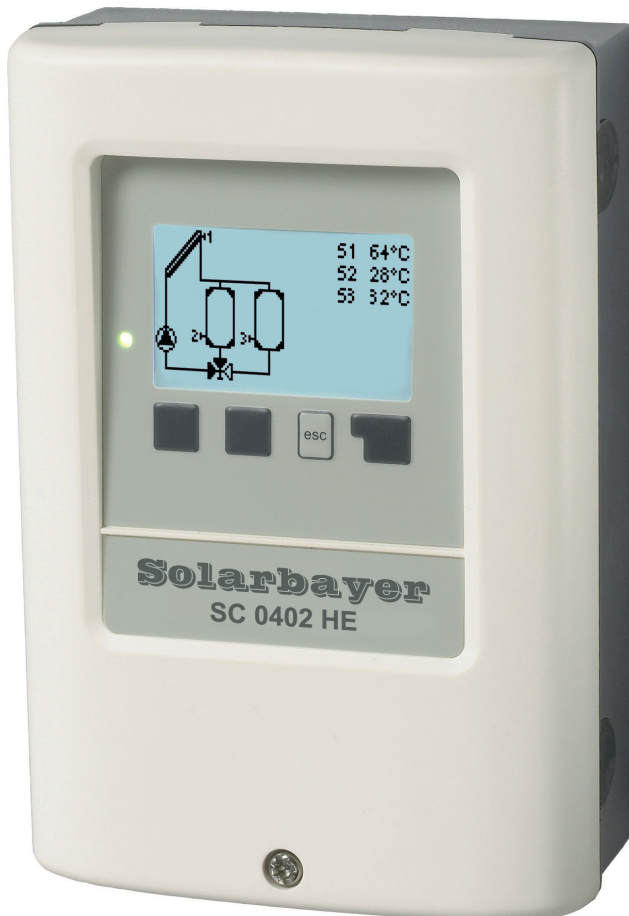




Temperature Difference Controller SC 0402 HE

Installation and operating instructions



Read carefully before installation, commissioning and operation!

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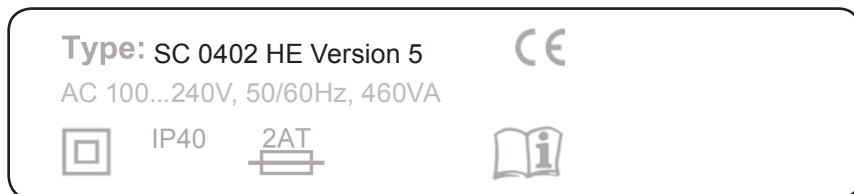
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This manual applies to the hardware SC 0402 HE versions 5, January 2015

When you are unsure which version you have, check the type label on the side of the controller.



If the version is not readable here, open the controller's "Service values" menu. The version is shown in the first line of the service values.

Safety instructions

A.1 EC declaration of conformity

By affixing the CE mark to the unit the manufacturer declares that the Temperature Difference Controller SC 0402 HE, conforms to the following relevant safety regulations:

- EC low voltage directive 2006/95/EC
- EC electromagnetic compatibility directive 2004/108/EC

Conforwithy has been verified and the corresponding documentation and the EC declaration of conforwithy are kept on file by the manufacturer.

A.2 General instructions

It is essential that you read this!

These installation and operating instructions contain basic instructions and important information regarding safety, installation, commissioning, maintenance and the optimal use of the unit. Therefore these instructions must be read completely and understood by the installation technician/specialist and by the system user before installation, commissioning and operation of the unit.

The valid accident prevention regulations, VDE regulations, the regulations of the local power utility, the applicable DIN-EN standards and the installation and operating instruction of the additional system components must also be observed. The controller does not under any circumstances replace any safety devices to be provided by the customer!

Installation, electrical connection, commissioning and maintenance of the unit may only be carried out by specialists who possess the appropriate training.

For the user: Make sure that the specialist gives you detailed information on the function and operation of the controller. Always keep these instructions in the vicinity of the controller.

A.3 Explanation of symbols



Failure to observe these instructions can result in danger to life from electric voltage.



Failure to observe these instructions can result in serious damage to health such as scalding, or even life-threatening injuries.



Failure to observe these instructions can result in destruction of the unit or the system, or damage to the environment.



Information which is especially important for the function and optimal use of the unit and the system.

Safety instructions

A.4 Changes to the unit



Changes to the unit can compromise the safety and function of the unit or the entire system.

- Changes, additions to or conversion of the unit are not permitted without the written permission from the manufacturer
- It is likewise forbidden to install additional components that have not been tested together with the unit
- If it becomes clear that safe operation of the unit is no longer possible, for example because of damage to the housing, then turn the controller off immediately
- Any parts of the unit or accessories that are not in perfect condition must be exchanged immediately
- Use only original spare parts and accessories from the manufacturer.
- Markings made on the unit at the factory must not be altered, removed or made illegible
- Only the settings actually described in these instructions may be made on the controller

A.5 Warranty and liability

The controller has been manufactured and tested with regard to high quality and safety requirements. The unit is subject to the statutory guarantee period of two years from the date of sale.

The warranty and liability shall not include, however, any injury to persons or material damage that is attributable to one or more of the following causes:

- Failure to observe these installation and operating instructions
- Improper installation, commissioning, maintenance and operation
- Improperly executed repairs
- Unauthorised structural changes to the unit
- Installation of additional components that have not been tested together with the unit
- Any damage resulting from continued use of the unit despite an obvious defect
- Failure to use original spare parts and accessories
- Use of the device for other than its intended purpose
- Operation above or below the limit values listed in the specifications
- Force majeure

Description of controller

B.1 Specifications

Electrical specifications:

Mains voltage	100 - 240VAC
Mains frequency	50 - 60Hz
Power consumption	0,5W - 2,5W
Internal fuse	2A/250V slow blow
Protection category	IP40
Protection class	II
Overvoltage Category	II
Degree of Pollution Category	II

mechanical relay 460VA for AC1 / 460W for AC3= 2 (R1)	2 (R1/R2)
0-10V output, tolerance 10%, 10 k Ω load or PWM output freq. 1 kHz, level 10 V	1 (V1)
PT1000 sensor input measuring range -40°C to 300°C	4 (S1 - S4)

Network connections CAN Bus

Permissible cable length of sensors and appliances:

Collector and outdoor sensor	<30m
other PT1000 sensors	<10m
CAN	<3m
PWM / 0...10V	<3m
mechanical relay	<10m

Real Time Clock RTC with 24 hour power reserve

Permissible ambient conditions:

Ambient temperature	
for controller operation	0°C...40°C
for transport/storage	0°C...60°C
Air humidity	
for controller operation	max. 85% rel. humidity at 25°C
for transport/storage	no moisture condensation perwitted

Other specifications and dimensions

Housing design	2-part, ABS plastic
Installation methods	Wall installation, optionally panel installation
Overall dimensions	163mm x 110mm x 52mm
Aperture dimensions	157mm x 106mm x 31mm
Display	Fully graphical display, 128 x 64 dots
Light diode	Multicolor red/green
Operation	4 entry keys

B.2 Temperature resistance table for Pt1000 sensors

°C	0	10	20	30	40	50	60	70	80	90	100
Ω	1000	1039	1077	1116	1155	1194	1232	1270	1308	1347	1385

Description of controller

B.3 About the controller

The Temperature Difference Controller SC 0402 HE facilitates efficient use and function control of your solar or heating system. The device is impressive most of all for its functionality and simple, almost self-explanatory operation. For each step in the input process the individual entry keys are assigned to appropriate functions and explained. The controller menu contains headwords for the measured values and settings, as well as help texts or clearly-structured graphics.

The SC 0402 HE can be used as a temperature difference controller for the various system variants illustrated and explained under B.5.

Important characteristics of the SC 0402 HE:

- Depiction of graphics and texts in a lighted display
- Simple viewing of the current measurement values
- Analysis and monitoring of the system by means of statistical graphics, etc.
- Extensive setting menus with explanations
- Menu block can be activated to prevent unintentional setting changes
- Resetting to factory settings

B.4 Scope of supply

- Temperature Difference Controller SC 0402 HE
- 3 screws 3,5 x 35 mm and 3 plugs 6 mm for wall installation
- 6 strain relief clips with 12 screws, replacement fuse T2A / 250V slow-blow
- Installation and operating instructions SC 0402 HE

Optionally contained depending on design/order:

- PT1000 temperature sensors and immersion sleeves

Additionally available:

- Pt1000 temperature sensor, immersion sleeves, overvoltage protection,
- Datalogger with Ethernet connection

B.5 Disposal and pollutants

The unit conforms to the European RoHS directive 2011/65/EU for the restriction of the use of certain hazardous substances in electrical and electronic equipment.



