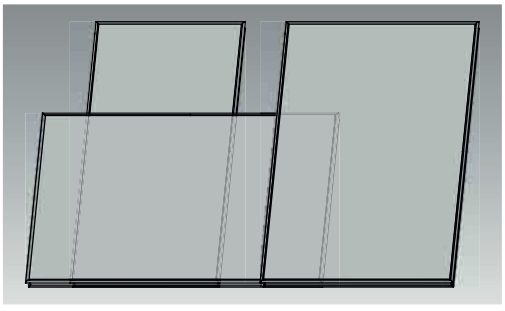
For certified companies

a member of DAIKIN group

ROTEX

ROTEX RPS4
Operating and installation instructions

Control and pump unit for Solaris solar systems



Valid for the following components

- ROTEX Solaris RPS4
- Solaris R4 differential temperature regulation

GB

Output 06/2015

List of contents

1 Guarantee and conformity

1.1 Warranty conditions

The legal guarantee conditions fundamentally apply. Our warranty conditions beyond that can be found online on your sales representative's webpage.

1.2 Declaration of conformity

for the Control and pump unit in the RPS4 series.

We, ROTEX Heating Systems GmbH, declare under our sole responsibility that the products

Product	Order No.
ROTEX RPS4	16 41 26

comply, in their standard design, with the following European Directives:

2004/108/EC	Electromagnetic Compatibility Directive
2006/95/EC	EC Low Voltage Directive

CE

Güglingen, 01.07.2015

Georg Blümel
Managing Director

2 Safety

2.1 Observing instructions

This manual is intended for authorised and trained technicians who have experience in the proper installation and commissioning of solar systems on account of their technical training and knowledge.

All necessary tasks for the installation, initial start-up, operation and setting of the system are described in this manual. For detailed information regarding the connected components of your heating system, please observe the respective documents.

Please read this manual carefully and thoroughly before proceeding with the installation and initial start-up or modification of the system.

Relevant documents

Documents listed below are part of the technical documentation of the ROTEX solar system and therefore must be observed. The documents are included in the scope of supply of the individual components.

– ROTEX high-performance flat solar panels Solaris V21P, V26P and H26P: Installation instructions for on-roof, in-roof and flat-roof mounting
– ROTEX hot water storage tank (Sanicube Solaris / HybridCube, GCU compact or HPSU compact): Operating and installation instructions

When connecting to an external heat generator or storage tank which is not included in the scope of delivery, the individual associated operating and installation instructions apply.

2.2 Warning signs and explanation of symbols

Meaning of the warnings

Warnings in this manual are classified according into their severity and probability of occurrence.

DANGER!

Draws attention to imminent danger.

Disregarding this warning can lead to serious injury or death.

WARNING!

Indicates a potentially dangerous situation.

Disregarding this warning can result in serious injury or death.

CAUTION!

Indicates a situation which may cause possible damage.

Disregarding this warning can lead to damage to property and the environment.

This symbol identifies user tips and particularly useful information, but not warnings or hazards.

Special warning signs

Some types of danger are indicated by special warning signs.


Electric power


Danger of explosion


Risk of burning or scalding

Order number

Notes related to Order numbers are identified by the cart symbol .

Handling instructions

- Instructions on actions are shown as a list. Actions of which the sequential order must be maintained are numbered.
  ➔ Results of actions are identified with an arrow.

2.3 Avoid danger

ROTEX solar installations are state-of-the-art and are built to meet all recognised technical requirements. However, improper use can lead to serious injuries or death, as well as causing material damage. Install and operate only ROTEX solar systems to avoid danger:

– as stipulated and in perfect condition,
– with an awareness of the safety and hazards involved.

This assumes knowledge and use of the contents of this manual, the relevant accident prevention regulations and the recognised safety-related and occupational medical rules.

2.4 Intended use

The ROTEX solar system may only be used for solar-supported heating of hot water systems. The ROTEX solar system must be installed, connected and operated only according to the instructions in this manual.

Any other use outside the intended use is considered as improper. The operator alone shall bear responsibility for any resulting damage.

Use as intended also involves compliance with maintenance and inspection conditions. Spare parts must at least satisfy the technical requirements defined by the manufacturer. This is the case, for example, with original spare parts.

2.5 Instructions for working safely

Working on the roof

- Installation work on the roof may only be carried out by authorised and trained persons (heating technicians, roofers, etc.) under observance of the relevant Accident Prevention Regulations.
- Material and tools must be secured against falling.
- Barriers must be erected to prevent persons from entering the area below the roof where the work is being carried out.

Before working on the heating system

- All work on the heating system (such as installation, connection and commissioning) may only be carried out by authorised and trained heating technicians.
- Switch off the main switch and secure it against unintended switching on when carrying out any work on the heating system.

Electrical installation

- Electrical installation must be carried out only by qualified electrical experts and in compliance with the valid electro-technical guidelines as well as the regulations of the relevant energy supply company (EVU).
- For the mains connection, use a separate EN 60335-1 disconnector for all-pole disconnection from the power mains and a GFCI circuit breaker with a reaction time ≤ 0.2 s.
- Before completing the mains connection, compare the mains voltage, indicated on the type plate (230 V, 50 Hz) with the supply voltage.
- Before beginning work on live parts, disconnect them from the power supply (switch off main switch, remove fuse) and secure against unintentional restart.
- Equipment covers and service panels must be replaced as soon as the work is completed.

Instructing the user/owner

- Before you hand over the heating system, explain to the user/owner how to operate and check the heating system.
- Make a record of the handover by filling out and signing the installation and instruction forms jointly with the user/owner.

3 Product description

3.1 Layout and constituent parts of the Solaris system

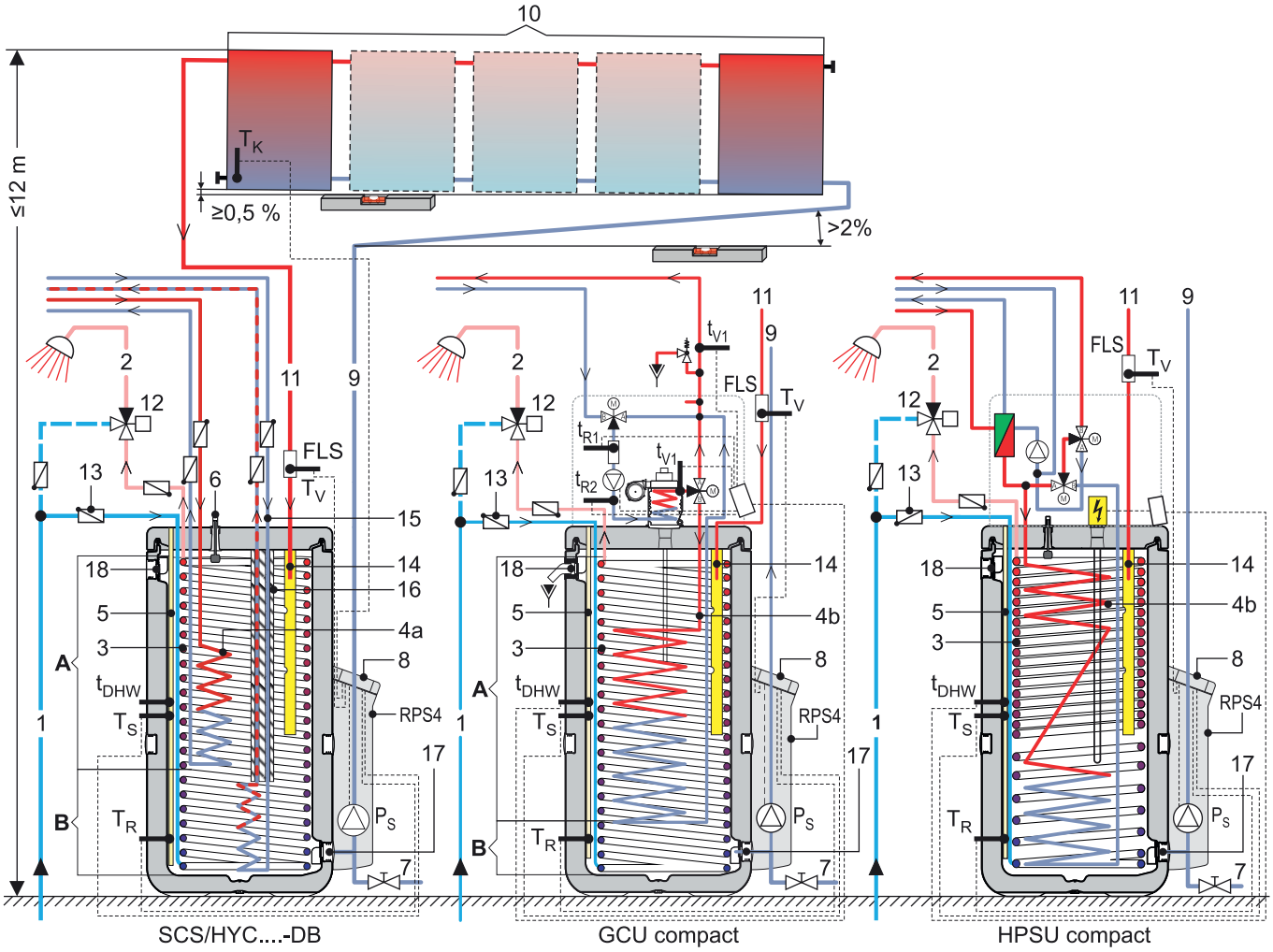


Fig. 3-1 Standard layout of a ROTEX Solaris installation (ROTEX recommends double-sided connection)

1	*Cold water connection line*
2	*Domestic water (hot) distribution line*
3	*Stainless steel corrugated heat exchanger for domestic water (hot)*
4a	*Stainless steel corrugated heat exchanger for storage tank charging*
4a	*Stainless steel corrugated heat exchanger for storage tank charging and heating support*
5	*Submersion sleeve for storage, return temperature sensors*
6	*Fill level display*
7	*Filling and draining cock (accessory **KFE BA, 16 52 15**)*
8	*Solaris R4 controller*
9	*Solar return line (at the bottom on the solar panel)*
10	*Solar panel array*
11	*Solar flow line (at the top on the solar panel)*
12	*Thermal mixing valve (scalding protection, provided by customer)*
13	*Convection brake (accessory)*
14	*Solar flow layering pipe*
15	*Corrugated stainless steel heat exchanger for heating support*
16	*Thermal insulation sleeve for corrugated stainless steel heat exchanger for heating support*
17	*Solar return connection*
18	*Safety overflow connection*
A	*Zone with water for domestic use*
B	*Solar zone*
FLS	*Solaris FlowSensor (flow measurement)*
P_S	*Solaris operating pump*
RPS4	*Control and pump unit*
t_{DHW}	*Storage temperature sensor*
T_K	*Solaris solar panel temperature sensor*
T_R	*Solaris return flow temperature sensor*
T_S	*Solaris storage cylinder temperature sensor*
T_V	*Solaris inflow temperature sensor*
GCU compact	*Gas Combi Unit*
HPSU compact	*Solar storage tank with integrated interior heat pump unit*
SCS/HYC - DB	*Energy storage Sanicube Solaris / HybridCube*

Tab. 3-1 Legend for fig. 3-1

3.2 Brief description

The ROTEX solar system is a thermal solar system for supplying hot water for consumption and solar support.

The ROTEX Control and pump unit RPS4 can only be installed and operated in the depressurised ROTEX Solaris System (DrainBack) using the installation material provided for the purpose.

The prerequisite for problem-free operation in the DrainBack system, is that the connection lines are routed with a constant gradient (at least 2 %), and that the bottom edges on the solar panels with double-sided connections are mounted with a constant gradient to the return connection, or, with same side connection, are mounted horizontally.

Mode of operation

The high-performance flat solar panels Solaris V21P, V26P and H26P convert the sun's radiation into heat with a high level of effectivity. Hereby, the heat transport media is normal tap water.

As soon as the solar collectors have reached a useful temperature level, the water of the heating jacket in the storage cylinder (which is not under pressure) is pumped directly through the collectors. With insufficient collector temperature, the circulation pump is switched off and the system is drained automatically. This operating mode has several advantages:

– High operational reliability, as there are no components that could be damaged or fail (such as expansion vessel, safety valve, venting valves, etc.).
– Excellent heat transfer and heat storage capacity (system works without antifreeze agents).
– Minimum maintenance requirements.
– Frost proof.
– Without separate solar heat exchanger.
– No stagnation problems.

Modular design

The system consists of several preassembled modules. Plug-in technology and a high degree of pre-assembly ensure fast and simple system installation.

Storage tank

The following storage tanks can be used for the ROTEX solar system:

– ROTEX Sanicube Solaris (SCS): Thermally insulated, depressurised plastic storage tank (with connection facility for a ROTEX condensing boiler).
– ROTEX Hybridcube (HYC): Thermally insulated, de-pressurised plastic storage tank (with connection facility for a ROTEX air-water heat pump).
– ROTEX GCU compact: Solar storage tank with integrated gas condensing boiler.
– ROTEX HPSU compact: Solar storage tank with integrated indoor unit of as air-water heat pump.

The layout, function, commissioning and operation of other Solaris components are not described in this instruction manual. Detailed information about the components can be seen in the operating and installation instructions of the individual units.

The handling instructions and descriptions listed in this manual apply fundamentally to all ROTEX storage tanks used in this solar system, even if just one type is described (e.g. SCS) for representative purposes. In the event of deviations from other storage tanks, a separate note is provided.

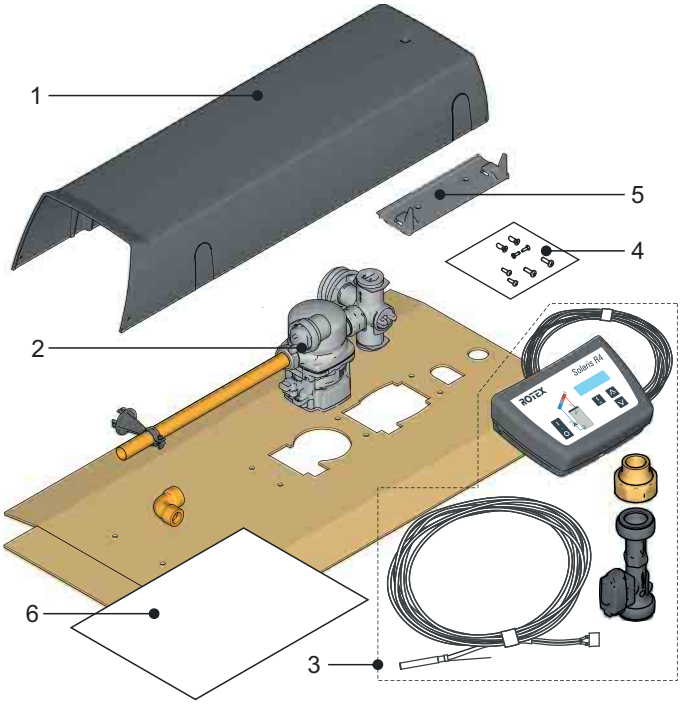
Electronic control

The fully-electronic ROTEX Solaris R4 controller ensures optimum solar heat exploitation (hot water heating, heating support) and compliance with all operational safety aspects.All parameters needed for trouble-free operation have been preset at factory.

3.3 System components

3.3.1 Control and pump unit RPS4

16 41 26



Consists of:

1 *Cover*
2 *Connection piping with circulation pump and solar operating pump*
3 *ROTEX Solaris R4 controller with storage tank temperature sensor, return temperature sensor, connection cable, solar panel temperature sensor FlowSensor, connection cable 230 V-mains connection (3 m)*
4 *Accessories pocket (6 fixing screws, 2 plastic plugs, 2 locking screws, plug fitting and gasket)*
5 *Mounting material (retaining bracket for pump mounting, holding bar and fixing bracket for controller)*
6 *Solaris documentation*

Fig. 3-2 Control and pump unit(RPS4)

3.3.2 Filling and draining cock (KFE BA) for RPS4

16 52 15

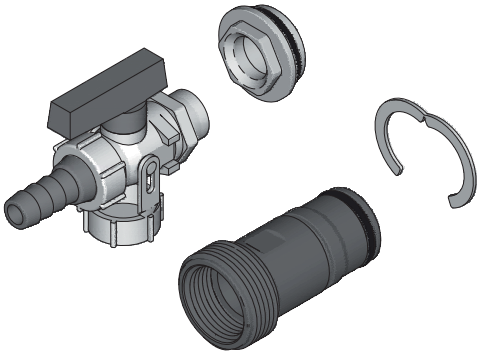


Fig. 3-3 KFE cock (optional)

3.3.3 Regulating valve FlowGuard FLG

16 41 02

For setting and display of flow rate of 2 - 16 l/min.

Consists of:
– FlowGuard FLG (a).
– 2x seals (b).

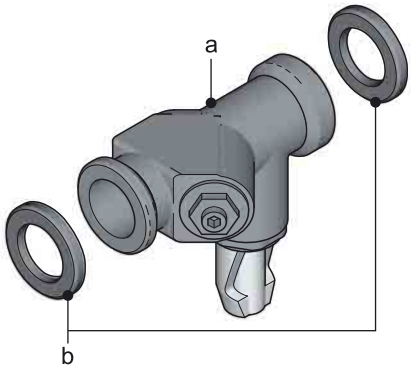


Fig. 3-4 FlowGuard FLG (optional)

3.3.4 Storage tank extension kit CON SX

16 01 20

For connecting 2 Sanicube Solaris storage tanks or 2 HybridCube storage tanks.

Consists of:

– Return connection line (a).
– Flow distribution line (b).

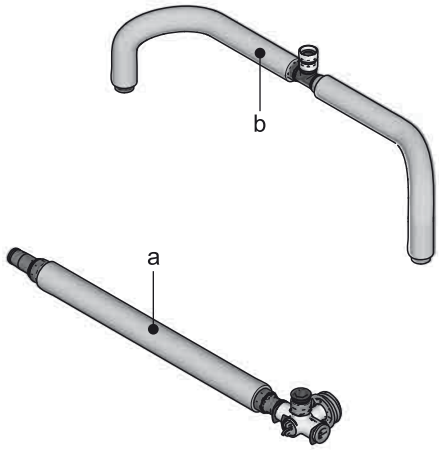


Fig. 3-5 CON SX (optional)

3.3.5 Storage tank extension kit 2 CON SXE

16 01 21

Extension for connecting an additional Sanicube Solaris storage tank or HybridCube storage tank.

Consists of:
– Return connection line (a).
– Flow distribution line (b).

