adjusting the controller step-by-step</b> .....	16
<b>1.2.1 Overview of connections</b> .....	5	<b>3.5 Overview of sensor and relay allocation</b> .....	17
<b>1.2.2 Sensors</b> .....	5	<b>4. Functions and options</b> .....	19
<b>1.2.3 Actuators</b> .....	6	<b>4.1 Menu: Solar</b> .....	19
<b>1.2.4 Bus</b> .....	7	<b>4.2 Menu:Arrangement</b> .....	26
<b>1.2.5 Mains connection</b> .....	7	<b>4.2.1 Heating circuits</b> .....	28
<b>2. Operation and function</b> .....	9	<b>4.3 Menu: Heat quantity measurement</b> .....	33
<b>2.1 Buttons for adjustment</b> .....	9	<b>4.4 Menu: Expert</b> .....	34
<b>2.2 Control lamp</b> .....	9	<b>4.4 Menu: Manual operation</b> .....	35
<b>2.3 Menu structure</b> .....	10	<b>5. Accessory</b> .....	35
<b>2.4 User code</b> .....	10	<b>6. Troubleshooting</b> .....	37
<b>2.5 Menu overview</b> .....	11	<b>Important notice</b> .....	44

## Safety advice

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

This product is to be used in accordance with its intended use only (see page 3).

Please pay attention to the valid local regulations!

## Instructions

Attention should be paid to

- the statutory provisions for prevention of industrial accidents,
- the statutory provisions for environmental protection,
- the Health and Safety at Work Act 1974
- Part P of the Building Regulations 2005
- BS7671 Requirements for electrical installations and relevant safety regulations of DIN, EN, DVGW, TRGI, TRF and VDE.

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

Errors and technical changes excepted.

## 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.

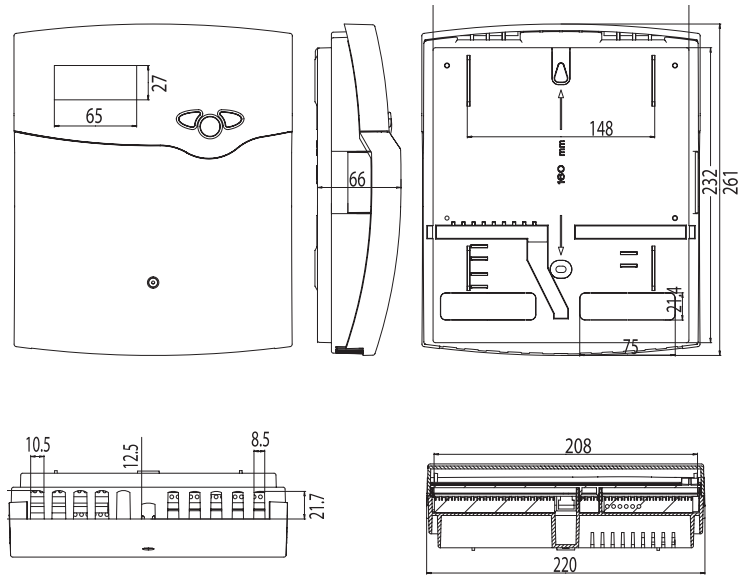


### Contents of accessory bag:

- 2 x dowels and screws for wall-mounting
- 1 x spare fuse T6,3A
- 11x strain relief and screw
- 3 x capacitor 4,7 nF for parallel connection when the load is smaller than 20 W
- 2 x sensor FKP6 2,5 m

## Overview

- text display with menu navigation
- 15 sensor inputs
- 9 relay outputs
- 7 basic solar systems
- add-on options and functions
- function blocks can be allocated as temperature differential functions and thermostat functions
- VBus® and RS232-interface
- parametrisation and control of the system via the Service Center Software



The controller DeltaSol® M is preprogrammed for 7 larger basic systems and allows the control of more complex solar systems. The controller is equipped with a multi-lingual menu, 9 relay outputs and 15 sensor inputs as well as a multitude of add-on functions and options, which enable the adaptation of the controller to individual solar- and heating-systems. Additionally, the controller offers up to two integrated calorimeters and allows the control of a

weather-compensated heating circuit. The DeltaSol® M is equipped with an interface for communication with the Service Center Software. The software allows a comfortable configuration, control and evaluation of the controller and the solar systems.

### Technical data:

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

**Protection type:**

IP 20 / DIN 40 050

**Ambient temp.:** 0...40 °C

**Dimensions:** 260 x 216 x 64 mm

**Installation:** wall mounting, also suitable for mounting into patch panels

**Display:** 4-line LC-text display (illuminated), menu navigation (multilingual), bicoloured LED

**Operation:** 3 push buttons at the front of the housing

**Functions:** Solar system controller for use in solar and heating systems. Two integrated calorimeters and control of a weather-compensated heating

circuit. Adjustable system parameters and additional options (menu-driven), balancing and diagnostic functions

**Sensor inputs:** 15 sensor inputs for Pt1000, RTA11-M, V40 and CS10

**Relay outputs:** 9 relay outputs, 4 of standards relays, 4 semi-conductor relays, and 1 potential-free (floating) relay.

**Bus:** VBus®, RS232

**Power supply:** 210 ... 240V~, 50 ... 60 Hz

**Switching capacity:** 1 A (semiconductor relay)

4 A electromechanical and potential-free relay

6,3 A (sum of all relays)

220 ... 240 V

**Degree of pollution:** 2

**Rated impulse voltage:** 2,5 kV

**Mode of operation:** type 1.c



Attention: Electrostatic discharge can cause damage of electronic components



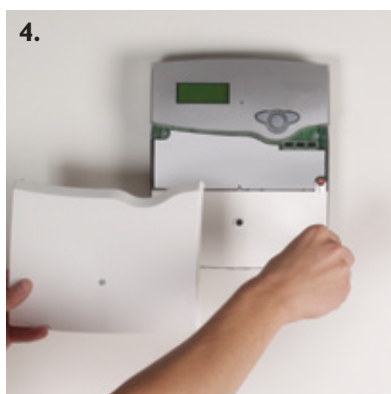
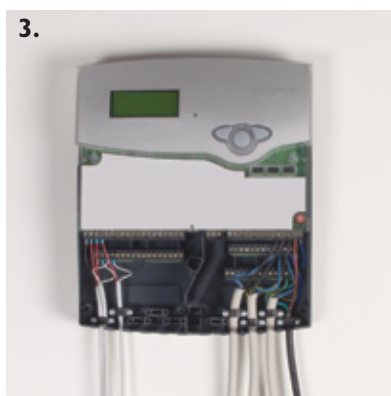
Warning: high-voltage components

## 1. Installation

### 1.1 Mounting



**WARNING!**  
Always disconnect the controller 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 mains cables.

1. Unscrew the cross-head screw from the cover and remove it along with the cover from the housing. Afterwards, unscrew cross-head screws from the terminal cover and remove the terminal cover.
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 (centres 160 mm). Drill and insert the lower wall plug and insert the lower fastening screw and tighten.
4. Connect relay, sensor and mains cables in accordance with the terminal allocation and secure with strain relief.
5. Insert terminal cover and housing cover and attach with the cross-head screws.

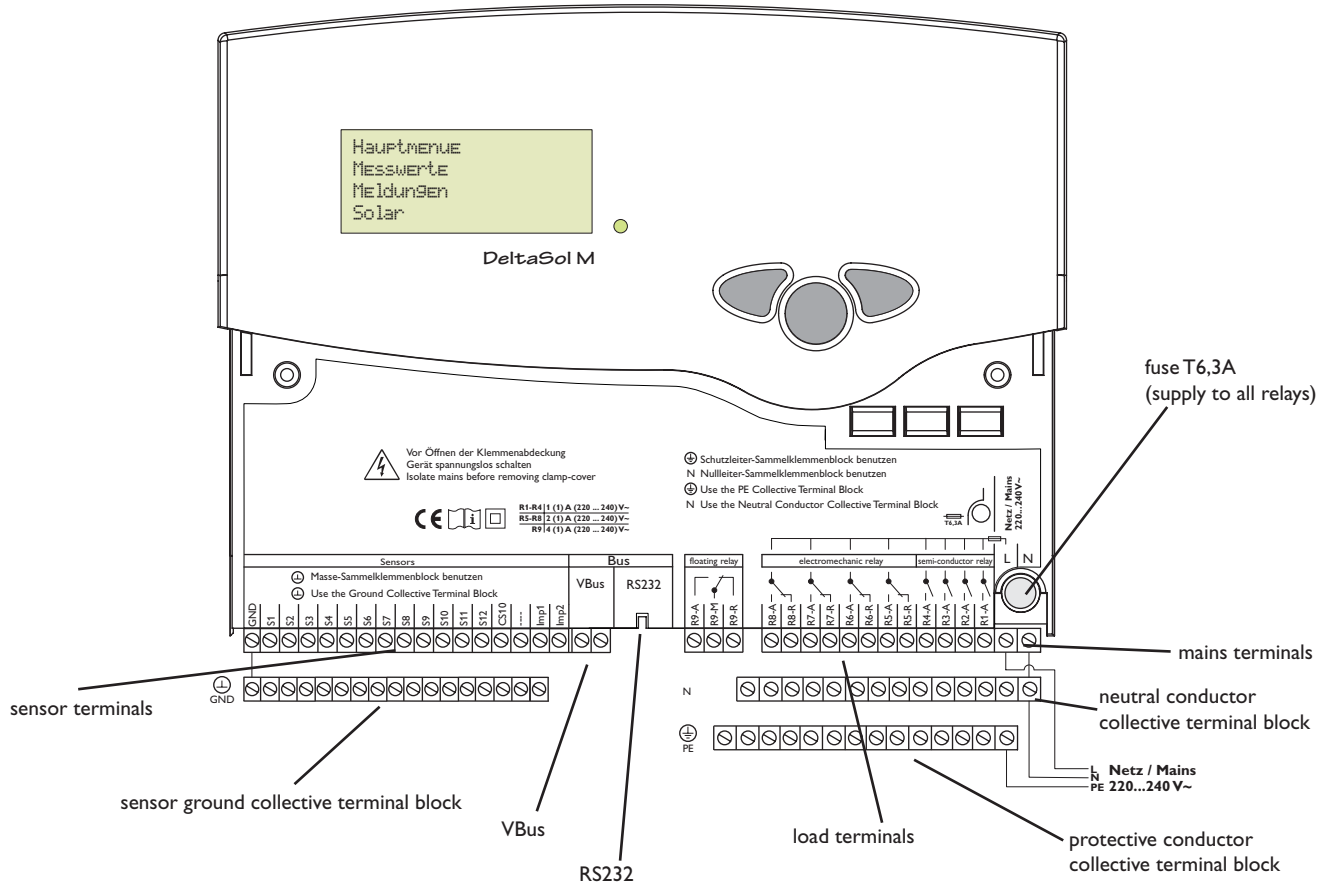
**Advice:**

Cable trunking (e.g. 60 x 110 mm<sup>2</sup>) should be mounted directly below the controller in order to facilitate the connection and separation of mains and sensor cables. The cables must be inserted into the terminal block with the stripped cable ends ensuring no stray wires.

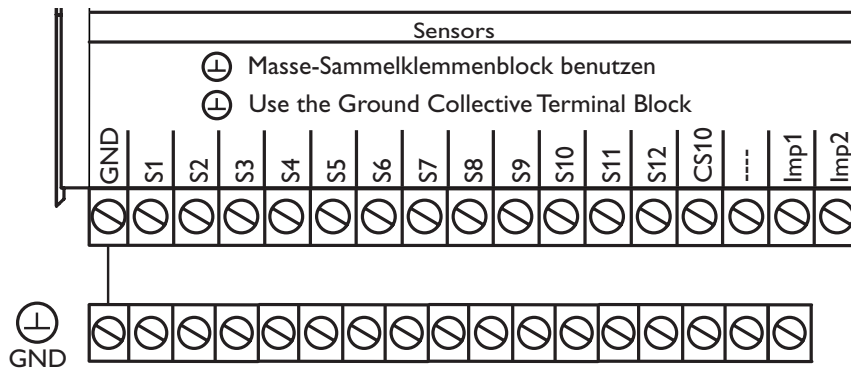


## 1.2 Electrical connection

### 1.2.1 Overview of electrical connections



### 1.2.2 Sensors



The controller is equipped with 15 sensor inputs in total. The ground connection for the sensors has to be carried out via the ground terminal block (GND).

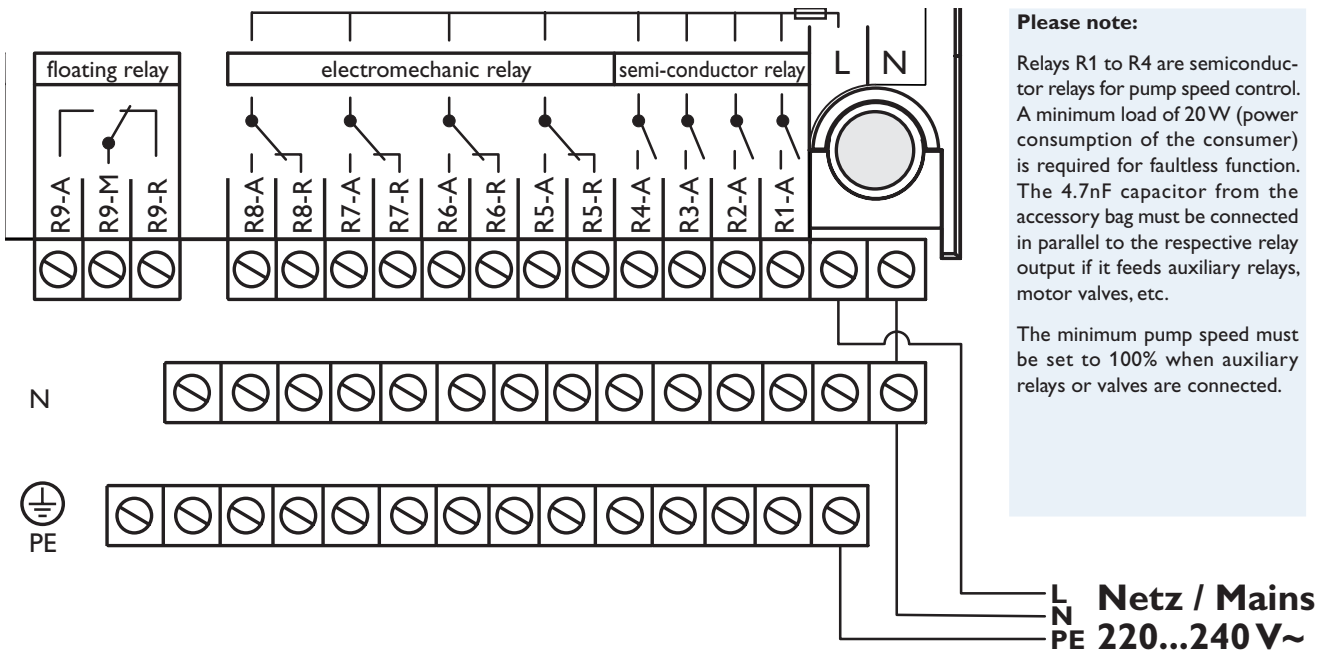
- **Temperature sensors** have to be connected to the terminals S1 ... S12 and GND (either polarity).
- The **irradiation sensor (CS10)** is to be connected to the terminals CS10 and GND with correct polarity. Connect the terminal GND of the sensor to the terminal

GND of the controller (ground terminal block), and the terminal CS of the sensor to the terminal CS10 of the controller.