Caution

The unit must not under any circumstances be disposed of with ordinary household refuse. Dispose of the unit only at appropriate collection points or ship it back to the seller or manufacturer.

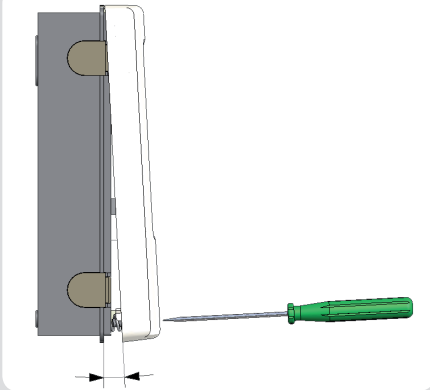
Installation

C.1 Wall installation



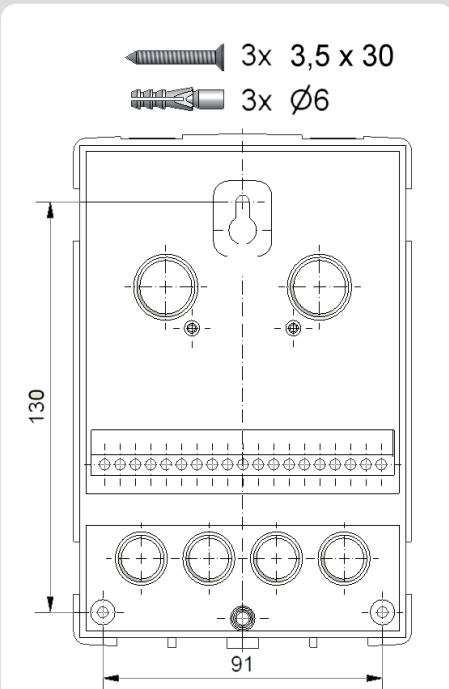
Install the controller only in dry areas and under the ambient conditions described under B.1 "Specifications". Carry out the following steps 1-8.

C.1.1



1. Unscrew cover screw completely
2. Carefully pull upper part of housing from lower part.
3. Set upper part of housing aside, being sure not to touch the electronics when doing so.
4. Hold the lower part of the housing up to the selected position and mark the 3 mounting holes. Make sure that the wall surface is as even as possible so that the housing does not become distorted when it is screwed on.

C.1.2



5. Using a drill and size 6 bit, drill 3 holes at the points marked on the wall and push in the plugs.
6. Insert the upper screw and screw it in slightly.
7. Fit the upper part of the housing and insert the other two screws.
8. Align the housing and tighten the three screws.

Installation

C.2 Electrical connection



Before working on the unit, switch off the power supply and secure it against being switched on again! Check for the absence of power!
Electrical connections may only be made by a specialist and in compliance with the applicable regulations. Do not use the controller if the housing shows visible damage.



Low-voltage cables such as temperature sensor cables must be routed separately from mains voltage cables. Feed temperature sensor cables only into the left-hand side of the unit, and mains voltage cables only into the right-hand side.



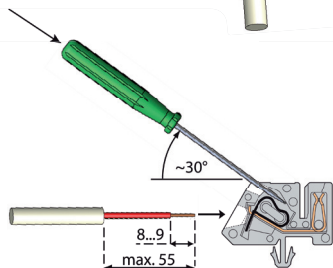
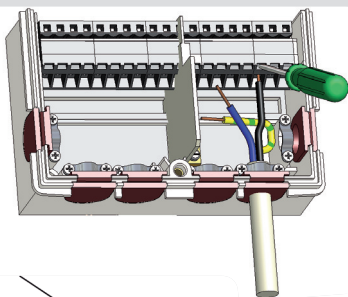
The customer must provide an all-pole disconnecting device, e.g. a heating emergency switch.



The cables being connected to the unit must not be stripped by more than 55 mm, and the cable jacket must reach into the housing just to the other side of the strain relief.

Installation

C.2.1



1. Select necessary program/hydraulics (Resp. D.1 - Hydraulic variants)

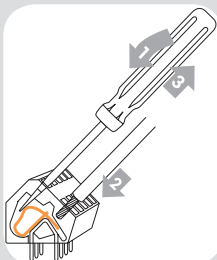
2. Strip cables by 55 mm max., insert, fit the strain relief devices, strip the last 8-9mm of the wires (Fig. C.2.1)

3. Open the terminals using a suitable screwdriver (Fig. C.2.1) and make electrical connections on the controller (s. D.1)

4. Refit upper part of housing and fasten with screw.

5. Switch on mains voltage and place controller in operation.

C.2.2



Instructions for clamps:

1. Insert screw driver into the upper hole. Push the lock clamp inside down. Keep the screw driver in this position.
2. Insert cable into the lower opening.
3. Remove screw driver. The clamp will lock the cable.

C.3 Installing the temperature sensors

The controller operates with Pt1000 temperature sensors which are accurate to the degree, thus ensuring optimal control of system functions.



Caution

If desired the sensor cables can be extended to a maximum of 30 m using a cable with a cross-section of at least 0.75 mm². Make sure that there is no contact resistance! Position the sensor precisely in the area to be measured! Only use immersion, pipe-mounted or flat-mounted sensor suitable for the specific area of application with the appropriate permissible temperature range.



Caution

The temperature sensor cables must be routed separately from mains voltage cables, and must not, for example, be routed in the same cable duct!

Installation

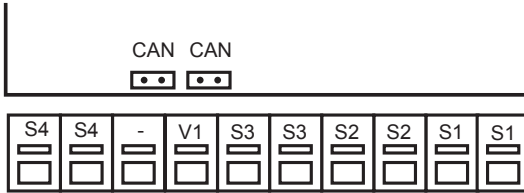
D. - Terminal connection diagram



Low voltage
max. 12V



Main voltage
230VAC



On the Controller platine:

CAN1 CAN Bus connection
CAN2 CAN Bus connection



Low voltage
max. 12V



Main voltage
230VAC

Low voltage max. 12VAC/DC

Terminal: Connection for:

S1	Temperature sensor 1
S1	Temperature sensor 1 (GND)
S2	Temperature sensor 2
S2	Temperature sensor 2 (GND)
S3	Temperature sensor 3
S3	Temperature sensor 3 (GND)
V1	0-10V/PWM speed controlled output for High efficiency pumps
-	speed controlled output for 0-10V gnd. / PWM for High efficiency pumps
S4	Temperature sensor 4
S4	Temperature sensor (GND)

Mains voltage 230VAC 50-60Hz

Terminal: Connection for:

N	Neutral conductor N
R1	Relay R1
N	Neutral conductor N
L	Mains phase conductor L
N	Neutral conductor N
R2	Relay R2

The PE protective conductor must be connected to the PE metal terminal block!

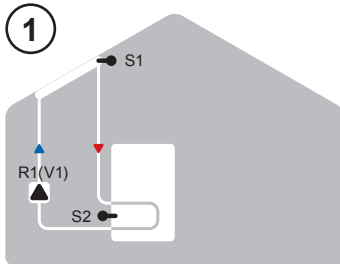
Description of controller

D.1 Hydraulic variants

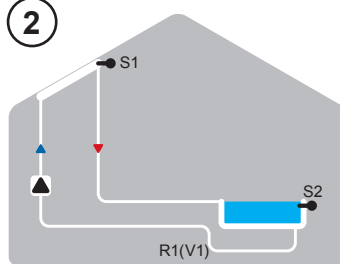


Caution

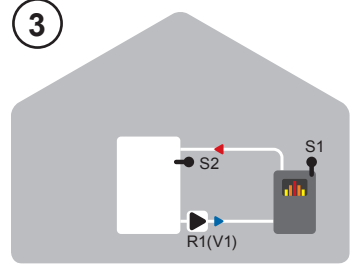
The following illustrations should be viewed only as schematic diagrams showing the respective hydraulic systems, and do not claim to be complete. The controller does not replace safety devices under any circumstances. Depending on the specific application, additional system components and safety components may be mandatory, such as check valves, non-return valves, safety temperature limiters, scalding protectors, etc., and must therefore be provided.