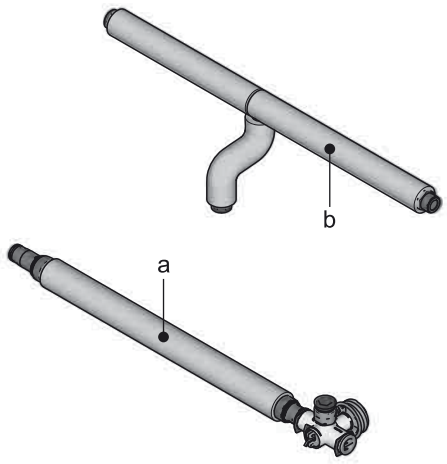


Fig. 3-6 CON SXE (optional)

4 Installation

4.1 System concepts

ROTEX solar systems are usually built according to one of the following system concepts. Information concerning hydraulic system incorporation with example schematics can be seen in chapter 8 "Hydraulic system connection".

4.1.1 Parallel connection

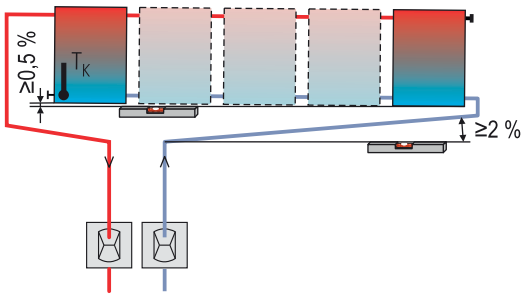


Fig. 4-1 Solar panel field with a connection at each end (recommended)

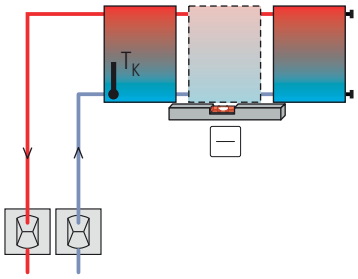


Fig. 4-2 Solar panel field with both connections at one end (max. 3 solar panels)

4.1.2 Serial connection

As an alternative to the parallel mode described in this manual, and if necessary, a maximum of 3 solar panels can be mounted one above the other. Solar panels or solar panel fields mounted one above the other must be connected in series (fig. 4-3).

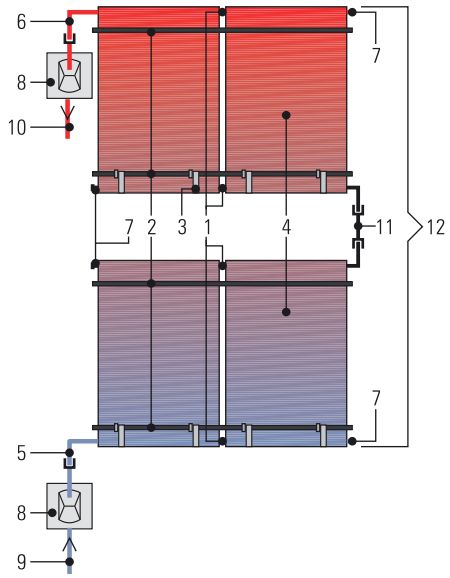


Fig. 4-3 Alternative solar panel arrangement

1 *Collector connector*
2 *Mounting rail*
3 *Solar panel securing hook*
4 *Solar panel*
5 *Return panel connection*
6 *Flow panel connection*
7 *Collector sealing cap*
8 *Roof penetration boxes for inflow/return flow*
9 *Solar return line*
10 *Solar flow line*
11 *Series panel connector*
12 *Solar panel array (2x 2 panels)*

Tab. 4-1 Legend for fig. 4-3

4.2 Installing the control and pump unit

WARNING!

Live parts can cause an electric shock on contact and cause life-threatening burns and injuries.

- Before beginning work on the boiler switching panel or the solar controller, disconnect the devices from the power supply (switch off fuse, main switch) and secure against unintentional restart.
- Electrical installations must always be carried out by qualified electrical technicians in conformity with the relevant electrical guidelines and the regulations of the electric utilities company to prevent hazards from damaged electric wiring.
- Comply with the relevant safety at work regulations.

DANGER!

Leaking gas in the immediate proximity of electrical components can cause an explosion.

- The Control and pump unit RPS4 and electrical components should not be installed in locations where there is a danger of flammable gas escaping.
- Pay attention to minimum distances from walls and in shafts.

4.2.1 Installation pump unit

CAUTION!

Large volumes of water may come out of the solar storage tank during installation.

- Mount the pump unit before filling the solar storage tank (depressurised range) with water.
- If the pump unit is to be connected to solar storage tank that is already in operation, the depressurised storage area must first be drained.

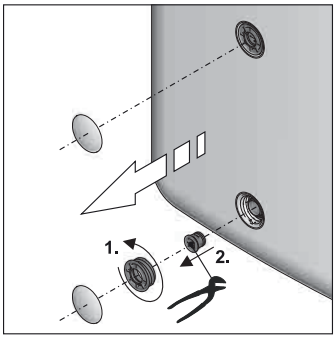


Fig. 4-4 Work step 1

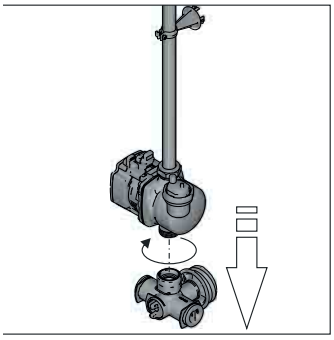


Fig. 4-5 Work step 2

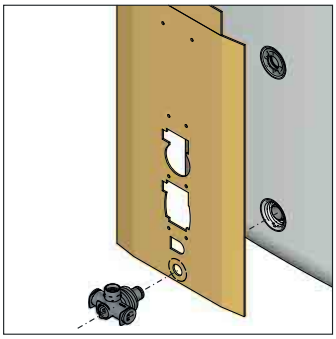


Fig. 4-6 Work step 3

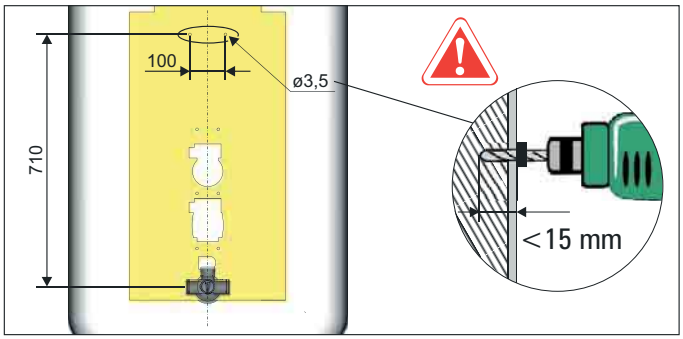


Fig. 4-7 Work step 4

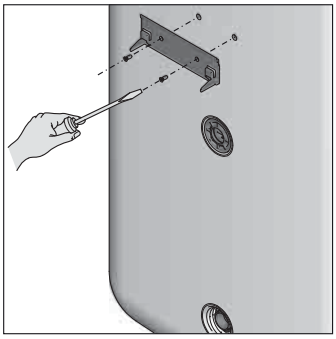


Fig. 4-8 Work step 5

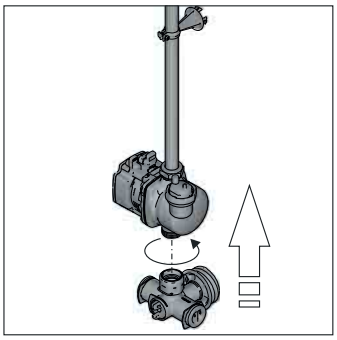


Fig. 4-9 Work step 6

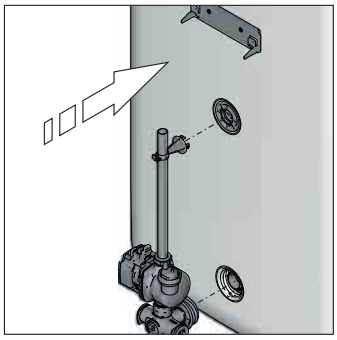


Fig. 4-10 Work step 7

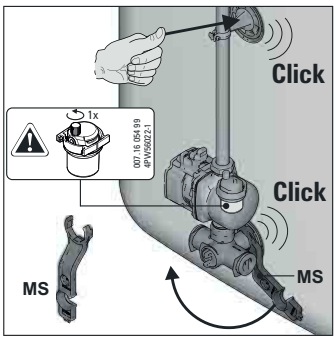


Fig. 4-11 Work step 8

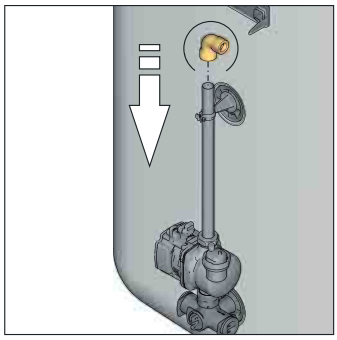


Fig. 4-12 Work step 9

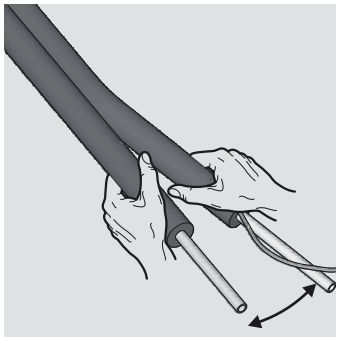


Fig. 4-13 Work step 10

10. Prepare feed line (VA 15 Solar) with sensor cable and return line (VA 18 Solar). Cut open the twin heat insulation in the middle.
11. Adapt the return line (VA 18 Solar) accordingly and route separately after separating the twin thermal insulation.

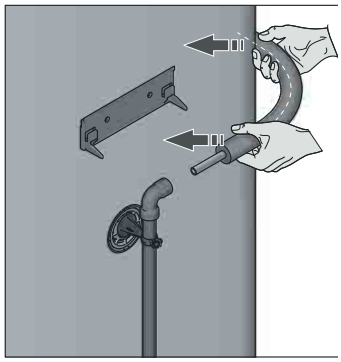


Fig. 4-14 Work step 11

12. Insert the pre-curved return line (VA 18 Solar) into the plug fitting on the pump outlet pipe.

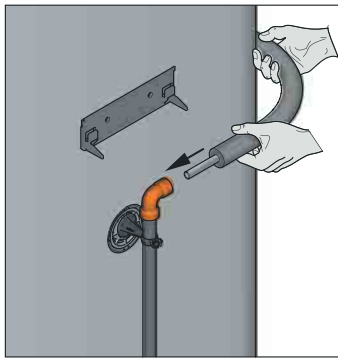


Fig. 4-15 Work step 12

13. Cut the flow line (VA Solar 15) to length on the storage tank side and insert into the plug fitting on the solar flow connection (see chapter 4.3 "Linking several solar storage tanks", FlowSensor, work step 4).

CAUTION!

In the case of longer pipe runs with only a minimum gradient, it is possible for water pockets to develop due to thermal expansion of the plastic pipes between the mounting points with siphon action:

- Use support cups (**TS 16 42 45**).
- Always make sure that pipe runs have a continuous gradient of at least 2 %.

4.2.2 Installation FlowSensor, FlowGuard (optional)

Note the direction of flow when installing the FlowSensor.

FlowSensor

The FlowSensor FLS 20 (fig. 4-17) is a measuring device that simultaneously determines the flow rate in the solar panel and the flow temperature. The measuring ranges are 0...20 l/min (flow quantity) and 0...120 °C (inflow temperature). The measured values are displayed on the Solaris R4 controller. By speed regulation of the solar operating pump P_S, the Solaris R4 controller automatically takes over the setting of the corresponding flow rate.

1. Insert the seal (b) on the solar flow connection (a) of the hot water storage tank.
2. Screw the FlowSensor (c) onto the solar flow connection (a) of the hot water storage tank.
3. Insert the seal (e) and fit the plug fitting (f) to the inlet to the FlowSensor (c).
4. Shorten the flow line (g) (Ø 15 mm) to the required length and insert into the plug fitting (f).
5. Run the FlowSensor cable between the FlowSensor (c) and the Solaris R4 controller.
6. Insert the cable of the FlowSensor on the FlowSensor (c) and at the edge of the board of the Solaris R4 controller, at the position FLS (4-pin, see fig. 4-23).

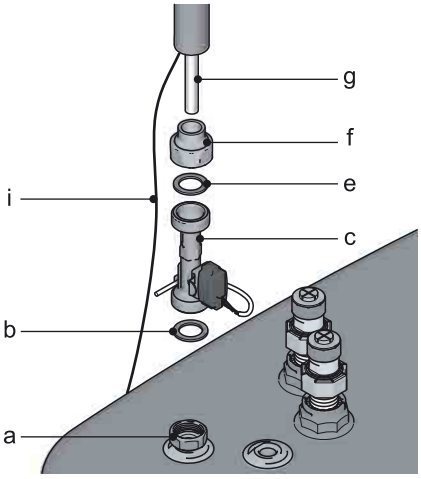


Fig. 4-16 Mounting FlowSensor FLS

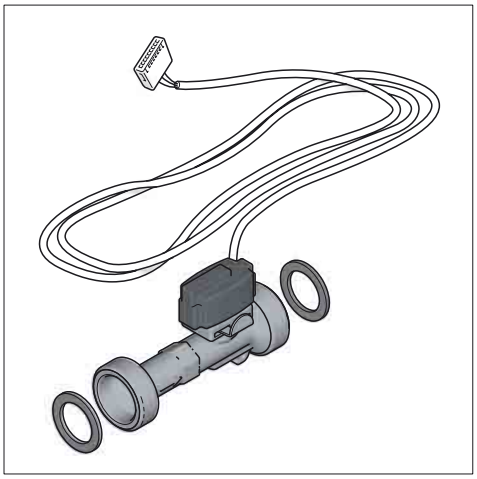


Fig. 4-17 FlowSensor FLS supplied with 3 m cable

FlowGuard

The FlowGuard FLG (fig. 4-19, **16 41 02**) is available as an accessory. It is a regulating valve with integrated flow indicator which can be used to set the flow rate through the solar panel array. The display range is 2...16 l/min.

1. Insert the seal in the flow connection (see fig. 4-18).
2. Mount the FlowGuard, and screw it tight.
3. Insert the seal and install the plug fitting into the input to the FlowGuard.
4. Insert a prepared flow pipe into the plug fitting of the FlowGuard.

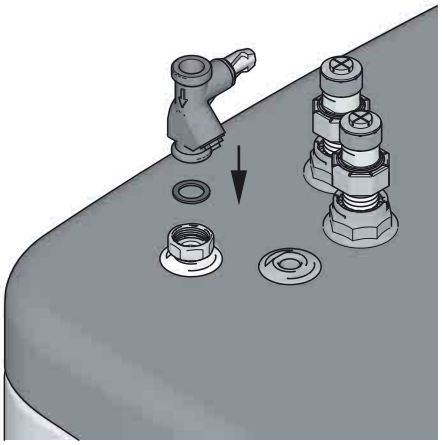


Fig. 4-18 Work step 1+2

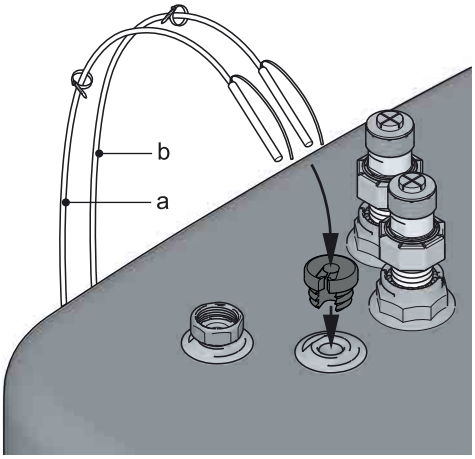
Fig. 4-19 Accessory FlowGuard FLG

4.2.3 Installing temperature sensor

CAUTION!

On no account may the storage cylinder temperature sensor of the boiler controller be inserted more than 75 cm into the sensor well. A sensor that is inserted too deeply can lead to overheating of the consumption water section, as well as a "hang-up" of the control unit during the storage cylinder charging phase.

1. Bend over the contact springs on both sensors (return temperature sensor, storage tank temperature sensor) and insert into the sensor tube.



a Solaris return flow temperature sensor
b Solaris storage cylinder temperature sensor

Fig. 4-20 Work step 1

2. Position the return flow temperature sensor in the sensor tube at approx. 130 cm insertion depth (cable tie).
3. Position the storage cylinder temperature sensor in the sensor tube at approx. 70 cm insertion depth (cable tie).

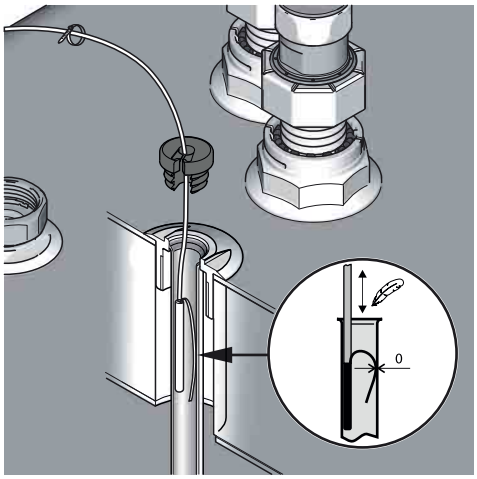


Fig. 4-21 Work step 2+3

4. Push the sealing plug into the well, and run the cables.

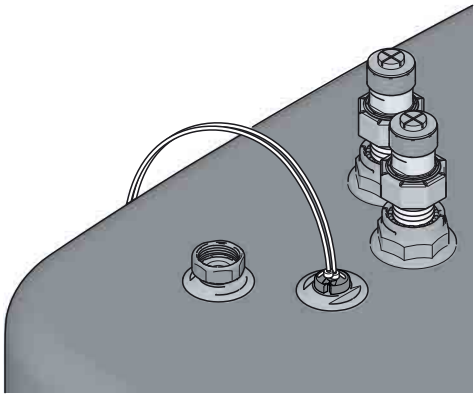


Fig. 4-22 Work step 4

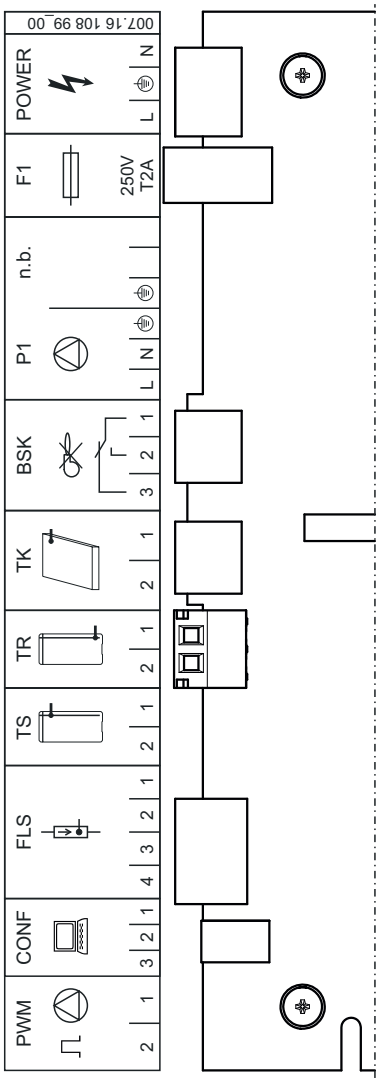
4.2.4 Preparing and fitting the control system

Requirements

– For electrical connections and consumable electrical materials (cable, insulation, etc.), follow all valid country-specific guidelines.
– For every fixed mains connection, use a separate EN 60335-1 disconnector for all-pole disconnection from the power mains and a GFCI circuit breaker with a reaction time ≤ 0.2 s.