- Two **flowmeters V40** can be connected to the terminals Imp1... Imp2 and GND (either polarity).



### 1.2.3 Actuators



**Please note:**

Relays R1 to R4 are semiconductor relays for pump speed control. A minimum load of 20 W (power consumption of the consumer) is required for faultless function. The 4.7nF capacitor from the accessory bag must be connected in parallel to the respective relay output if it feeds auxiliary relays, motor valves, etc.

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

The controller is equipped with 9 relays in total to which **loads** (actuators) such as pumps, valves, mixers and auxiliary relays can be connected (A = normally open contact; R = normally closed / break contact):

- **Relays R1 ... R4** are semiconductor relays, designed for pump speed control.

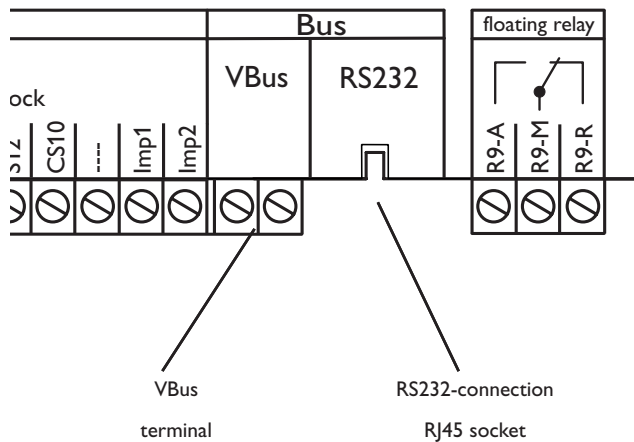
R1-A ... R4-A =	normally open R1 ... R4
N =	neutral conductor N (common terminal block)
PE =	protective earth conductor PE (common terminal block)
- **Relays R5 ... R8** are electromechanical relays with change-over contact.

R5-A ... R8-A =	normally open R5...R8
R5-R ... R8-R =	normally closed R5 ... R8
N =	neutral conductor N (common terminal block)
PE =	protective earth conductor PE (common terminal block)
- **Relay R9** is a floating / potential-free relay with change-over contact:

R9-M =	center contact R9
R9-A =	normally open R9
R9-R =	normally closed R9

**Note:** If a heating circuit pump is controlled via the internal heating circuit with relay 9, an insulated jumper has to be run from the mains input L to R9-M!

## 1.2.4 Bus



The controller is equipped with two bus interfaces for data communication:

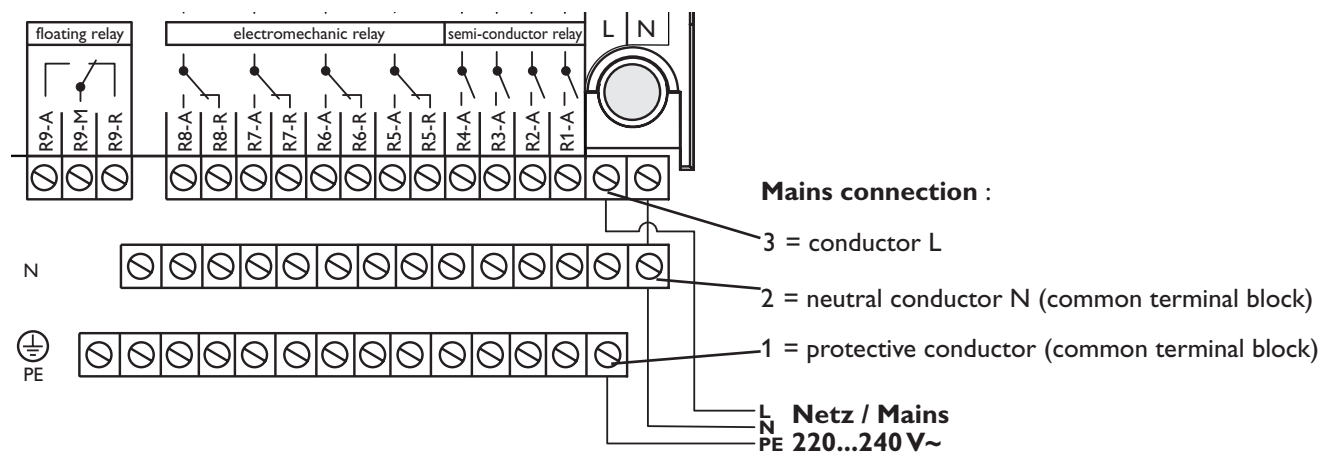
- 1.) The **VBus®** for data transfer with and energy supply to external modules. The connection is carried out at the two terminals marked "VBus®" (any polarity). One or more **VBus®** modules can be connected via this data bus:

- WMZ calorimeter

- 2.) The **RS232-interface** for direct connection to a PC. Measured values and parameters of the controller can be read out, adjusted, processed and visualised by means of the evaluation tool RSC (ServiceCenter Software). The software allows easier parametrisation and function control of the system.

## 1.2.5 Mains supply

Figure 1.2.5.A



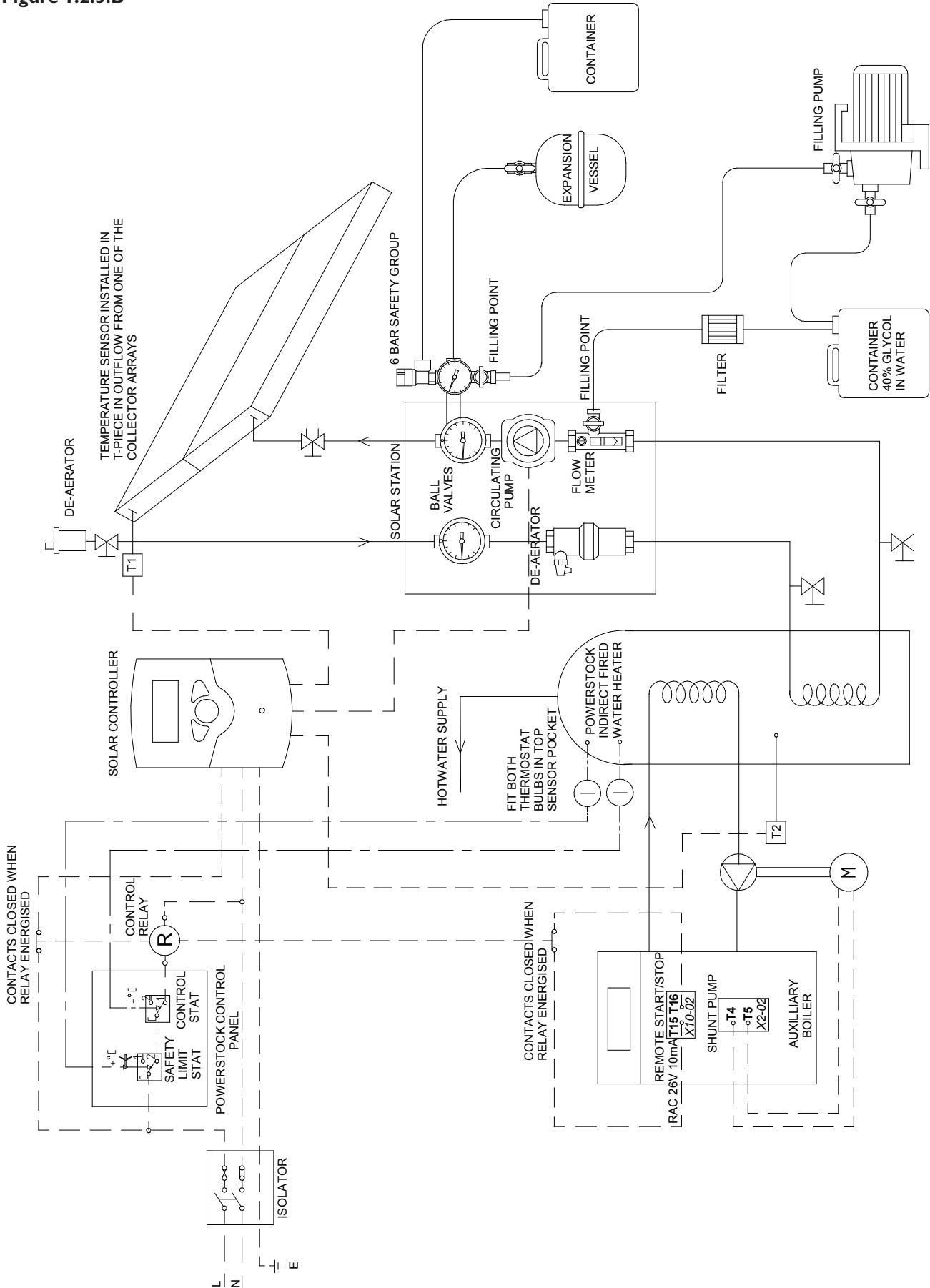
The power supply to the controller must be carried out via an external power switch (last step!) and the supply voltage must be 220 ... 240 V~ (50 ... 60 Hz). Flexible cables must be attached to the housing with the enclosed strain relief and the

corresponding screws or be run into the controller housing in a cable conduit or trunking (see advice on page 4).

The mains electrical supply to the controller must be wired through an electrical contactor interlocked to any hot water cylinder limit stat.

See figure 1.2.5.B

Figure 1.2.5.B



## 2. Operation and function

### 2.1 Buttons for adjustment



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

- Briefly press button 3 in order to get to the main menu
- Select the requested menu using buttons 1 and 2.
- Briefly press button 3, the selected submenu is then shown on the display. By selecting the menu line "back", the display returns to the former menu level.
- Press buttons 1, 2 and 3 to scroll until the chosen menu line is reached.
- Briefly press button 3 in the respective menu line to modify adjustment values - "change value" appears on the display - adjust the requested value by pressing the buttons 1 and 2 (for large intervals, keep the button pressed).
- Briefly press button 3 in order to finish the adjustment.
- To save the change, answer the security inquiry "Save?" by choosing "yes" or "no" (buttons 1 and 2) and confirm with button 3.

• **Note:**

If in the display mode no button is pressed within 4 minutes, the display changes back to measured values menu (in the case of a message, the message menu is indicated).

If nothing is entered and no security inquiry answered within 7 seconds, the controller automatically changes to the respective menu.

When button 3 is pressed for 2 seconds, the display changes back to the main menu.

### 2.2 Control lamp

The controller is equipped with a red-/green control lamp. The following control and system status are signalled:

- green automatic operation
- red flashing: malfunction of the system
- green flashing manual mode

## 2.3 Menu structure

- |    |                  |
|----|------------------|
|    | MAIN MENU        |
| 1. | MEAS. VALUES     |
| 2. | REPORTS          |
| 3. | SOLAR            |
| 4. | ARRANGEMENT      |
| 5. | WAZ              |
| 6. | MANUAL OPERATION |
| 7. | USER CODE        |
| 8. | EXPERT           |

The clear-text display shows a 4-line part of the selected menu.

Adjustment and control of the controller are carried out via the menu. When the controller is commissioned, the display level is in the main menu. In the first line of each submenu you will find the option “back”, by means of which it is possible to get to the former menu level. In the following diagrams you will find the complete menu contents; since some of the menu points depend on the system, option or message, in some cases not all of the shown text lines are indicated.

MAIN MENU is shown on the display in the initial state. A selection can be made between 8 submenus.

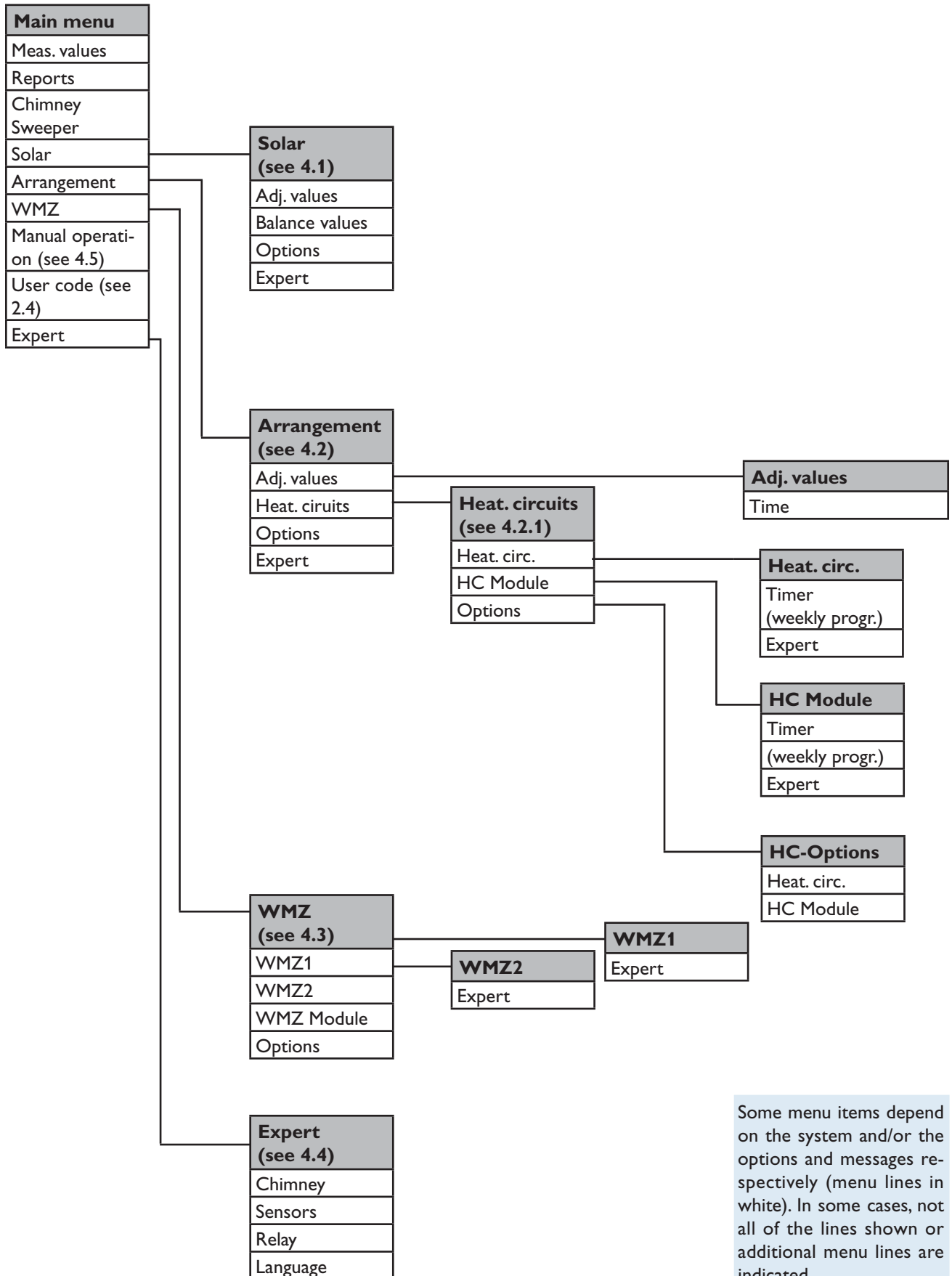
**Note:** The choice of adjustment values and options depends on different functions and the user code. Some only appear in the display if they are available for the adjusted system parameters.

## 2.4 User code

- 1. Expert **Code 262** (factory setting)  
All menus and adjustment values are shown and all values can be altered.
- 2. User **Code 077**  
The expert level is shown, parameter access is restricted.
- 3. Customer **Code 000**  
The expert level is not shown, adjustment values (solar) can be changed partly; modification of options, parameter and balance values is not possible.  
For safety reasons, the user code should generally be set to “000” before the controller is handed to the customer!

**Note:** After the menu point “user code” has been chosen, enter the user code!

## 2.5 Menu overview



Some menu items depend on the system and/or the options and messages respectively (menu lines in white). In some cases, not all of the lines shown or additional menu lines are indicated.

### 3. Commissioning

#### 3.1 Commissioning the controller

The controller is partially freely programmable. For special applications, the relays and the corresponding sensors are assigned in steps.

7 basic systems with different hydraulic variants each are pre-programmed.

1. Adjust the basic system; sensors and relays will be allocated automatically (see 3.2 and 4.1).
2. Activate further options (bypass, external heat exchanger etc. see 4.1 and 4.2.)
3. Select free function blocks for further applications (return preheating, use of further heat sources; see 3.3 and 4.2.)
4. Finally, after every step, carry out special adjustments (switching conditions and limits; see 4.1 and 4.2).
5. Up to 2 heat quantity measurement functions (see 4.3) and other functions such as reports or chimney sweeper can be activated.

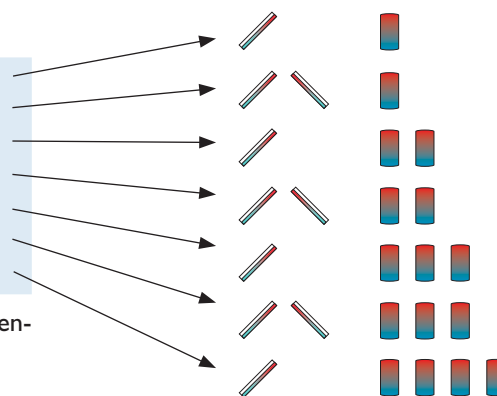
The controller can be adjusted in steps (see 3.4.) All functions, options and menu items are described in detail in chapter 4.

#### 3.2 Basic systems and hydraulic variants

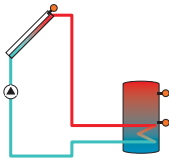
The controller is preprogrammed for 7 basic systems. The selection depends on the number of heat sources (collector fields) and heat sinks (stores, pool). Factory setting is system 1.

System 1: 1 collector field	- 1 store
System 2: east/west collectors	- 1 store
System 3: 1 collector field	- 2 stores
System 4: east/west collectors	- 2 stores
System 5: 1 collector field	- 3 stores
System 6: east/west collectors	- 3 stores
System 7: 1 collector	- 4 stores

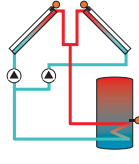
A solar system with a store charging in layers is implemented as a 2-store system (store top = store 1; store bottom = store 2).



Beginning with system 2, different hydraulic variants are possible (pump or valve control):



system 1



system 2 variant 1

For each variant, the controller allocates the corresponding relays and sensors. The allocations of the most important combinations are shown in 3.5.

The system and the variant have to be selected first (*SOLAR/OPTIONS/...*)!



**Important note:**

If you select a new system, any previous adjustments which have been done will be set back to the factory settings (reset)!



### 3.3 Function blocks

Depending on the selected combination system/variant other options e.g. internal heating circuit module, certain relays are already assigned. Relays which are not assigned can be allocated to one of the 5 function blocks other uses e.g.(extra valves, stores, heat sources etc).

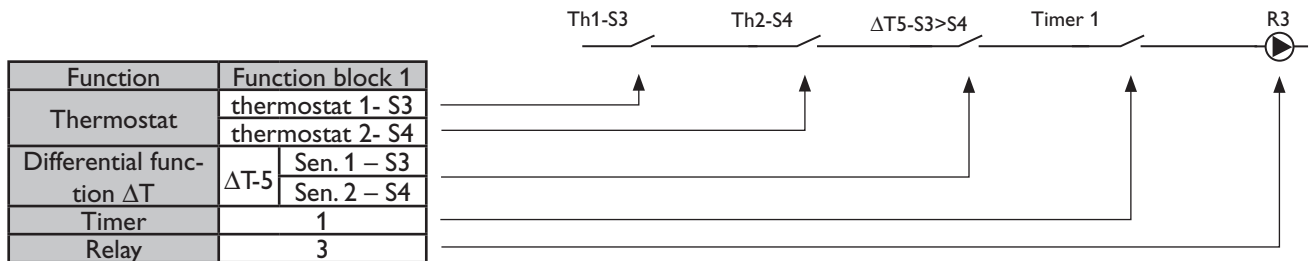
Each function block provides 4 functions:

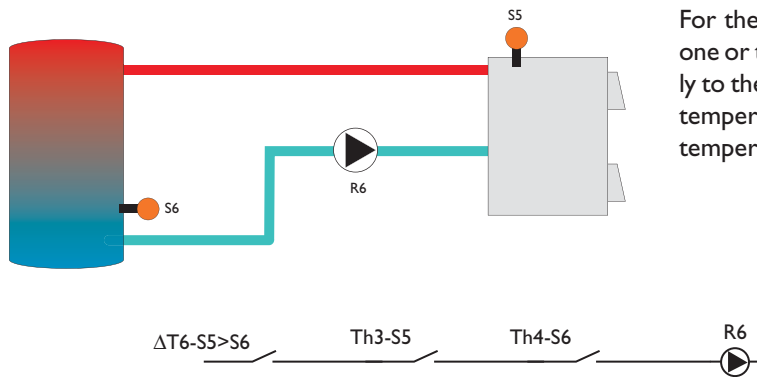
- 1 temperature differential function
- 2 thermostat function
- 1 timer (with 3 time frames)

Function	Function block 1	Function block 2	Function block 3	Function block 4	Function block 5
Thermostat	thermostat 1- S3	thermostat 3- S5	thermostat 5- S7	thermostat 7- S9	thermostat 9- S11
	thermostat 2- S4	thermostat 4- S6	thermostat 6- S8	thermostat 8- S10	thermostat 10- S12
Differential function $\Delta T$	$\Delta T-5$ sen. 1 – S3	$\Delta T-6$ sen. 1 – S5	$\Delta T-7$ sen. 1 – S7	$\Delta T-8$ sen. 1 – S9	$\Delta T-9$ sen. 1 – S11
	sen. 2 – S4	sen. 2 – S6	sen. 2 – S8	sen. 2 – S10	sen. 2 – S12
Timer	1	2	3	4	5
Relay	3	6	7	8	9

Within a function block, these functions can be activated and combined as required in the menu (*ARRANGEMENT/OPTIONS/...*). All switch-on conditions of all activated functions have to be fulfilled in order to energise the relay allocated to the func-

tion block (*ARRANGEMENT/ADJ. VALUES/...*). These functions can be compared to switches connected in series:



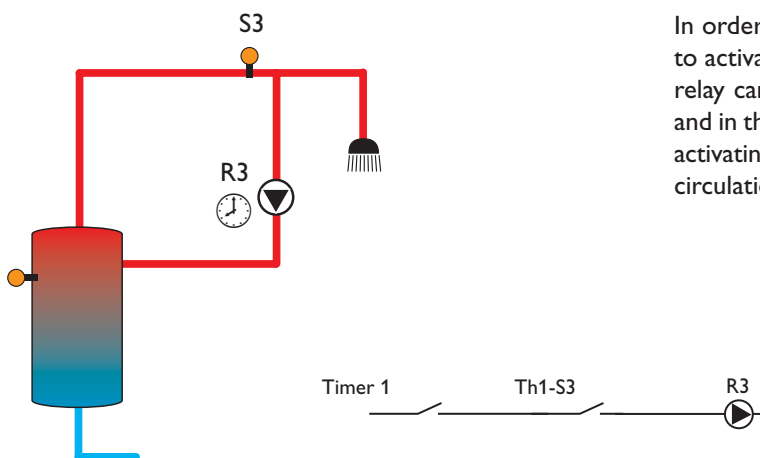


For the use of a further heat source (e.g. solid fuel boiler), one or two thermostat functions can be activated additionally to the differential function, in order to allocate a minimum temperature to the boiler or to limit the maximum store temperature.

- ARRANGEMENT/OPTIONS/ $\Delta$ T-FUNC6..... change setting to "Yes"
- ARRANGEMENT/OPTIONS/THERMO.3..... change setting to "Yes"
- ARRANGEMENT/ADJ. VALUES/T-TH3 ON..... change value to "60"
- ARRANGEMENT/ADJ. VALUES/T-TH3 OFF.... change value to "55"
- ARRANGEMENT/OPTIONS/THERMO.4..... change setting to "Yes"
- ARRANGEMENT/ADJ. VALUES/T-TH4 ON..... change value to "58"
- ARRANGEMENT/ADJ. VALUES/T-TH4 OFF ... change value to "60"

minimum temperature limitation for the boiler

maximum temperature limitation for the store



In order to control a circulation pump, it might be enough to activate the timer. With the aid of the 3 time frames, the relay can be switched individually in the morning, at noon and in the evening. This process can be further optimised by activating a thermostat function so that - with a sensor in the circulation line- control is also temperature-dependent.

- ARRANGEMENT/OPTIONS/TIMER 1 ..... change setting to "Yes"
- ARRANGEMENT/ADJ. VALUES/TIMER 1/T1 ON..... change value to "06:00"
- ARRANGEMENT/ADJ. VALUES/TIMER 1/T1 OFF..... change value to "08:00"
- ARRANGEMENT/ADJ. VALUES/TIMER 1/T2 ON..... change value to "11:30"
- ARRANGEMENT/ADJ. VALUES/TIMER 1/T2 OFF..... change value to "13:30"
- ARRANGEMENT/ADJ. VALUES/TIMER 1/T3 ON..... change value to "18:00"
- ARRANGEMENT/ADJ. VALUES/TIMER 1/T3 OFF..... change value to "21:00"
- ARRANGEMENT/OPTIONS/THERMO. 1 ..... change setting to "Yes"
- ARRANGEMENT/ADJ. VALUES/T-TH1 ON ..... change value to "50"
- ARRANGEMENT/ADJ. VALUES/T-TH1 OFF ..... change value to "55"

## 3.4 Adjusting the controller step-by-step

Before adjusting the controller, select the language (*EXPERT/LANGUAGE/...*).

Points 1.– 3. have to be adjusted for all systems, points 4.– 18. are adjusted optional to suit the system requirements, points 19. and 20. should be adjusted before the system is handed over to the operator.

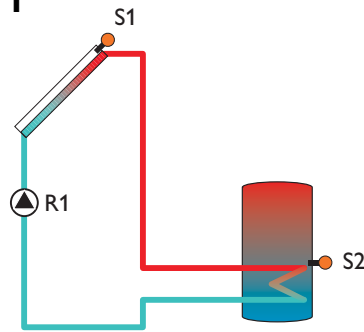
- |  |  |
|--|--|
| <p>1. Select basic solar system<br/>(<i>SOLAR/OPTIONS/SYSTEM</i>)</p> <p>2. Select hydraulic variant (beginning with system 2)<br/>(<i>SOLAR/OPTIONS/LOADING</i>)</p> <p>3. Adjust date and time<br/>(<i>ARRANGEMENT/ADJ. VALUES/TIME</i>)</p> <p>4. Activate internal heating circuit module if needed<br/>(<i>ARRANGEMENT/HEAT. CIRCUITS/OPTIONS/HEAT. CIRC.</i>)</p> <p>5. Adjust parameters for internal heating circuit module<br/>(<i>ARRANGEMENT/HEAT. CIRCUITS/HEAT. CIRC./...</i>)</p> <p>6. Activate external heating circuit module if needed<br/>(<i>ARRANGEMENT/HEAT. CIRCUITS/OPTIONS/HC MODULE</i>)</p> <p>7. Adjust parameters for external heating circuit module<br/>(<i>ARRANGEMENT/HEAT. CIRCUITS/HC MODULE/...</i>)</p> <p>8. Activate desired functions with relay allocation (if needed)</p> <p>Bypass<br/>(<i>SOLAR/OPTIONS/BYPASS</i>)</p> <p>External heat exchanger<br/>(<i>SOLAR/OPTIONS/EXT. HEAT. EX</i>)</p> <p>Cooling function<br/>(<i>SOLAR/OPTIONS/COOL. FUNC.</i>)</p> <p>Parallel relay<br/>(<i>SOLAR/OPTIONS/PAR.RELAY</i>)</p> <p>After-heating suppression<br/>(<i>SOLAR/OPTIONS /AH SUPPRESS.</i>)</p> <p>HSE<br/>(<i>ARRANGEMENT/OPTIONS/HSE</i>)</p> <p>Store loading<br/>(<i>ARRANGEMENT/OPTIONS /STORE LOAD.</i>)</p> <p>Error message<br/>(<i>EXPERT/MESSAGE REL.</i>)</p> | <p>9. Activate further functions without relay allocation (if needed):</p> <p>Tube collector function<br/>(<i>SOLAR/OPTIONS/TUBE COL.</i>)</p> <p>Collector cooling function<br/>(<i>SOLAR/OPTIONS/COL. COOLING</i>)</p> <p>Recooling function<br/>(<i>SOLAR/OPTIONS/RECOOLING</i>)</p> <p>Frost protection<br/>(<i>SOLAR/OPTIONS/FROST. PROT.</i>)</p> <p>Target temperature<br/>(<i>SOLAR/OPTIONS/TARGET TEM.</i>)</p> <p>CS-Bypass<br/>(<i>SOLAR/OPTIONS/CS-BYPASS</i>)</p> <p>10. Adjust special parameters of the selected options<br/>(<i>SOLAR/ADJ. VALUES/...</i>),<br/>(<i>SOLAR/EXPERT/...</i>) and<br/>(<i>ARRANGEMENT/ADJ. VALUES/...</i>)</p> <p>11. Activate functions of function blocks (if needed)<br/>(<i>ARRANGEMENT/OPTIONS/...</i>)</p> <p>12. Adjust switching conditions for the activated functions<br/>(<i>ARRANGEMENT/ADJ. VALUES/...</i>)</p> <p>13. Activates heat measurement function(s) (if needed)<br/>(<i>WMZ/OPTIONS/...</i>)</p> <p>14. Adjust special parameters<br/>(<i>WMZ/WMZ 1 (2)/EXPERT/...</i>)</p> <p>15. Deactivate warning message (if needed)<br/>(<i>EXPERT/...</i>)</p> <p>16. Carry out sensor offset (if needed)<br/>(<i>EXPERT/SENSORS/...</i>)</p> <p>17. Increase minimum speeds (if needed)<br/>(<i>EXPERT/RELAY/...</i>)</p> <p>18. Setup and adjust chimney sweeper function (if needed)<br/>(<i>EXPERT/CHIMNEY SWEEPER/...</i>)</p> <p>19. Carry out relay test<br/>(<i>MANUAL OPERATION/...</i>)</p> <p>20. Save adjustments<br/>(<i>USER CODE/000</i>)</p> |
|--|--|

## 3.5 Overview of sensor and relay allocations

All systems reserve sensor inputs Imp1 and Imp2 for heat quantity measurement and these are therefore not listed in the tables on the following pages.

Imp1	Imp2
V40	V40
WMZ1	WMZ2

### System 1 variant 1



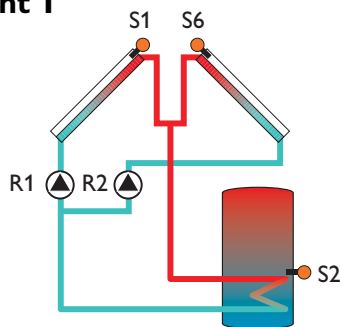
#### Sensor allocation

sen.1	sen.2	sen.3	sen.4	sen.5	sen.6	sen.7	sen.8	sen.9	sen.10	sen.11	sen.12
Tcol	Tstb HSE	Th 1 T1-ΔT5 Tby T-HE	Th 2 T2-ΔT5	Th 3 T1-ΔT6	Th 4 T2-ΔT6	Th 5 T1-ΔT7	Th 6 T2-ΔT7 HC Tst2	Th 7 T1-ΔT8 T1 WMZ1 HC T-FL	Th 8 T2-ΔT8 T2 WMZ1 HC RTA11	Th 9 T1-ΔT9 T1 WMZ2 HC T-outdoor	Th 10 T2-ΔT9 T2 WMZ2 HC Tst1

#### Relay allocation

relay 1	relay 2	relay 3	relay 4	relay 5	relay 6	relay 7	relay 8	relay 9
solar pump	ext. HE	func.bl. 1	cooling func.	HSE bypass par. relay (HC-pump)	func.bl. 2 store load. HC-afterheat. (HC-Pump)	func.bl. 3 HC-Mi open	func.bl. 4 HC-Mi closed	func.bl. 5 message rel. AH suppress. HC-pump (HC-afterheat.)

### System 2 variant 1



#### Sensor allocation

sen.1	sen.2	sen.3	sen.4	sen.5	sen.6	sen.7	sen.8	sen.9	sen.10	sen.11	sen.12
Tcol	Tstb HSE	Th 1 T1-ΔT5 Tby T-HE	Th 2 T2-ΔT5	Th 3 T1-ΔT6	Th 4 Tcol2 T2-ΔT6	Th 5 T1-ΔT7	Th 6 T2-ΔT7 HK Tst2	Th 7 T1-ΔT8 T1 WMZ1 HC T-FL	Th 8 T2-ΔT8 T2 WMZ1 HC RTA11	Th 9 T1-ΔT9 T1 WMZ2 HC T-outdoor	Th 10 T2-ΔT9 T2 WMZ2 HC Tst1

#### Relay allocation

relay1	relay 2	relay 3	relay 4	relay 5	relay 6	relay 7	relay 8	relay 9
pump col. 1	pump col. 2	func.bl. 1 ext. HE	cooling func.	HSE bypass par. relay (HC-pump)	func.bl. 2 store load. HC-afterheat. (HC-Pump)	func.bl. 3 HC-Mi open	func.bl. 4 HC-Mi closed	func.bl. 5 message rel. AH suppress. HC-pump (HC-afterheat.)

## Abbreviations - sensors

Sensor	Designation
Tcol	temperature-collector
Tcol2	temperature-collector 2
Tstb	temperature-store 1 base
Tst2b	temperature-store 2 base
Tst3b	temperature-store 3 base
Tst4b	temperature-store 4 base
T-HE	temperature-heat exchanger
Tby	temperature-bypass
HSE	temperature-protection against legionella
Th 1-10	temperature-thermostat 1-10
T1-ΔT5-9	temperature- ΔT5-9 high
T2-ΔT5-9	temperature- ΔT5-9 low
T1-AH-HC	temperature-afterheating-heating circuit
T2-AH-HC	temperature-afterheating-heating circuit
HC T-FL	temperature- heating circuit flow
HC T-outdoor	temperature- heating circuit outdoor
HC RTA11	heating circuit remote control
T1 WMZ	temperature- flow heat quantity measurement
T2 WMZ	temperature- return heat quantity measurement
WMZ	flowmeter
Digital input	message input

## Abbreviations - relays

Relay	Designation
solar pump 1-2	solar pump collector field 1-2
2-PV st 1-4	2-port valve store 1-4
3-PV st 1-2	3-port valve store 1-2
func.bl. 1-5	function block 1-5
HSE	protection against legionella
bypass	bypass-control
cooling func.	cooling function
store load.	store loading
par. relay	parallel relay
ext.WT	external heat exchanger
message rel.	message relay
AH suppress.	afterheating suppression
HC-afterheat.	heating circuit afterheating
HC-pump	heating circuit pump
HC-Mi open	heating circuit mixer open
HC-Mi closed	heating circuit mixer closed

## 4. Functions and options

### 4.1 Menu: Solar

#### System:

*SOLAR/OPTIONS/SYSTEM*

adjustment range: 1 ... 7

factory setting: 1

Select the appropriate basic system (see 3.2).

#### Note:

Select the basic system first, because the subsequent selection of a new system will reset all other adjustments to the factory settings!

#### Hydraulic variants:

*SOLAR/OPTIONS/LOADING*

adjustment range: 1 ... 4

factory setting: 1

Many hydraulic variants distinguish between pump and valve control e.g. for multiple stores. The adjustment has to be carried out in accordance with the overview of the basic systems with their hydraulic variants (see 3.2). Broadly speaking, variants with pumps allow speed control, variants with valves do not and will automatically set the minimum speed to 100%.

#### Bypass:

*SOLAR/OPTIONS/BYPASS*

selection: "Yes", "No"

factory setting: "No"

In order to prevent energy from being extracted from the store when starting store loading, this function makes sure that the cold fluid in the pipes is diverted past the store via a bypass (valve or pump). Once the pipe is warm enough, the store can be loaded.

The bypass relay is energised if the temperature at the reference sensor is by 2,5 K higher than the store temperature and if the switch-on condition for store loading (see store loading) is fulfilled. The relay is switched-off if this temperature difference is lower than 1,5 K. These temperature differences cannot be adjusted.

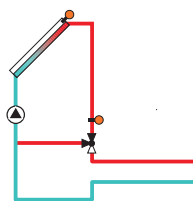
#### Variant valve or bypass

*SOLAR/EXPERT/BYPASS*

selection: "Valve", "Pump"

factory setting: "Valve"

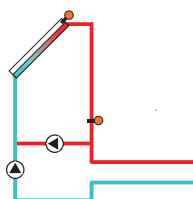
#### Variant valve:



A bypass valve is placed into the solar circuit.

The solar heat exchanger is first bypassed when store loading is possible. If the above-mentioned switch-on condition is fulfilled, the bypass relay switches the collector circuit via the heat exchanger.

#### Variant pump:



In this version, a bypass pump is placed in front of the collector pump.

The bypass pump is first activated when store loading is possible. If the above-mentioned switch-on condition is fulfilled, the bypass pump is switched-off and the collector circuit pump is activated.

This variant is available in 1-collector systems only.

## Bypass Sensor:

*SOLAR/EXPERT/SEN. BYPASS*

adjustment range: 1 ... 14

factory setting: 3

## External heat exchanger:

*SOLAR/OPTIONS/EXT. HEAT. EX*

selection: "Yes", "No"

factory setting: "No"

*SOLAR/ADJ. VALUES/HE ΔTON*

adjustment range: 2,0 ... 19,5 K

factory setting: 5,0 K

*SOLAR/ADJ. VALUES/HE ΔTOFF*

adjustment range: 1,5 ... 19,0 K

factory setting: 3,0 K

*SOLAR/EXPERT/SEN. EXT. HE*

adjustment range: 1 ... 14 K

factory setting: 4

## Tube collector function:

*SOLAR/OPTIONS/TUBE COL.*

selection: "Yes", "No"

factory setting: "No"

*SOLAR/EXPERT/TUBE-RUN*

adjustment range: 5 ... 500 s

factory setting: 30 s

*SOLAR/EXPERT/TUBE-INIT*

adjustment range: 00:00 ... 00:00

factory setting: 07:00

*SOLAR/EXPERT/TUBE-FINAL*

adjustment range: 00:00 ... 00:00

factory setting: 19:00

*SOLAR/ADJ. VALUES/TUBE COL*

adjustment range: 1 ... 60 min

factory setting: 30 min

The reference sensor is located in front of the valve or the pump respectively. The default is sensor 3, but this can be changed using this menu item.

This function is used to link loading circuits that are separated by an external heat exchanger.

The heat exchanger relay is activated if the temperature at the reference sensor exceeds the store temperature by the adjusted value "HE ΔTon" and if the switch-on conditions for store loading (see "store loading") are fulfilled.

The relay is switched-off if this temperature difference falls below the adjusted switch-off difference HE-ΔToff.

In contrast to the bypass function, a differential regulation between "T-HE" ("Sen. Ext. HE") and "Tst" can be carried out by means of the heat exchanger relay.

The reference sensor can be arbitrarily allocated.

In systems in which stores are equipped with their own loading pumps, the relay "external heat exchanger" controls the primary circuit pump.

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

This function operates within a given time frame ("tube init" and "tube-final"). It activates the collector circuit pump for 30 seconds (adjustable via the parameter "tube-run") every 30 minutes (adjustable via the parameter "tube col") in order to compensate for the delayed temperature measurement.

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

The collector circuit is operated at minimum pump speed.

## 2-collector systems 2 separate collector circuits (2 pumps)

Both collectors are operated independently from each other by means of this function.

If a store is being loaded by one collector, the other one is nevertheless operated after the adjusted standstill time.

## shared collector circuit (1 pump)

If store loading is carried out by one collector, the other one is nevertheless operated after the adjusted standstill time.

This means the pump speed may reduce briefly to the minimum as the normal pump speed is ignored by the controller

## Cooling function (1-store systems):

*SOLAR/OPTIONS/COOL FUNC.*

selection: "Yes", "No"

factory setting: "No"

The cooling function can be used in 1-store systems (basic systems 1 and 2). If the store temperature exceeds its maximum limitation ( $T_{stmax}$ ), the surplus energy in the collector can be diverted. The minimum pump speed is set to 100%.

## Function (switching conditions):

If  $T_{stmax}$  is exceeded, and the switch-on temperature difference  $\Delta T_{on}$  between collector and store are reached, the solar circuit (primary) and the cooling relay are operated. If the store temperature falls to less than  $T_{stmax}$ , the cooling relay switches off.

If the switch-off temperature difference  $\Delta T_{off}$  is underrun during this period, the solar circuit and the cooling relay are switched-off.

## 2-collector system: (basic system 2)

In this system, only the collector circuit which fulfills the switch-on conditions described above, is operated.

## Collector cooling function:

*SOLAR/OPTIONS/COL. COOLING*

selection: "Yes", "No"

factory setting: "Yes":

*SOLAR/ADJ. VALUES/TCOLMAX*

adjustment range: 80 ... 160 °C

factory setting: 105 °C

hysteresis 5 K

The collector cooling function starts, when the adjusted maximum collector temperature is reached. If this temperature is underrun by 5 K, this function is switched off.

The collector is cooled via heat transfer to the next free store (a store which is not blocked). The numerically last store is not used (swimming pool protection or in the case of multi-store systems). Note this may override  $T_{stmax}$  so additional scald protection may be needed.

The pump output (provided that it is activated) is controlled with maximum relative pump speed.

### Note:

It is not possible to adjust a temperature value for the maximum collector temperature ( $T_{colmax}$ ) which is higher than the collector safety shutdown temperature. There must be a difference between these two temperatures of at least 10 K.

## 2-collector systems:

### 2 separated collector circuits (2 pumps):

The collector circuit which needs to be cooled is operated. If one store is being loaded by another collector, this loading is continued.

### shared collector circuit (1 pump):

"Pump speed" depends on collector cooling which takes priority.



**Recooling:**

*SOLAR/OPTIONS/RECOOLING*

selection: "Yes", "No"  
 factory setting: "Yes"

This function is used for keeping the system temperatures and consequently the thermal load as low as possible.

If the temperatures of all stores of the system have exceeded the maximum temperature, the Tstmax for the first store is temporarily overridden to reduce the surplus energy via the pipework and the collector. Note Tstmax may be exceeded so additional scald protection may be required.

This "circulation" is switched-off once the maximum store temperature is underrun by 2 K.

**2-collector systems:** Both collector circuits are activated in a 2-collector system.

**Combination with collector cooling function:** If the option "collector cooling" is activated in addition to the recooling function, the behaviour of the recooling function changes.

The objective is now to dissipate the energy supplied by collector cooling.

If the temperature at the collector decreases by 5 K below that of the store, the recooling function is activated and the loading circuit is again operated to cool the store.

If the difference between collector and store decreases below 3 K during that cooling period, the function is switched-off.

**2-collector system:** In a 2-collector system, the collectors are operated separately using the switch-on conditions described above.

**Frost protection:**

*SOLAR/OPTIONS/FROST PROT.*

selection: "Yes", "No"  
 factory setting: "No"

As soon as the temperature at the collector is 4 °C, the frost protection function operates the loading circuit between the collector and the 1<sup>st</sup> store in order to protect the medium in the loading circuit against freezing or coagulation.

If the collector temperature exceeds 5 °C, this function is switched-off.

If the 1<sup>st</sup> store in the system is blocked, this function is switched off or suppressed.

The pump output uses maximum pump speed.

**2-collector system:** In these systems, the circuit which fulfills the switch-on conditions described above is operated.

## Target temperature:

*SOLAR/OPTIONS/TARGET TEM.*

selection: "Yes", "No"

factory setting: "No"

if you select "Yes":

*SOLAR/ADJ. VALUES/TCOLSET*

adjustment range: 20 ... 110 °C

factory setting: 65 °C

Pump speed is controlled according to collector temperature rather than (usual) temperature difference. The aim is to maintain constant collector temperature, adjustable with parameter "Tcolset".

## Parallel relay:

*SOLAR/OPTIONS/PAR. RELAY*

selection: "Yes", "No"

factory setting: "No"

If the solar circuit pump is switched-on, this relay is activated in parallel.

In 2-collector systems which are working with 2 pumps, the parallel relay is activated if one of the 2 pumps is activated.

## CS-Bypass:

*SOLAR/OPTIONS/CS-BYPASS*

selection: "Yes", "No"

factory setting: "No"

if you select "Yes":

*SOLAR/ADJ. VALUES/CS-BYP.*

adjustment range: 100 ... 500 W/m<sup>2</sup>

factory setting: 200 W/m<sup>2</sup>

If the irradiation exceeds the adjusted value CS-bypass, the collector circuit is operated. It is switched off when the irradiation has fallen below the value „CS-bypass“ for at least 2 minutes.

The collector circuit is operated with minimum pump speed.

## 2-collector systems:

If a loading of the stores is carried out in these systems, the function is switched-off.

## Afterheating suppression:

*SOLAR/OPTIONS/AH SUPPRESS.*

selection: "Yes", "No"

factory setting: "No"

if you select "Yes":

*SOLAR/EXPERT/AH SUPPRESS.*

adjustment range: St 1 ... St 4

factory setting: St 1

This function is activated if a previously selected solar store (parameter designation: "AH suppress." in the menu solar expert) is being loaded.

Solar loading means that store loading is only carried out for energy supply and not for cooling purposes etc.

## Collector emergency shutdown:

*SOLAR/ADJ. VALUES/TCOLSEC*

adjustment range: 110 ... 200 °C

factory setting: 140 °C

hysteresis: 10K

At high collector temperatures (depending on system pressure or antifreeze concentration etc.) the systems is shut off. This means that solar loading is not possible.

If the adjusted temperature threshold „Tcolsec“ is exceeded, the corresponding collector will no longer be used for loading.

## collector blocked

A collector is considered to be blocked, if either the sensor is defective or the emergency shutdown temperature is reached.

## Collector minimum limitation:

*SOLAR/EXPERT/TCOLMIN*

adjustment range: -25 ... 90 °C

factory setting: 20 °C

hysteresis 2 K

This is the minimum temperature which must be exceeded for the solar pump to switch on. If the adjusted minimum temperature is not exceeded or the condition "collector blocked" is fulfilled.

## St2on...St4off:

*SOLAR/OPTIONS/ST2 ON (... ST4 ON)*

selection: "Yes", "No"

factory setting: "Yes"

By means of this function, the respective store can be "removed" from solar control. This means that it is no longer considered for solar loading.

The temperature of the store will be indicated but a sensor defect will not be recognised.

## Store loading:

*SOLAR/ADJ. VALUES/ΔTON (...ΔT4ON)*

adjustment range: 1,0 ... 20,0 K

factory setting: DeltaTon: 6,0 K

DeltaT2/3/4on: 6,0 K

*SOLAR/ADJ. VALUES/ΔTOFF (...ΔT4OFF)*

adjustment range: 0,5 ... 19,5 K

factory setting: DeltaToff: 4,0 K

DeltaT2/3/4off: 4,0 K

If the adjusted switch-on difference  $\Delta T_{on}$  between collector and store is exceeded, the store will be loaded.

If this difference falls below the adjusted switch-off difference  $\Delta T_{off}$ , the loading function will be switched off.

Loading of the store will also be switched-off or suppressed if the relevant store or collector is blocked (collector blocked, see collector minimum limitation) or if the store is at maximum limitation, e.g.  $T_{stmax}$ .

*SOLAR/ADJ. VALUES/ΔTSET (...ΔT4SET)*

adjustment range: 2,0 ... 30,0 K

factory setting: 10 K

The parameter " $\Delta T_{set}$ " is the nominal temperature difference between collector and store used for pump speed control. Once  $\Delta T_{set}$  is reached, the pump speed is increased by 10 %.

## Store maximum limitation:

*SOLAR/ADJ. VALUES/TSTMAX (...TST4MAX)*

adjustment range: 4 ... 95 °C

factory setting:  $T_{stmax}$ : 65 °C

$T_{st2/3/4max}$ : 65 °C

If the adjusted maximum temperature  $T_{stmax}$  is exceeded, loading of the store is stopped. If the store cools down by more than 2 K (hysteresis), the store will be loaded again.

## Hysteresis

*SOLAR/EXPERT/ΔT-STMAX (...ΔT-ST4MAX)*

adjustment range: 0,5 ... 5,0 K

factory setting: 2,0 K

### store emergency shutdown

value 95 °C

hysteresis = 2 K

If the cooling options are activated (e.g. collector cooling), the store will be loaded beyond the adjusted maximum temperature.

In order to avoid too high temperatures in the store, the emergency shutdown of the store is additionally provided, which also blocks the store for the cooling options. If a store reaches the temperature of 95 °C, the emergency shutdown is activated

### store blocked

A store is blocked if either the corresponding sensor is defective or the emergency shutdown temperature has been reached.

## Priority logic and store sequence control:

*SOLAR/ADJ. VALUES/PRIORITY ST1 (...ST4)*

adjustment range: 1 ... 4

factory setting: 1; 2; 3; 4

Priority logic is used in multi-store systems only.

If St1, St2, St 3, St4 are set to 1, the stores with a temperature difference to the collector are loaded in parallel as long as their switch-on conditions are fulfilled.

If St1 is set to 1, St2 to 2, St 3 to 3, and St4 to 4 (factory setting) the first store will be loaded first as long as its switch-on conditions are fulfilled. When the selected priority store reaches its adjusted maximum temperature, the subordinate stores will be loaded in numerical order via oscillating loading: store 1, then store 2, then store 3, then store 4.

## Store sequence control:

*SOLAR/EXPERT/T-CIRC.*

adjustment range: 1 ... 60 min

factory setting: 15 min

The controller checks whether the stores can be loaded.

When the priority store cannot be loaded, the subordinate stores are checked. If a subordinate store can be loaded, it will be loaded for the "oscillating loading time" ("t-circ."). After this period of time, the loading process stops. The controller monitors the increase in collector temperature. If it increases by the "collector rise temperature" ( $\Delta T_{-COL}$ ) within the loading break time "t-st", the elapsed break time is set to 0. The break time starts again.

## Loading break time:

*SOLAR/EXPERT/T-ST*

adjustment range: 1 ... 60 min

factory setting: 2 min

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 subordinate stores will be continued. If the priority store reaches its maximum temperature, oscillating loading will not be carried out.

## Collector rise temperature:

*SOLAR/EXPERT/ $\Delta T_{-COL}$*

adjustment range: 1 ... 10 K

factory setting: 2 K

## Balance values:

*SOLAR/BALANCE VALUES*

The controller has integrated registers which record the following values:

- maximum temperatures
- operating hours of the relays
- operating days since commissioning of the controller

The values can be reset, except "operating days".

## 4.2 Menu:Arrangement

### HSE (protection against legionella):

*ARRANGEMENT/OPTIONS/HSE*

selection "Yes", "No"

factory setting: "No"

*ARRANGEMENT/ADJ. VALUES/T-START*

adjustment range: 00:00 ... 00:00

factory setting: 17:00

*ARRANGEMENT/EXPERT/SEN-HSE*

adjustment range: 1 ... 14

factory setting: 2

The HSE-function checks whether the temperature at the given sensor (Sen-HSE) exceeds 60 °C at certain times for legionella control.

If 60 °C has not been achieved by the HSE start time, the HSE relay is energised in order to activate e.g. afterheating. The HSE start time (t-start) is adjustable.

The relay is switched-off once 60 °C is reached at the relevant sensor (factory setting 2 - selectable) or at midnight (reset point).

If the relevant sensor is defective, this function is suspended.

### Store loading:

*ARRANGEMENT/OPTIONS/STORE LOAD.*

selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/ADJ. VALUES/T-TH3ON*

adjustment range: -40,0 ... 250,0 °C

factory setting: 140,0 °C

*ARRANGEMENT/ADJ. VALUES/T-TH3OFF*

adjustment range: -40,0 ... 250,0 °C

factory setting: 130,0 °C

*ARRANGEMENT/EXPERT/SEN-TH3*

adjustment range: 1 ... 14

factory setting: 5

*ARRANGEMENT/EXPERT/SEN-TH4*

adjustment range: 1 ... 14

factory setting: 6

In order to carry out afterheating of a store within a store volume (zone), this function uses 2 sensors (default 5 and 6) to monitor the switch-on and switch-off level.

The switch-on and -off temperatures Th3on and Th3off are used as reference parameters.

Adjust the reference sensors via Sen-Th3 and Sen-Th4.

If the measured temperatures at both reference sensors fall below the adjusted switching threshold Th3on, the relay is switched-on. It is switched-off if the temperature at both sensors is higher than Th3off.

If one of the two sensors is defective, store loading is suppressed or switched off.

*ARRANGEMENT/OPTIONS/TIMER2*

Selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/ADJ. VALUES/TIMER2/T1(T2,T3)ON*

adjustment range: 00:00 ... 00:00

factory setting: 00:00

*ARRANGEMENT/ADJ. VALUES/TIMER2/T1(T2,T3)OFF*

adjustment range: 00:00 ... 00:00

factory setting: 00:00

In addition to the above, a timeswitch can be set to temporarily block operation in three time frames by means of the daily timer 2.

## Function blocks:

*ARRANGEMENT/OPTIONS/THERMO. 1 (...10)*

Selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/OPTIONS/ΔT-FUNCS (...9)*

selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/OPTIONS/TIMER 1 (...5)*

Selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/EXPERT/SEN-TH1 (...10)*

*ARRANGEMENT/EXPERT/SEN1-ΔT5 (...9)*

*ARRANGEMENT/EXPERT/SEN2-ΔT5 (...9)*

## Thermostat function

### (function block 1 ...5):

*ARRANGEMENT/OPTIONS/THERMO. 1 (...10)*

Selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/ADJ. VALUES/T-TH1(...10)ON*

adjustment range: -40,0 ... 250,0 °C

factory setting: Th1/2/5/6/7/8/9/10on: 40,0 °C

Th3on: 140,0 °C, Th4on: 65,0 °C

*ARRANGEMENT/ADJ. VALUES/T-TH1(...10)OFF*

adjustment range: -40,0 ... 250,0 °C

factory setting: Th1/2/5/6/7/8/9/10off: 45,0 °C

Th3off: 130,0 °C, Th4off: 64,5 °C

*ARRANGEMENT/EXPERT/SEN-TH1 (...10)*

adjustment range: 1 ... 14

factory setting: 3 (...12)

### ΔT-function (function block 1 ...5):

*ARRANGEMENT/OPTIONS/ΔT-FUNCS (...9)*

selection: "Yes", "No"

factory setting: "No"

*ARRANGEMENT/ADJ. VALUES/ΔT5(...9)ON*

adjustment range: 1,0 ... 50,0 K

factory setting: DeltaT5/6/7/8/9on: 5,0 K

*ARRANGEMENT/ADJ. VALUES/ΔT5(...9)OFF*

adjustment range: 0,5 ... 50,0 K

factory setting: DeltaT5/6/8/9off: 3,0 K

DeltaT7off: 2,0 K

Depending on the selected system and activated options, there are up to 5 function blocks including thermostat functions, timer and differential functions. With these, further components or functions e.g. solid fuel boiler, heating backup and DHW afterheating can be implemented (for example see 3.3).

Function blocks are assigned to the relays (see 3.5) and the relay cannot be changed. Each function block has allocated sensors that can be changed in the expert menu if needed. It is also possible to „double up“ in the programming and use a sensor already allocated to another function. E.g. the collector sensor can double as a flow sensor for heat quantity.

Within a function block the functions are interconnected (AND gate). This means that the conditions of all the activated functions have to be fulfilled (e.g. thermostat and timer) for switching the allocated relay. As soon as one condition is not fulfilled, the relay is switched off.

The relay allocated to the function block is switched on, when the adjusted switch-on temperature (Th(x)on) is reached. It is switched off when the adjusted switch-off temperature (Th(x)off) is reached. The switching conditions of all other activated functions of the function block have to be fulfilled as well.

Allocate the reference sensor in the expert menu.

Adjust the maximum temperature limitation with Th(x)off> Th(x)on and the minimum temperature limitation with Th(x)on> Th(x)off. The temperatures cannot be set to an identical value.

The relay allocated to the function block is switched on as soon as the adjusted switch-on temperature (ΔTh(x)on) is reached. It is switched off as soon as the adjusted switch-off temperature (ΔTh(x)off) is reached. The switching conditions of all other activated functions of the function block have to be fulfilled as well.

## *ARRANGEMENT/EXPERT/SEN 1-ΔT5 (...9)*

adjustment range: 1 ... 14  
 factory setting: Sen1DeltaT5: 3, Sen1DeltaT6: 5  
 Sen1DeltaT7: 8, Sen1DeltaT8: 9, Sen1DeltaT9: 11

## *ARRANGEMENT/EXPERT/SEN 2-ΔT5 (...9)*

adjustment range: 1 ... 14  
 factory setting: Sen2DeltaT5: 4, Sen2DeltaT6: 6,  
 Sen2DeltaT7: 7, Sen2DeltaT8: 10, Sen2DeltaT9: 12

Adjust the reference sensor in the expert menu.

## **Timer function (function block 1...5):**

### *ARRANGEMENT/OPTIONS/TIMER 1 (...5)*

Selection: "Yes", "No"  
 factory setting: "No"

### *ARRANGEMENT/ADJ. VALUES/TIMER 1 (...5)/T1(2,3)-ON*

adjustment range: 00:00 ... 00:00  
 factory setting: 00:00

### *ARRANGEMENT/ADJ. VALUES/TIMER 1 (...5)/T1(2,3)-OFF*

adjustment range: 00:00 ... 00:00  
 factory setting: 00:00

Each timer function provides up to 3 time frames. The relay allocated to the function block is activated as long as the time frame (t(x)on ... t(x)off) is open. The switching conditions of all other activated functions of the function block have to be fulfilled as well.

## **4.2.1 Heating circuits:**

The controller can control two independent weather-compensated heating circuits. One heating circuit can be controlled via the internal heating circuit function and a second via an additional external module HKM2.

### **Internal heating circuit control:**

The internal heating circuit is activated in this menu.

### *ARRANGEMENT/HEAT.CIRCUITS/OPTIONS/HEAT.CIRC.*

selection: "Yes", "No"  
 factory setting: "No"

### **Flow temperature**

The TFlow-value indicates the measured actual flow temperature of the heating circuit.

### *ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/TFLOW*

### **Outdoor temperature**

The Temperature-outdoor-value indicates the measured outdoor temperature depending on weather conditions.

### *ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/TOUTD.*

### **Set flow temperature**

The set flow temperature is calculated from the measured outdoor temperature and the heating curve. Onto this, the dial setting of the remote control (RTA11-M) and the controller day correction or night correction are added.

### *ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/FLOW SET*

Set flow temperature = heating curve temperature + remote control + (day correction or night correction). If the calculated set flow temperature is higher than the adjusted maximum flow temperature, the set flow temperature will be equated with the maximum flow temperature.

### Night correction:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
NIGHT CORR.*

adjustment range: -20...+30 K  
factory setting: -5 K

Adjustment channel for night correction (night set back) of the heating circuit. For the night correction function, time frames (see below) can be adjusted. Within these time frames, the set flow temperature of the curve will be decreased (set back) by the adjusted temperature value.

### Day correction:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
DAY CORR.*

adjustment range: -5...+45 K  
factory setting: 5 K

Adjustment channel for the day correction function of the heating circuit. The day correction function is always activated **outside** the 3 time frames of the night correction function and generally raises or lowers the setpoint during building occupation. The set flow temperature of the curve will be decreased or increased by the adjusted temperature value.

### Maximum flow temperature:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
TFLOW MAX*

adjustment range: 10...+100 °C  
factory setting: 50 °C

Adjustment channel for the admissible maximum flow temperature of the heating circuit. If the maximum flow temperature is exceeded, the heating circuit will be switched off. (the mixer will close and the pumps will be switched off).

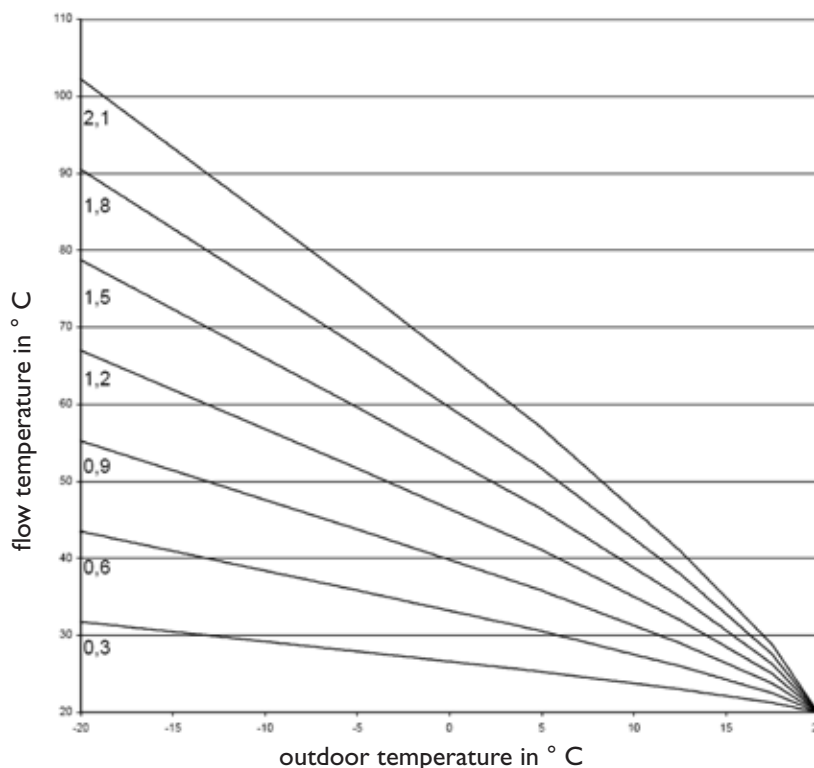
### Heating curve:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
HEAT. CURVE*

adjustment range: 0,3... 3,0  
factory setting: 1,0

The heating curve used by the controller can be increased or decreased to suit the building heating load as shown in the family of curves below. Increasing this value has the effect of raising the flow set temperature, reducing the value will lower the set flow temperature.

heating curves





## Mixer:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/MIXER*

adjustment range: 1 ...20 s

factory setting: 4 s

## Summer:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
SUMMER*

adjustment range: 0 ...40 °C

factory setting: 20 °C

## Store priority:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
STORE PRIO.*

selection: "Off", "On"

factory setting: "Off"

## Timer:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
TIMER/MODE*

selection: "Night / Day", "Off / Day", "Without"

factory setting: "Night / Day"

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/TIMER/  
T1(...21)-ON*

adjustment range: 00:00 ... 00:00

factory setting: 22:00 (t1...t7-on)

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/TIMER/  
T1(...21)-OFF*

adjustment range: 00:00 ... 00:00

factory setting: 05:00 (t1 ... t7-off)

**Example:** The night correction runs from Monday to Tuesday from 22:00 to 6:00 and Tuesday from 15:00 to 18:00, when t1-on is set to mon 22:00, t1-off to tue,6:00 and t2-on to tue,15:00 and t2-off to tue,18:00.

## Flow sensor:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/SEN.FLOW.*

adjustment range: 1 ... 14

factory setting: 9

## Outdoor temperature sensor:

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/SEN.OUTDOOR*

adjustment range: 1 ... 14

factory setting: Sensor 11

The mixer function controls the mixing valve position according to the difference between the actual flow temperature and the set flow temperature. The valve is opened or closed in pulses depending on this deviation. The parameter „mixer“ allows the pulse operating time to be matched to suit the valve operating time.

Adjustment channel for summer operation. If the outdoor temperature exceeds the adjusted value, the heating circuit will be switched off. The hysteresis is 1,0 K.

This function switches off the heating circuit when domestic hot water is being afterheated.

For this purpose, the option domestic hot water priority and afterheating via store loading (see 4.2) of the controller DeltaSol® M have to be active as well.

The timer determines whether day correction or night correction (set back) is used for changing the set flow temperature. 21 different time frames (3 for each day) can be set for night correction of the heating circuit.

If one of the time frames is set to 'active', night correction will be active.

If none of them is active, the set flow temperature will be adapted with day correction. The timers are pre-allocated such that every day from 10:00 pm to 5:00 am (the following day) night set back is activated.

The **mode** determines the operation mode of the timer:

<i>NIGHT / DAY</i>	time frame for night correction
<i>OFF / DAY</i>	time frame for heating circuit off
<i>WITHOUT:</i>	timer deactivated

Adjustment channel for allocating the flow sensor.

The default is sensor 9 – this can be reallocated if needed. A sensor which is already in use can be allocated without influencing its original function in the system.

Adjustment channel for allocating the outdoor temperature sensor.

The default is sensor 11 – this can be reallocated if needed. A sensor which is already in use can be allocated without influencing its original function in the system.

## Note:

If an additional external module HKM2 is additionally used, only 1 outdoor temperature sensor is required. In order to ensure that both heating circuits use the same outdoor temperature, adjust to sensor 16.

### Afterheating

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/AFT.-HEAT.*

selection: "None", "Therm.", "Store"  
factory setting: "None"

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/ΔT AH ON*

adjustment range: -15,0 ... 49,5 K  
factory setting: 4,0 K

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/ΔT AH OFF*

adjustment range: -14,5 ... 50,0 K  
factory setting: 14,0 K

### Sensor 1 store

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/S1 STORE*

adjustment range: 1 ... 14  
factory setting: 12

### Sensor 2 store

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/S2 STORE*

adjustment range: 1 ... 14  
factory setting: 8

### Heating circuit relay allocation

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/HC RELAY VAR.*

selection: 1, 2, 3  
factory setting: 1

The set flow temperature is compared with the temperature at one or two store (buffer) reference sensors (differential control). If this temperature differential is too small ( $\Delta TH_{on}$ ), afterheating will be activated. It will be switched off, if the differential ( $\Delta TH_{off}$ ) between store and set flow temperature is large enough.

Select the after-heating type via the parameter "Aft.-Heat." ("None", "Therm.", or "Store").

If "None" is selected, no afterheating will be carried out.

If "Therm." is selected, the set flow temperature is compared with a store reference sensor.

If "Store" is selected, the comparison is made with 2 reference sensors. The switching conditions to both reference sensors have to be fulfilled.

With this parameter, the 1<sup>st</sup> reference sensor for heating circuit afterheating can be selected.

With this parameter, the 2<sup>nd</sup> reference sensor can be selected for store dependent afterheating.

With the parameter "HC Relay var." it is possible to choose different relay allocations for the heating circuit pump and heating circuit afterheating. Factory setting "1" is the standard relay allocation (see 3.5).

If "2" is selected, the relays of the heating circuit pump and HC-afterheating are interchanged.

If "3" is selected, HC-afterheating is allocated to relay 9 and the heating circuit pump to relay 5 (for systems 1 - 4 only).

As soon as in the basic systems 1 - 5 an option referring to relay 6 is activated (or relay 3 in basic systems 6 and 7 respectively), the parameter "HC Relay Var." will be blocked. Therefore, the following steps have to be carried out in the correct order (see also 3.4):

1. Select basic solar system and hydraulic variant
2. Activate heating circuit and select relay allocation.
3. Activate options (e.g. store loading).

## Manual correction (remote control)

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/MAN. CORR.*

selection: "Yes", "No"  
factory setting: "No"

The remote control (RTA11-M) allows manual adjustment of the heating curve ( $\pm 15$  K). The remote control is optional and it is not included in the full kit.

The heating circuit can be switched off manually, if the remote control is set to the position "heating circuit off".

Heating circuit switched-off means that the heating circuit pump is switched off and the mixer closed.

Flow temperature is boosted to maximum for rapid heating when the remote control it is set to "rapid heating".

## Sensor remote control

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/SEN. REMOTE*

adjustment range: 1 ... 14  
factory setting: 10

Adjustment channel for allocating the remote control sensor. The factory setting is sensor 10.

## Pump HCmax

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/PUMP HCmax*

selection: "ON", "OFF"  
factory setting: "OFF"

With this option it is possible to determine whether the heating circuit pump remains switched-on or should be switched off when the adjusted maximum flow temperature is reached.

## Chimney sweeper

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/CHIMNEY*

selection: "Yes", "No"  
factory setting: "No"

When this option is activated, the heating circuit opens (mixer opens) and the heating circuit pump is switched-on (provided that the chimney sweeper function is active, see 4.4). The protective function of the heating pump maximum limitation will still be active.

## External heating module:

### Heating module

*ARRANGEMENT/HEAT.CIRCUITS/OPTIONS/HC MODULE*

selection: No / HCM1 / HCM2  
factory setting: "No"

*ARRANGEMENT/HEAT.CIRCUITS/HEATING CIRCUIT/  
EXPERT/SEN.OUTDOOR*

adjustment range: 1 ... 21  
factory setting: 11  
change to: 16

An additional external heating circuit module can be activated (HKM) if a further compensated heating circuit is required.

If the external heating circuit module HKM2 is additionally used, only 1 outdoor temperature sensor is required. In order to ensure that both heating circuits control using the same outdoor temperature, adjust to sensor 16 and connect the external sensor to the HKM module.

*ARRANGEMENT/HEAT.CIRCUITS/HC MODULE...*

The displays and functions are similar to that of the internal heating circuit (see also manual HKM2). The parameter "heating circuit relay allocation" is not available.

### 4.3 Menu: Heat quantity measurement

*WMZ/OPTIONS/WMZ 1 (2, MODULE)*

selection: "Yes", "No"

factory setting: "No"

*WMZ/WMZ 1 (2)/ EXPERT/FLOWMETER*

Selection: "Yes", "No"

factory setting: "Yes"

*WMZ/WMZ 1 (2)/EXPERT/SEN. FLOW*

adjustment range: 1 ... 14

factory setting: WMZ 1= 12, WMZ 2= 11

*WMZ/WMZ 1 (2)/EXPERT/SEN. RETURN*

adjustment range: 1 ... 14

factory setting: WMZ 1= 10, WMZ 2= 10

#### Heat quantity measurement without flowmeter V40

set *WMZ/OPTIONS/WMZ 1 (2)* to "Yes" and

*WMZ/WMZ 1 (2)/EXPERT/FLOWMETER* to "No"

*WMZ/WMZ 1 (2)/EXPERT/FLOW*

adjustment range: 1,0 ... 50,0 l

factory setting: 3,0 l

*WMZ/WMZ 1 (2)/EXPERT/RELAY*

adjustment range: 1 ... 9

factory setting: 1

#### Heat quantity measurement with flowmeter V40

set *WMZ/OPTIONS/WMZ 1 (2)* to "Yes" and

*WMZ/WMZ 1 (2)/EXPERT/FLOWMETER* to "Yes"

*WMZ/WMZ 1 (2)/EXPERT/VOL./PULS.*

adjustment range: 0,5 ... 99,5 (liter/pulse)

factory setting: 1 (liter/pulse)

#### Antifreeze type

*WMZ/WMZ 1 (2)/EXPERT/ANTIFREEZE TYPE*

selection: 0, 1, 2, 3

factory setting: 0

#### Antifreeze

*WMZ/WMZ 1 (2)/EXPERT/ANTIFREEZE*

adjustment range: 20 ... 70 Vol %

factory setting: 45 Vol %

#### Heat quantity

*WMZ/WMZ 1 (2)/HEAT*

The controller has two separate integrated calorimeters which can be configured with or without flowmeter V40. Furthermore, the values of a separate WMZ module can be displayed.

Allocate the sensors.

Factory settings are as shown – but other sensors can be allocated without influencing their original function in the system. E.g. the collector sensor could be used for the flow sensor if desired.

The heat quantity measurement calculation uses the difference between flow and return temperature and the user entered flow rate. The flow rate should be read from the window of the flow setter at 100 % pump speed. Heat quantity measurement is carried out when the output selected in the "relay" menu is active.

The heat quantity measurement calculation uses the difference between flow and return temperature and the volume flow transmitted by the flowmeter V40.

Adjust the pulse rate corresponding to the flowmeter V40 used (See the flag on the V40 cable):

V40-06: 1 litre/pulse

V40-15: 10 litres/pulse

others: 25 litres/pulse

Adjustment channel to ensure the controller uses the correct specific heat capacity for the heat transfer fluid used

0 for water

1 for propylene glycol

2 for ethylene glycol

3 for Tyfocor® LS

Adjustment channel for the concentration water/ glycol for antifreeze types 1 and 2.

The overall heat quantity results from the sum of the values in Wh, kWh and MWh.

The different values can be reset to 0. To reset, select the desired value and answer the security prompt "Save?" with "No".

## 4.4 Menu: Expert

### System warning “ $\Delta T$ too high“

*EXPERT/ $\Delta T$  TOO HIGH*

selection: “Yes“, “No“

factory setting: “Yes“

This message is shown, if solar loading has been carried out for a period of 20 minutes with a differential higher than 50 K.

The message function can be deactivated by selecting “No“.

### System warning “Non-ret. valve“

*EXPERT/NON-RET. VAL.*

selection: “Yes“, “No“

factory setting: “Yes“

This message is shown if between 11 p.m. and 5.00 a.m. the collector temperature is higher than 40 °C or a store is loaded because of a high temperature difference.

The message function can be deactivated by selecting “No“.

### Message relay (error message)

*EXPERT/MESSAGE REL.*

selection: “Yes“, “No“

factory setting: “Yes“

Activate this function by selecting “Yes“. If the controller detects a fault, the message relay is energised (e.g. for signal lights).

These errors are:

- Sensor defective
- Real-time-clock (RTC) defective
- Storage module (EEPROM) defective

Please note that a message caused by one of the plausibility controls (non-return valve,  $\Delta T$  too high) does not activate the relay.

### Chimney sweeper

*EXPERT/CHIMNEY*

selection: “Yes“, “No“

factory setting: “No“

*EXPERT/CHIMNEY SWEEPER*

This function is used for activating a given relay state when required.- e.g. flue gas measurement if the system controls a boiler. Activate this function by selecting “Yes“.

Adjust the required relay status in the chimney sweeper menu (expert / chimney sweeper).

If the chimney sweeper function is activated, “chimney sweeper“ is indicated in the main menu.

### Sensor offset

*EXPERT/SENSORS/CS-TYPE*

selection: A, B, C, D, E

factory setting: E

*EXPERT/SENSORS/CS-ADJUST*

*EXPERT/SENSORS/CS-OFFSET*

*EXPERT/SENSORS/SENSOR 1 (...12)*

adjustment range: -5,0 ... 5,0 K

factory setting: 0,0 K

Adjust the CS-type in this menu. The CS-type should be matched to the code letter printed on the CS type label.

The CS-offset adjustment should be carried out with the irradiation sensor disconnected.

Furthermore, an offset for sensors 1 ... 12 can be carried out.

## Minimum speed

*EXPERT/RELAY/MIN SPEED 1 (... 4)*

adjustment range: 30 ... 100 %

factory setting: 30 %

Relays 1 to 4 are semiconductor relays for pump speed control of standard pumps. Relative pump speed is adapted in 10 % steps to the current temperature difference between the collector and the store (see also 4.1 speed control).

In some cases, it is necessary to adapt the factory setting of the minimum pump speed (30%). If it is set to 100 %, pump speed control is deactivated (valves).

## Language

*EXPERT/LANGUAGE*

factory setting: "German"

In the submenu "language", different languages are available.

## 4.5 Menu: manual mode

*MANUAL OPERATION/ALL RELAYS*

*MANUAL OPERATION/RELAY 1 (... 9)*

selection: "Off", "Auto", "On"

factory setting: "Auto"

In this menu, individual or all relays can be switched-on (relay test), switched-off, or set into automatic mode.

## 5. Accessory

### 5.1 Sensors



sensor in immersion sleeves

Precision-platin sensors PT1000 (**553001048** and **553001049**) are used for the controller DeltaSol® M.

Depending on the individual solar system, the product range contains 3 different sensor types: sensors with immersion sleeves, flatscrew sensors and 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:

**553001048:** 1,5 m weather- and temperature resistant silicone cable for temperatures between -50 °C ... +180 °C, mostly used for collectors.

**553001049:** 2,5 m PVC cable for temperatures between -5 °C ... +80 °C, mostly used for stores.

## Photocell



The solar cell CS10 is used for detecting the light intensity. The short-circuit current rises with the increase in light intensity. The relationship between short-circuit current and light intensity is directly proportional. The connecting cable can be extended by up to 100 m.

## Flowmeter



The V40 is a measuring instrument for detecting the flow of water or water/glycol mixtures and is used in combination with the calorimeter integrated into the *DeltaSol*® M. After a specific volume has passed, the V40 reed switch sends an impulse to the calorimeter. The heat quantity used is calculated by the calorimeter using these impulses and the measured temperature difference with the help of pre-defined parameters (glycol type, concentration, heat capacity, etc.).

## 6. Troubleshooting

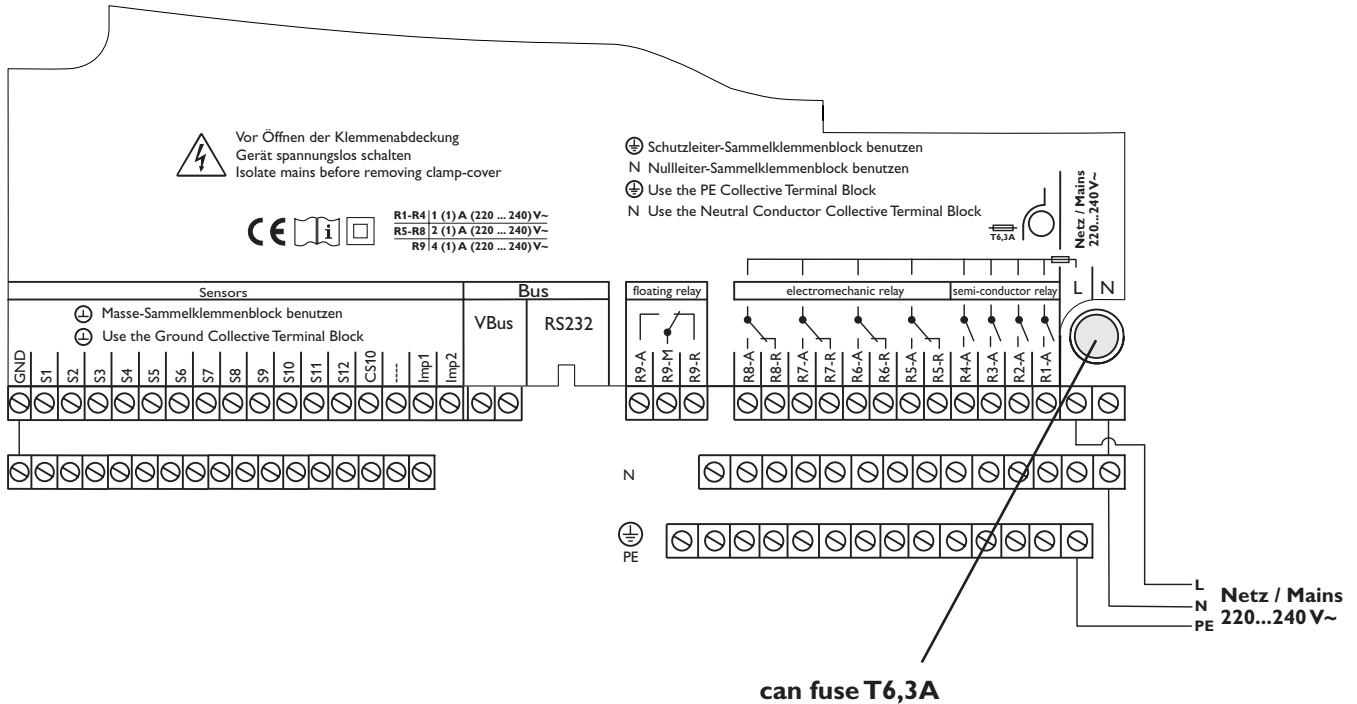


**WARNING!**  
Switch-off power supply and disconnect from mains before opening the housing!

If the controller DeltaSol® M does not work correctly, please check the following items:

### 1. Power supply:

Check power supply if the control lamp is extinguished. The controller is protected with 1 can fuse. T6,3 A. This fuse can be replaced when the cover and the terminal cover are removed (spare fuse is enclosed in accessory bag).



°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

### 2. Sensor defects:

The control lamp for operation flashes red and a message is shown in the display if there is a defect in the control circuit caused by a defective senso.

**! SENSOR BROKEN** for a broken sensor cable and  
**! SENSOR SHORT** for a sensor cable short circuit appears and the defective sensor is indicated.

**Short-circuit:** Short-circuit of a sensor cable with indication of the respective temperature sensor. The error code -88.8 is shown in the display.

**Broken cable:** Broken sensor cable with indication of the respective temperature sensor. The error code 888.8 is shown in the display.

Disconnected PT1000 temperature sensors can be checked with an ohmmeter. Please check the resistance values correspond with the table to the left.



### 3. Messages:

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

Message “! Sensor broken“ / “! Sensor short“  
Control lamp flashes

Indication of a broken cable or a short-circuit with indication of the respective sensor.

Message “!ΔT too high”

A store has been loaded for a period of at least 20 minutes with a T of 50 K. Possible reasons are a defective pump, defective valve or a calcified heat exchanger.

Message “!EEPROM“

Indicated as malfunction during memory access. In this case, please switch-off the controller for a while and then switch it on again (please check all adjustments).  
If the fault can be removed in this way, it has been a matter of data communication. But if the fault is still present, the controller should be returned to the manufacturer.

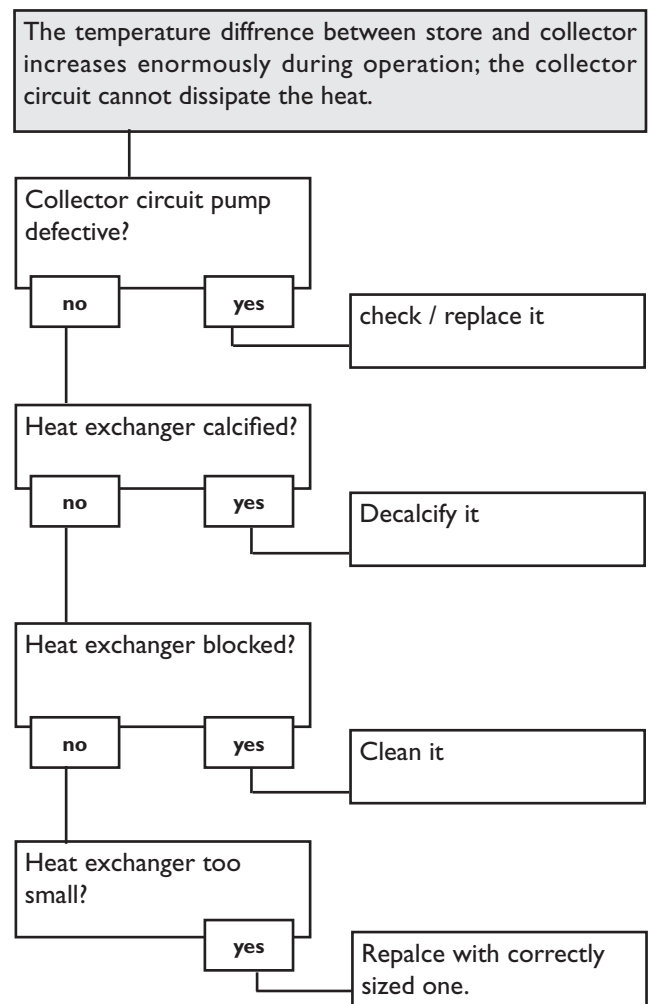
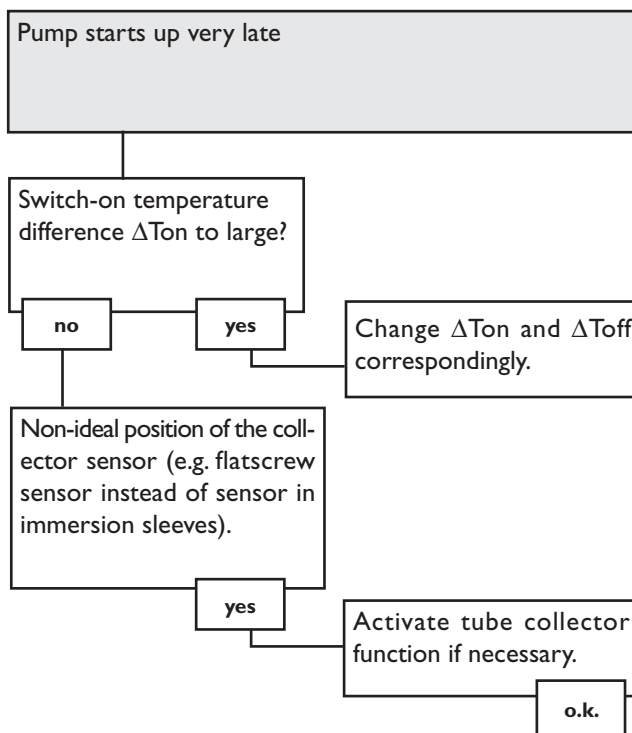
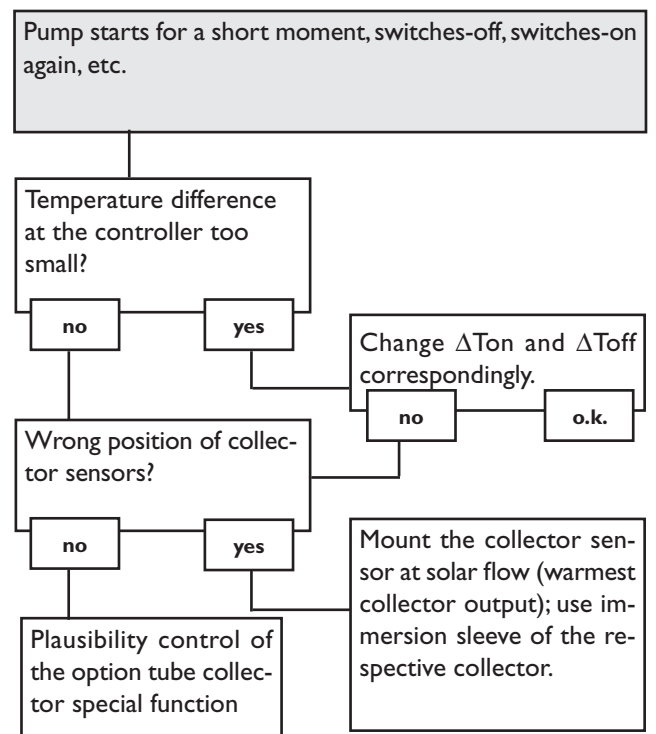
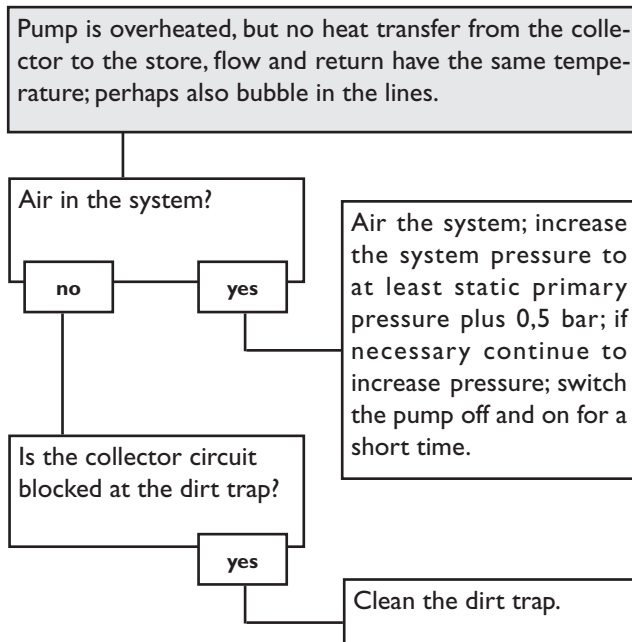
Message “? Non-ret. valve“

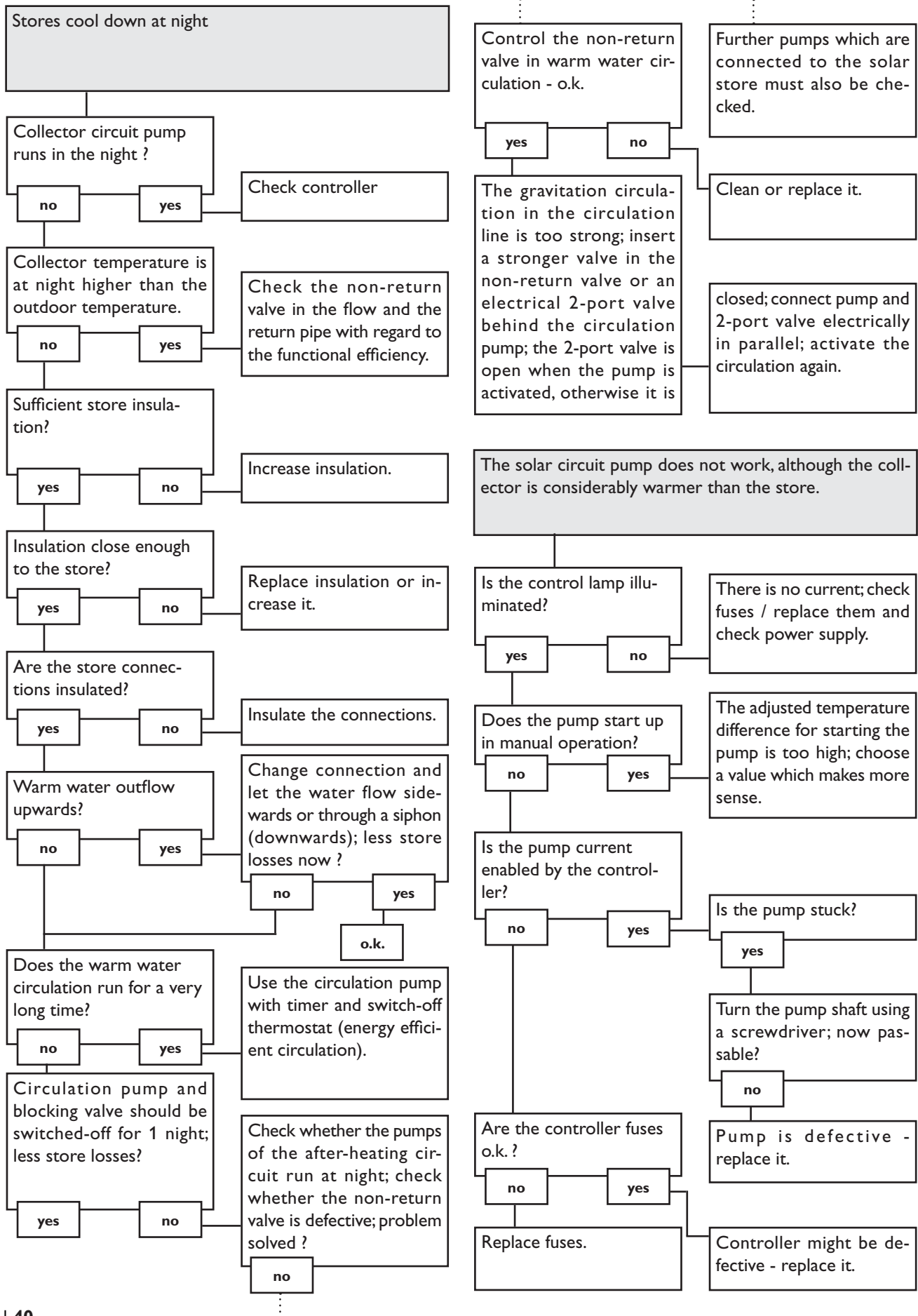
If the collector temperature is higher than 40 °C between 11 p.m. and 5.00 a.m. or the present temperature difference is higher than the switch-on temperature difference, this can indicate a heat return current (e.g. due to defect of non-return-valve).  
This message is to be seen as a warning and it should always be considered in relation to the outdoor temperature.

Message “!RTC“:

Indicates a malfunction of the real-time-clock of the controller. Please switch-off the controller for a while and then switch it on again (please check the set time). If the fault is still present, all temporarily controlled functions and options are disturbed. Emergency operation of the system is guaranteed, but the controller should be returned to the manufacturer.

## 4. Various:





**Notes**

## Notes

## Notes

**Distributed by:**

**Customer Service Centre**

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**Important notice:**

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

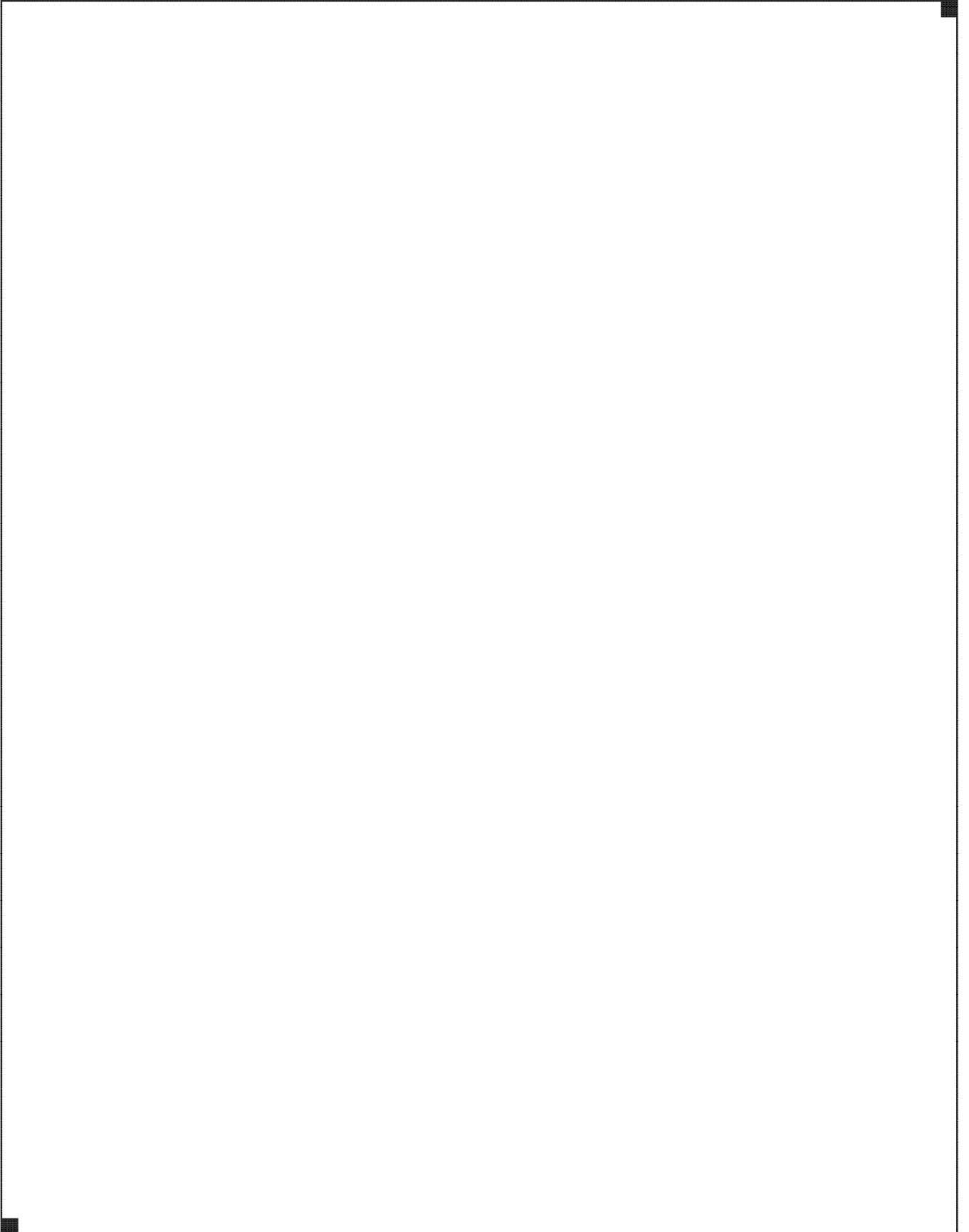
**Please note:**

The design and the specifications can be changed without prior notice. The illustrations may differ from the original product.

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Editor: Hamworthy Heating Limited

# Notes





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## **Northern Ireland (Sales & Service)**

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