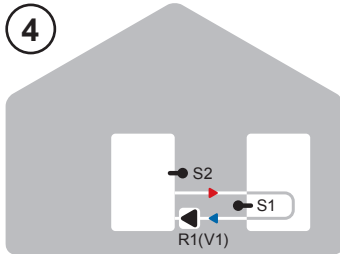
Solar with storage



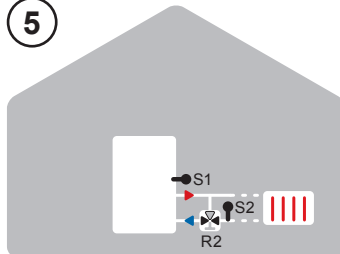
Solar with pool



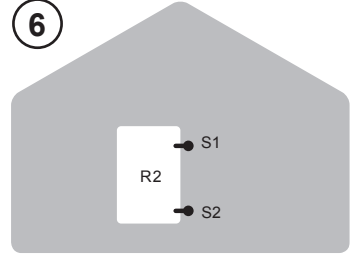
Solid fuel boiler with storage



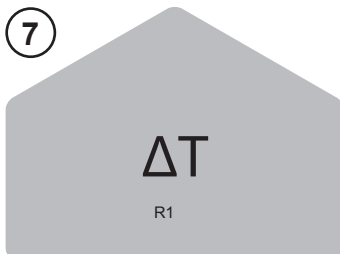
Storage transfer



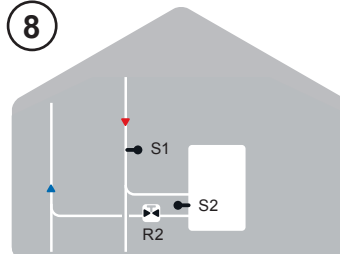
Solar with heating circuit



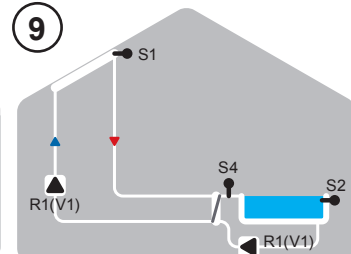
Thermostat



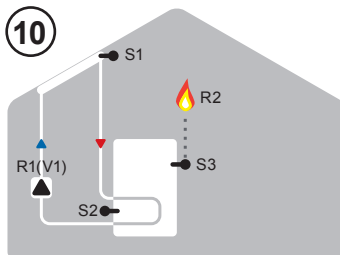
Universal Delta T.



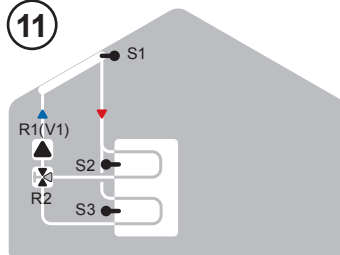
Shutoff valve



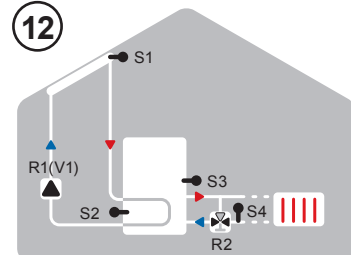
Solar with pool and heat exchanger



Solar with thermostat (auxiliary heating)



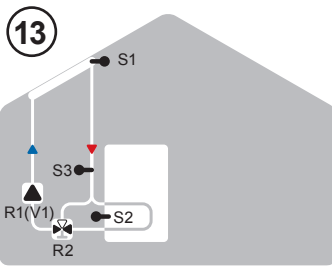
Solar with two-zone storage



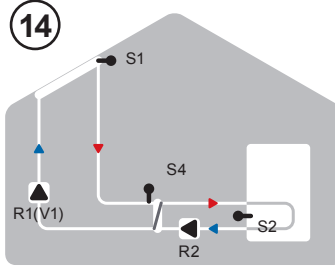
Solar with heating circuit

Description of controller

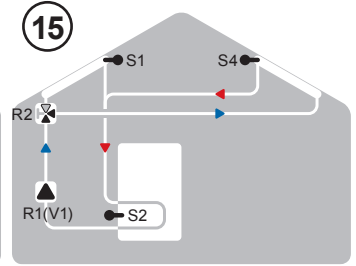
Hydraulic variants



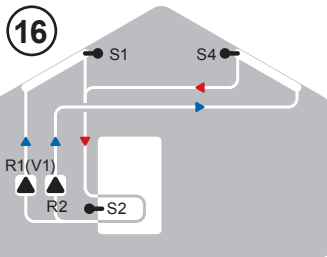
Solar with bypass



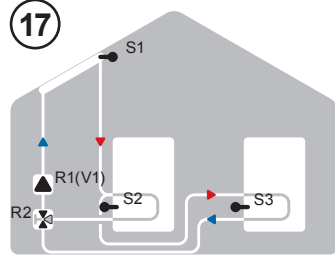
Solar with heat exchanger



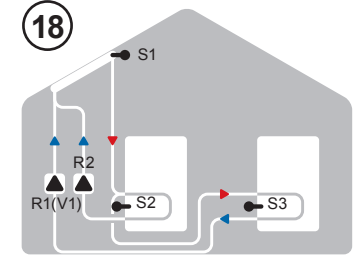
Solar with 2 collector surfaces and switching valve



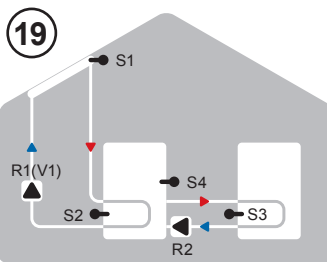
Solar with 2 collector surfaces and 2 pumps



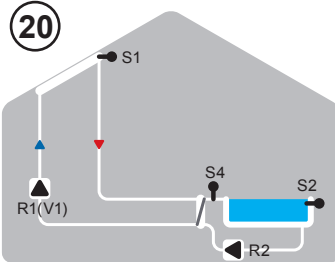
Solar with 2 storages and switching valve



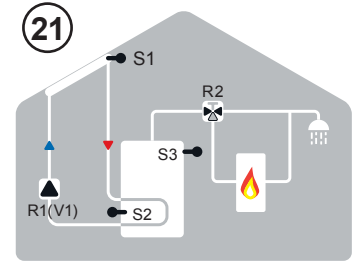
Solar with 2 storages and 2 pumps



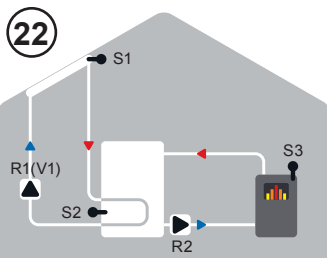
Solar with storage transfer



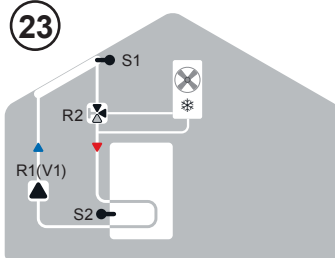
Solar with pool and heat exchanger



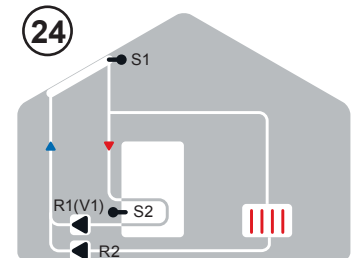
Solar with thermostat and switching valve



Solar with storage and solid-fuel boiler



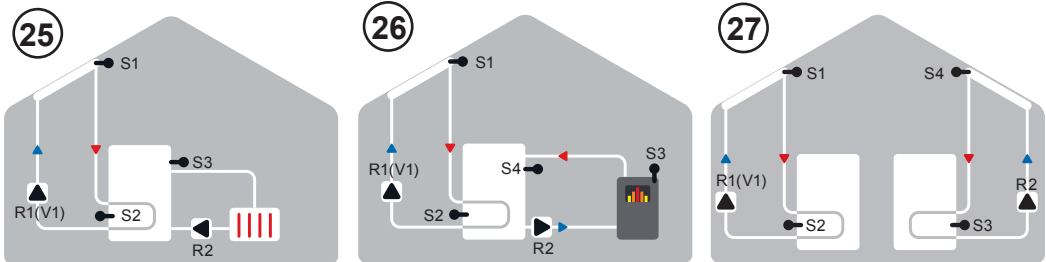
Solar with cooling 1 (collector cooling)



Solar with cooling 2 (collector cooling)