Permissible cable types at the terminal strip:
– Single core ≤ 2.5 mm^2
– Multi-core ≤ 2.5 mm^2
– Multi-core with wire end sleeves with insulating collar ≤ 1.5 mm^2
– Multi-core with wire end sleeves without insulating collar ≤ 2.5 mm^2

Electrical connection



BSK Burner inhibit contact
CONF Programming socket for Software update
FLS FlowSensor
TS Storage cylinder temperature sensor
TR Return flow temperature sensor
TK Collector temperature sensor

P_S Solar operating pump
F1 Fuse
Power Mains supply

Fig. 4-23 Connection assignment

1. Fix the cable supplied to the back of the control system using the edge connectors. The connectors are polarised to prevent errors. A connecting diagram is provided in the control unit cover.

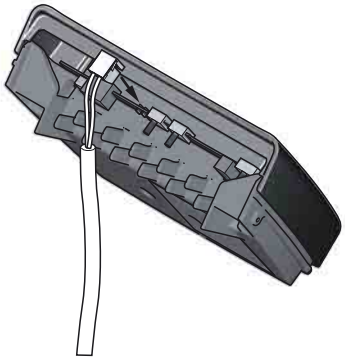


Fig. 4-24 Work step 1

2. To ensure reliable tension relief, all cables should be run through the respective labyrinths.

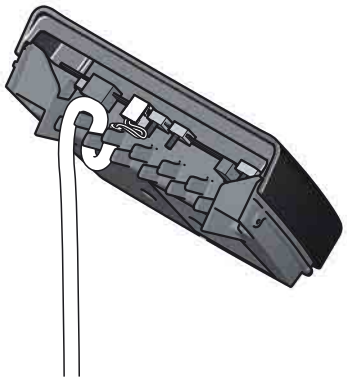


Fig. 4-25 Work step 2

3. Connect the solar panel temperature sensor line (integrated in the connection line) to the plug terminals.

Fig. 4-26 Work step 3

4. Insert the plug at the edge of the board on the controller, at position TK (2-pin, see fig. 4-23).

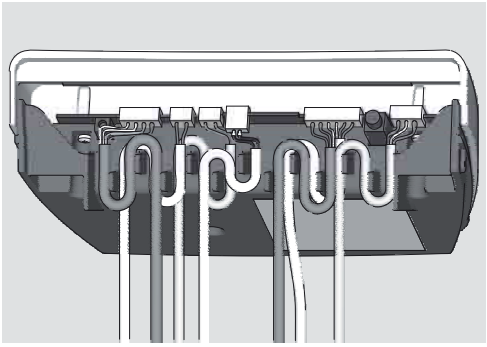


Fig. 4-27 Basic wiring: FlowSensor, storage tank, return, solar panel sensor, pumps and mains wiring

5. Suspend the controller from above in the fixing bracket.
   – Make sure that the cable loops (as shown in fig. 4-27 and fig. 4-28) point downwards.

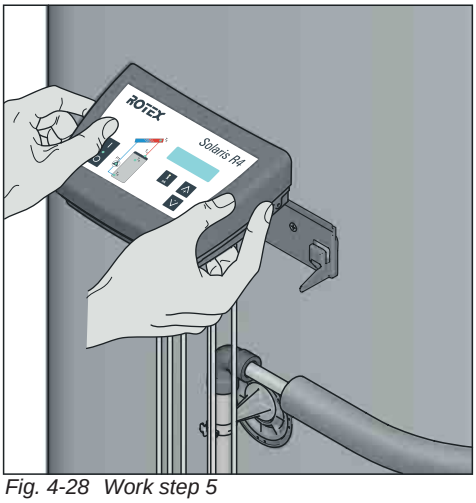


Fig. 4-28 Work step 5

6. Cabling of the solar operating pump P_S:
   – Connect the pump cable to the solar operating pump P_S.

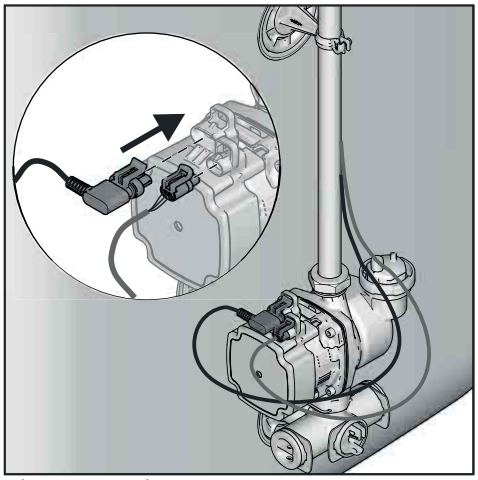


Fig. 4-29 Work step 6

7. Lay the cable for the control system along the return line and fix using cable ties.

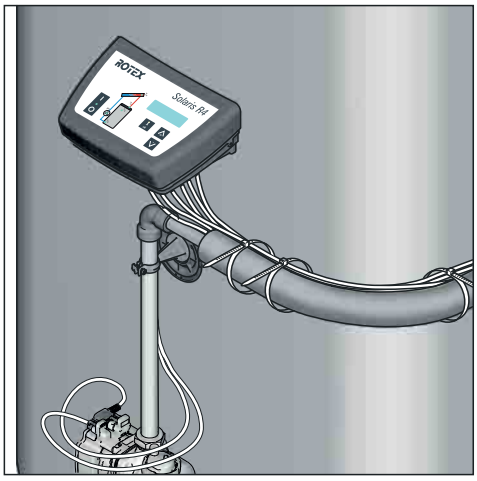


Fig. 4-30 Work step 7

4.2.5 Fit the covering hood

1. Slide the covering hood in position and align. Slide the covering hood under the controller housing so that a constant gap is produced round the controller.

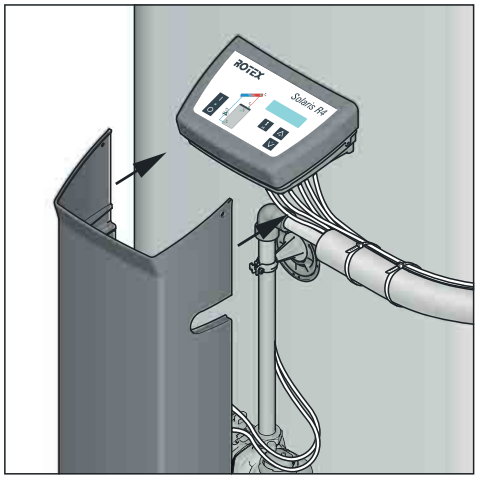


Fig. 4-31 Work step 1

2. Screw the covering hood to the controller housing on both sides using countersunk head screws.

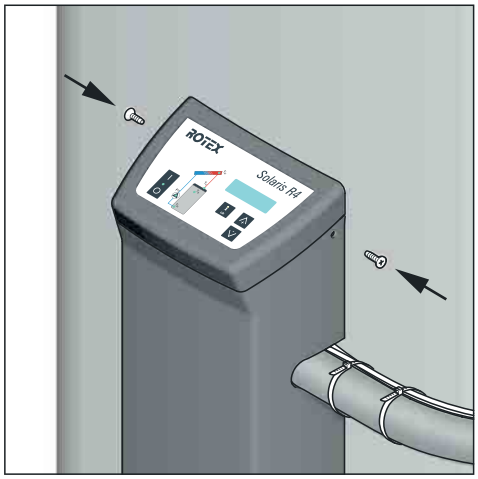


Fig. 4-32 Work step 2

3. Fix the covering hood to the storage tank connection bracket that is located underneath. Carefully screw the self-tapping fixing screw (pre-installed in the covering hood) over the depression in the lower section of the housing front and then insert the covering cap.

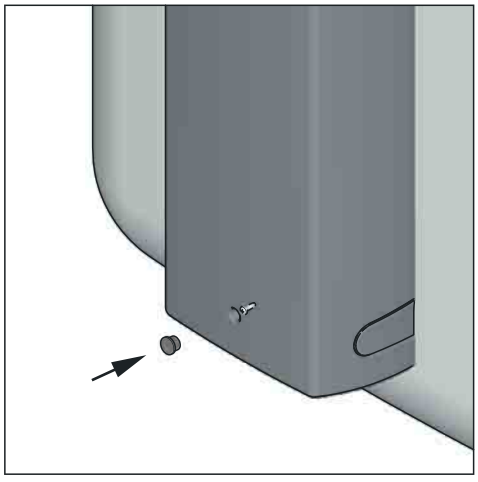


Fig. 4-33 Work step 3

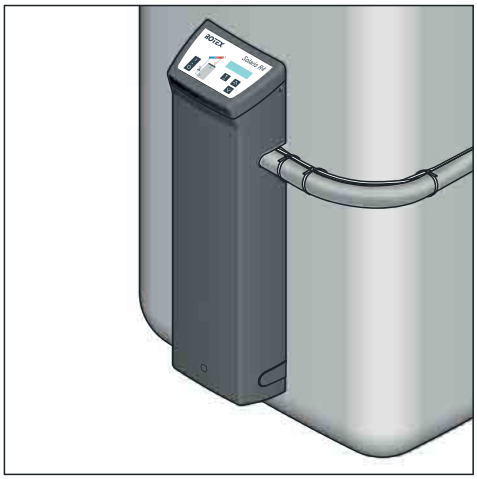


Fig. 4-34 Completely installed RPS4

4.3 Linking several solar storage tanks

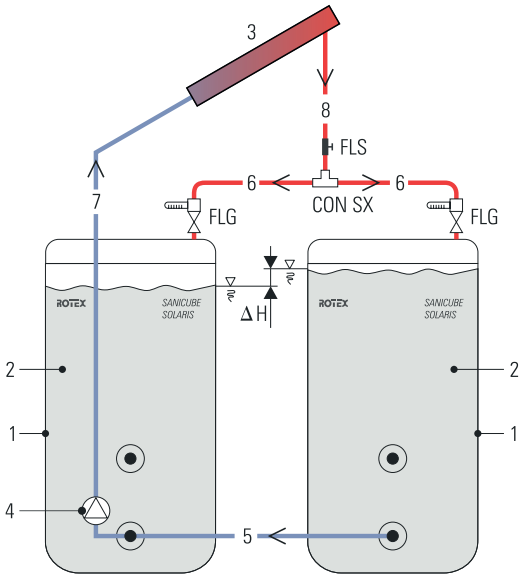
The ROTEX-storage tank extension is a system of connecting lines and permits parallel linking of several hot water storage tanks for use in the ROTEX solar system.

The solar storage tank extension kit CON SX (**16 01 20**) can be used to link, per Control and pump unit RPS4, 2 hot water storage tanks used for solar systems (fig. 4-35). It is possible to link a maximum of 3 hot water storage tanks to produce a storage tank battery (solar storage tank extension kit 2 for a third hot water storage tank - CON SXE (**16 01 21**).

The optional ROTEX FlowGuard FLG (**16 41 02**) ensures even filling of the linked hot water storage tanks. One FlowGuard should be installed per hot water storage tank. The FlowSensor is installed in the common flow (fig. 4-34).

Operating principle

– The solar return is taken from the solar zone of the linked hot water storage tanks via the return connection line (fig. 4-35, item 5).
– The common return is pumped to the solar panel array by the Control and pump unit RPS4 (fig. 4-35, item 4).
– The water is heated in the solar panel array and is directed, as the solar flow, to the hot water storage tank via the flow distribution line (fig. 4-35, item 6).



1 Solar storage tank
2 Non-pressurised area
3 Solar panel array
4 Control and pump unit RPS4
5 Return flow connection pipe (non-pressurised area)
6 Solar flow distribution line
7 Solar return line
8 Solar flow line

ΔH	*Level difference in the de-pressurised storage tank area*
CON SX	*Storage tank extension kit*
FLS	*Flow sensor*
FLG	*FlowGuard*

Fig. 4-35 Operating principle of the common return flow pipe

Installation of storage tank extension for 2 hot water storage tanks

WARNING!

Danger of scalding by releasing the connection lines from the storage tank or when working on the hydraulics on the Control and pump unit (e.g. when changing a pump).

- Empty the storage tank (de-pressurised area) before working on the connecting line or the hydraulics.

CAUTION!

Large volumes of water may come out of the solar storage tank during installation.

- Mount the storage tank extension kit before filling the hot water storage tank (depressurised range) with water.
- If the solar system is to be connected to solar storage tank that is already in operation, the depressurised storage area must first be drained.

1. Mounting the Control and pump unit RPS4 without fitting the hood (see section 4.2).
2. Unscrew the covering cap on the solar return connection from the second solar storage tank.

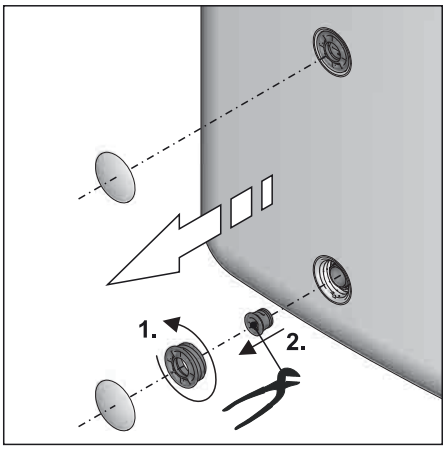


Fig. 4-36 Work step 2

3. Aligning the solar storage tank. The centre-to-centre distance between the storage cylinders must be 830 mm. Note also the recommended wall distance of 200 mm.
4. Preparation of the storage tank connection bracket (on the Control and pump unit RPS4).
   - Remove the holding bar on the extension side and remove the ball valve or blind plug, depending on the existing structure.
   - Adjusting the desired operating position:
   – X2: storage tank extension on the right-hand side, fig. 4-38.
   – X4: storage tank extension on the left-hand side, fig. 4-40.
   – X1: without storage tank extension, fig. 4-42 (standard ex works)

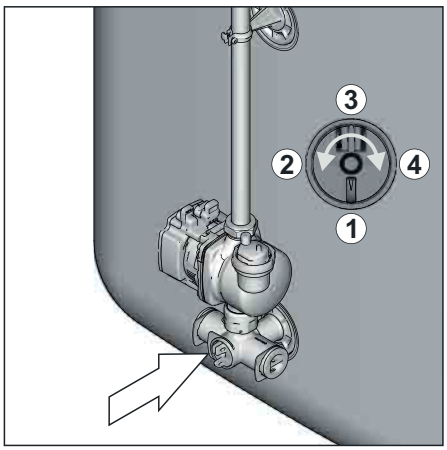


Fig. 4-37 Work step 4

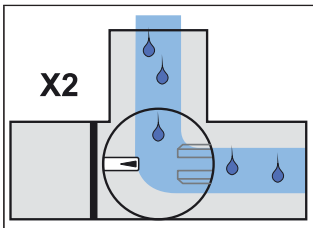


Fig. 4-38 Operating position with right-hand storage tank extension

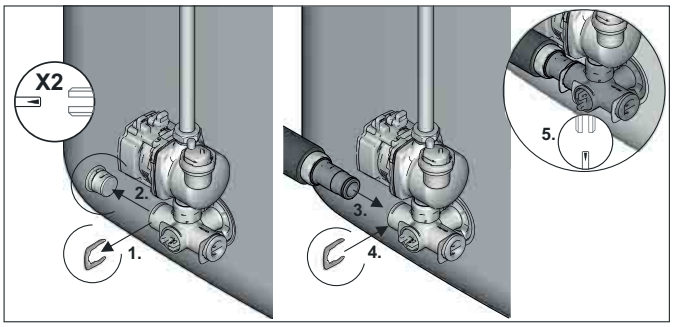


Fig. 4-39 Storage tank extension on the right-hand side

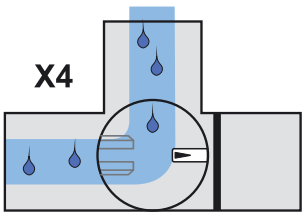


Fig. 4-40 Operating position with left-hand storage tank extension

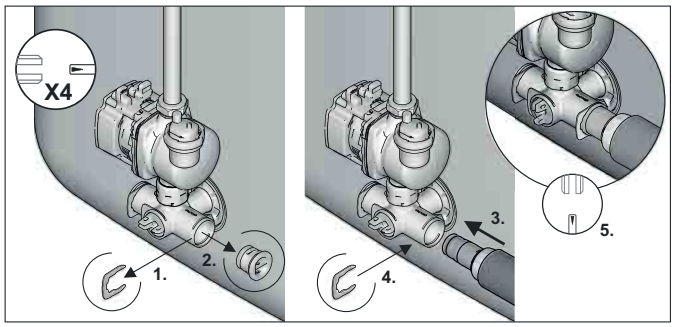


Fig. 4-41 Storage tank extension on the left-hand side

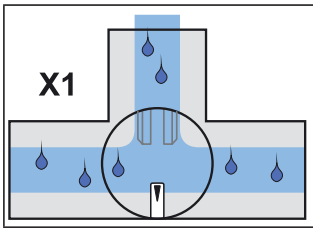
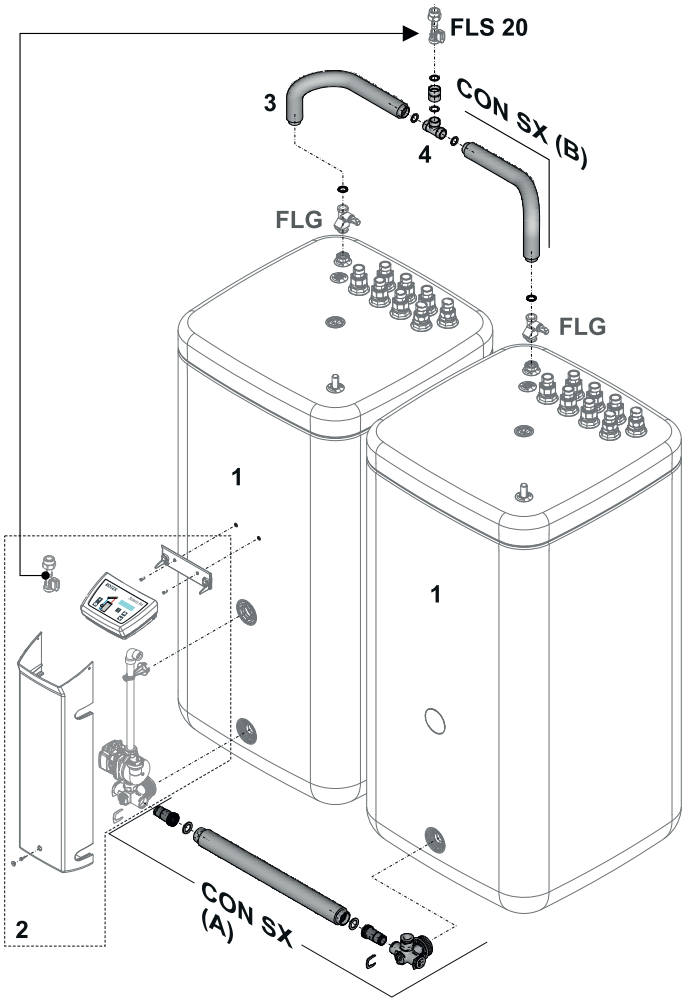


Fig. 4-42 Operating position without storage tank extension

5. Mount the removed plug on the return connection line pre-installed by ROTEX on the second storage tank connection bracket.
6. Insert the return line, completed in this way, in the free outlet of the storage tank connection elbow of the Control and pump unit RPS4 using the free plug fitting (Ø 28).
7. Fix the return line to the return connection of the second hot water storage tank.
8. Remove the lower covering lid on the relevant side from the covering hood.
9. Fit the covering hood to the hot water storage tank (see chapter 4.2.5).
10. Fit a FlowGuard (optional) to the solar flow connections on the storage tank (see chapter 4.2.2).