Description of controller

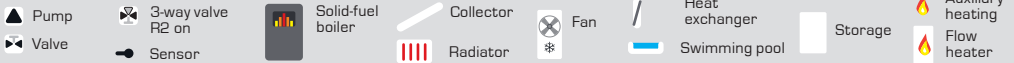
Hydraulic variants



Solar with cooling 3 (collector cooling)

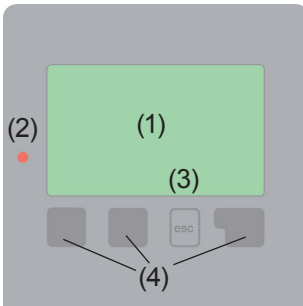
Solar with storage and solid-fuel boiler and S4

2x Solar

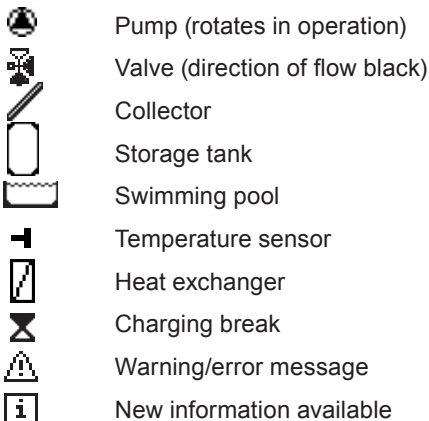


Operation

E.1 Display and input



Examples of display symbols:



The display (1), with its extensive text and graphics mode, is almost self-explanatory, allowing easy operation of the controller.

The LED (2) lights up green when a relay is switched on. The LED (2) lights up red when operating mode "Off" is set. The LED (2) flashes slowly red in the operating mode "Manual". The LED (2) flashes quickly red when an error is present.

Entries are made using four keys (3+4), which are assigned to different functions depending on the situation. The "esc" key (3) is used to cancel an entry or to exit a menu. If applicable there will be a request for confirmation as to whether the changes which have been made should be saved. The function of each of the other three keys (4) is shown in the display line directly above the keys; the right-hand key is generally has a confirmation and selection function.

Examples of key functions:

+/-	= enlarge/shrink values
▼/▲	= scroll menu down/up
yes/no	= approve/reject
Info	= additional information
Back	= to previous screen
ok	= confirm selection
Confirm	= confirm setting

E.2 Commissioning help



1. Set language, time and date

2.a) Start setup wizard (menu 6.8.) The setup wizard guides through the necessary basic settings in the correct order. Every parameter is briefly explained in the display. Pressing the „esc“ key takes you back to the previous setting.

or

2.b) without setup wizard: The settings should be made in the following order:

- menu 9. Language.
- menu 2. Time, Date and Operating Times.
- menu 3. Heating Circuit Settings, all values.
- menu 5. Protection Functions (if any adjustments necessary).
- menu 6. Special Functions (if any adjustments necessary).

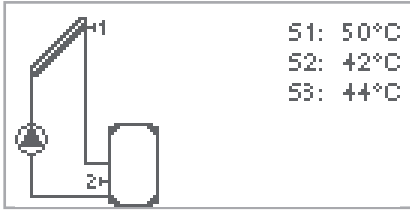
NB: The setup wizard can always be selected in Menu 6.8.

Caution: Consider the explanations for the individual parameters on the following pages and check if further settings are necessary for your application.

3. In Menu 3.2, the operating mode should be set to ‚Manual‘ to test the switch outputs with the consumers connected and check the sensor values for plausibility. Then set to automatic mode.

Operation

E.4 Menu sequence and menu structure



S1: 50°C
S2: 42°C
S3: 44°C

The graphics or overview mode appears when no key has been press for 2 minutes, or when the main menu is exited by pressing “esc”.



Pressing a key in graphics or overview mode takes you directly to the main menu. The following menu items are then available for selection there:



Measurement values

1. - Measurement values



The menu “1. Measurement values” serves to display the currently measured temperatures.

The menu is closed by pressing “esc” or selecting “Exit measurement values”.



Caution

If “--” appears on the display instead of the measurement value, then there may be a defective or incorrect temperature sensor. If the cables are too long or the sensors are not placed optimally, the result may be small deviations in the measurement values. In this case the display values can be compensated for by making entries on the controller. Follow the instructions under 6.7. What measurement values are displayed depends on the selected program, the connected sensors and the specific device design.

Statistics

2. - Statistics



The menu “2. Statistics” is used for function control and long-term monitoring of the system.

The menu is closed by pressing “esc” or selecting “Exit statistics”.



Caution

For analysis of the system data it is essential for the time to be set accurately on the controller. Please note that the clock does not continue to run if the mains voltage is interrupted, and must therefore be reset. Improper operation or an incorrect time may result in data being deleted, recorded incorrectly or overwritten. The manufacturer accepts no liability for the recorded data!

2.1. - Operating hours

Display of operating hours of the solar pump connected to the controller; various time ranges (day-year) are available.

2.2. - Heat output

Display of the heat output of the system.

2.3. - Graphic overview

This provides a clearly-organised display of the data listed under 2.1. - 2.3. as a bar graph. Various time ranges are available for comparison. The two left-hand keys can be used to page through the data.

2.4. - Message log

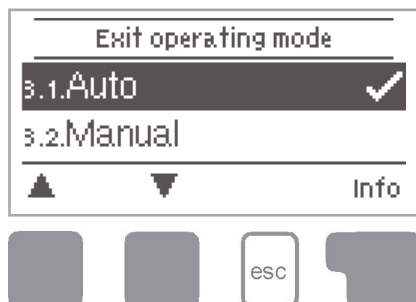
Display of the last 10 events occurring in the system with indication of date and time.

2.5. - Reset/clear

Resetting and deleting the individual analyses. The function “All statistics” clears all analyses but not the error messages.

Operating modes

3. - Operating modes



In menu “3. Operating modes” the controller can either be placed in automatic mode, switched off, or placed in a manual operating mode.

The menu is closed by pressing “esc” or selecting “Exit operating modes”.

3.1. - Automatic

Automatic mode is the normal operating mode of the controller. Only automatic mode provides proper controller function taking into account the current temperatures and the parameters that have been set! After an interruption of the mains voltage the controller automatically returns to the last operating mode selected!

3.2. - Manual

The relay and thus the connected consumer are switched on and off by pressing a key, with no regard to the current temperatures and the parameters which have been set. The measured temperatures are also shown to provide an overview and function control.



When operating mode “Manual” is activated, the current temperatures and the selected parameters are no longer considered. There is a danger of scalding or serious damage to the system. The operating mode “Manual” may only be used by specialists for brief function tests or during commissioning!

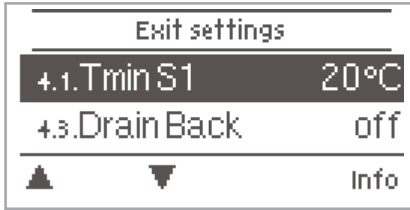
3.3. - Off



When the operating mode “Off” is activated, all controller functions are switched off. This can lead, for example, to overheating on the solar collector or other system components. The measured temperatures are still displayed to provide an overview.

Settings

4. - Settings



The necessary basic settings required for the control function are made in menu "4. Settings".



This does not under any circumstances replace the safety facilities to be provided by the customer!

The menu is closed by pressing "esc" or selecting "Exit settings".



Various settings can be made depending on the selection of hydraulic variant 1-20. The following pages contain generally valid descriptions for the settings.

4.1. - Tmin S1

Enable/start temperature at sensor 1

If this value is exceeded at sensor 1 and the other conditions are also met, then the controller switches the associated pump and/or valve on. If the temperature at sensor 1 drops below this value by 5 °C, then the pump and/or the valve are switched off again.

4.3. - Priority Storage 1

Priority of Storages S1

This determines the order, in which the storages are charged. If the same priority is set for 2 storages, the charging is not switched over until charging the active storage is not possible anymore.

4.4. - ΔT Solar S (X)

Switch-on/switch-off temperature difference for sensor X:

If this temperature difference between the reference sensors is exceeded and the other conditions are also met, then the controller switches the applicable relay on. When the temperature drops to ΔT Off, then the relay is switched off.



Caution

If the set temperature difference is too small, this may result in ineffective operation, depending on the system and sensor positions. Special switching conditions apply for speed control (see „6.3. - Speed control R1“)!