11. Fit the flow distribution lines left and right to the connection T-piece (fig. 4-43, item 3 + 4).
12. Place gaskets on both FlowGuards and screw the flow distribution line to the two FlowGuards using union nuts.
13. Position seal on the connecting t-piece and screw on the double swivel nut (1").
14. Position seal in double swivel nut (1").
15. Mounting the FlowSensor (see chapter 4.2.2).



1 *Solar storage tank*
2 *Control and pump unit RPS4*
3 *Solar flow distribution pipe*
4 *Connecting T-piece*

CON SX (A) *Storage tank extension kit (bottom)*
CON SX (B) *Storage tank extension kit (top)*
FLS *Flow sensor*
FLG *FlowGuard*

Fig. 4-43 Installation of storage tank extension for 2 Solar storage tank (shown on 2 Sanicube Solaris)

When extending to the maximum three storage tanks, you must take note of the installation instructions for the storage tank extension kit 2 CON SXE (1**6 01 21**).

5 Start-up and decommissioning

5.1 Start-up

WARNING!

The solar system cannot be started until all hydraulic and electrical connections have been completed.

Incorrect commissioning will impair the system's function, and can lead to damage to the entire installation. Installation and start-up must therefore must conducted by ROTEX-authorised and trained heating experts.

CAUTION!

Commissioning in frosty conditions can result in damage to the entire heating system.

- Commissioning at outdoor temperatures below 0 °C only with a guaranteed water temperature of at least 5 °C in the solar circuit (e.g. prior heating of the hot water storage tank).

ROTEX recommends that you avoid operating the system in extremely frosty conditions.

All the following work must be carried out in the specified sequence.

1. Filling the storage cylinder:
   - Filling the heat exchanger for domestic water.
   - Fill buffer storage volume via the filling and draining valve (**KFE BA, 16 52 15**) on the Control and pump unit RPS4 until water comes out of the safety overflow.
   - Close the filling and draining valve (**KFE BA, 16 52 15**).
2. Switch on the Solaris R4 controller.
   ➔ The initialisation phase starts.
3. When the initialisation phase is finished (temperature display), fill and vent the solar system by simultaneously pressing both arrow keys (starting manual mode).
   ➔ The solar operating pump P_S now runs at full power and the solar system is exposed to the maximum possible operating pressure. The solar system fills, the air escapes through the flow line into the air compartment of the storage tank.
4. Check the entire system for leaky joints (in the building and on the roof). Seal any leaks that occur in a professional manner.
5. Switch off the Solaris R4 controller.
6. Check the filling level in the hot water storage tank.

Within a few minutes after switching off and emptying of the solar system, the fill level indicator in the hot water storage tank once again reach almost to the fill level.

- The reason for a slightly lower fill level is the remaining of a small volume of water in the lower collection pipes in the panels. If the solar panels are correctly aligned, this volume of water is not dangerous for the panel, even under the effects of frost, since there is adequate space for expansion.
- If the fill level remains considerably below the fill level, this can be an indication of undiscovered leaks or faulty line routing (water pockets). In this case you must undertake a very careful check of the system again.

7. Adjusting the filling time:
   - Switch the Solaris R4 controller on again (initialisation phase starts).
   - When the initialising phase is finished (temperature display), you can start the manual operating mode by simultaneously pressing both arrow keys.
   - Measure the time it takes to fill the solar system completely. The system is fully filled when you can no longer hear any air noises and a steady value for the flow rate is displayed (activate the measuring point "Flow rate" using the arrow keys).
   - Set the measured time plus 20 s at the parameter "Time P2" (see section 6.3.6).
8. Switch the Solaris R4 controller to automatic mode by simultaneously pushing both arrow keys or by switching off and on again.
   ➔ The solar system is now ready for operation.

The correct flow rate in the solar circuit is set automatically by regulating the speed of the solar operation pump P_S.

9. Only when connecting a Control and pump unit RPS4 to several solar storage tanks:
   - The entire flow rate, measured with the FlowSensor in the solar flow line, must be distributed evenly to all the connected solar storage tanks. We recommend using a FlowGuard (FLG) at each storage tank for regulation purposes.
10. Instruct the user, fill out the acceptance report, and send it to the address indicated on the rear cover of this manual.

5.2 Decommissioning

5.2.1 Temporary shutdown

CAUTION!

A heating system which is shut down can freeze in the event of frost and may suffer damage.

- Drain the heating system that is shut down if there is danger of frost.

CAUTION!

Pumps that remain switched off for an extended period can seize up.
With temporarily shut-down solar systems, the protection function from seized pumps (pump kick function) is also deactivated.

- Check for correct pump function when re-starting. Seized pumps can normally be released again manually.

The ROTEX solar system can be shut down temporarily by switching the main switch off on the Solaris R4 controller or by separating the mains plug from the power supply.

If there is a danger of frost:

– the ROTEX solar system must be taken into operation again
or
– suitable antifreeze measures must be applied to the connected heating system and hot water storage tank (e.g. draining).

If the danger of freezing will only last for a few days, the very good heat insulation of the ROTEX means that it need not be drained, as long as the storage tank temperature is observed regularly and not permitted to fall below +3 °C. This does not, however, provide any protection against frost for the connected heat distribution system!

Draining the storage tank

- Separate all power circuits of the solar and heating system from the power supply and secure against inadvertent switching on again.
- GCU compact only: Close gas stopcock.
- Connect the drain hose to the filling and draining valve (**KFE BA, 16 52 15**) (fig. 5-1, item A) and run to a drainage point that is at least soil deep.

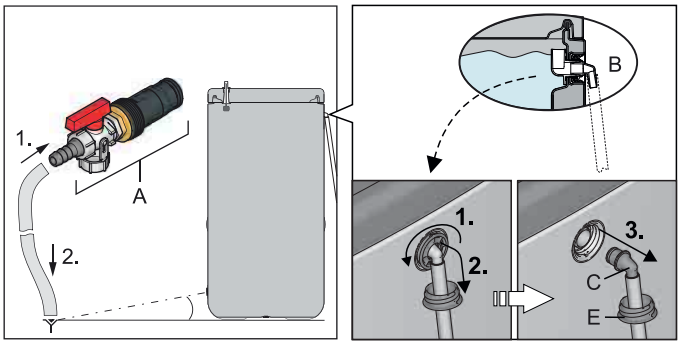


Fig. 5-1 Connecting the drainage hose

- Adjust the valve insert on the connecting angle so that the path to the blind plug is blocked off (fig. 5-2).
- Remove the blanking plug from the connecting angle (fig. 5-2) and place a suitable collection trough beneath the unit.

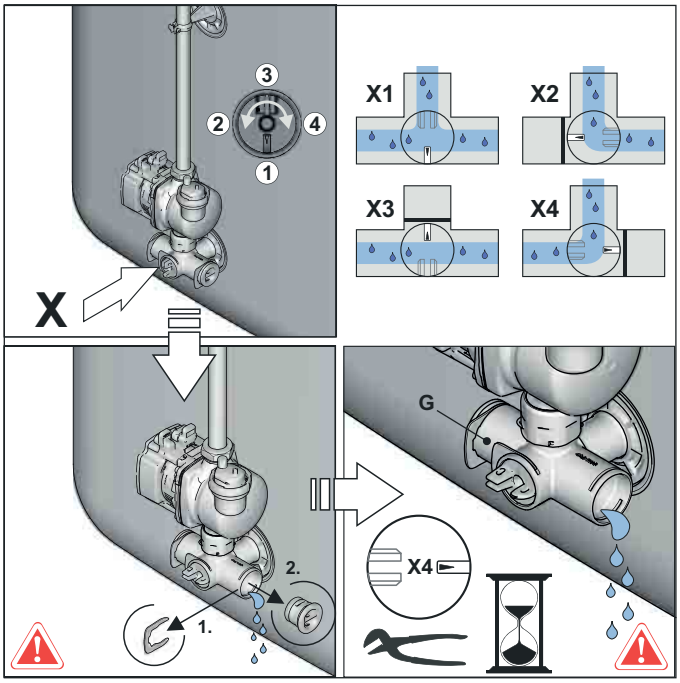


Fig. 5-2 Shutting off the valve insert and removing the blanking plug from the connecting angle

- Insert the **KFE filling connection** (**KFE BA, 16 52 15**) into the connection elbow and secure with the clamp (fig. 5-3).

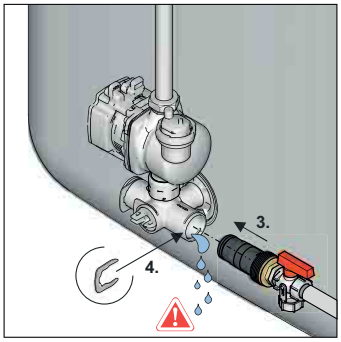


Fig. 5-3 Assembling the KFE filling connection in the connecting elbow

- Open the KFE valve on the **KFE filling connection** (**KFE BA, 16 52 15**).
- Adjust the valve insert on the connecting angle so that the flow to the drain hose is opened (also refer to fig. 5-2) and drain the water content of the storage tank.

5.2.2 Final shutdown

- Take the ROTEX solar system out of service (see chapter 5.2.1 "Temporary shutdown").
- Control and pump unit RPS4 disconnected from all electrical and water connections.
- Control and pump unit RPS4 to be dismantled in accordance with the instruction manual (chapter 4 "Installation") in reverse order.
- Control and pump unit RPS4 disposed off in a professional manner.

Recommendations for disposal

Thanks to the environmentally friendly design of the solar system, ROTEX has complied with requirements for environmentally sound disposal. During the disposal process, the only waste created is that which can be used for material or thermal recycling.
The materials used that are suitable for recycling can be sorted into individual types.

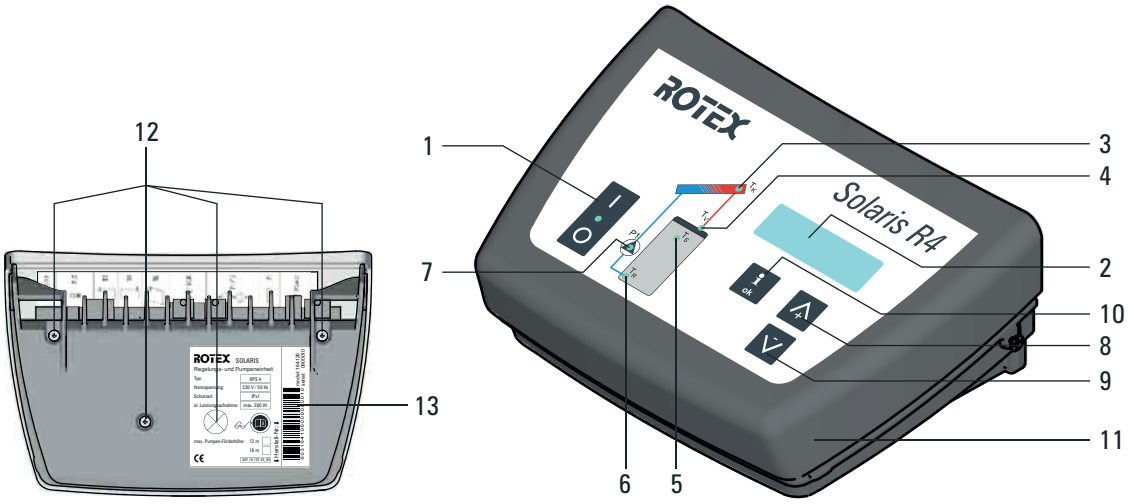
The designation of the product means that electrical and electronic products may not be disposed of together with unsorted domestic waste.
Proper disposal in compliance with the respective national regulations of the country of use is the responsibility of the user/owner.

- Disassembly of the system, handling of coolant, oil and other parts may only be carried out by a qualified fitter.
- Disposal may only be carried out by an organization that specialises in reuse, recycling and recovery.

Further information is available from the installation company or the responsible local authorities.

6 Control

6.1 Operating and display components



1	*Main switch with indicator light*	**7**	*Operating status light for speed-controlled solar operating pump P_S (lights up when pump running - flickers if the pump is running in a restricted condition)*	**10**	*Information key for accessing the information level (displays measured values, maximum values and calculated values) and OK key for confirming and storing settings in the setting menu*
2	*Display of temperature and parameter display (energy saving function: Display illumination is switched off 10 minutes after the last key actuation)*	**8**	*Up arrow for moving the temperature or parameter display up by one setting/increasing parameter settings*	**11**	*Controller housing*
3	*Light for collector temperature display*	**9**	*Down arrow for moving the temperature or parameter display down by one setting/decreasing parameter settings*	**12**	*Locking screws for device housing (back)*
4	*Light for solar flow temperature and flow measurement (FLS)*			**13**	*Type plate*
5	*Light for storage cylinder temperature display*			⚠	*Unit may only be opened by an authorised technician. Remove the plug before opening!*
6	*Light for solar return flow temperature display*				

Fig. 6-1 Operating and display elements

6.2 Controller operating principle

The Solaris R4 controller has been fitted with an update function for optimum use of the solar system, based on continuous improvements. Therefore, some functions described in this chapter are applicable to specific software versions only. These functions are indicated separately by symbols.

Software updates for the Solaris R4 controller must only be carried out only by the ROTEX service technician.

The mains switch completely separates the Solaris R4 controller from the mains power. Switching of the mains switch takes more effort in pushing the button than is required for actuating the operating buttons.

6.2.1 Pump operation

The solar system is operated fully-automatically all year round without the need for manual intervention. The speed-controlled pump operation is controlled by the Solaris R4 controller. The operating and display elements are shown in fig. 6-1.

Criterion for actuation:

– Pump operation depends on the continuously measured temperature difference between the solar panel (T_K) and the return flow temperature (T_R) and a comparison with the set value of the parameter "Delta T on".
  The solar operating pump P_S switches on if the temperature difference ($=T_K - T_R$) exceeds the value set in the parameter "Delta T on" (e.g. return temperature = 40 °C and "Delta T on" = 15 K; solar panel temperature > 55 °C).

Criteria for switching off:

– The solar operating pump P_S switches off if the temperature difference falls below the value set in the parameter "Delta T off".
  1. Possibility: Normal switch-off if the "Filling time" (parameter "Time P2") has expired and the temperature difference between the flow and return temperatures achieves the switch-off condition ($T_V - T_R$<"Delta T off").
  2. Possibility: Rapid switch-off if the solar panel cools off too quickly within the "Filling time" (parameter "time P2") ($T_K - T_R$<"Delta T off").

If there is active frost protection (T_K<0 °C within the last 24 h) there will be no rapid switch-off. The solar operating pump P_S is operated for an extended period, so that the connecting lines are heated up to such a temperature that does not permit the formation of ice plugs.

In this case, however, a considerably higher solar panel temperature must be achieved before the solar operating pump P_S switches on.

– Achieving the maximum storage tank temperature set via parameter "T_S max" ($T_S$indicator flashes). In this case, restarting the solar operating pump P_S is only possible if the storage tank temperature has fallen by more than 2 K.
– Achieving the maximum permissible solar panel temperature (T_K-light flashes) set using the parameter "$T_K$perm". In this case, restarting the solar operating pump P_S is only possible if the solar panel temperature has fallen below the parameter value "T_K perm" by more than 2 K.
– Faulty FlowSensor.

6.2.2 Booster function for high solar panel temperatures

From a solar panel temperature of "T_K max" = 70 °C (booster temperature), the output of the solar operating pump P_S is increased in steps.

➔ This increases the system pressure as well as the flow quantity, which enables more heat to be stored within a shorter time.

The booster temperature can be changed by the heating expert using the parameter "T_K max". This increase in output is switched off again automatically if the booster temperature falls by 5 K.

6.2.3 Start optimisation

Start optimisation prevents too frequent cycling and reduces the power consumption. This is a self-inhibiting function (activated in the factory).

The switch-on condition (see section 6.2.1) is supplemented by a variable constituent (VAR):

DT on + VAR >= T_K - T_R.

With the function activated, the current spread TV - TR is assessed after the filling time (parameter "Time P2"). The existing value of VAR is updated based on this measurement. Three cases must be differentiated:

– If the spread is above the top limit OG_{VAR}, VAR is reduced by the step size ΔVAR.
  ➔ The next filling thus starts at a lower temperature difference T_K - T_R.
– If the spread is below the bottom limit UG_{VAR}, VAR is increased by the step size ΔVAR.
  ➔ The next filling thus starts at a higher temperature difference T_K - T_R.
– If the spread is between the threshold values, the current value of VAR is retained.

6.2.4 Switch-on block functions

The switch-on block functions prevent:
– switching on again if, because of reaching the set maximum storage tank temperature "T_S max" the solar system has been automatically switched off (T_S light flashes).
– pump operation with activated "intensified frost protection function" (star symbol flashes in the display - see section 6.2.11).
– Pump operation, if the solar panel temperature exceeds the adjustable value set by the heating expert by parameter "T_K zul" (T_K indicator flashes).

After switching off the solar operating pump P_S as a result of the maximum storage tank temperature, continuing impingement of the sun's rays on the solar panel can cause temperatures of over 100 °C. If the storage tank temperature falls below the release temperature ("T_S max" – 2 K), (e.g. by the removal of hot water), the solar operating pump P_S is only switched on again if the temperature at the solar panel falls below the value set with the parameter "T_K perm" of the set restart protection temperature by 2 K.

The function blocking time ensures that the solar operating pump P_S is only released again, after the occurrence of a switch-off condition, after expiry of the blocking time (0 - 600 secs.) set in the parameter "Time SP".

This means:
– the cycling of the solar system can be minimised.
– the solar panel can achieve a higher temperature.
– when filling the solar system, the flow temperature does not fall below the switch-off condition and the system regulates itself more quickly.

If the solar operating pump P_S is switched on at solar panel temperatures over 100 °C (T_K perm > 100 °C), the return water vapourises as soon as it reaches the solar panel. The dissipation of the thermal over-capacity in the solar panels and the associated boiling noises created by vapourisation can last for several minutes.

The water vapour escapes in a depressurised manner into the solar storage tank in a correctly installed solar system, where it condenses again to a large extent. A slight increase in the consumption of buffer water, caused by the escaping unpressurized water vapour, is a normal operating condition.

6.2.5 Pump kick function

During extended shut-down periods, the solar operating pump P_S is activated for a few seconds every 24 hours.

This prevent s the solar operating pump from seizing up.

6.2.6 Manual operation

Exclusively for commissioning and test purposes, the system can be switched on manually for the time period saved in the parameter "H/A". All the regulation functions are switched off and the solar operating pump P_S runs continuously, independent of the system temperatures, at the set output stage.

- Pressing (>1 s) both arrow keys simultaneously activates or deactivates manual operation.

CAUTION!

Uncontrolled manual operation can lead to heat loss, excessively high storage tank temperatures and, under certain cold situations, even to frost damage.

The manual mode cannot be activated with active "enhanced frost protection function" (star symbol in display flashing - see section 6.2.10).

6.2.7 FlowSensor

The FlowSensor (FLS) serves to measure the flow rate "V" and the flow temperature "T_V".
With the sensor connected and working:
– the measurement values "V" and "T_V" are displayed.
– the controller operates after the filling process with the real spread T_V - T_R.

If the system has detected the FlowSensor once, the display shows an error message if a sensor is faulty or is disconnected (see chapter 7.1 "Display of events"). The system then works in the emergency mode without the FlowSensor.

If the controller detects a FlowSensor after a new installation or a technician reset, the value "20" is set automatically in the parameter "FLS active".

The correct parameter value for the FlowSensor fitted to the system must always be checked and adjusted if necessary (see tab. 6-1). The Flow Sensor can be disabled by input of the parameter value "0".

If the heating expert deactivates the FlowSensor, then no fault signal will appear. The control system now operates without the measured value for the flow. The feed temperature "T_V" is set to be equal to the solar panel temperature "T_K".

FlowSensor type	Parameter value "FLS active"	Minimum flow Start phase "V1" in l/min	Minimum flow operating phase "V2" in l/min
As required	0	FLS deactivated - no flow rate	
FLS12 (on request)	12	1.5	1.0
FLS 20 (included in scope of supply)	20*	2.0	1.5
FLS 40 (on request)	40	4.0	2.5
FLS 100 (on request)	100	10.0	5.5

Tab. 6-1 Overview of FlowSensors

**automatically set value with detected FlowSensor*

6.2.8 Output calculation, maximum values, and yield count

The balancing and calculation of the system operating data (e.g. solar heat yield) does not replace a calibrated thermal energy meter. These values may not be used for invoicing heating costs or similar legally valid accounting purposes.

If a FlowSensor is connected, the system operating data is calculated and balanced, such as the current heat output and the solar heat yield. The maximum and calculated values can be called up o the display (see chap. 6.3). Values greater than "0" that have not been deleted will continue to be displayed even after removal or deactivation of the FlowSensors (without further updates).

6.2.9 Speed regulation of the solar operating pump P_S

After reaching the switch-on conditions, the SOlaris R4 controller leaves:

– the actuation of the solar operating pump P_S at full output for filling the solar system. This takes place dependent on the set parameter value "Time P2" in [secs].

➔ If the correctly adjusted FlowSensor detects a steady flow before this time has expired, the solar system is completely filled with water.

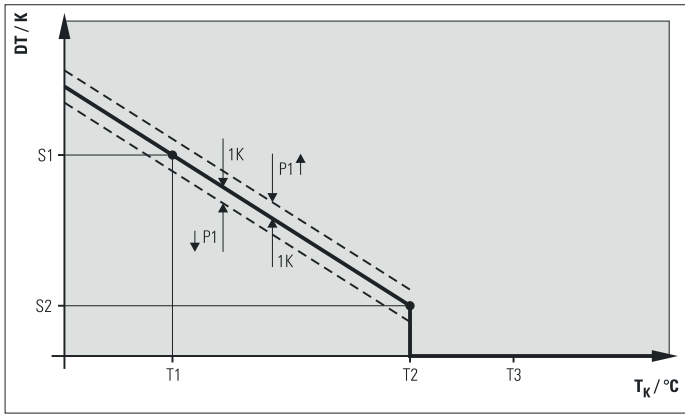
– the actuation of the solar operating pump P_S at full output up to possible maximum flow rate of the system.

– the stepless output reduction of the solar operating pump P_S, until the calculated target spread "DT" maintains the set value in accordance with fig. 6-2, or until the flow rate falls below the minimum flow rate V2 (fig. 6-3 and tab. 6-1).

– the stepless increase in output of the solar operating pump P_S after a safety period "t_2" (fig. 6-3).

If the pump output is too low, the flow in the solar circuit can collapse as a result of system and temperature influences. If the flow rate falls below the value "V2" (fig. 6-3 and tab. 6-1), the controller detects a flow rate breakaway, the last valid output stage is saved as the minimum pump output value. Lower pump output stages are automatically blocked.

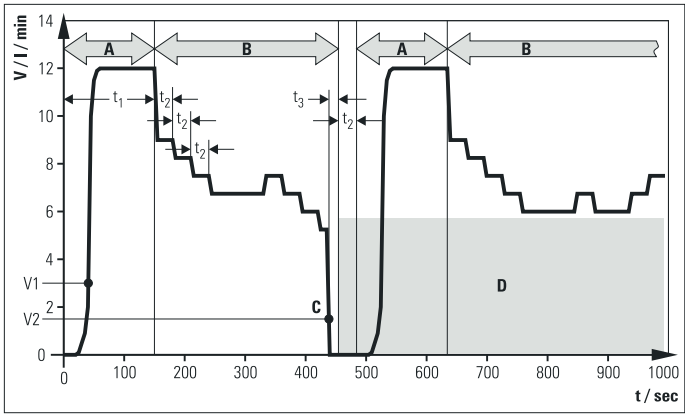
The temperature-dependent output regulation of the solar operating pump P_S then takes place between the determined minimum and maximum outputs. The spread of "T_V" and "T_R" (=T_V – T_R) is measured continuously and compared with the target spread "DT". If the temperature spread between "T_V" and "T_R" is too great, the pump output (max. 10 stages) and thus also the flow rate through the solar panel is increased until the target spread is achieved. If the spread is too small, the pump output is reduced (fig. 6-2). The current pump output is displayed during its active running time in the operating display "Throughput", next to the throughput measured value in percent. A typical operating sequence of a modulating solar system is shown in fig. 6-3.



DT *Target spread (calculated for the operating point)*
P_S *Solar operating pump*
S1 *Top target spread ("Spread 1")*
S2 *Bottom target spread ("Spread 2")*
T_K *Collector temperature*
T1 *Frost protection temperature ("T frost")*
T2 *Booster temperature ("T_K max")*
T3 *Restart protection temperature ("T_K perm")*
— *Target spread*
- - *Switching limits for pump modulation*
Pump output is increased
Pump output is reduced

Fig. 6-2 Pump output control as a function of temperature difference

Controller is switched off and back on again:
– automatically blocked pump stages are released again.
– the system is automatically regulated again.
– manually blocked pump stages (see chapter 6.3.8) remain blocked.



A *Start phase*
B *Operating phase (modulation)*
C *Interrupted flow*
D *Low pump output stages are automatically blocked after a flow breakaway*
P_S *Solar operating pump*
t *Time*
t_1 *Minimum running time of solar operating pump P_S at maximum output ("Time P2")*
t_2 *Stabilisation time*
t_3 *Interruption detection period (10 s)*
V *Solar circuit flow*
V1 *Minimal flow rate in the start phase*
V2 *Minimal flow rate in the operating phase*

Fig. 6-3 Example for modulation operation with flow-caused block of low pump stages on systems with FlowSensor

6.2.10 Total Reset Function

A total reset deletes all individual settings and the event memory is deleted. All calculated values (info parameters) are set to zero.

If this total reset function is triggered via the menu path, the total thermal yield remains. This value is also deleted using the quick access via the button combinations.

The device reacts to a total reset with a new start (self-test), all parameters are reset to the factory settings and then all the blocked pump output stages are released. The reset takes place:

- Via menu path: Activation by heating expert in the "System" setting menu.
- By quick access: Simultaneous pushing of the OK and arrow keys.

6.2.11 Frost protection function

As soon as the solar panel temperature "T_K" falls below "T frost" (factory determined frost protection temperature), the frost protection function is activated. It remains activated for 24 h after the limit temperature has been exceeded.

While frost protection is active a star icon is shown in the standard temperature display.

Fig. 6-4 Operating display with active frost protection

The solar system only starts up with active frost protection if the switch-on condition is fulfilled and the solar panel temperature "T_K" exceeds the value "T_K save" (factory setting 70 °C). The solar operating pump P_S, after switching on, runs at least for the time defined in the parameter "Time P2", even if the switch-off temperature condition is reached before that.

If necessary, (e.g. for long connecting lines outdoors), this minimum start run time can be extended by the heating expert by an adjustable time ("Time frost"). This prevents the build-up of ice in the connecting pipe.

The status of the frost protection function "FR active" shows whether the function is activated or deactivated (fig. 6-7). The heating expert can switch the function on and off manually.

The position of the solar panel temperature sensor can be adjusted in the parameter "TK_{pos}".

For optimising the frost protection, the solar panels must be installed with the sensor position "Bottom".

The parameter "TK_{pos}" must be set to the actual mounting position of the solar panel temperature sensor (see section 6.3.7).

Enhanced frost protection function

As soon as the Solaris R4 controller detects a solar panel temperature "T_K" under -5 °C (non usable parameter "T frost off"), the enhanced frost protection function becomes active. This completely blocks the pump operation - also in manual mode.

The function remains active for another 24 hours after exceeding this threshold temperature.

The enhanced frost protection function is indicated by a flashing star symbol on the display of the Solaris R4 controller. **The function cannot be switched off manually.**

6.2.12 Leak protection function

If, after switching on the solar operating pump P_S and expiry of the filling time "Time P2", a minimum flow start phase "V1" in accordance with tab. 6-1 is not detected at the FlowSensor, then there may be:

– a defect of the FlowSensor, or
– a leak in the solar system.

In order to prevent the entire buffer water volume from being pumped out of the system, the solar operating pump P_S is switched off for 2 hours, and the error message "W" flashes in the left-hand column on the display.

If this fault occurs 3 times in a row, without reaching the minimum flow rate start phase "V1" in the interim, the solar operating pump P_S switches off long-term and the error message "F" appears in the left-hand column on the display.

- Replace the defective FlowSensor or repair the leak.
- Delete the error messages by "Switching OFF/ON" on the main switch.
  ➔ The system is then ready for operation again.

6.3 Adjustment and menu guide

Tab. 6-2 shows an overview of the available measuring points and the associated display formats. Tab. 6-3 summarises the views of the calculated parameters.

Measuring point	Designation Display	Measuring range	Resolution	Sensor
T_K	Collector temperature	-30 to 250 °C	1 K	Pt 1000 temperature sensor
T_R	Return flow temperature	0 to 100 °C	1 K	PTC temperature sensor
T_S	Storage cylinder temperature	0 to 100 °C	1 K	PTC temperature sensor
T_V	Flow temperature	0 to 100 °C	1 K	FlowSensor (all types) with voltage output 0.5 to 3.5 V
V	Flow	0.0 to 12.0 l/min	0.1 l/min	FlowSensor FLS12 with voltage output 0.36 to 3.5 V
		0.0 to 20.0 l/min		FlowSensor FLS 20 with voltage output 0.36 to 3.5 V
		0.0 to 40.0 l/min		FlowSensor FLS 40 with voltage output 0.36 to 3.5 V
		0.0 to 100.0 l/min		FlowSensor FLS 100 with voltage output 0.36 to 3.5 V

Tab. 6-2 Overview of measurement points

Parameter	Designation	Value range	Resolution	Remark
T_K max	Max. measured collector temperature	-30 to 250 °C	1 K	–
T_K min	Min. measured collector temperature	-30 to 250 °C	1 K	–
V max	Maximum flow rate	0.0 to 12.0 l/min	0.1 l/min	Maximum flow measured during filling
		0.0 to 20.0 l/min		
		0.0 to 40.0 l/min		
		0.0 to 100.0 l/min		
PS	Peak output	0,0 to 99.9 kW	0.1 kW	Maximum value from 5 min output average
PS (15h)	Peak value of the day	0,0 to 99.9 kW	0.1 kW	Maximum value of the peak output within the last 15 hours
W (15h)	Daily thermal yield	0.0 to 999.9 kW	0.1 kWh	Thermal yield within the last 15 hours
W	Total thermal yield	0.0 to 9999.9 kWh or 10.000 to 99.999 MWh	to 0.1 0.001 kW	Total solar thermal yield determined from the momentary output
P	Momentary output	0,0 to 99.9 kW	0.1 kW	Mean value during the last minute
DT	Target spread	1 to 15 K	1 K	Nominal temperature difference T_V–T_R at modulation operation (calculated)
P1	Output stage in normal mode	0 to 100 %	1 %	–
Min. stage	Smallest released output stage P1	1 to 10 0 to 100 %	1; 1 %	Only accessible for an expert (see fig. 6-7)
Stage ‘On’	Running time for the solar operating pump P_S	0 to 99999 h	1 h	Only accessible for an expert (see fig. 6-7)
VAR	Variable step width for optimised switch-on condition	0 to 10	1 K	–

Tab. 6-3 Info parameter (maximum values and calculated values)

6.3.1 Display during start-up

After switching on, the Solaris R4 controller performs a self-test where the display elements are actuated in a targeted manner and the setting parameters of the user level are displayed. The following testing steps are carried out, and the results displayed for about 2 seconds (fig. 6-5):

– Immediately after switching on, the start display appears which shows the installed software version and the serial number of the device.
– During initial commissioning, the desired display language is queried.
– After this, the current parameter settings which the user can change are displayed.
– When the operating display appears, the self test is complete.
– The functions of the solar operating pump P_S and their operating status lights can only be tested manually, for safety reasons (see section 6.2.6).

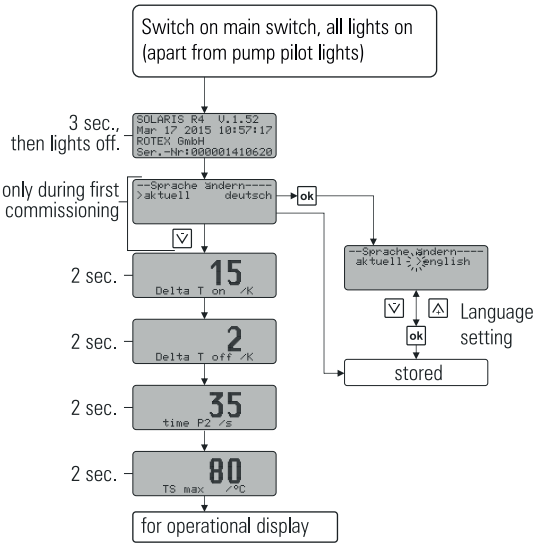


Fig. 6-5 Display during start-up

6.3.2 Display during operation

During operation, the display shows the system temperatures, maximum values, and calculated values. After the start display, the Solaris R4 controller is automatically in the operating display mode, an operating value is displayed and the associated light comes on.

- You can navigate between the four temperature measured values and the flow measured value (see tab. 6-2 and tab. 6-6) by pushing the arrow keys.
- Pressing the Info key displays the maximum values and the calculated values (see tab. 6-3).

The left-hand column of the display serves as a status display:

– "1" in the first line, solar operating pump P_S normal operation active.
– "2" in the 2nd line, solar operating pump P_S active with maximum output (booster).
– "B" in the 3rd line, burner block contact active (see section 6.3.10) or a fault status (see chapter 7.2 "Troubleshooting").
– "H" in the 4th line, manual operating mode.

So long as no manual adjustments are made or an event corresponding to tab. 7-2 produces a different display, the actuated measured value or information display remains active. It is activated again, even after parameter changes or "Switching OFF-ON". If info parameters are displayed, a measuring point check light is not activated.

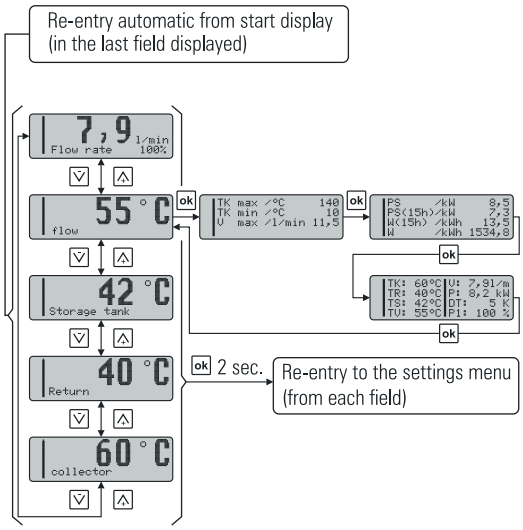


Fig. 6-6 Display during operation

6.3.3 Setup menu

The parameters of the Solaris R4 controller are displayed and changed in the menu.

- Press once (>2 s) on the OK push button to open the menu or to return to the operating display. Briefly pressing the key confirms a selection, opens the next menu item, or displays "Saved" for about 1 second after a value has been changed.
- In the required parameter display press OK to open parameter change mode.

In the menu (fig. 6-7) the active menu path is displayed in the first line, a cursor (">") in the left column indicates the next lower menu path or a parameter. From here, you navigate to the respective menu tree by means of the arrow keys: up (+ key) or down (– key).

The adjusted value can be changed accordingly with the arrow keys. Briefly pressing an arrow key changes the value by one step, and continuous pressing speeds up the change.