Settings

4.5. - Tmax S2

Switch-off temperature at sensor 2

If this value is exceeded at sensor 2 and the other conditions are also met, then the controller switches the associated pump and/or valve off. If sensor 2 falls below this value again and the other conditions are also met, then the controller switches the pump and/or valve on again.



Temperature values which are set too high can lead to scalding or damage to the system. Scalding protection must be provided by the customer!

4.6. - Priority Storage 2

Priority of Storages S2

This determines the order, in which the storages are charged. If the same priority is set for 2 storages, the charging is not switched over until charging the active storage is not possible anymore.

4.7. - ΔT Solar S3

Settings, see „4.4. - ΔT Solar S (X)“

4.8. - Tmax S3

Settings, see „4.5. - Tmax S2“

4.13. - Tmax SB (pool)

Switch-off temperature at pool sensor

If this value is exceeded at the applicable sensor, the controller switches the associated pump and/or valve off. If the temperature falls below this value again and the other conditions are also met, then the controller switches the pump and/or valve on again.



Temperature values that are set too high can lead to scalding or damage to the system. Scalding protection must be provided by the customer!

Settings

4.14. - Tmax SB WT (pool heat exchanger)

Switch-off temperature at heat exchanger sensor

If this value is exceeded at the applicable sensor, the controller switches the associated pump and/or valve off. If the temperature falls below this value again and the other conditions are also met, then the controller switches the pump and/or valve on again.



Temperature values that are set too high can lead to scalding or damage to the system. Scalding protection must be provided by the customer!

4.15. - T priority

Temperature threshold for absolute priority. In systems with two storage tanks charging of the lower-priority storage tank will never take place until this temperature at sensor of the higher-priority storage tank is exceeded.

4.16. - Loading time

Interruption of charging into the lower priority storage tank. The charging of the lower-priority storage tank is interrupted after the settable time in order to check whether the collector has reached a temperature level that allows charging in the higher-priority storage tank. If so, the priority storage tank is charged. If not, the increase is measured, to check if charging of the priority storage tank will be possible shortly.

4.17. - Increase

Extension of the charging pause due to temperature increase in the collector

For precise setting of the charging priorities for systems with multiple storage tanks, the necessary temperature increase of the collector at which the interruption of the charging into the lower-priority storage tank is extended by one minute is set here. The interruption is extended because the temperature increase of the collector is expected to enable charging in the higher-priority storage tank soon. As soon as ΔT conditions are met, the priority storage tank is charged. If the rise in temperature falls below the set value, then the charging of the lower-priority storage tank is enabled again.

Protective functions

5. - Protective functions



Menu “5. Protective functions” can be used to activate and set various protective functions.



Caution

This does not under any circumstances replace the safety facilities to be provided by the customer!

The menu is closed by pressing “esc” or selecting “Exit settings”.

5.1. - System protection

Priority protection

System protection prevents overheating of system components by automatic shutdown of the solar pump. If “SProt Ton” is exceeded at the collector, the pump is switched off. The pump is activated again when the temperature drops below “SProt TOff”.



Caution

When system protection is on, the temperature in the idle collector will be very high, thus the pressure in the system will rise and can damage your system. Pay close attention to the instructions of the system manufacturer.

5.2. - Collector protection

Collector protection prevents overheating of the collector. The pump is switched on to transfer heat from the collector to the storage tank.

If “CP Ton” is exceeded at the collector sensor, the pump is switched on until the temperature reaches “CP Toff” or the temperature “CP Tmax storage” is exceeded in the storage or pool.



Danger

When collector protection is active, the storage or pool is heated well beyond Tmax S2 (see 5.2) which can result in scalding and system damage.

Protective functions

5.3. - Recooling

In hydraulic systems with solar when the recooling function is activated excess energy from the storage tank is fed back into the collector. This only takes place if the temperature in the storage tank is higher than the value "Recool Tsetpoint" and the collector is at least 20 °C cooler than the storage tank and before the storage tank temperature has dropped below the value "Recool Tsetpoint". In systems with two storage tanks the setting applies to both storage tanks.



Caution

Energy is lost via the collector when Recooling is active! Recooling should only be active in periods with very little demand for heat e.g. during longer absence / holidays.

5.4. - Frost protection

A two-stage frost protection function can be activated. In stage 1 the controller switches the pump on for 1 minute every hour if the collector temperature drops below the set value "Frost stage 1". If the collector temperature drops further to the set value "Frost stage 2" the controller switches the pump on continuously. If the collector temperature then exceeds the value "Frost stage 2" by 2 °C, then the pump switches off again.



Caution

This function causes energy to be lost via the collector! It is normally not activated for solar systems with antifreeze.
Observe the operating instructions for the other system components!

5.5. - Seizing protection

If the seizing protection is activated, then the controller switches the relay in question and the connected consumer on every day at 12:00 and on Sundays at 12:00 for 5 seconds in order to prevent the pump and/or the valve from sticking after an extended stationary period.

5.6. - Col.- Alarm

If this temperature is exceeded at the collector sensor when the solar pump is on a warning or error message is triggered. A warning message is shown in the display.

Special functions

6. - Special functions



Menu "6. Special functions" is used to set basic items and expanded functions.



Other than the time all settings may only be made by a specialist.

Caution

The menu is closed by pressing "esc" or selecting "Exit special functions".

6.1. - Program selections

The suitable hydraulic variant for the specific application is selected and set here (see B.5 Hydraulic variants). The associated diagram can be displayed by pressing "info".



Caution

Normally the program selection is made only once during initial commissioning by the specialist. Incorrect program selection can lead to unpredictable errors.



Caution

If the program is changed, the settings revert to factory settings.

6.2. - Signal V1

This menu contains the settings for the speed controlled output V1.

6.2.1. - Type of pump

The type of speed controlled pump must be entered here.

Standard: Speed control for standard pumps.

0-10V: Speed control of e.g. High efficiency pumps by 0-10V signal.

PWM: Speed control of e.g. High efficiency pumps by PWM signal.

6.2.2. - Pump

In this menu, preconfigured profiles for various pumps can be selected. Please note that individual settings are still possible even when a profile has been selected.

6.2.3. - Output Signal

This menu determines the type of pump used: Solar pumps perform at their highest power when the signal is also maxed, heating pump on the other hand are set to high-power when the control signal is at the lowest. Solar = normal, heating = Inverted.

Special functions

6.2.4. - 0-10V / PWM off

This voltage is put out when the pump is turned off (Pumps that can detect cable break need a minimum voltage).

6.2.5. - 0-10V / PWM on

This voltage is needed to turn the pump on at minimum speed.

6.2.6. - 0-10V / PWM max

This determines the output voltage for the highest speed of the pump, that is used e.g. during purging or manual operation

6.2.7. - Show signal

Displays the set signal in text and a graphical diagram.

Special functions

6.3. - Speed control

With speed control the SC 0402 HE makes it possible to vary the speed of connected pumps.



This function should only be activated by a specialist. Depending on the pump and pump stage used, the minimum speed should not be set too low, because otherwise the pump or the system may be damaged. The information provided by the relevant manufacturer must also be observed! If in doubt, the min. speed and the pump stage should generally be set to high rather than too low.

6.3.1. - Modes

The following speed variants are available here:

Off: There is no speed control. The connected pump is only switched on or off with full speed.

Mode 1: After the purging time the controller switches to the set max. speed. If the temperature difference Set ΔT between the reference sensors (collector and storage tank) is less than the set value, then the speed is decreased by one stage after the control time elapses. If the temperature difference between the reference sensors is greater than the set value, then the speed is increased by one stage after the control time elapses. If the controller has adjusted the speed of the pump down to the smallest stage and the Set ΔT between the reference sensors is ΔT off, the pump is switched off.

Mode 2: After the purging time the controller switches to the set min. speed. If the temperature difference Set ΔT between the reference sensors (collector and storage tank) is greater than the set value, then the speed is increased by one stage after the control time elapses. If the temperature difference Set ΔT between the reference sensors is below the set value, then the speed is decreased by one stage after the control time elapses. If the controller has adjusted the speed of the pump down to the smallest stage and the ΔT between the reference sensors is $T\Delta$ off, the pump is switched off.

Mode 3: After the purging time the controller switches to the set min. speed. If the temperature at the reference sensor (collector) is greater than the setpoint to be set subsequently, then the speed is increased by one stage after the control time expires. If the temperature at the reference sensor (collector) is less than the setpoint to be set subsequently, then the speed is decreased by one stage after the control time expires.

Mode 4: When the primary storage is loaded, speed control works as in M3.

When the secondary storage is loaded, speed control works as in M2.

Special functions

6.3.2. - Purging time

During this time period, the pump is running with full speed (100%) to ensure trouble-free startup. After this time has passed, the pump is set to speed control and is set to max. speed or min speed, depending on the speed control variant „6.3.1. - Modes“ on page 26 chosen. Purging time can not be applied with PWM or 0-10V output.

6.3.3. - Sweep time

Sweep time determines the inertia of the speed control to prevent strong fluctuations in temperature. Sweep time is the timespan for a complete change from minimum to maximum pump speed.

6.3.4. - max. speed

The maximum speed of the pump is specified here. During the setting the pump runs at the specified speed and the flow rate can be determined.



The indicated percentages are guide values that may vary to a greater or lesser extent depending on the system, pump and pump stage.

6.3.5. - min. speed

The minimum speed of the pump at relay R1 is specified here. During the setting the pump runs at the specified speed and the flow rate can be determined.



The indicated percentages are guide values that may vary to a greater or lesser extent depending on the system, pump and pump stage. 100% is the maximum possible voltage/frequency of the controller.

6.3.6. - Setpoint

This value is the control setpoint for variant 3 (see „6.3.1. - Modes“). Below this value at the collector sensor, the speed is reduced. Exceeding the speed is increased.

6.3.7. - Set ΔT

This value is the selectable temperature difference for mode 1 and 2 (see “6.3.1 - Speed Mode”). Below this value ΔT between the reference sensors, the speed is reduced. Exceeding the speed is increased.

Special functions

6.5. - Relay functions


6.2.Pump settings V1	
6.5.Relay 2	Thermostat2
6.6.Sensor calibration	
▲	▼
OK	

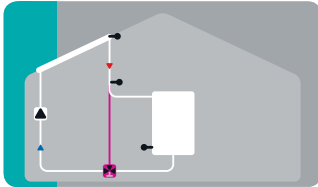
Exit relay 2	
6.5.1.Solar bypass	
6.5.2.Thermostat	
▲	▼
OK	

Exit solar bypass	
6.5...1.Solar bypass	off
▲	▼
OK	


The here explained additional functions can be assigned to unused relays. Every additional function can only be used once. Pay special attention to the technical data of the relays („B.1. - Specifications“).

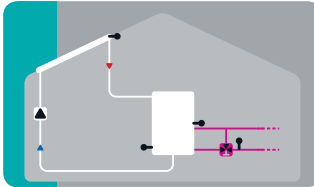
Example

System 1 + 




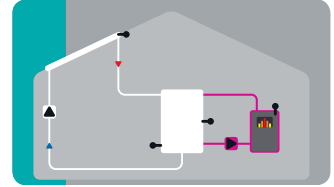
Solar with storage with additional function Solar Bypass

System 1 + 



Solar with heat exchanger with additional function Return Flow Increase

System 1 + 



Solar with heat exchanger with additional function Solid Fuel Boiler



Caution

The enumeration does not correspond to the controllers menu enumeration.



6.5.1. - Solar bypass

Use the relay to switch a bypass valve or a bypass pump

This can direct the flow pass the storage, when the flow temperature at the bypass sensor is lower than the storage that has to be charged.

6.5.1.2. - Variant

This menu determines whether a pump or valve is used to direct the flow through the bypass.

6.5.1.3. - Bypass (sensor)

The flow sensor for the bypass function is selected in this menu. Do not install in the return flow.



6.5.2. - Thermostat

Thermostat is used for time- and temperature controlled additional heating.



Temperature values which are set too high can lead to scalding or damage to the system. Scalding protection must be provided by the customer!



In Energy savings mode, different settings may apply, see e.g. T eco.

6.5.2.2. - TH TSet

Target temperature at thermostat sensor 1. Below this temperature, additional heating is switched on, till TH set + hysteresis is reached.

6.5.2.3. - TH hysteresis

Hysteresis of setpoint temperature.

6.5.2.4. - Thermostat

T set is measured with thermostat sensor 1.

When thermostat sensor 2 is connected, the relay switches on when T set is undershot at thermostat Sensor 1, and switches off when T set + hysteresis at thermostat sensor 2 is exceeded.

6.5.2.5. - Thermostat 2

Optional switch off sensor

When T set + hysteresis is exceeded at the optional thermostat sensor 2, the relay is switched off.

6.5.2.6. - T eco

For Energy saving mode

When Energy saving mode is active: During solar charge T eco is used instead of TH set. When the temperature drops below T eco at thermostat sensor 1, the relay is switched on and heats up to T eco + hysteresis.

6.5.2.7. - Storage

For Energy saving mode

Loading this storage activates the Energy saving mode

When this storage is charge by solar, additional heating is only switched on when the temperature is below T eco.

6.5.2.8. - Energy saving mode

Energy saving mode switches the heating on when T eco is undershot und heats up to T eco + hysteresis when solar charge is active.

6.5.2.9. - Periods

Thermostat activity times

Set the desired periods of time when the thermostat should be active. 3 periods can be set per day, settings can also be copied to other days. Outside the set times the thermostat is switched off.



6.5.3. - Cooling

This is used to cool down e.g. storages to a setpoint temperature by radiating heat.

6.5.3.2. - Co T set

Target temperature at thermostat sensor 1. Cooling is on above this temperature till Co T set + hysteresis is reached.

6.5.3.3. - Co hysteresis

If the temperature at th drops below Co T set + hysteresis, the relay is switched off.

6.5.3.4. - Cooling (sensor)

Reference sensor of the cooling function.

6.5.3.5. - Periods

Cooling activity times

Set the desired periods of time when the cooling should be active. 3 periods can be set per day, settings can also be copied to other days. Outside the set times the cooling function is switched off.



6.5.4. - Return flow increase

This function is used to raise the temperature of e.g. the return flow by the storage.

6.5.4.2. - RF Tmax

Maximum temperature at the return flow sensor. If this temperature is exceeded, the relay is switched off.

6.5.4.3. - ΔT return flow

Switch-on temperature difference:

When this difference is exceeded between return flow sensor and storage sensor, the relay is switched on.

Switch-off temperature difference:

When this difference is exceeded between return flow sensor and storage sensor, the relay is switched off.

6.5.4.4. - Return flow (sensor)

Determines the sensor for return flow increase.

6.5.4.5. - Storage (sensor)

Determines the storage sensor



6.5.5. - Field cooling

This function controls an external cooling unit to cool down the collector.

6.5.5.2. - Tmax field

If this temperature is exceeded at the reference sensor, the relay is switched on.

6.5.5.3. - Hys min

When the temperature falls below Tmax field + Hys min, the relay is switched off.

6.5.5.4. - Hys max

To protect the cooling unit itself from damage, the relay is switched off as soon as the temperature at the reference sensor reaches Tmax field + Hys max

6.5.5.5. - Field cooling sensor

Reference sensor of the collector field cooling function.



This function does not activate the solar pump to cool the collector. Therefore, please refer to the collector protection.



6.5.6. - Anti Legionella

This function is used to heat up the system during selected periods to eliminate legionella bacteria.

6.5.6.2. - AL T set

This temperature has to be detected for the time set in AL residence time at the AL sensors for a successful heat up.

6.5.6.3. - AL residence time

This determines the time span for which the AL T set temperature must be detected for a successful AL heat up.

6.5.6.4. - Last AL heat

This displays the date and time of the last successful heat up.

6.5.6.5. - AL sensor 1

This temperature is used to measure the AL temperature.

6.5.6.6. - AL Sensor 2

Optional AL sensor

When a second sensor is connected, both sensors must reach and hold the set-point temperature for the residence time for a successful heat up.

6.5.6.7. - AL-times

During this periods the AL heat up is attempted.



Caution

This anti-Legionella function does not provide complete protection against Legionella, because the controller is dependent on sufficient energy being fed in, and it is not possible to monitor the temperatures in the entire range of the storage tanks and the connected piping system. To provide complete protection against Legionella bacteria, it must be ensured that the temperature is raised to the necessary temperature, and at the same time there must be water circulation in the storage tank and piping system by means of other additional energy sources and external control units.



Caution

The anti-Legionella function is switched off at delivery. Whenever heating-up has been carried out with the anti-Legionella function switched on, an information message with the date appears on the display.



Danger

During the anti-Legionella function the storage tank is heated up over the set value "Tmax S(X)", which can lead to scalding and damage to the system.



6.5.7. - Heat transfer

This is used to transfer energy from one storage to another with a pump.