If the desired parameter has been changed and the entire parameter list has been scrolled down, you will arrive back to the selection menu "Selection 2/2", and from there into the operating display (see fig. 6-7). The control unit starts working with the changed parameter value(s) immediately. The display always returns to the operating display mode after 10 minutes, provided that no key is pressed during this time.

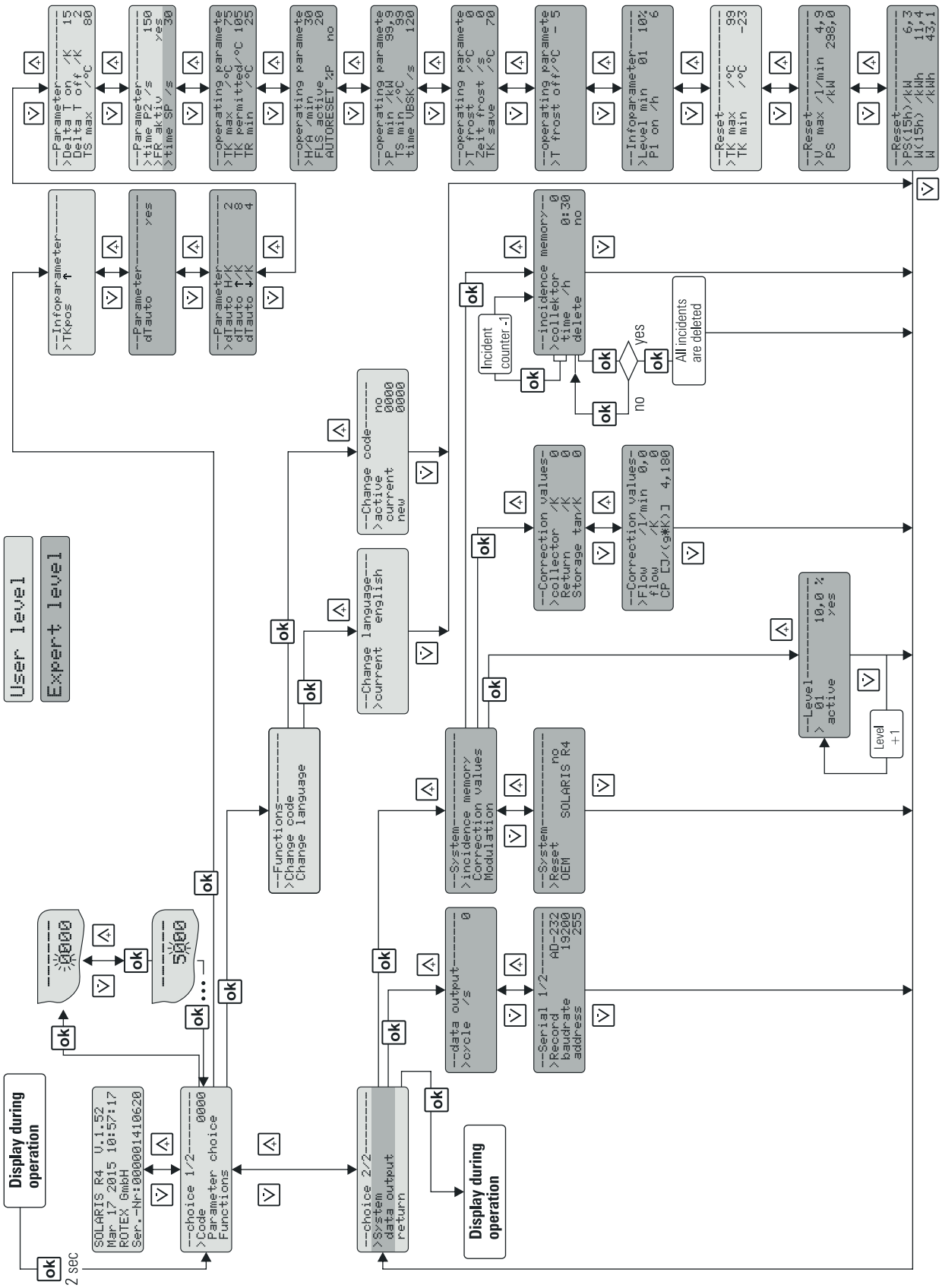


Fig. 6-7 Setup menu

6.3.4 Password input

The technician area of the settings menu is protected by a password, which is entered when opening the settings menu. Also the Operator level can be protected. The user level and the expert level are shown in different colours in fig. 6-7.

Alternative quick access to the setting menu:
After switching the controller on, during the start display, long push on the up arrow key (+).

As long as the system is being operated manually, no further password entry is required. Passwords remain valid for about 10 minutes after the last key has been pressed. After entering the password for the required level, the following display appears for about 2 seconds:
– "User OK",
– "Technician OK" or
– "Password incorrect".

User password

This password is not activated in the factory setting of the Solaris R4 controller. By entering a 4-digit number code, all the parameters adjustable in Operator level are protected against unauthorised access (child protection or caretaker function). The parameters of the user level can only ever be changed with deactivated or valid user password.

A user password can be activated and changed or reassigned in the following menu path: "Selection 1/2" -> "Functions" -> "Change passw." (see fig. 6-7):
- Enter old password into "current 0000" and new into "new 0000". Hereby, every digit must be confirmed with the OK key.
- For a new password, enter the new password in "current 0000" and also in "new 0000".

If the user password is activated, the menu path "Selection 1/2" only shows "Password 0000". The user password only becomes active after 10 mins. or after switching the Solaris R4 controller on again.

Technician password

The password is entered in the menu path: "Selection 1/2" under "Password 0000". It activates all important systems parameters in the settings menu for technicians (see fig. 6-7).

6.3.5 Language selection

During initial commissioning, or after a total reset, the display (fig. 6-5) is retained during the start and a language choice is requested.
- Select a language with arrow keys and confirm with OK.

It is possible to select a different language later on via the menu item: "Selection 1/2" -> "Functions" -> "Change language" to select a different language (see fig. 6-7):

Alternative quick access to the language selection:
Simultaneous pushing of the OK key and the up arrow key (+).

6.3.6 Setting and resetting parameters

Setting the parameters is in accordance with fig. 6-7. All adjustable parameters are shown with access level, adjustment range and factory setting in the tab. 6-5. In the menu path: "Selection 1/2" -> "Parameter selection" -> "Reset" the maximum values and calculated values (see tab. 6-5) can be reset. Hereby, the selected max. value is set to zero immediately with the OK key. The arrow key "Down" cancels this operation, and the cursor goes back to the left. The OK key confirms the selection. Press the down arrow key repeatedly to open "Selection 2/2". Confirming "Back" returns you to the operating display.

Using the menu path: "Selection 2/2" -> "System" -> "Reset" can trigger the total reset function. The system is then restarted (see also section 6.2.10).

A total reset deletes all individual settings and the event memory is deleted. All calculated values (info parameters) are set to zero.

If this total reset function is triggered via the menu path, the total thermal yield remains. This value is also deleted using the quick access via the button combinations.

6.3.7 Setting the mounting position of the solar panel temperature sensor

CAUTION!

Considerable steam generation when switching on again can cause damage to the solar system.

- If the solar panel sensor for DrainBack systems has been mounted at the bottom of the solar panel, in accordance with the installation instructions, the parameter "TK_{pos}" must always be changed over to "↓" (see fig. 6-8).

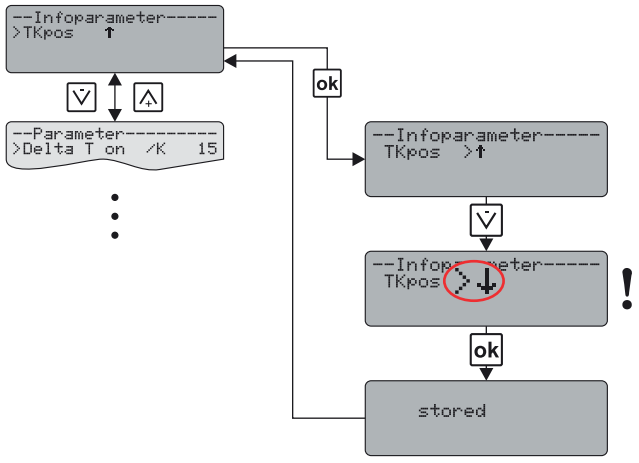


Fig. 6-8 Setting parameter "TK_{pos}" at mounting position solar panel "bottom"

If the solar panel temperature sensor has been mounted at the top on existing solar systems, the factory setting "↑" of the parameter "TK_{pos}" need not be changed.

6.3.8 Manual setting of the pump speed regulation

With certain output stages of the speed-regulated solar operating pump P_S noise problems can sometimes arise. The current output of the selected stage is displayed in the bottom line "Flow rate" in the operating display (see fig. 6-6) as a percentage.

- Make a note of the problematic output stage.
- Using the menu path: "Selection 2/2" -> "System" -> "Modulation" navigate to the "Stage" (see fig. 6-7).

Here, up to 10 speed ranges can be disabled. Next to the reference number of the output stage (starting with 01 for the lowest output) and the operating status, the output of the relevant stage is displayed as a percentage under "Output".

- Noise-intensive stages should be set to "No" in the parameter "Active".
  ➔ The stage is skipped when the solar operating pump P_S is activated. The block remains, even after "Switching OFF/ON the controller. It can be cancelled again by setting the parameter "active" to "yes" or by the total reset function.

6.3.9 Correction values for measuring points

These settings are only accessible after entering the expert password.

If the measured value of a sensor deviates from the real value, it can be adjusted using a correction value.

- Using the menu path: "Selection 2/2" -> "System" -> "Correction values" select the correction parameter (see fig. 6-7) and change in accordance with tab. 6-4.

Designation	Measurement & adjusting range	Factory value	Increment
Collector temperature correction	-9 to +9	0 K	1 K
Return flow temperature correction	-9 to +9	0 K	1 K
Storage cylinder temperature correction	-9 to +9	0 K	1 K
Inflow temperature correction	-9 to +9	0 K	1 K
Flow correction	-2 to +2	0 l/min	0.1 l/min

Tab. 6-4 Correcting values

6.3.10 Burner inhibit contact

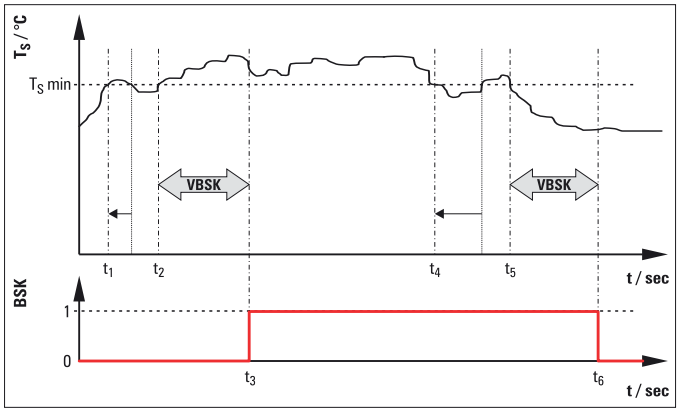
This contact controls an external heat generator in such a way that under favourable weather conditions, the storage cylinder is not heated by the external source. This requires the connection cable BSKK (🛒 **16 41 10**) offered as an accessory. If the solar system reaches a momentary output, adjustable by the heating expert (menu path: "Selection 1/2" -> "Parameter selection" -> "Operating parameter "P min") or if the storage tank heated up to the minimum storage tank temperature adjustable by the heating expert (Operating parameter "T_S min" see tab. 6-5) the burner is deenergised, for example, via a contact. The parameter setting for the burner blocking contact is described in fig. 6-7.

Using the parameter "Time VBSK", it is possible to set a delay in the switching time for the burner blocking contact. The burner blocking contact only switches after expiry of the set delay time when the minimum storage tank temperature "T_S min" is exceeded or if the set minimum momentary output for burner stop "P min" is exceeded (example see fig. 6-9).

In the following example (fig. 6-9) we show a fictional sequence of the storage tank temperature.

At time "t_1" the minimum burner stop temperature, defined in the operating parameter "T_S min", is exceeded for the first time. Since the storage tank temperature "T_S" shortly afterwards falls back below this value, this does not lead to activation of the burner blocking contact.

Since the storage tank temperature "T_S" is constantly exceeded at time "t_2", this leads to activation of the burner blocking contact, with the delay "VBSK" at timet "t_3". In a similar way, the burner blocking contact is only deactivated at time "t_6".



0	*Not active*
1	*Active*
t	*Time*
t_1...t_6	*Discrete times*
BSK	*Burner inhibit contact*
TS	*Storage tank temperature*
TS min	*Minimum temperature for burner stop*
VBSK	*Delay burner blocking contact*

Fig. 6-9 For example: Function of the delay time when initiating the burner blocking contact

6.4 Recommended settings

6.4.1 Standard parameter settings, recommended setting ranges

The following table summarises the factory settings and the possible and recommended setting ranges or the system parameters for the Solaris R4 controller.

Parameter	Designation	Access level	Setting range	Recommended setting range	Factory setting	Increment
TK_{pos}	Solar panel	Specialist	↑ ↓	Real mounting position	↑	—
Delta T on auto	Activation of start optimisation with variable switch-on condition		Off / On	On	On	—
Delta T On	Switch-on temperature difference	Operator	1...80 (>"Delta off")	10 to 15 kW	15 K	15 K
Delta T Off	Switch-off temperature difference		1...20 (>"Delta on")	2 to 5 kW	2 K	1 K
TS max	Maximum storage tank temperature		20 to 85 °C	75 to 85 °C	80 °C	1 K
Time P2	Minimum run time of the solar operating pump P_S at maximum output		10 to 999 kW	Filling time +20 s	150 s	1 s
Time Sp	Blocking time solar operating pump P_S	Specialist	0 to 600 s	—	30 s	1 s
TK max	Booster temperature (maximum solar panel temperature)		20 to 110 °C	—	75 °C	1 K
TK perm	Restart protection temperature (max. permissible operating solar panel temperature)		90 to 250 °C	—	95 °C	1 K
TR min	Minimum return temperature		10 to 60°C	—	25 °C	1 K
T frost	Threshold solar panel temperature for activation of the frost protection function		0 to 10 °C	—	0 °C	1 K
TK save	Minimum solar panel temperature fro release of pump operation with active frost protection function		50 to 80°C	—	70 °C	1 K
Time Frost	Additional start run time of the solar operating pump P_S with active frost protection function		0 to 600 s	—	0 s	1 s
FR active	Status frost protection function		Yes/No	Automatic	No	—
H/A	Automatic resetting from manual to automatic mode		1 to 900 min	—	30 min	1 min
FLS enabled	FlowSensor activation		12 to 100	FLS12: 12 FLS 20: 20 FLS 40: 40 FLS 100: 100	With FLS: 20	12, 20, 40, 100
P min	Min. output for burner stop		0,0 to 99.9 kW	—	99.9 kW	0.1 kW
TS min	Minimum storage tank temperature for burner stop		0 to 99 °C	—	99 °C	1 K
Time VBSK	Delay burner blocking contact		10 to 600 s	—	120 s	10 s
T frost off	Threshold temperature for activation of the enhanced frost protection function for solar panels		-5	—	-5°C	—
AUTORESET%P	Release blocked pump stages every 24 hours		Yes/No	—	No	—

Tab. 6-5 Overview of parameters

During commissioning, the system parameters must be adjusted individually to suit the installed system, and might need fine tuning during subsequent operation. Usually, the system will operate with the default settings.

The following instructions help with determining the setting values and guarantee optimum thermal yield with low power consumption:

- Set the cut-in temperature difference "Delta T on" so the system remains operating after start-up under even solar radiation conditions and does not shut down immediately the solar panels cool down after removing heat. The lower this value can be adjusted, the longer will be the operating periods with a correspondingly higher heat yield. If the switch-on temperature is too low, the solar panel already cools so much during filling that the switch-off temperature difference is not achieved.
  ➔ The pumps are switched off immediately, with resulting lower heat yield and higher power consumption.
- Adjust the switch-off temperature difference "Delta T Off" so that the heat yield obtainable at the switch-off point is higher than the electrical power required to drive the pump.
  ➔ Since the power consumption of the solar operating pump P_S is virtually independent of the size of the connected solar panel array, but the thermal power that can be exploited is directly dependent on the number of solar panels, the parameter value on a few solar panels is set higher, but with multiple solar panels it is set lower.
- The run time "Zeit P2" for maximum output of the solar operating pump P_S to be set so that, in all cases, the total cross-section of the flow line is filled with water. Determine the time from the detection of air noises from switching on the solar operating pump P_S to entry into the storage tank and add a safety factor of 20 secs. The filling period depends on the adjusted flowrate, the number of collectors, system height, and the length of the connecting pipe.
- The max. storage cylinder temperature "TS max" is adjusted according to individual requirements. The higher the value of the parameter, the higher will be the available heat storage capacity, and thus the output potential of the ROTEX solar system.

WARNING!

Temperatures in excess of 60 °C can arise in the solar storage tank.

- Fitting scald protection.
  – Scald protection VTA32 (**15 60 15**)
  – Screw connection set 1" (**15 60 16**)

System switch-on involving steam generation can often be disconcerting for the operator. In order to prevent boiling noises and steam exit, the restart protection temperature "TK perm" is set in the factory. The Solaris R4 controller only switches the solar operating pump P_S on if the solar panel temperature has fallen below the set parameter value by 2 Kelvin. The system operates without forming steam in the solar panels. However, on a cloudless day, this can lead to a situation where the system only switches on again in the late afternoon, although the storage cylinder temperature permits additional heating.

- In order to maximise energy input, set the "parameter restart protection temperature" to a value greater than 100 °C and thus deactivate the restart protection function.
  In this case the system operator should be advised of audible bubbling noises and steam knocking during filling.

6.4.2 Additional settings for your solar system

The following setting instructions apply only to basic setting with fitted FlowGuard:

- Activate manual mode.
- After filling the system completely, set the water flow rate so that each solar panel is transited at 90 to 120 l/h. Influence the flow rate either by setting the speed stage at the solar operating pump P_S or/and by setting the FlowGuard (regulating valve with flow indication). Reference values for correct valve and pump stage settings are listed in tab. 6-6.
- Switch the Solaris R4 controller off after completing the setting.

Number of solar panels	Nominal flow in l/min	Desired flow in l/hour
2	3.0 to 4.0	180 to 240
3	4.5 to 6.0	270 to 360
4	6.0 to 8.0	360 to 480
5	7.5 to 10.0	450 to 600

Tab. 6-6 Setting the flow rate on the FlowGuard (FLG)

For rapid safe filling of the system, always set the solar operating pump P_S to a high speed stage, if the system height H, as the height difference between the solar storage tank installation floor level and the top of the solar panel does not exceed 10 m (in stage 2) or 8 m (stage 1) and an adequate flow rate is achieved.

Even if the flow volume is set correctly, the cut-in temperature difference "Delta T on" and good weather conditions will occasionally shut down the solar system. With a rising or setting sun, and an increasing storage cylinder temperature, the collector temperature gradually falls after the pumps have been switched on, i.e. the switch-off conditions are met. The continuing solar radiation will increase the temperature of the solar panels, the pumps will operate and the system will cycle because the solar radiation is no longer sufficient for continuous operation. The FlowSensor reduces this effect by pump speed regulation.

6.4.3 Setting recommendation for the post-heating via external heat sources or by the electrical immersion heater, burner blocking contact

For the highest performance potential:

- Heat the solar storage tank only infrequently and then only to a just adequate temperature via the external heat source or electrical immersion heater.
- Restrict charging times via the timer programmes:
  a) Determine the optimum times for "normal use" by regular consumption habits.
  b) enable supplementary heating for 1/2 to 2 hours before usual usage time depending on the external source.
- The charging time should be limited so that the storage cylinder does not need to be directly heated after a normal consumption cycle.

The optimum charging temperature depends on personal needs; frequently a storage cylinder temperature of 50 °C is adequate. An average shower requires about 30 to 50 l of hot water with an outlet temperature of 40 °C. The cold water that flows into the storage tank when taking a shower must be heated in the solar storage tank in a through-flow heating manner.

- If greater volumes of hot water are used and to maintain comfortable temperatures during periods of unusual use, set the temperature in the hot water zone to a sufficiently high level or enable the heat generator for supplementary heating, e.g. by switching to a different timer programme.

Setting the storage tank charging temperature

- Set the hot water target temperature so that there is adequate hot water for drawing off (e.g. for one shower) at the lowest possible setting value. This setting serves to ensure that the maximum heating of the hot water by the solar system with a specific volume of water being used.

Heating by means of an external heat generator

Depending heating requirements (related to the building's insulation standard, outdoor temperature, and desired room temperatures) and the installed collector surface, it might be expedient to disable the external heat generator by fitting a burner inhibit contact. For this purpose, also if the heater control demands additional heat:

- set the operating parameters "P min", "T_S min" and "Time VBSK" in such a way that (see section 6.3.10), the external heat generator is not heating,
  – if a a minimum heating output is provided by the solar panels, or
  – the storage cylinder has reached a sufficiently high temperature.

6.4.4 Tips for optimised user behaviour

Hot water needs and user behaviour are highly individual. The higher the desired storage cylinder temperature is, and the longer the periods for non-solar charging heating have been adjusted, the more will the storage potential for solar heat generation be limited. Careful consumption behaviour, adapted to the particular strengths of the solar system minimises the energy consumption for non-solar charging processes.

- Use modern and efficient shower heads with draw-off rates of 5 to 7 l/min.
  ➔ The lower draw-off rate (hot water consumption volume per minute) means a reduced requirement for supplementary heating and therefore more hot water at a higher temperature.
- Reduce the consumption times.
  ➔ Lower energy consumption.
- Only use hot water to begin with when filling a bath.
  ➔ After the domestic water stored in the solar storage tank has been drawn off, the hot water outlet temperature drops slightly and the water is mixed in the bath. In this way, the storage capacity is used in an optimal manner with a minimum charging temperature; an adequate amount of hot water is available.

6.4.5 Domestic water hygiene

If no hot water is used for several days and the storage temperature of the does not reach at least 60 °C, for hygiene reasons (Legionella protection) it is periodically heated up to above 60 25 °C once.

7 Faults and malfunctions

7.1 Display of events

Event code	Plain text display	Description	Status display (flashing)	Lamp (flashing)	Consequence
0	Collector	Collector sensor: Short-circuited or open	K	TK	Long-term switch-off of P_S
1	Return flow	Return flow sensor: Short-circuited or open	R	TR	
2	Storage cylinder	Storage cylinder sensor: Short-circuited or open	S	TS	
3	Flow	FlowSensor: Short-circuited or open	D		Operation without FlowSensor
4	Inflow	FlowSensor: Short-circuited or open	V		
5	A/D	Internal A/D converter fault	G		Long-term switch-off of P_S
6	Supply	Internal equipment fault of the supply voltage	G		
7	Reference	Internal equipment fault of the reference voltage	G		
8	Reset	Overall reset was carried out			Parameters to factory settings, calculated values and event entries deleted (see chapter 6.2.10), equipment re-start
12	Start flow	Minimum flow rate V1 (see tab. 6-1) not achieved in the start phase after expiry of "Time P2" (description see chapter 6.2.1 and 6.2.12)	W		Switch-off of P_S for 2 h, then ready for operation again or status "F"
			F	TV	Long-term switch-off of P_S, if an event arises 3x in a row without intermediate successful start.
13	TS > Tsmax	Storage tank maximum temperature ("TS max") exceeded (description see chapter 6.2.1 and 7.2)		TS	Temporary switch-off of P_S
14	TR >> TS	$T_R - T_S > 10$ K and $T_R > 40$ °C (description see chapter 7.2)		TR	
15	TK > TK perm	Permitted solar panel maximum temperature ("TK perm") exceeded - (description see chapter 6.2.1 and 7.2)		TK	
16	Interrupt	Flow breakaway during operating phase detected (V < V2, see chapter 6.2.9 and tab. 6-1)			Temporary switch-off of P_S (minimum for stabilisation time), blocking of current pump modulation stage, and the one below, refilling by P_S for "Time P2" at next switch-on condition.
202	P-on Reset	Switching on			Restart, all parameter settings and info parameters remain, automatically blocked pump output stages are released again.
204	Brown-out	Reset caused by prohibited reduction in the mains voltage			Restart in accordance with Code 202.
205	Watchdog	Reset caused by external interference influences (e.g. over-voltages caused by thunderstorms)			Restart in accordance with Code 202.

Tab. 7-1 Event storage

Using the menu path: "Selection 2/2" -> "System" -> "Event memory" and, after entering the technician password (see section 6.3.4 and fig. 6-7), any events that occur during operation can be displayed. The Solaris R4 controller has a simple fault diagnosis system for this purpose. The events memory stores nature and time of the event. The event is displayed in clear text and using a code, the time since the start of the event is displayed in hours. Starting with the most recent event, you can leaf through the individual events by means of the Info key.

If the parameter "delete" is shown in the menu item: "Selection 2/2" -> "System" -> "Event memory" is set to "yes", all events are deleted. Deletion of individual events is not possible. An overview of possible entries in the event memory is given in tab. 7-1.

Sensor-specific error messages

The Solaris R4 controller reacts as follows to cable breaks and for short circuits in sensors or sensor cables (see tab. 7-2):

– A flashing code letter in the display indicates the fault in the status column and a message appears.
– The lamp associated with the fault flashes.
– In addition, the control unit automatically intervenes in system operation.

All other sensor values remain accessible via the arrow keys.

Sensor	Cause of the fault	Status (blinks)	Display	Lamp (flashing)	Consequence
Collector temp.	Interruption	K	uuuu	T_K	Long-term switch-off of P_S
	Short circuit		——–	T_K	
Return flow temp.	Interruption	R	uuuu	T_R	
	Short circuit		——–	T_R	
Storage cylinder temp.	Interruption	S	uuuu	T_S	
	Short circuit		——–	T_S	
Inflow temp.	Voltage drop	V	——	without lamp	Operation without FlowSensor
FlowSensor	Voltage drop	D	——	without lamp	

Tab. 7-2 Sensor fault table

7.2 Troubleshooting

Operating events similar to faults

The storage tank temperature "T_S" in the solar storage tank reaches the value set in the parameter "TS max":

– Pumps are switched off, the system is drained. In the Solaris R4 controller, the T_S lamp flashes, the display shows the measured storage tank temperature. As soon as the storage cylinder temperature falls more than 2 K, normal system operation is resumed.

Hereby, short-term evaporation in the collectors is possible. The pressureless steam escapes into the storage cylinder. On rare occasions, small volumes of water vapour come out of the solar storage tank for short periods.

The temperature in the solar panel is higher than the restarting protection temperature "TK perm":

– Pumps are switched off. The T_K lamp flashes in the Solaris R4 controller. If the set switch-on inhibit temperature falls by more than 2 K, normal system operation is enabled automatically.

Failures

WARNING!

Live parts can cause an electric shock on contact and cause life-threatening burns and injuries.

- Electrical installations must always be carried out by qualified electrical technicians in conformity with the relevant electrical guidelines and the regulations of the electric utilities company to prevent hazards from damaged electric wiring.
- Rectification of damage to live components of the Control and pump unit RPS4 must only be carried out by heating engineers authorised and recognised by the energy supply company.
- Before beginning the repair work, disconnect the Control and pump unit RPS4 from the power supply (fuse, shut off main switch) and secure against unintentional restart.
- Comply with the relevant safety at work regulations.

CAUTION!

Danger of burning on hot surfaces.

- Let the device cool down for a reasonably long time before maintenance and inspection work.
- Wear protective gloves.

The T_R lamp flashes in the Solaris R4 controller. Return temperature "T_R" is greater than 40 °C and is 10 K higher than the storage temperature "T_S". The solar operating pump P_S is switched off. The cause is a defective or incorrectly connected sensor.

- Install the sensor correctly or replace it; normal system operation will be resumed.

"W" flashes in the status column on the Solaris R4 controller. The minimum flow rate start phase "V1" at the FlowSensor (see page 23, tab. 6-1) is not achieved after switching on the solar operating pump P_S and after expiry of the time defined by the parameter "Time P2" (fig. 6-3).

➔ The system goes to temporary blocking for 2 hours (solar operating pump P_S is switched off), but still tries to restart automatically after the blocking time.

➔ If this event occurs three times in a row, without intermediate starting, the solar operating pump P_S is switched off for an extended period and the status "F" is set.

"F" flashes in the status column on the Solaris R4 controller. The minimum flow rate start phase "V1" at the FlowSensor (see page 23, tab. 6-1) is not achieved after switching on the solar operating pump P_S and after expiry of the time defined by the parameter "Time P2" (fig. 6-3). The solar operating pump P_S is switched off.

- If a leak is suspected, examine the solar system, rectify faults and then release the block by "Switching OFF/ON" on the controller.

If the system cannot be filled (status "F"), even though the solar operating pump P_S is actuated by the controller, the following faults can be the cause:

1. Air drawn down when the system was running idle is in the solar operating pump P_S.
   - Check that the solar operating pump P_S is running. The automatic vent must always be working! Check the sealing cap and loosen it if necessary (do not remove).
2. Check the installation for leaks.
   - Check the installation for leaks and rectify if necessary. Follow instructions in chapter 5 "Start-up and decommissioning"".
3. The start run time "Time P2" (chap. 6.4).
4. Check the installation for blockages.In the event of frost, ice plugs can be formed in poorly routed connection lines.
5. Check valve position on storage tank connection elbow.

If there is nothing showing on the display, and the main switch in the illuminated "On" position:

- Replace the control system (electronic fault).

If the main switch is not illuminated in the "On" position, there is no power supply to the control unit.

- Check the plug connection of the mains plug and the mains connection (fuse, switch).

If water vapour is coming out of the solar storage tank when the sun impinges on it, the flow rate is too low.

- In this case, the system settings must be checked.

Special notes on electric sensors

Only original ROTEX replacement parts may be used.

- Assess the display on the Solaris R4 controller.
- Unhook the Solaris R4 controller housing and unplug the relevant sensor and remove terminal if necessary.
- Examine the contact positions of the affected sensors, and measure the resistance (or the DC voltage for flow temperature and flow rate sensors) on the sensor end.

When the fault has been rectified, the system automatically resumes normal operation and is in the operating mode.

The resistance or DC voltage values of the sensors are listed in fig. 9-1 and in fig. 9-2. Internal faults in the controller electronics that can be diagnosed are displayed in the display in accordance with tab. 7-1 (status "G"). They also cause a safety switch-off of the pumps. "Switching OFF" and "Switching ON again" after waiting for 2 mins. either rectifies the fault or the controller needs to be replaced.

8 Hydraulic system connection

8.1 Schematics

WARNING!

Temperatures in excess of 60 °C can arise in the solar storage tank.

- Fitting scald protection.
  - Scald protection VTA32 (**15 60 15**)
  - Screw connection set 1" (**15 60 16**)

CAUTION!

The ROTEX units can also be optionally fitted with gravity breaks (**16 50 70**) made of plastic. They are suitable for maximum operating temperatures of 95 °C. If a heat exchanger is operated at temperatures greater than 95 °C, another gravity brake must be installed in the building.

A selection of diagrams of the most common installed systems is shown below. The arrangements shown are only examples, and are no substitute for careful system planning. For more diagrams, please see the ROTEX home page at http://www.rotex.de.

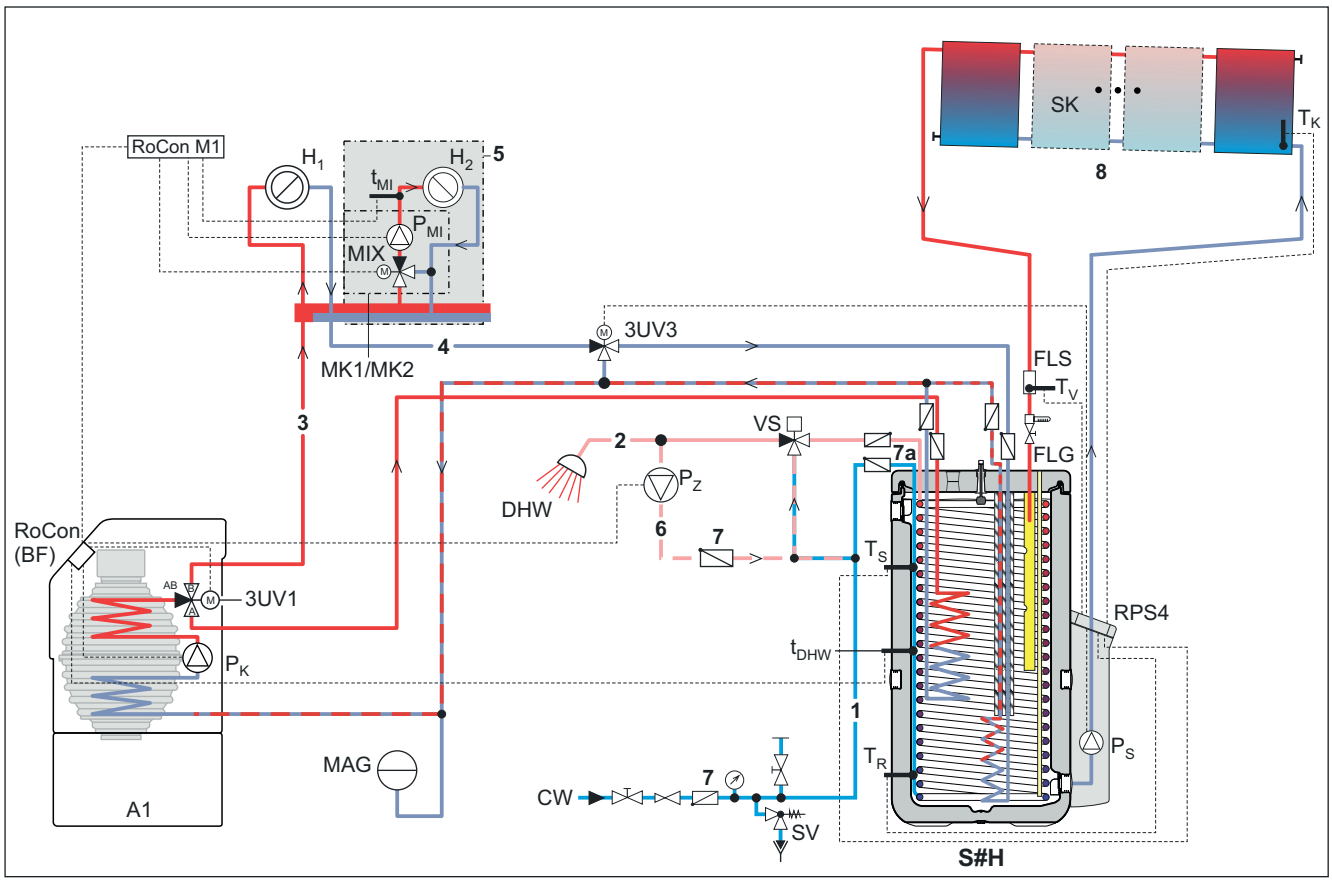


Fig. 8-1 Standard Solaris incorporation with SCS 538/16/0 and A1 Gas or A1 Oil condensing boiler [1)]

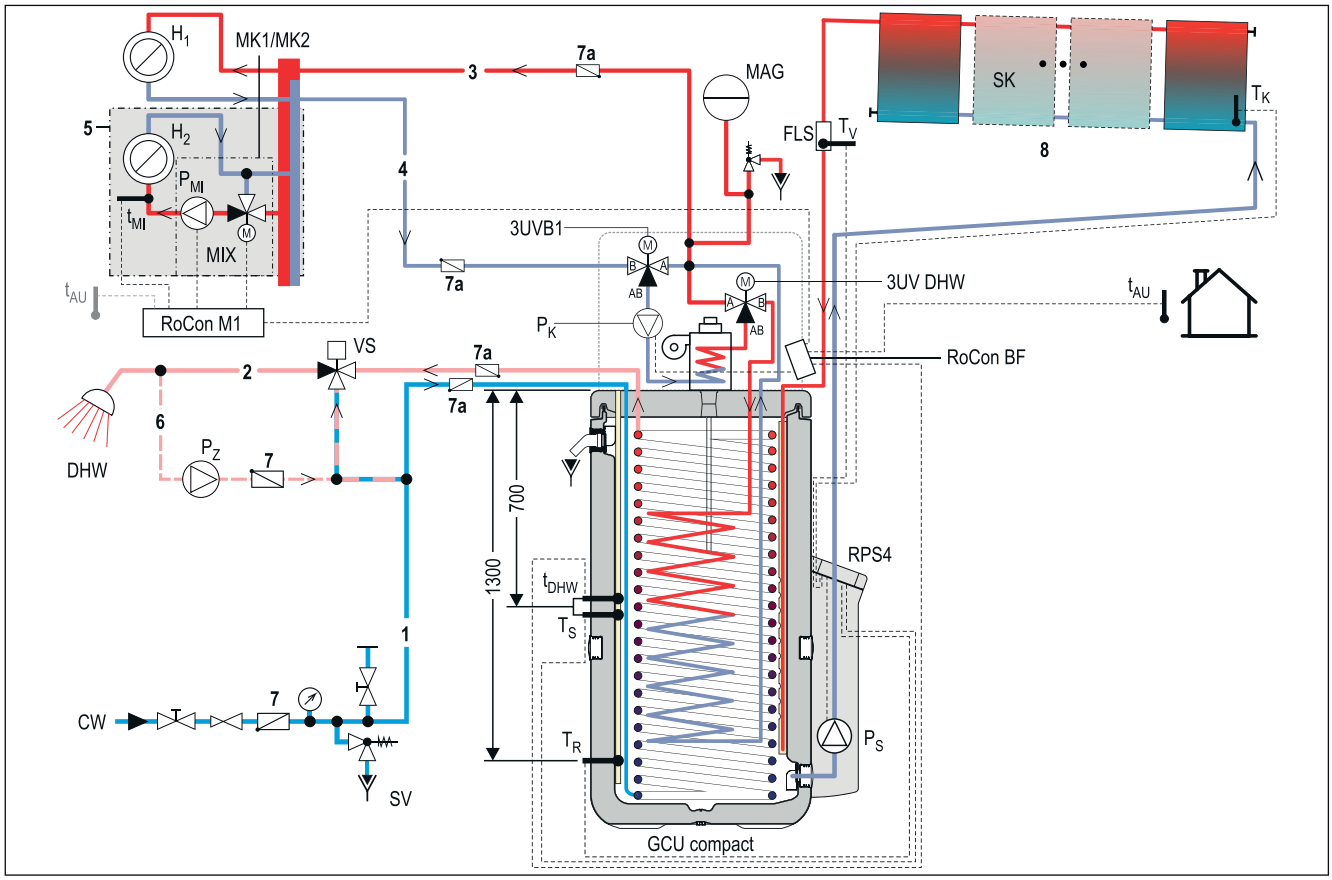


Fig. 8-2 Standard Solaris incorporation with GCU compact [1)]

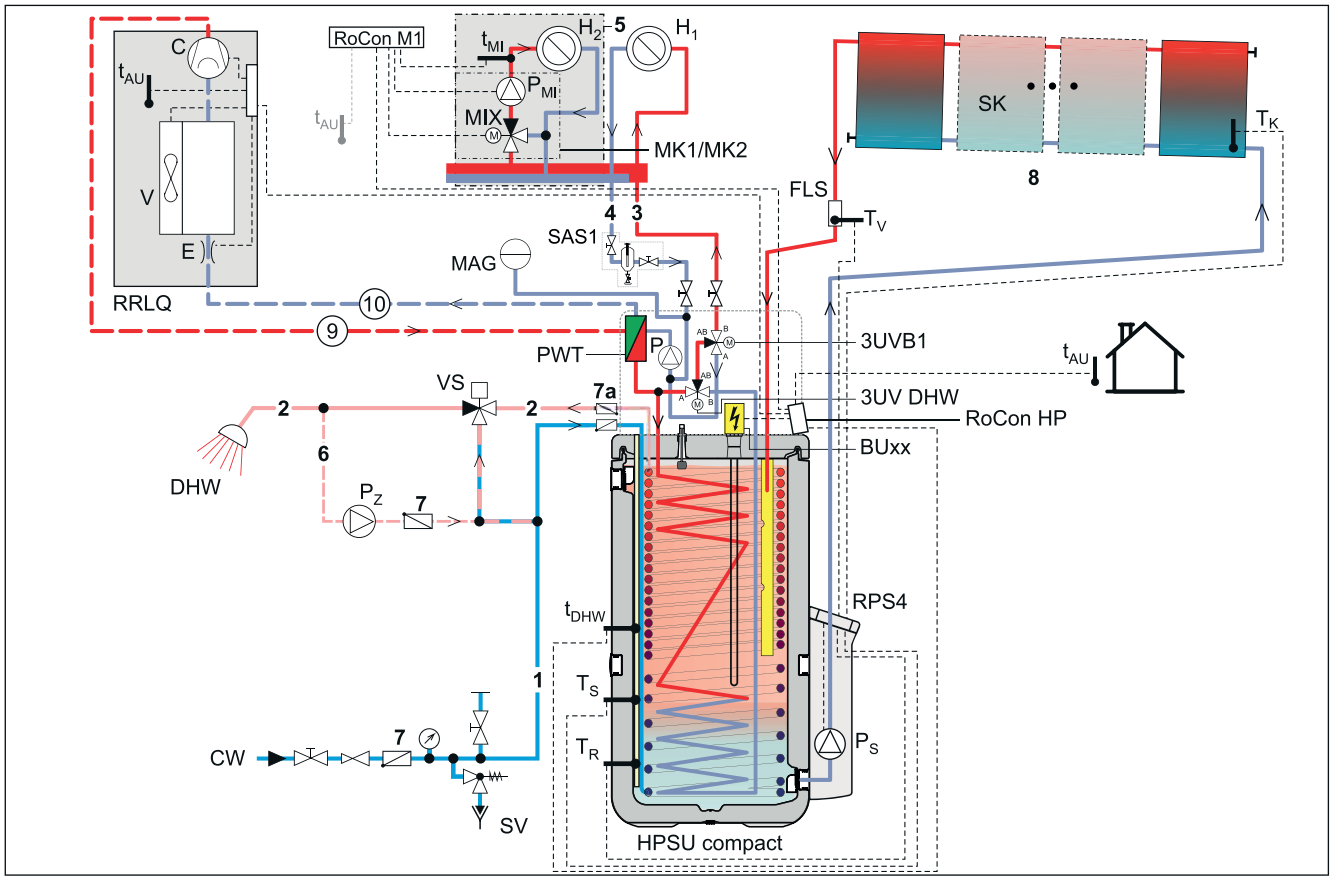


Fig. 8-3 Standard Solaris incorporation with Air-Water Heat Pump HPSU compact [1)]

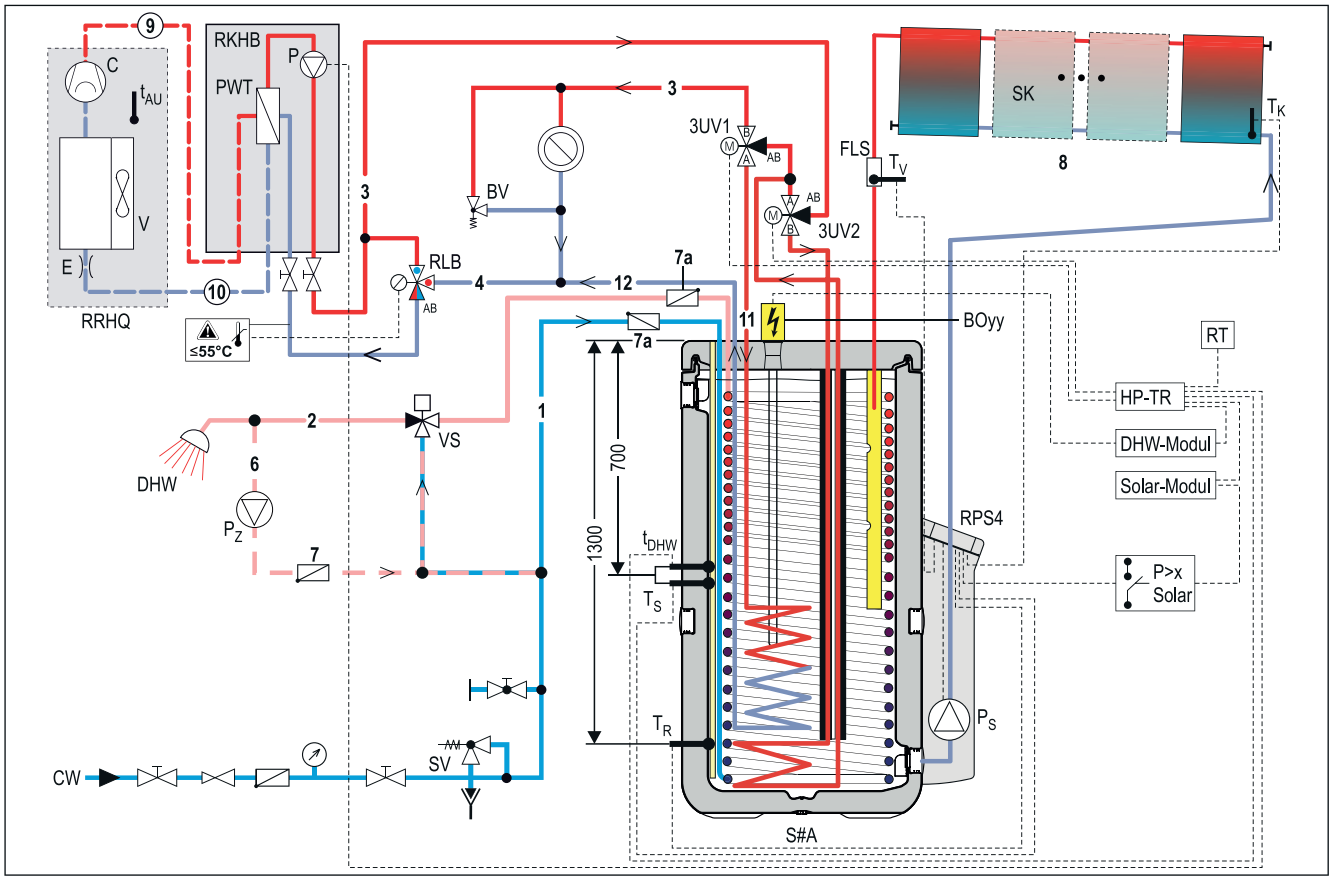


Fig. 8-4 Standard Solaris incorporation with Air-Water Heat Pump (HPSU Bi-Bloc with Room Heating and Cooling Function) [1)]

1) The displayed plant schematics do not claim to be complete and do not replace careful indoor planning.

Short name.	Meaning
1	Cold water distribution network
2	Hot water distribution network
3	Heating flow
4	Heating return flow
5	Mixing circuit
6	Circulation
7	Check valve, return valve
7a	Non return valves
8	Solar circuit
9	Gas pipe (coolant)
10	Fluid pipe (coolant)
11	Storage tank flow
12	Storage tank return flow
3UV1	3-way switch valve (DHW)
3UV2	3-way switch valve (cooling)
3UV3	3-way switch valve (heating support)
3UVB1	3-way switch valve (heating, internal circuit regulated)
3UV DHW	3-way switch valve (DHW + heating support regulated)
A1	A1 oil or gas condensing boiler
BOyy	Electric immersion heater (Booster Heater)
BUxx	Electric immersion heater (Backup Heater)
BV	Bypass valve
C	Roolant compressor
CW	Cold water
DHW	Domestic hot water
E	Expansion valve
FLS	Flow sensor, FlowSensor FLS 20 or alternative type in accordance with tab. 6-1 (flow and feed temperature measurement)
FLG	FlowGuard regulating valve with flow indicator
GCU compact	GasCombiUnit range (solar storage tank with integrated gas condensing unit)
H_1, H_2 ... H_m	Heating circuits
HP-TR	Main regulator heat pump
HPSU compact	HPSU compact range (solar storage tank with integrated heat pump unit)
MAG	diaphragm expansion vessel
MIX	3-way-mixer with drive motor
MK1	Mixer group with high-efficiency pump
MK2	Mixer group with high-efficiency pump (PWM controlled)
P	High-efficiency pump
P_K	Boiler circuit pump
P_{Mi}	Mixing circuit pump
P_S	Solar operating pump p=0 + +p
P_Z	Circulation pump
PWT	Panel heat exchanger (condenser)
RLB	Return temperature limiter
RoCon HP	HPSU compact regulation
RoCon BF	Regulation A1 condensing boiler
RoCon M1	Mixer circuit control

Short name.	Meaning
RPS4	Solaris control and pump unit p=0
RKHB	Internal unit HPSU Bi-Bloc heat pump
RRHQ	External unit HPSU Bi-Bloc heat pump
RRLQ	HPSU compact outdoor unit
RT	Room thermostat
S#A	HYC 343/19/0-DB
S#H	SCS 538/16/0-DB
SAS1	Sludge and magnetic separator
SK	Solar panel field
SV	Safety over-pressure valve
t_{AU}	Outdoor temperature sensor Rocon OT1 (included in the scope of supply of GCU compact)
t_{DHW}	Storage tank temperature sensor (included in the scope of supply)
t_{Mi}	Mixer circuit flow temperature sensor
T_K	Solar collector temperature sensor
T_R	Solar return flow temperature sensor
T_S	Solar storage cylinder temp. sensor
T_V	Solar flow temperature sensor
V	Fan (vaporiser)
VS	Protection against scalding VTA32

Tab. 8-1 Short names in hydraulic drawings

8.2 Connection of a pressure solar panel system

If the structural conditions do not permit mounting the solar panels above the storage tank, or if the connecting line cannot be installed with a continuous gradient between the solar panel and the storage tank, you **cannot use** the depressurised ROTEX solar system (DrainBack) and thus **the Control and pump unit RPS4.**

Instead, the heating system can be executed with the ROTEX solar pressure system. The following solar components can be used equally in both systems:

- Solaris high-performance flat solar panels V21P, V26P, H26P
- Solaris on-roof, flat-roof and in-roof mounting packages
- Solaris hot water storage tank

Other system components must only be used under system-specific conditions.

9 Technical data

9.1 RPS4 control and pump unit

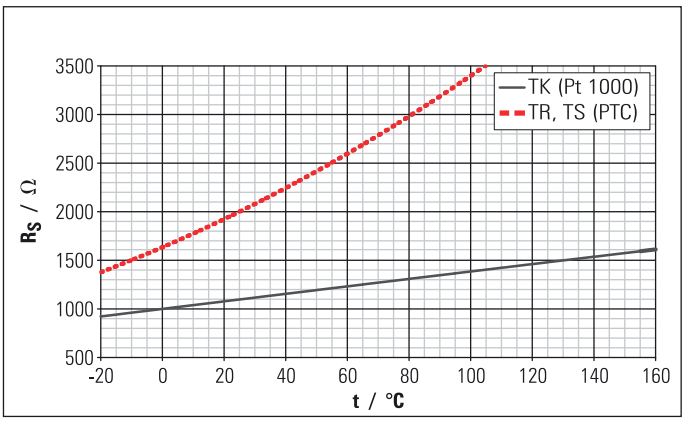
	Control and pump unit RPS4
Dimensions H x W x D	230 x 815 x142 mm
Operating voltage	230 V / 50 Hz
Solar operating pump	Grundfos UPS 15-145
Maximum electrical power consumption RPS4	During start: 65 W In normal mode: 15-65 W (modulated)
Solaris R4 controller	Digital differential temperature controller with plain text display
Max. electric power consumption of the control unit	2 W
Solar panel temperature sensor	Pt 1000
Storage cylinder and return flow temperature sensor	PTC
Feed temperature and flow sensor	FLS 20 (alternative FLS12, FLS40, FLS 100)

Tab. 9-1 Technical data Control and pump unit

9.2 Sensor characteristics

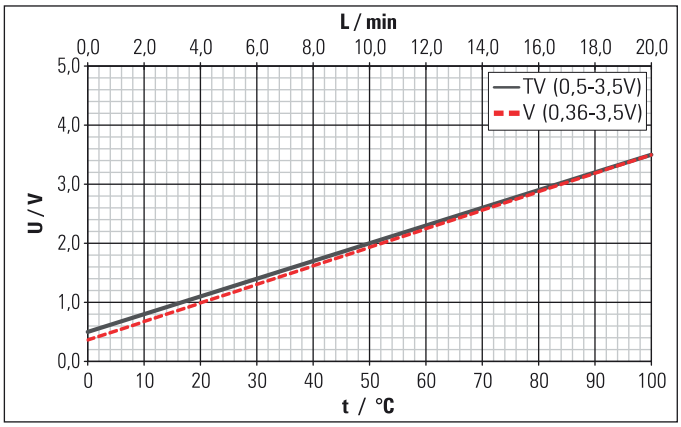
Temperature sensor																
Solaris sensor	Sensor type	Measured temperature in °C														
		-20	-10	0	10	20	30	40	50	60	70	80	90	100	110	120
		Sensor resistance in Ohm according to standard or manufacturer's indications														
TR, TS	PTC	1386	1495	1630	1772	1922	2080	2245	2418	2598	2786	2982	3185	3396		
TK	Pt 1000	922	961	1000	1039	1077	1116	1155	1194	1232	1270	1308	1347	1385	1423	1461
FlowSensor		Sensor output voltage in V														
TV	(0.5, - 3.5 V)			0.5	0.80	1.10	1.40	1.70	2.00	2.30	2.60	2.90	3.20	3.50		
Flowrate																
FlowSensor		Measured flow in l/min														
		0.0	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0				
		Sensor output voltage in V														
V	(0.36, - 3.5 V)	0.36	0.67	0.99	1.30	1.62	1.93	2.24	2.56	2.87	3.19	3.50				

Tab. 9-2 Table of the Solaris sensors



R_S *Sensor resistance (PTC, Pt 1000)* ***t*** *Temperature*

Fig. 9-1 Resistance characteristic curves of Solaris sensors

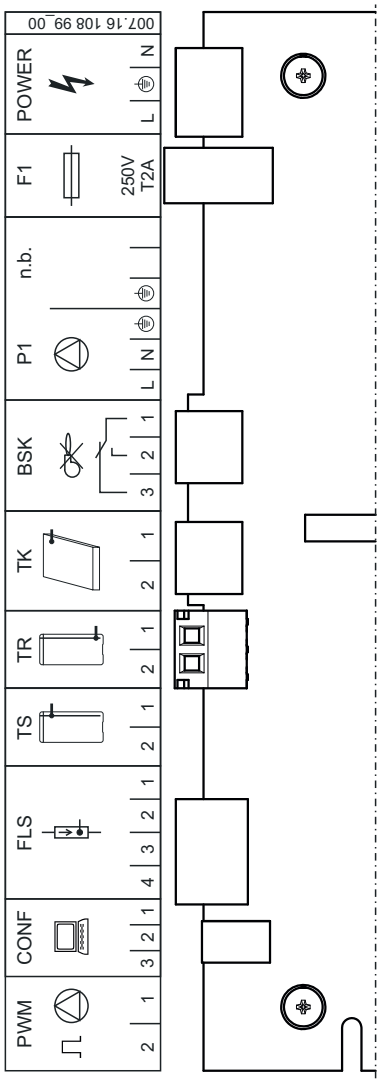


L *Flow rate* ***t*** *Temperature*
U *Sensor output voltage*

Fig. 9-2 Characteristic curves of the FlowSensor

9 Technical data

9.3 Connection allocation RPS4 controller



BSK Burner inhibit contact
CONF
Programming socket for Software update
FLS FlowSensor
TS Storage cylinder temperature sensor
TR Return flow temperature sensor
TK Collector temperature sensor

P_S Solar operating pump
F1 Fuse
Power
Mains supply

Fig. 9-3 Terminal assignment

The technical data for the ROTEX condensing boilers, heat pumps and hot water storage tanks is located in the ROTEX price list and the relevant technical documentation for the products.

10 List of keywords

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