6.5.7.2. - Shift Tmin

Minimum temperature in source storage to enable the heat transfer.

6.5.7.3. - ΔT Heat transfer

Temperature difference for heat transfer function.

When the temperature difference between HT Source and HT Drain reaches ΔT Heat Transfer On, the relay is switched on. As soon as the difference drops to ΔT Heat Transfer Off, the relay is switched off again.

6.5.7.4. - Setpoint

Setpoint temperature of the target storage

When this temperature is detected in the target storage, heat transfer is switched off.

6.5.7.5. - HT Source (sensor)

This menu determines the sensor, that is placed in the source storage.

6.5.7.6. - HT Drain (Target sensor)

This determines the sensor placed in the storage that is receiving energy from the source storage.



6.5.8. - Difference

The relay is switched on when a specific temperature difference (ΔT) is reached.

6.5.8.2. - Diff Tmin

Minimum temperature at source sensor to enable the difference relay

When the temperature at the source sensor is below this level, the difference function is disabled.

6.5.8.3. - ΔT difference

Switch on - difference:

When this temperature difference is reached, the relay is switched on.

Switch off - difference:

When this temperature difference is reached, the relay is switched off.

6.5.8.4. - DF Tmax

Maximum temperature at target sensor to enable difference function

If the temperature at the target sensor exceeds this value, difference function is disabled.

6.5.8.5. - DF source (sensor)

Heat source sensor for Difference function

This determines the sensor for the heat source.

6.5.8.6. - DF Drain (sensor)

Drain sensor / Target sensor for difference function

This determines the sensor for the target storage.



6.5.9. - Solid fuel boiler

The relay is used to control an additional solid fuel boiler.

6.5.9.2. - SF Tmin

Minimum temperature in the solid fuel boiler to switch on the pump. If the temperature at the boiler sensor is below this temperature, the relay is disabled.

6.5.9.3. - ΔT Solid fuel

Switch on and Switch off condition for the temperature difference between boiler and storage. Switch on difference ΔT SF. Switch off temperature difference ΔT SF.

6.5.9.4. - SF Tmax

Maximum temperature in the storage. If this is exceeded, the relay is switched off.

6.5.9.5. - Boiler sensor

This determines the sensor, that is used as boiler sensor.

6.5.9.6. - Storage sensor

This determines the sensor, that is used as storage sensor.



6.5.10. - Error message

The relay is switched on, when one or more protective function is active or a message is shown. This function can be inverted, so that the relay is always on and switches off when a protective function or a message is shown.

Collector protection, System protection, Frost protection, Recooling, Anti-legionella protection, Messages, Collector alarm



6.5.11. - Booster pump

Additional pump that fills the system at the start of every solar charge.

6.5.11.2. - Filling time

Time the pump is switched on

This setting determines the length of time the pump is switched on at the start of a solar charge.



6.5.12. - Parallel operation R (X)

The relay is switched on at the same time as the set relay R1 or R2.

6.5.12.2. - Delay

This menu determines how long after the start of R1 or R2 the parallel relay is switched on.

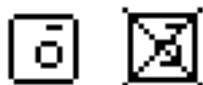
6.5.12.3. - Followup time

This menu determines how long after the switch off of R1 or R2 the parallel relay is switched off.



6.5.13. - Always on

Relay is always switched on.



6.5.14. - Heating circuit

Heat circuit pump is controlled with a fixed hysteresis of (+/-1° for setpoint temperature). 30 seconds Switch on and Switch off delay is fixed setting to prevent unnecessary switching of the pump. RC21 room controller can be used as room temperature sensor.

6.5.14.2. - Room set day

Room reference temperature in day mode. If this temperature is exceeded at the room temperature sensor at the set times, the relay is switched off.

6.5.14.3. - Room set night

Room reference temperature in night mode. If this temperature is exceeded at the room temperature sensor at the set times, the relay is switched off.

6.5.14.4. - Room sensor

This menu determines the sensor for the room temperature.

6.5.14.5. - Periods

Set the desired periods of time when the heat circuit day mode should be active. 3 periods can be set per day, settings can also be copied to other days. Outside the set times the heating function is working in night mode.

Special functions

6.6. - Heat quantity

6.6.1. - Constant flow

When the heat meter mode „Flow rate“ is selected, an approximated heat quantity is calculated using the values the user has to enter. These are type of glycol/AntiFreeze, glycol portion and flow rate. These values are put into correlation with the temperature data of collector sensor and storage sensor. If necessary a correction value for ΔT can be set: Since for the heat meter the collector and the storage temperature are used, a difference to the flow respectively return flow temperature can be compensated by changing Offset ΔT accordingly.

Example:

Displayed collector temp. 40°C, measured flow temperature 39°C, displayed storage temperature 30°C, measured return temperature 31°C = results in a correction value of -20% (displayed ΔT 10K, real ΔT 8K = -20% correction)



The heat quantity measured in the mode “Flow rate” is a calculated approximation for function control of the system.

6.6.2. - Flow sensor (X)

This determines the sensor that is used to measure the flow temperature.

6.6.3. - Return sensor

This determines the sensor that is used to measure the return temperature.

6.6.4. - Anti freeze type

Set the type of anti freeze used. If none is used, please set to 0.

6.6.5. - Glycole percentage

The amount of anti freeze agent in the system.

6.6.6. - Flow rate (X)

Flow rate that is used to calculate the heat quantity

This determines the flow rate in litres per minute that is used for the calculation of the heat quantity.

6.6.7. - Offset ΔT

Correction value for temperature difference

Since for the heat meter the collector and the storage temperature are used, a difference to the flow respectively return flow temperature can be compensated by changing Offset ΔT accordingly.

Example:

Displayed collector temp. 40°C, measured flow temperature 39°C, displayed storage temperature 30°C, measured return temperature 31°C = results in a correction value of -20% (displayed ΔT 10K, real ΔT 8K = -20% correction)

Special functions

6.7. - Sensor calibration

Deviations in the temperature values displayed, for example due to cables which are too long or sensors which are not positioned optimally, can be compensated for manually here. The settings can be made for each individual sensor in steps of 0.8 °C (temperature) resp. 0.2 % of the measuring range of the VFS / RPS sensor (flow rate / pressure) per step.



Caution

Settings are only necessary in special cases at the time of initial commissioning by the specialist. Incorrect measurement values can lead to unpredictable errors.

6.8. - Commissioning

Starting the commissioning help guides you in the correct order through the basic settings necessary for commissioning, and provides brief descriptions of each parameter in the display. Pressing the “esc” key takes you back to the previous value so you can look at the selected setting again or adjust it if desired. Pressing the “esc” more than once takes you back to the selection mode, thus cancelling the commissioning help. (see also E.2).



Caution

May only be started by a specialist during commissioning! Observe the explanations for the individual parameters in these instructions, and check whether further settings are necessary for your application.

6.9. - Factory settings

All of the settings that have been made can be reset, thus returning the controller to its delivery state.



Caution

The entire parametrisation, analyses, etc. of the controller will be lost irrevocably. The controller must then be commissioned once again.

6.10. - Start aid function

With some solar systems, especially with vacuum tube collectors, it may occur that the measurement value acquisition at the collector sensor occurs too slowly or too inaccurately because the sensor is often not at the hottest location. When the start help is activated the following sequence is carried out: If the temperature at the collector sensor increases by the value specified under “Increase” within one minute, then the solar pump is switched on for the set “Purging time” so that the medium to be measured can be moved to the collector sensor. If this still does not result in a normal switch-on condition, then the start help function is subject to a 5-minute lockout time.



Caution

This function should only be activated by a specialist if problems arise with acquisition of measurement values. In particular follow the instructions from the collector manufacturer.

Special functions

6.11. - Time and date

This menu is used to set the current time and date.



Caution

For analysis of the system data it is essential for the time to be set accurately on the controller. Please note that the clock does not continue to run if the mains voltage is interrupted, and must therefore be reset.

6.12. - Daylight saving time

When this function is active, the controller's clock changes automatically to and from DST (DST, Daylight Savings Time).

6.13. - Eco display mode

When active, the displays backlight is switched off after 2 minutes of inactivity.



Caution

If a message is waiting, the backlight is not switched off.

6.14. - Temperature unit

This menu is used to select the temperature unit that is displayed.

6.15. - Network

In this menu, the settings of the Ethernet connection of the data logger are set.

6.15.1. - Access Control

In this menu you can add or remove four users who should have access to the data logger. To add a user in the list, select <add user>. The list shows you the last 5 users that tried to connect to the data logger. Select a user with OK to give it to grant access. To revoke access again choose one of the 4 users from your list and choose <remove user>.

6.15.2. - Ethernet

In this menu, the settings of the ethernet connection of the data logger can be set.

6.15.2.1. - Ethernet

Activate or deactivate the ethernet function.

6.15.2.2. - MAC Address

Displays the individual MAC address of the data logger.

6.15.2.3. - Auto-Configuration (DHCP)

If activated, the datalogger requests IP addresses and network parameters from a DHCP server.

6.15.2.4. - IP-Address

In this menu, the IP address of the data logger can be set.

6.15.2.5. - Subnet

In this menu the subnet mask of the data logger can be set.

6.15.2.6. - Gateway

In this menu, the IP of the gateway for the data logger can be set.

6.15.2.7. - DNS-Server

In this menu, the IP address of the DNS server can be set.

Menu lock

7. - Menu lock



Menu “7. Menu lock” can be used to secure the controller against unintentional changing of the set values.

The menu is closed by pressing “esc” or selecting “Exit menu lock”.

The menus listed below remain completely accessible despite the menu lock being activated, and can be used to make adjustments if necessary:

1. Measurement values
2. Analysis
3. Display mode
- 6.11. Time & date
7. Menu lock
8. Service values

To lock the other menus, select “Menu lock on”.

To enable the menus again, select “Menu lock off”.

Setting range: on, off/default setting: off

9. - Service values



The menu “8. Service values” can be used for remote diagnosis by a specialist or the manufacturer in the event of an error, etc.

The menu can be closed at any time by pressing “esc”.

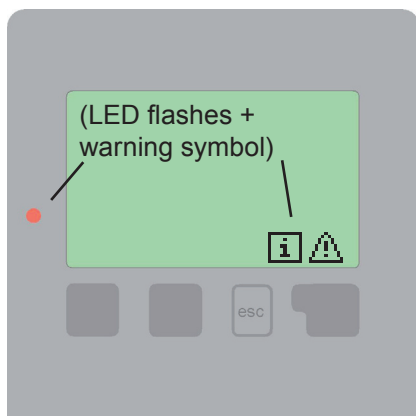
8. - Language



Menu “9. Language” can be used to select the language for the menu guidance. This is queried automatically during initial commissioning. The choice of languages may differ, however, depending on the device design. Language selection is not available in every device design!

Malfunctions

2.1. Malfunctions with error messages



If the controller detects a malfunction, the red light flashes and the warning symbol also appears in the display. If the error is no longer present, the warning symbol changes to an info symbol and the red light no longer flashes.

To obtain more detailed information on the error, press the key under the warning or info symbol.



Do not try to deal with this yourself.
Consult a specialist in the event of an error!

Possible error messages:	Notes for the specialist:
Sensor x defective	Means that either the sensor, the sensor input at the controller or the connecting cable is/was defective. (Resistance table see „B.2. - Temperature resistance table for Pt1000 sensors“)
Collector alarm	Means that the collector has fallen/fell below the temperature set under menu „5.6. - Collector alarm“
Restart	Means that the controller was restarted, for example due to a power failure. Check the date&time!
Time & Date	This message appears automatically after a mains failure because the time & date have to be checked, and reset if necessary.
No flow	Is displayed when ΔT between storage and collector is 50 °C or higher for 5 minutes without interruption.
Frequent on / off	A relay was switched on and off more than 5 times within 5 minutes.
AL failed	Is displayed when AL ref -5 °C was not measured for the set AI residence time at the AL sensor.

Malfunctions

Z.2 Replacing the fuse

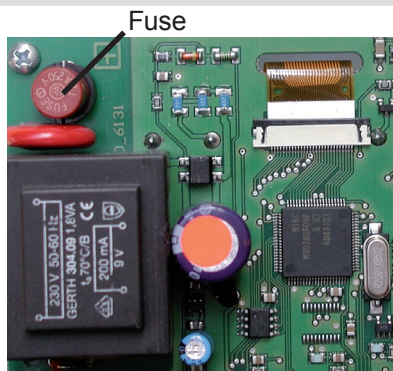


Repairs and maintenance may only be performed by a specialist. Before working on the unit, switch off the power supply and secure it against being switched on again! Check for the absence of power!



Only use the supplied spare fuse or a fuse of the same design with the following specifications: T2A 250V

Z.2.1



If the mains voltage is switched on and the controller still does not function or display anything, then the internal device fuse may be defective. In that case, open the device as described under C, remove the old fuse and check it.

Exchange the defective fuse for a new one, locate the external source of the error (e.g. pump) and exchange it. Then first recommission the controller and check the function of the switch outputs in manual mode as described under 3.2.

Z.3 Maintenance



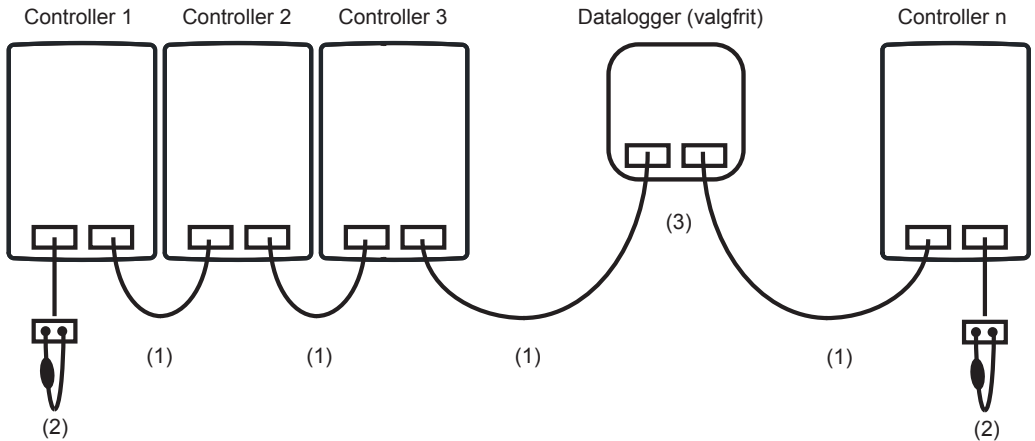
In the course of the general annual maintenance of your heating system you should also have the functions of the controller checked by a specialist and have the settings optimised if necessary.

Performing maintenance:

- Check the date and time (see „6.11. - Time and date“)
- Assess/check plausibility of analyses (see „2. - Statistics“)
- Check the error memory (see „2.4. - Message log“)
- Verify/check plausibility of the current measurement values (see „1. - Measurement values“)
- Check the switch outputs/consumers in manual mode (see „3.2. - Manual“)
- Possibly optimise the parameter settings

Z.4 CAN-Bus

The CAN bus can be used to connect two or more controllers with each other or with the data logger to exchange data.



1. The controllers are connected in series with the CAN bus cable (1).
2. The first and last controller/data logger in this connection series must be fitted with a terminating resistor (2).

The wiring of the two CAN sockets is optional.

3. Optionally, the data logger (3) can be integrated in a CAN bus.

The available CAN functions are subject to the controller type as well as the software version used and can be seen in the corresponding manual.

Tips & Tricks



Instead of setting the flow rate for the system using a flow rate limiter, it is better to adjust the flow rate using the switch on the pump and by means of the “max. speed” setting on the controller (see 6.3.4). This saves electricity!



The service values (see 8.) include not only current measurement values and operating states, but also all of the settings for the controller. Write the service values down just once after commissioning has been successfully completed.



In the event of uncertainty as to the control response or malfunctions the service values are a proven and successful method for remote diagnosis. Write the service values down (see 8.) at the time that the suspected malfunction occurs. Send the service value table by fax or e-mail with a brief description of the error to the specialist or manufacturer.



In programs with pool the charging of the pool, e.g. for winter operation, can be switched off using a simple function. To do this, simply press and hold the “esc” key down for several seconds on the diagram/overview screen. A message appears on the display as soon as the pool is switched off or when the pool is switched on again.



To protect against loss of data, record any analyses and data that are particularly important to you (see 2.) at regular intervals.

Hydraulic variant set:

Commissioned on:

Commissioned by:

Final declaration:

Although these instructions have been created with the greatest possible care, the possibility of incorrect or incomplete information cannot be excluded. Subject as a basic principle to errors and technical changes.

Your specialist dealer:

Manufacturer: