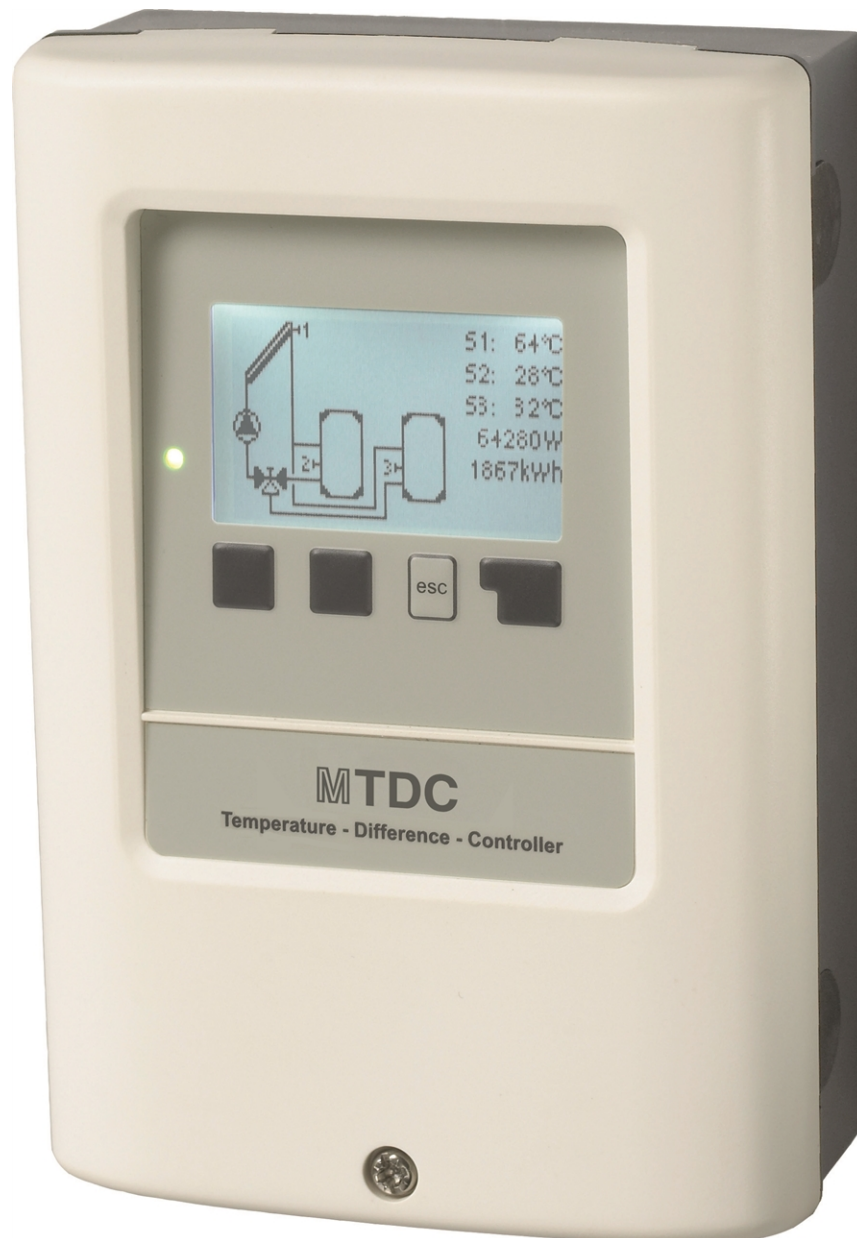


Temperature difference controller MTDC

Installation and operating instructions



Read carefully before installation, commissioning and operation

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EU-Conformity

By affixing the CE mark to the unit the manufacturer declares that the MTDC conforms to the following relevant safety regulations:

- EU low voltage directive 2014/35/EU
- EU electromagnetic compatibility directive 2014/30/EU

conforms. Conformity has been verified and the corresponding documentation and the EU declaration of conformity are kept on file by the manufacturer.

General instructions

Please read carefully!

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 and understood completely by the installation technician/specialist and by the system user before installation, commissioning and operation of the unit.

This unit is an automatic, electrical Temperature difference controller. Install the unit only in dry areas and under the ambient conditions described in "Specifications".

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.

Under no circumstances does the unit replace any safety devices to be provided by the customer!

Installation, electrical connection, commissioning and maintenance of the device may only be carried out by an appropriately trained specialist. Users: Make sure that the specialist gives you detailed information on the function and operation of the unit. Always keep these instructions in the vicinity of the unit.

The manufacturer does not take over any liability for damage caused through improper usage or non-compliance of this manual!

Explanation of Symbols



Danger

Failure to observe these instructions can result in electrocution.



Danger

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



Caution

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



Caution

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

Changes to the Unit

- Changes, additions to or conversion of the unit are not permitted without 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, turn the Unit 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 described in these instructions may be set using the Unit.



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

Warranty and Liability

The unit 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.
- Use of the device for other than its intended purpose.
- Operation above or below the limit values listed in the 'Specifications' section.
- Force majeure.

Disposal and Pollutants

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



Under no circumstances may the device be disposed of with the normal household waste. Dispose of the unit only at appropriate collection points or ship it back to the seller or manufacturer.

Description MTDC

About the Controller

The Temperature difference controller MTDC facilitates efficient use and function control of your solar or heating system possible while its handling is intuitive. After every input step the suitable functions are matched to the keys and explained in a text above. In the menu 'measurement values and settings' are help text and graphics in addition to key words.

The MTDC can be used with different variants of installations, See "Hydraulic Variants" on page 7.

Important characteristics of the MTDC are:

- Depiction of graphics and texts using a lit display.
- Simple viewing of the current measurement values.
- Statistics and system monitoring by means of statistical graphics
- Extensive setting menus with explanations.
- Menu block can be activated to prevent unintentional setting changes.
- Resetting to previously selected values or factory settings.

Specifications

Electrical specifications:			
Power supply		100 - 240VAC, 50 - 60 Hz	
Power consumption / standby		0,5W - 2,5W/ X	
Internal fuse	1	2A slow blow 250V	
Protection Class		IP40	
Protection Class		II	
Overvoltage category		II	
Degree of pollution category		II	
Inputs/Outputs			
Sensor inputs	4	Pt1000	-40 °C ... 300 °C
Outputs mechanical relay	2		
mechanical relay	R1-R2	460VA for AC1 / 460VA for AC3	
0-10V/PWM output	V1	for 10 k Ω working resistance 1 kHz, level 10 V	
Max. cable length			
Collector sensor	S1	< 30 m	
CAN		< 3 m; at \geq 3 m, a shielded twisted pair cable must be used. Isolate shielding and connect it to the protective conductor of <u>only one</u> of the devices. Max. cable length of the complete system 200 m.	
0-10V/PWM		< 3 m	
mechanical relay		< 10 m	
Interface			
Fieldbus		CAN	
Permissible Ambient Conditions			
for controller operation		0 °C - 40 °C, max. 85 % rel. humidity at 25 °C	
for transport/storage		0 °C - 60 °C, no moisture condensation permitted	
Other Specifications and Dimensions			
Housing Design		2-part, ABS plastic	
Installation Methods		Wall installation, optionally panel installation	
Overall dimensions		163 mm x 110 mm x 52 mm	
Aperture installation dimensions		157 mm x 106 mm x 31 mm	
Display		Fully graphical display, 128 x 64 dots	
Light diode		multicolour	
Real Time Clock		RTC with 24 hour power reserve	
Operation		4 entry keys	

Scope of Supply

- Temperature difference controllerMTDC
- 3 screws 3,5 x 35 mm and 3 plugs 6 mm for wall installation.
- MTDC Installation and operating instructions

Optionally contained depending on design/order:

- CAN Bus Accessories: Datalogger with Ethernet connection
- External relay for V1: 77502

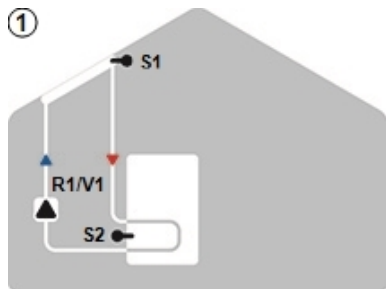
Hydraulic Variants



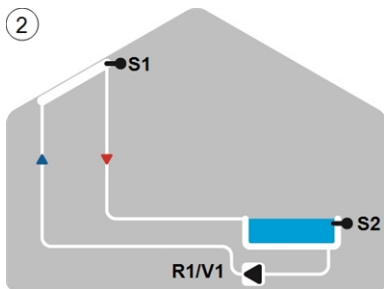
The following illustrations should be regarded only as schematic representations of the respective hydraulic systems and do not claim to be complete. Under no circumstances should the controller replace any safety devices. Depending on the specific application, additional system and safety components such as check valves, non-return valves, safety temperature limiters, scalding protectors, etc., may be required.



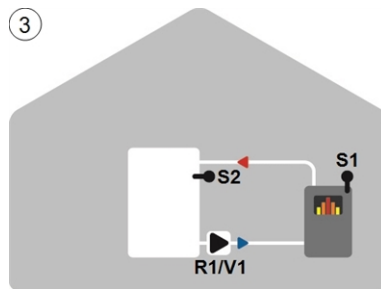
For 3-way valves, the flow direction in energized state (relay active) is shown in the used hydraulic version.



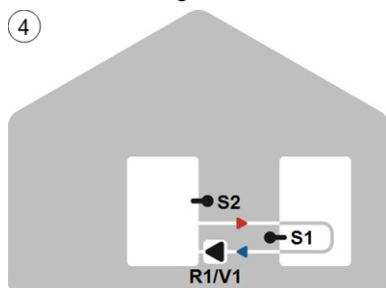
Solar with storage



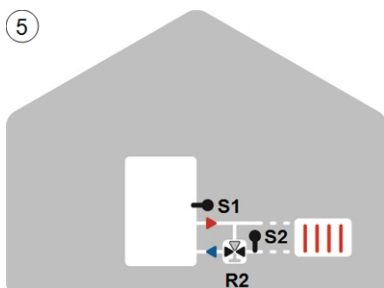
Solar with pool



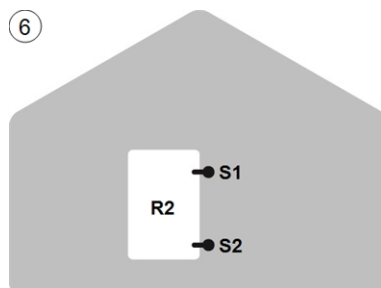
Solid fuel boiler with storage



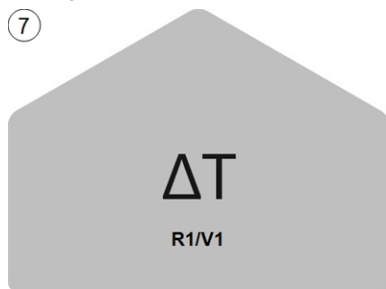
Storage transfer



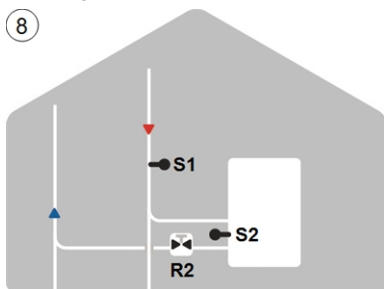
Heating circuit return flow increase



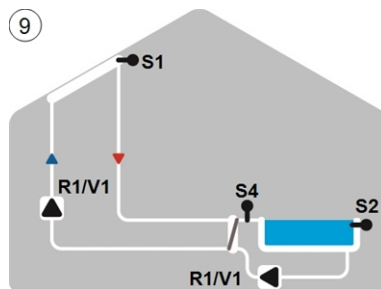
Thermostat



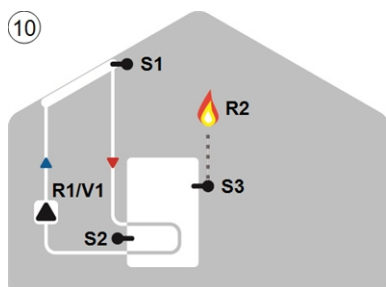
Universal Delta T



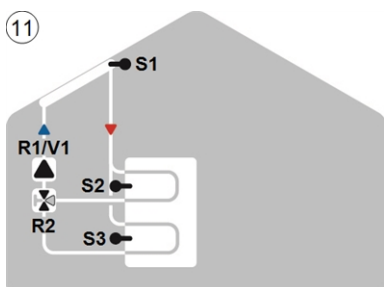
Shutoff valve



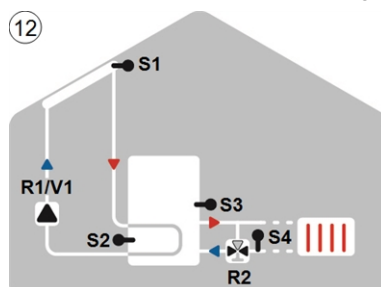
Solar with pool and heat exchanger



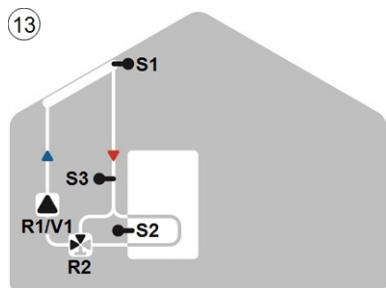
Solar with thermostat (auxiliary heating)



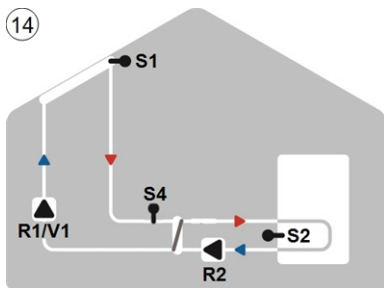
Solar with two-zone storage



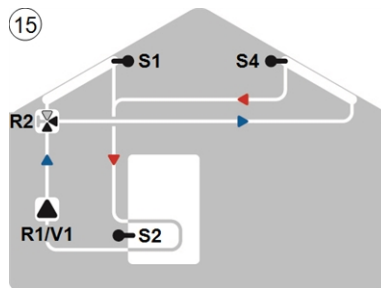
Solar with heating circuit



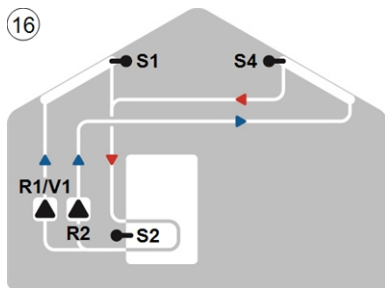
Solar with bypass



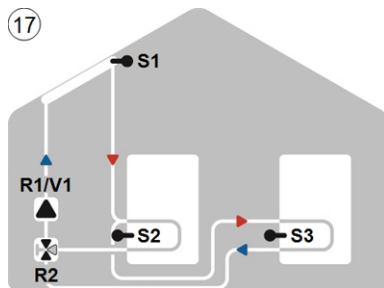
Solar with heat exchanger



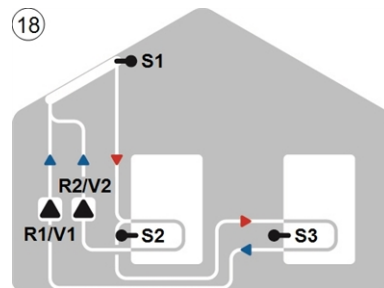
Solar with 2 collector surfaces



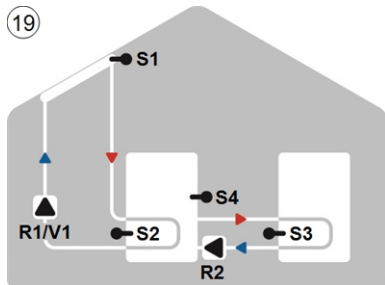
16 Solar with 2 collector surfaces and 2 pumps



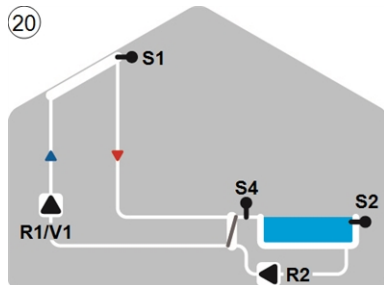
17 Solar with 2 storages and switching valve



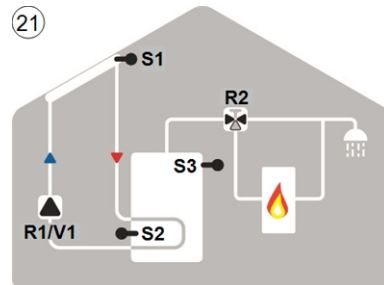
18 Solar with 2 storages and 2 pumps



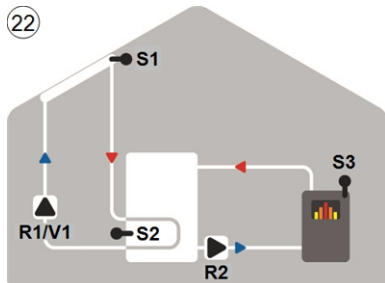
19 Solar with storage transfer



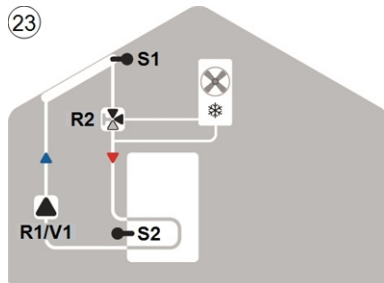
20 Solar with pool and heat exchanger



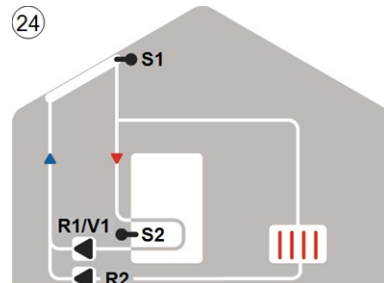
21 Solar with thermostat and switching valve



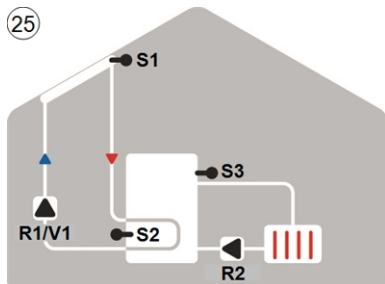
22 Solar and solid-fuel boiler



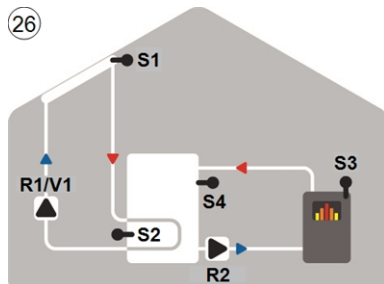
23 Solar with cooling 1 (collector cooling)



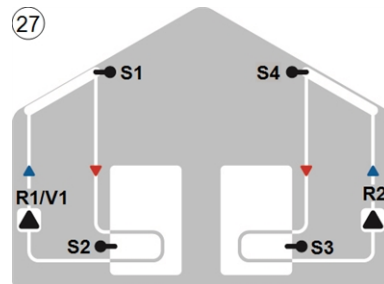
24 Solar with cooling 2 (collector cooling)



25 Solar with cooling 3 (collector cooling)

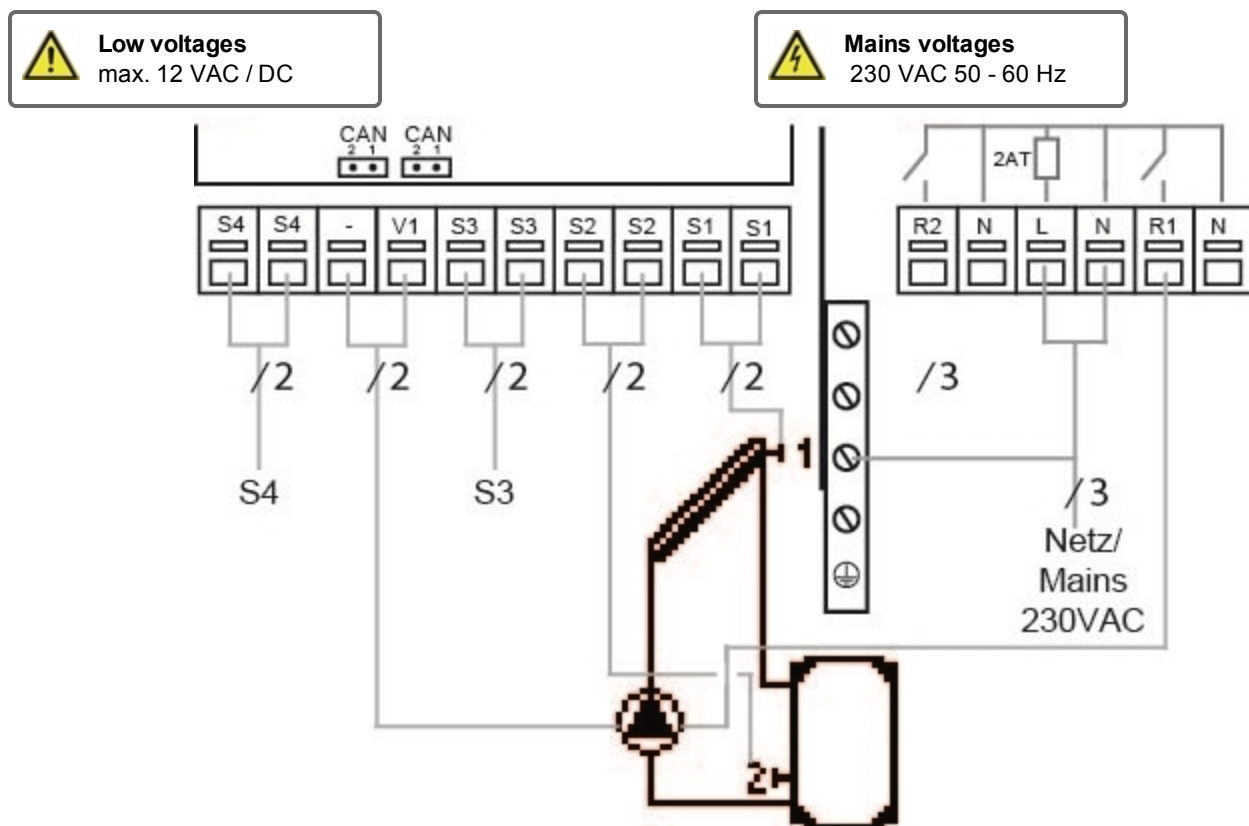


26 Solar with storage and solid-fuel boiler and S4



27 2x Solar

Electrical Terminals



On the control board

CAN CAN bus connection 1= high 2= low
CAN CAN bus connection 1= high 2= low

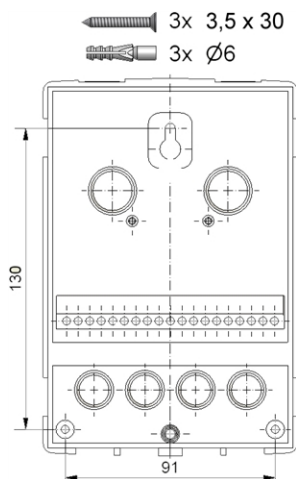
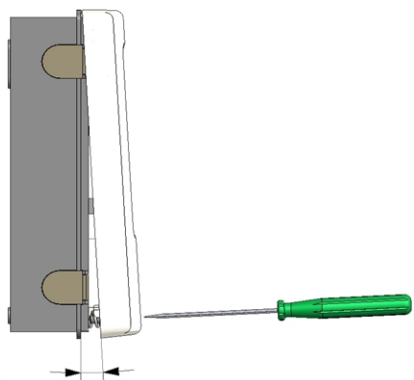
Terminal:	Connection for:	Terminal:	Connection for:
S1	Temperature Sensor 1	N	Neutral conductor R1
S1	(GND)	R1	Outer conductor R1
S2	Temperature Sensor 2	N	Neutral conductor main
S2	(GND)	L	Outer conductor main
S3	Temperature Sensor 3	N	Neutral conductor R2
S3	(GND)	R2	Outer conductor R2
V1	0-10V / PWM signal output e.g. for controlling high-efficiency pumps	The PE protective conductor must be connected to the PE metal terminal block!	
-	speed controlled output for 0-10V GND/ PWM high-efficiency pumps		
S4	Temperature Sensor 4	In high-efficiency pumps with 0-10V / PWM signal input, the power supply must go through the corresponding relay (V1 -> R1, R2 -> V2), because the relay turns on and off together with the control signals.	
S4	(GND)		



"Connection of PWM pumps"

PWM pumps are connected to the controller with 2 wires 1) PWM Input (default: brown) 2) GND (default: blue). Some pumps have a third wire (PWM Output Signal (default: black)). This is not used for the connection!

Wall Installation



1. Unscrew cover screw completely.
2. Carefully pull upper part of housing from lower part. During the removal, the brackets are released as well.
3. Set upper part of housing aside. Do not touch the electronics.
4. Hold the lower part of the housing in 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 screwed on.
5. Using a drill and size 6 bit, drill three holes at the points marked on the wall and push in the plugs.
6. Insert the upper screw and screw it in lightly.
7. Fit the upper part of the housing and insert the other two screws.
8. Align the housing and tighten the three screws.

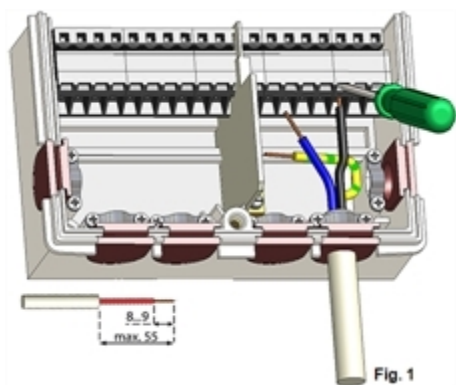


Fig. 1

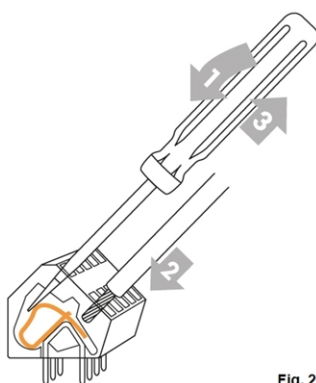


Fig. 2

1. Open the terminal cover.
2. Strip lines a max. of 55 mm, assemble the strain reliefs, strip wire ends 8-9 mm (Figure 1)
3. Open the terminals with a fitting screwdriver (figure 2) and connect the electrical system to the controller.
4. Clip on the terminal cover again and close it with the screw.
5. Turn on mains supply and put the controller into operation.


If problems occur with the operation of the terminals, our video on our YouTube page can help you:


You Tube





<http://www.sorel.de/youtube>


Electrical Connection

 Before working on the unit, switch off the power supply and secure it against being switched on again! Check that there is no power flowing! Electrical connections may only be made by a specialist and in compliance with the applicable regulations. The unit may not be put into operation if there is visible damage to the housing, e.g. cracks.

 The unit may not be accessible from behind.


 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. an emergency heating 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.

Installing the Temperature Sensors

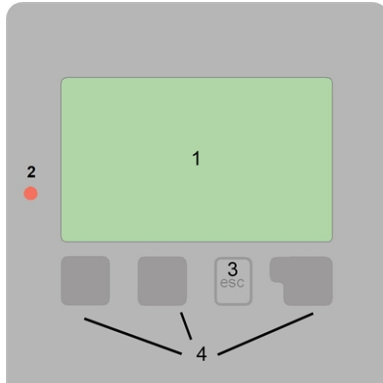
The controller operates with Pt1000 temperature sensors which are accurate to 1 °C, ensuring optimal control of system functions.

 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. Ensure there is no contact resistance! Position the sensor precisely in the area to be measured! Only use immersion, pipe-mounted or flat-mounted sensors suitable for the specific area of application with the appropriate permissible temperature range.

Temperature Resistance Table for Pt1000 Sensors

°C	-20	-10	0	10	20	30	40	50	60	70	80	90	100
Ω	922	961	1000	1039	1077	1116	1155	1194	1232	1270	1308	1347	1385

Display and Input



	Pump (rotates when active)
	Valve (direction of flow black)
	Collector
	Storage / buffer
	Solid fuel boiler
	Pool
	Thermostat On/Off
	Temperature Sensors
	heat exchanger
	External thermostat off

Further symbols can be found in the special functions

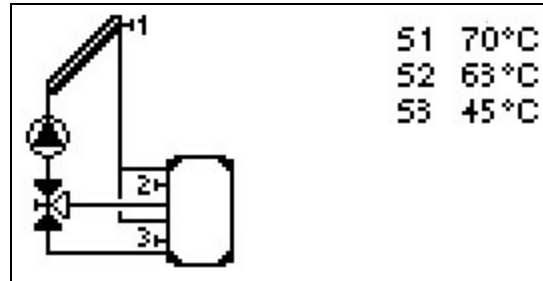
Examples for key settings:

+/-	Increase / decrease values
▼/▲	Scroll menu down / up
Yes/No	agree / reject
About	further information
Back	to the previous display
Ok	Confirm selection
Confirm	Confirm setting

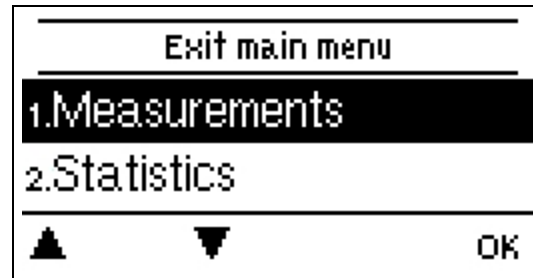
The display's (1), extensive text and graphical mode, enables simple, almost self-explanatory, operation of the controller.

The LED (2) lights up green when the primary pump is switched on (automatic mode). The LED (2) lights up red when operating mode ,Off' is set. The LED (2) flashes quickly red when an error is present.

The function of the other 3 keys (4) is shown in the display right above the keys. The right-hand key generally has a confirmation and selection function.



The graphics mode appears if not key is pressed for 2 minutes or after exiting the main menu with 'esc'.



Hitting the "esc" key in the graphics mode takes you directly to the main menu.

Commissioning help

Setup wizard

Would you like to start the setup wizard?

no

yes

1. Set language and time
2. Commissioning help / setup wizard
 - a) select or
 - b) skip.

The setup wizard guides through the necessary basic settings in the correct order. Every parameter is explained on the display of the controller. Pressing the „esc“ key takes you back to the previous setting.

b) With free commissioning the settings should be made in the following order:

- Menu 9. Language
- menu 3. Operating hours
- menu 4. Settings, all values
- menu 5. Protection Functions (if any adjustments necessary).
- menu 6. Special Functions (if any adjustments necessary).

3. In Menu operating mode "Manual", test the switch outputs with the consumers connected and check the sensor values for plausibility. Then set to automatic mode. See " Manual " on page 15



The setup wizard can be accessed in menu 6.8. at any time.



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

1. Measurement values

Exit measurements

1.1.S1 Collector

70°C

1.2.S2 Storage

21°C

▲

▼

Serve to display the current measured temperatures.

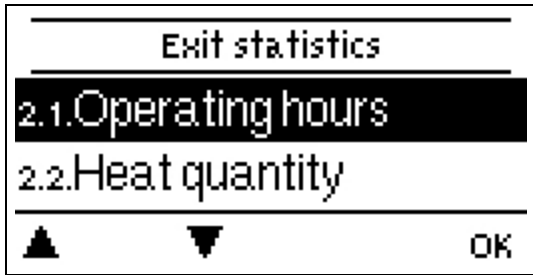


If „error“ appears on the display instead of the measurement value, there may be a defective or incorrect temperature sensor.



If the cables are too long or the sensors are not well-placed, small deviations in the measurement values may occur. In this case, the display values can be compensated by adjustments in the controller. See " Sensor Calibration " on page 28. The selected program, connected sensors and the specific model design determine which measurement values are displayed.

2. Statistics



Serve for function control and long-term monitoring of the system.



For time-dependent functions such as circulation and anti-legionella and the evaluation of system data, it is essential that the time is accurately set on the controller. Please note that the clock continues to run for about 24 hours if the mains voltage is interrupted, and afterward must be reset. Improper operation or an incorrect time may result in data being cleared, recorded incorrectly or overwritten. The manufacturer accepts no liability for the recorded data!

Operating hours

Display of the operating hours of the consumers connected to the controller (for example, solar pumps, valves etc.) whereby different time ranges (day-years) are available!

Heat quantity

Display of the consumed heat quantity from the system in kWh.



This is an indicative value.

Graphic overview

This results in a clear illustration of the data as a bar graph. Different time ranges are available for comparison. You can page through with the two left keys.

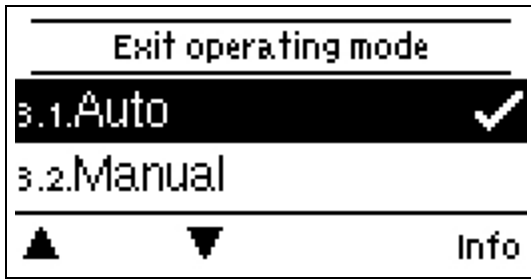
Notifications

Display of the last 20 errors in the system with indication of date and time.

Reset / Clear

Resetting and clearing the selected statistics. Selecting 'all statistics' clears everything except the messages.

3. Operating mode




Auto


The automatic mode is the normal mode of the controller. A correct controller function under consideration of the current temperatures and the set parameters is only present in automatic mode! After an interruption of the mains voltage, the controller automatically returns to the last operating mode selected.

Manual

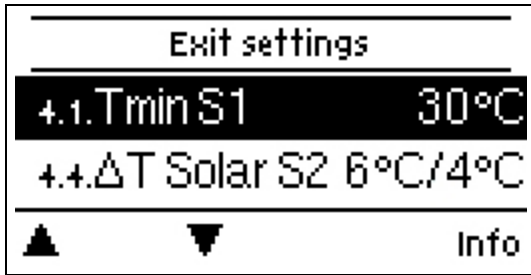
The individual relay outputs, v outputs and the connected consumers can be checked for proper functioning and correct assignment.

 The operating mode 'Manual' may only be used by specialists for brief function tests, e.g. during commissioning! Function in manual mode: The relays and thus the connected consumers are switched on and off by pressing a key, with no regard to the current temperatures and set parameters. At the same time, the current measurement values of temperature sensors are also shown in the display for the purposes of function control.

Off

 If the operating mode "off" is enabled, all control functions are turned off. The measured temperatures are displayed for the overview.

4. Settings



By no means does the controller replace the safety appliances on site!

Tmin S1

Enable/start temperature at sensor 1:

If this value on the sensor 1 (collector sensor) is exceeded and the other conditions are not fulfilled, the controller will turn on the affiliated pump or the valve. If the temperature on the sensor 1 falls 5 °C below this value, the pump or the valve will be turned off again.

Priority Storage X

Priority of storages in a multiple storage system. 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.

Example: if several storages or storage areas in your system are integrated, you can specify a priority for each sensor of the storage or the storage area. The "X" in the menu item priority S(X) indicates the sensor of the respective storage or storage area. The priority for the first storage is thus set under priority S2 and for the 2. storage under priority S3.

ΔT Solar S(X)

Switch-on/switch-off temperature difference for sensor X: If the temperature difference ΔT solar between the reference sensors is exceeded and the other conditions are fulfilled, the controller will turn on the pump/valve on the corresponding relay. If the temperature difference falls to ΔT Off, the pump/valve will be turned off again.



If the set temperature difference is too small, this may lead to ineffective operation depending on the system and sensor positioning. For speed regulation (See "Speed control" on page 19), special switch conditions apply!

Example: if several storages or storage areas in your system are integrated, you can specify ΔT for each sensor of the storage or the storage area. The "X" in the menu item ΔT solar S(X) indicates the sensor of the respective storage or storage area. ΔT solar for the first storage is thus set under ΔT solar S2 and for the 2. storage under ΔT solar S3.

Tmax S2

Switch off temperature at sensor 2:

If this value is exceeded on the sensor 2, the controller turn off the affiliated pump or the valve. If this value on the sensor 2 is undershot and the other conditions are fulfilled, the controller will turn on the pump or the valve.



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 multiple storage systems, if the shut-down temperature S2 is exceeded, a downstream installed storage or storage area is switched to.

Tmin Storage X

Switch-off temperature at sensor X at multiple storage systems

If this value is exceeded at sensor X then the controller switches the associated pump and/or valve off. If sensor (X) 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!


In multiple storage systems, if the shut-down temperature S(X) is exceeded, a downstream installed storage or storage area is switched to.

Example: if several storages or storage areas in your system are integrated, you can specify a priority for each sensor of the storage or the storage area. The "X" in the menu item priority S(X) indicates the sensor of the respective storage or storage area.

The priority for the first storage is thus set under priority S2 and for the 2. storage under priority S3.

Tmax Pool / Tmax Pool HE

Switch-off temperature at heat exchanger sensor. If this value is exceeded at the specified sensor, the controller turn off the affiliated pump or the valve. If this value on the sensor is undershot and the other conditions are fulfilled, the controller will turn on the pump or the valve.

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

Priority temperature

Temperature threshold for absolute priority charge. 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.

Loading time

Interruption of charging into the lower priority storage. The charging of the lower-priority storage 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. If so, the priority storage tank is charged. If not, the increase is measured (See " Increase " on page 17), to check if charging of the priority storage will be possible shortly.

Increase

Extension of the charging pause due to temperature increase. 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.

5. Protective Functions



The 'Protective functions' can be used by specialists to activate and set various protective functions.




By no means does the controller replace the safety appliances on site!

System protection

Priority protection function


The system protection should prevent an overheating of the components installed in the system through the forced shut down of the solar circulation pump. If the value "AS Ton" on the collector has been exceeded for 1 Min. the pump will be turned off and not turn on again in order to protect the collector, for example, from steam. The pump will only be switched on again, when the collector temperature falls below "SP Toff".

 With the system protection (on), there are increased standstill temperatures in the solar collector and therefore an increased pressure in the system. The operating manuals from the system components must be observed.

Collector protection


Priority protection function

The collector protection prevents the collector from overheating. A forced switching of the pump makes sure that the collector is cooled through the storage. If the value "KS Ton" is exceeded on the collector, the pump will be turned on in order to cool the collector. The pump is shut down if the value "KS Toff" on the collector is not met or the value "KS Tmax Sp." on the storage is exceeded.

 System protection has priority over collector protection! Even if the switch requirements for the collector protection are present, the solar circulation pump is turned off once "AS T on" is reached. Normally the values from the system protection (depending on the maximum temperature of the storage or other components) are higher than the collector protection.


Recooling

In the system hydraulics with solar, excess energy is guided from the storage back to the collector with an activated return cooling function. This only occurs if the temperature in the storage is greater than the value "Return cooling Tref" and the collector is at least 20 °C colder than the storage and until the storage temperature has fallen below the value "Return cooling Tref". For multi-storage systems, the return cooling applies to all storage.

 Energy is lost through the collector through this function! The recooling should only be activated in cases of exception, with low heat acceptance, for example, during vacation.

Frost Protection

A 2-level frost protection function can be activated. In level 1, the controller turns on the pump every hour for 1 minute if the collector temperature is below the set value "Frost Level 1". If the collector temperature continues to decrease to the set value "Frost Level 2", the controller will turn on the pump without disruption. If the collector temperature exceeds the value "Frost level 2" by 2 °C, the pump will turn off again.

 Energy is lost through the collector through this function! It is normally not activated for solar systems with antifreeze. The operating manuals from the other system components must be observed.

Seizing Protection

If the anti-seizing protection is activated, the controller switches the heat pump and the mixer on/off at 12:00 noon or weekly on Sundays at 12:00 for 5 seconds to prevent seizing of the pump/valve after long periods of inactivity.


Collector alarm

If this temperature at the collector sensor is exceeded when the solar pump is turned on, a warning or error notification is triggered. There is a corresponding warning in the display.

6. Special Functions




Used to set basic items and expanded functions.

 The settings in this menu should only be changed by a specialist.


Program selection

Here the hydraulic variation fitting to the respective use case is selected and set.

 The program selection normally occurs only once during the first entry into service by a specialist. An incorrect program selection may lead to unpredictable errors.

Pump settings

Settings from the 0-10V or the PWM pump can be made in this menu.

 When this menu is selected, you may receive a request to save the speed settings.

Profile

In this menu, the preset profiles for actuators can be selected or under "manual" all settings can be done personally. The settings can still be changed after a profile has been selected.

Signal type

Only available, if the function is used on one of the V-outputs. The type of device to be controlled is set here.

0-10V: Control by 0-10V signal.

PWM: Control by means of a PWM signal.

Output Signal

In this menu the type of actors are set: heating pumps have the greatest output with a small input signal, solar pumps in contrast have very little output with a small input signal. Solar = normal, heating = inverted. For 0-10 V pump always choose the "Normal" setting

PWM / 0-10V off

This voltage / this signal is emitted if the actor is turned off (actor with cable break detection require a minimum voltage / a minimum signal).

PWM / 0-10V on

This voltage / signal is required the actuator to switch on and run at minimum speed.

PWM / 0-10V max.

With this value, the maximum voltage level / maximum signal can be specified for the highest speed of the actuator, which is used, for example, during the flushing or manual operation.

Show signal

Represents the set signal in a graphic and text overview.

Speed control

If the speed control is activated, itMTDC offers the possibility through a special internal electronic system to change the speed of pumps depending on the process.



This function should only be activated by a technician. Depending on the pump being used and the pump level, the minimum speed may not be set too small, because the pump or the system may be damaged. The specifications from the affected manufacturer must be observed for this! When in doubt, the min. speed and the pump level should be set too high instead of too low.

Variant

The following speed variants are available here:

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

Mode M1: The controller changes to the set max. speed after the purging time. If the temperature difference ΔT between the reference sensors is below the set switch on temperature difference $\Delta T R1$, the speed will be reduced. If the temperature difference between the reference sensors is above the set switch on temperature difference $\Delta T R1$, the speed will be increased. If the controller has decreased the speed of the pump to the smallest level and the ΔT between the reference sensors is still only ΔT_{off} , the pump will be turned off.

Mode M2: The controller changes to the set min. speed after the Speed. If the temperature difference ΔT between the reference sensors is above the set switch on temperature difference $\Delta T R1$, the speed will be increased. If the temperature difference ΔT between the reference sensors is below the set switch on temperature difference $\Delta T R1$, the speed will be reduced. If the controller has decreased the speed of the pump to the smallest level and the ΔT between the reference sensors is still only ΔT_{off} , the pump will be turned off.

Mode M3: The controller changes to the set min. speed after the Speed. If the temperature on the reference sensors is above the set value to be set in the following, the speed will be increased. If the temperature on the reference sensors is below the set value to be set in the following, the speed will be reduced.

Mode M4 (2 storage system):

When the primary storage is loaded, speed control works as in M3. When the secondary storage is loaded, speed control works as in M1.

Purging time

For this time, the pump runs with its full speed (100%) in order to guarantee a secure start-up. Only after expiration of this purging time will the pump have a controlled speed and will switch, depending on the set variant, to the max. or min. speed. Speed.

Sweep time

With the control time, the inertia of the speed control is determined in order to prevent strong temperature deviations as much as possible. The timespan is entered here, which is needed for a complete cycle from minimum speed to maximum speed.

Max. Speed

The maximum speed of the pump is determined here in %. During the setting, the pump runs in the respective speed and the flow can be determined.



The specified percentages are variables, which may deviate more or less strongly depending on the system, pump and pump level. 100% is the maximum possible power of the controller.

Min. Speed

The minimum speed of the pump is determined here. During the setting, the pump runs in the respective speed and the flow can be determined.



The specified percentages are variables, which may deviate more or less strongly depending on the system, pump and pump level. 100% is the maximum possible power of the controller.

Setpoint

This value is the control setpoint. If this value is below at the sensor, the speed is reduced. When it is exceeded, the speed is increased.

Setpoint 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. When it is exceeded, the speed is increased.

Relay functions

Free, i.e. in the specific hydraulic variant unused relays, can be assigned to various additional functions. Every additional function can only be assigned once.

R1 to R2: mechanical relay 230V

V1: PWM and 0-10 V output

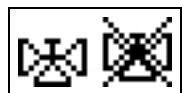
Please pay special attention to the relay's technical information (see "Specifications").

The symbols shown here are displayed on the main overview screen when the special function is activated.



The sequence in this list does not correspond to the menu numbering in the controller.

Solar bypass



Use a relay to switch a bypass valve or a bypass pump. With this function, the flow can be guided past the storage if the flow temperature at the bypass sensor is less than in the storage to be filled.

Solar bypass

Variant

In this menu, you can set if the flow is guided through the bypass with a pump or a valve.

Bypass sensor

The reference sensor for the bypass function to be placed in the flow is selected in this menu.

Thermostat



Through the thermostat function, additional energy can be added to the system while being time and temperature controlled. The thermostat function can be used in 2 modes.

"On" = the relay is switched on when all switching conditions are reached

"Inverted" = the relay is switched off when all switching conditions are reached and is otherwise switched on.



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



Other values, for example, Teco, apply in economy mode.

Thermostat

DHW request

Thermostat is started for a DHW - heat request.

Heating Circuit request

Thermostat is started with a heating circuit - heat request.

Tset

The target temperature of the thermostat sensor 1. Below this temperature, the thermostat turns on until Tset+ Hysteresis is reached.

Hysteresis

Hysteresis of set point temperature.

Thermostat sensor 1

TH Set is measured at thermostat sensor 1. With a connected thermostat sensor 2, the relay switches on if "TH Ref" at thermostat sensor 1 is undershot and off if "TH Ref" + hysteresis is exceeded at thermostat sensor 2.

Thermostat sensor 2

Optional switch off sensor

If "TH target" + hysteresis is exceeded on thermostat sensor 2, the relay will be shut down.

Teco

T Set for energy saving mode

If the energy saving mode (See "Energy Saving Mode" on page 21) is on: During a solar charge, instead of "TH reference", this set value "Teco" will be used as the reference value. When the temperature drops below Teco at thermostat sensor 1, the relay is switched on and heats up to "T eco" + hysteresis.

Energy Saving Mode

The Energy Saving Mode switches the heating on when "T Eco on" is undershot and heats up to "T Eco" + hysteresis when solar charge or solid fuel boiler is active.

Thermostat enable

Thermostat activity times

Here the desired periods are set in which the thermostat function is approved. For each weekday, three times can be specified, furthermore, you can copy individual day to other days. The thermostat function is shut down outside of the set times.

Thermostat 2



Through the thermostat function, additional energy can be added to the system while being time and temperature controlled See "Thermostat" on page 20.

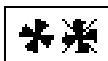


Temperature values which are set too high can lead to scalding or damage to the system. Scalding protection must be provided by the customer!



Other values, for example, Teco, apply in economy mode.

Cooling



This function is used e.g. to cool down storages to a setpoint temperature in which heat is dissipated.

Tset

The target temperature at the set sensor for the function cooling (dissipation).

Hysteresis

When the temperature at the cooling sensor $T_{set} + Hys$, the relay is switched off.

Cooling sensor

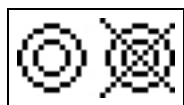
Reference sensor of the cooling function.

Periods

Cooling release times

Here the desired periods are set in which the cooling function is approved. For each weekday, three times can be specified, furthermore, you can copy individual day to other days. The cooling function is shut down outside of the set release times.

Return flow increase



With this function, for example, the return temperature of a heating circuit is increased through the storage.

Return flow increase

Activate function.

Return flow increase Tmax

Maximum temperature set on the storage sensor set for this function. If this temperature is exceeded at the RL storage sensor, the function is deactivated again.

ΔT return flow

Switch on temperature difference:

The relay is turned on if this temperature difference is exceeded between the storage sensor and the recooling sensor.

Switch off temperature difference:

The relay is turned off if this temperature difference is undershot between the storage sensor and the recooling sensor.

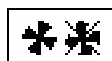
Return flow sensor

Selection of the return flow sensor.

Storage sensor

Selection of the storage sensor.

Field cooling



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

Tmax field

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

Hys min

When the temperature at the reference sensor of the field cooling falls below $T_{max\ field} + Hys\ min$, the relay is switched off.

Hys max

To protect the cooling unit itself from damage, the relay is switched off as soon as the temperature at the reference sensor of the field cooling reaches $T_{max\ field} + Hys\ max$.

Field cooling sensor

Reference sensor of the field cooling function.



This function does not activate the solar pump to cool the collector via the storage. Therefore, please activate the collector protection in the protection functions.

Anti Legionella



The anti-legionella function is an additional function for certain relay functions such as: electric heating rod, burner, circulation, compressor.

With the help of the anti legionella function (hereinafter referred to as: AL), the system can be heated up at selected times in order to free it of legionella.



In the delivery state, the anti legionella function is switched off.



Antilegionella function is not shown in the menu "Protective functions". It is instead shown as submenu of the corresponding special function. Special functions with AL include: Solar, burner, circulation and compressor.



As soon as it has heated up with "AL" turned on, information with the date will be shown in the display.



This anti legionella function does not offer any secure protection against legionella, because the controller requires an adequate added amount of energy and the temperatures cannot be monitored in the entire storage area and the connected pipe system.



During the operation of the anti legionella function, if applicable, the storage is heated above the set value "Tmax", which may lead to scalding and system damage.

AL Tset

For a successful heating, this temperature has to be reached at the AL sensor(s) for the exposure time period.

AL residence time

For this period of time the AL Tsettemperatures at the activated AL-sensors have to be reached for a successful heating.

Last AL heat

This displays when the last successful heating has occurred.

AL sensor 1

On this sensor, the temperature of the AL function is measured.

AL Sensor 2

Optional AL sensor

If this sensor is set for a successful heating Tset AL have to be achieved at this sensor too for the action time.

AL-times

During this periods the AL heat up is attempted. If within the defined period, the AL-condition is met (Tset at the defined sensors for the exposure time period), the heating is completed and logged as "Last AL heating".

Heat transfer



With this function, energy from one storage can be loaded in another.

Heat transfer

HT Tmin

Minimum temperature in the source storage for the approval of the Heat Transfer.

Δ T Heat transfer

Temperature difference for the transfer. If the temperature difference between the sensors ΔT transfer On is reached, the relay is switched on. As soon as the difference on ΔT Transfer off falls, the relay is turned off again.

HT Tmax

Target temperature of the target storage

If this temperature is measured on the sensor in the target storage, the Heat Transfer will be shut down.

Source

In this menu, the sensor is set, which is placed in the storage from which the energy is extracted.

Drain

In this menu, the sensor is set that is placed in the storage in which it is loaded.

Difference



The assigned relay is activated as soon as there is a preset temperature difference (ΔT on/off) between the source and target sensors.

Difference

Tmin Source

Minimum temperature on the source sensor for approval of the difference relay.

If the temperature on the source sensor is below this value, the difference function will not be switched on.

ΔT Difference

Switch on - difference:

If this temperature difference is reached, the relay will switch on.

Switch off difference:

If this temperature difference is reached, the relay will switch off.

Tmax Drain

Maximum temperature on the target sensor for approval of the difference relay.

If the temperature at the target sensor exceeds this value, the difference function will not be turned on.

DF-Source

Heat source sensor/heat supplier for differential function

Adjusts the sensor from the heat source.

DF-Drain

Heat decreasing sensor / heat customer for the different functions

Sets the sensor of the heat customer.

Solid fuel boiler



In solid-fuel boiler function, a pump is controlled with a assigned relay, which loads the heat energy from a solid-fuel boiler into a storage tank.

The solid-fuel boiler function controls the charge pump of a solid-fuel boiler based on the temperature difference between the solid-fuel boiler sensor and the storage tank sensor.

If a control output (V1 or V2, ...) is used with this function, a speed control with a PWM / 0-10V HE pump is possible.

Solid fuel boiler

Solid fuel boiler Tmin

Minimum temperature in the solid fuel boiler to start the pump.

If the temperature at the solid fuel boiler sensor exceeds the temperature set here, the relay switches on the pump, if the other starting conditions are met.

Below the solids boiler Tmin temperature, the solids boiler function is deactivated.

ΔT Solid fuel boiler

Switch-on and switch-off difference between solid fuel boiler (SFB) and storage tank.

If the temperature difference between the sensors defined for this function exceeds the value set here (ΔT SF **On**), the function switches **on** the assigned output (relay or signal output).

If the set temperature difference (ΔT SF **Off**) between the solids boiler and the storage tank is below, the function switches **off** the assigned output (relay or signal output).

Solid fuel boiler Tmax

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

Boiler sensor of this function

Sensor used as a solids boiler sensor. Considered for SF Tmin and ΔT on/off.

Storage sensor

Sensor used as a storage tank sensor. Considered for FS Tmax and ΔT on/off.

Error Messages



The relay is switched on if one or several of the set protective functions are activated. This function can be inverted so that the relay is turned on (Duration on) and then turned off again if a protective function is activated.

Pressure monitor



In this menu, the system pressure monitoring can be activated through a direct sensor. As soon as the set pressure conditions are under-shot or exceeded, the set relay will switch on.

Pressure monitor

Relay turns on if the pressure goes below the minimum or exceeds the maximum.

RPS-Type

Type of pressure sensor

In this menu, you can adjust which pressure sensor is being used. Please note: If e.g. VFS1 is connected, RPS1 option is not shown.

RPS Min

Minimum pressure. If this pressure is not met, the controller emits an error notification and the relay switches.

RPS Max

Maximum pressure in the system. If this pressure is exceeded, the controller emits an error notification and the relay switches.

Booster Pump



An additional booster pump can be activated with this function if the primary pump is no longer sufficient.

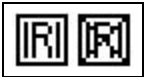
Booster Pump

Activate function.

Charge time

When solar charging begins, the connected booster pump fills the system for the time set here.

Parallel operation R1/R2



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

Parallel operation

Here you can additionally set the switch mode.

On : The function switches parallel to the set signal output.

Inverted : The function switches contrary to the set signal output.

Delay

In this menu, it is set how long to wait after switching the signal output until the parallel operated relay switches as well.

Follow-up time

In this menu, it is set how long the parallel-operated relay continues to operate after the set signal output has been deactivated.

Always on



Relay is permanently switched on.

Heating circuit



In the heating function, a simple heating circuit in the system controls the time and temperature. The settings of the heating circuit define "Room Reference (Day)" and "Room Reference (Night)" values for the associated room sensor.

Heating circuit

Activate function.

Room Reference (Day)

The set temperature considered as reference temperature for the defined room sensor in daytime operation. The daytime mode is defined by the heating circuit periods; three time periods can be specified for each weekday and copied to the following days.

Room Reference (Night)

The set temperature considered as reference temperature for the defined room sensor in nighttime operation. The nighttime mode is defined outside the heating periods.

Room

This menu determines the sensor for the room temperature.

Periods

Thermostat activity times


Set the desired periods of time when the thermostat should be active. For each weekday, three times can be specified, furthermore, you can copy individual day to other days. Outside the set times the thermostat is switched off.

Heat quantity

Constant flow

If "Constant flow" is activated as the type of heat quantity metering, the approximate heat from the manually entered values for anti-freeze, its concentration and the flow from the system and the measured sensor values from the collector and storage are calculated. Additional information about antifreeze, its concentration and the flow of the system is required. Additionally through the setting offset ΔT , a correction factor can be set for the heat quantity collection. Since the collector temperature and the storage temperature can be used for the heat quantity metering, depending on the system, there may be deviations from the displayed collected temperature to the actual previous temperature or the displayed storage temperature to the actual return temperature. Through the setting Offset ΔT , this deviation can be corrected.

Example: displayed collector temperature 40°C, read previous temperature 39°C, displayed storage temperature 30°C, read return temperature 31° means a setting of -20% (displayed ΔT 10K, actual ΔT 8K => -20% correction value)

 The heat quantity data in the "Constant flow" mode only consists of calculated values for the functional inspection of the system.

Flow temperature sensor (X)

In this menu, it is set which sensor is used to measure the flow temperature.

Return flow sensor

In this menu, you can set which sensor is used to measure the return flow temperature.

Glycol type

In this menu, the antifreeze used is set. If none is used, please set glycol proportion to 0.

Glycol percentage

The percentage of antifreeze in the medium.

Flow rate supply flow (X)

Nominal system flow.

The flow of the system in liters per minute, which is used as calculation basis for heat metering.

Offset ΔT

Correction factor for the temperature difference for heat metering

Since the collector temperature and the storage temperature can be used for the heat quantity metering, depending on the system, there may be deviations from the displayed collected temperature to the actual previous temperature or the displayed storage temperature to the actual return temperature. This deviation can be corrected with the adjustment value Offset ΔT

Example: displayed collector temperature 40°C, read previous temperature 39°C, displayed storage temperature 30°C, read return temperature 31° means a setting of -20% (displayed ΔT 10K, actual ΔT 8K => -20% correction value)

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 0.5 °C.



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

Commissioning

Starting 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 ,esc' more than once takes you back to the selection mode, thus cancelling the commissioning help (See "Commissioning help" on page 13).



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.

Factory Settings

All settings can be reset, returning the controller to its delivery state.



All of the controller's parametrization, statistics, etc. will be lost irrevocably. The controller must then be commissioned once again.

Starting aid

For some solar systems, in particular for vacuum tube collectors, the measurement recording on the collector sensors may be too slow or imprecise, because the sensor is often not on the warmest spot. With an activated starting aid, the following procedure occurs: If the temperature on the collector sensor increases within a minute by the value defined under "increase", the solar circulation pump will be turned on for the set "purging time" so that the medium to be measured is transported to the collector sensor. If there is still no normal switching condition through this, there will be a 5 minute block time for the start wizard function.



This function should only be activated by a technician if problems occur with the measurement recording. Observe in particular the instructions from the collector manufacturer.

The menus "Purging time" and "Increase" are only displayed when the starting aid function is set to "On".

Purging time

If the temperature on the collector sensor increases within a minute by the value defined under "increase", the solar circulation pump will be turned on for the set "purging time" so that the medium to be measured is transported to the collector sensor. If the set ΔT is not reached, a 5-minute circulation pause time for the starting aid function will apply.

Increase

If the temperature at the collector reaches within a minute the value defined, the solar pump is turned on for the duration of the purging time.

Time & Date

Serve to set the current time and date.



For time-dependent functions such as circulation and anti-legionella and the evaluation of system data, it is essential that the time is accurately set on the controller. Please note that the clock continues to run for about 24 hours if the mains voltage is interrupted, and afterward must be reset. Improper operation or an incorrect time may result in data being cleared, recorded incorrectly or overwritten. The manufacturer accepts no liability for the recorded data!

Daylight saving time

If this function is activated, the controller automatically changes to winter time or summer time (DST, Daylight Savings Time).

Eco Display Mode

In Eco Display Mode the backlight of the display is switched off if no buttons are pushed for 2 minutes.



If a message exists, the backlight does not switch off until the message has been scanned by the user.

Temperature unit

In this menu you can select between the temperature units °C and °F.

Network

If necessary, the network settings of the connected data logger must be set.

Access Control

This menu lets you give up to 4 users access to the data logger. The users that are registered then have access to the controller or respectively the data logger.

To add a user in the list, select <add user>. Leave the now visible menu open und connect to the address of the connector or respectively the data logger. Your user name is going to appear in this menu and can be selected and confirmed with 'OK'.

Note

You can find the address of the connector or respectively the data logger on the address sticker on the outside of the casing. Pointers and help on how to establish a connection you can find in the enclosed SOREL Connect instructions or the instructions of the data logger.

Select a user with ,OK' to grant access.

To revoke access again, choose one of the users from your list and choose <remove user>.

Ethernet

The data logger's Ethernet connection settings can be set using this menu.

MAC Address

Displays the individual MAC address of the data logger.

Auto-Configuration (DHCP)

If auto-configuration is activated, the data logger requests IP addresses and network parameters from a DHCP server that assigns an IP address, subnet mask, gateway IP and DNS server IP. **If you deactivate the auto configuration (DHCP), you will have to make the required network settings manually!**

IP-Address

Please refer to the router configuration for the IP address to be set.

Subnet Mask

Please refer to the router configuration for the subnetz mask to be set.

Gateway

Please refer to the router configuration for the gateway to be set.

DNS-Server

Please refer to the router configuration for the DNS server to be set.

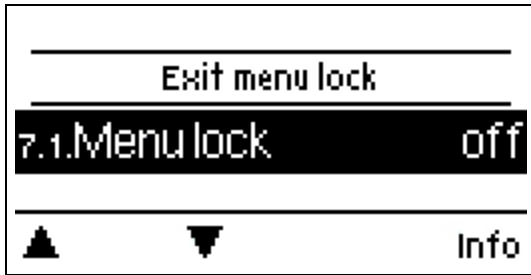
Sensor send interval

The send interval determines how often the sensor and output values of the controller may be send via CAN. If a value changes, it is sent and starts the interval. The next values are not sent until the interval has expired. If no value changes, nothing is sent.



If there are several controllers in the CAN network, a too short send interval can lead to an overload of the CAN network.

7. Menu Lock



Secure the controller against unintentional changing and compromise of basic functions.

Menu lock active = "On"

Menu lock off = "Off"

In addition, the "Simple" menu view can be used to hide menu items that are not necessary for the daily use of the controller after commissioning. The menu item "Menu lock on/off" is also hidden when the "Simple" menu view is selected!

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. Statistics
4. Settings
6. Special Functions
7. Menu lock
9. Language

8. Service Values



Serve for remote diagnosis by a specialist or the manufacturer in the event of errors, etc.



Enter the values into the table when an error occurs.


9. Language




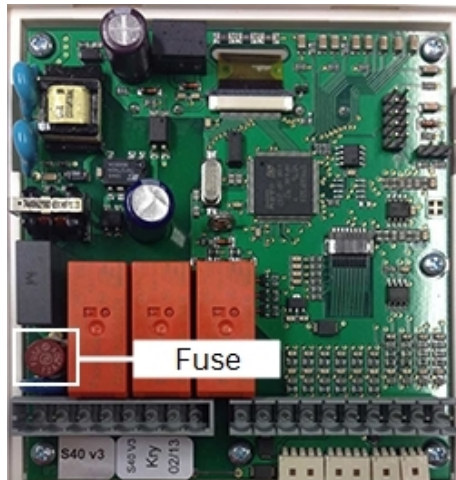
To select the menu language. During initial commissioning and longer power interruptions, the query is made automatically.

Malfunctions/Maintenance

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 that there is no power flowing!

 Only use the included safeguard or a similar safeguard with the following specifications: T2A / 250 V.




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. First find the external fault source (e.g. pump), replace it and then check the device fuse.

To replace the device fuse, open the device as described under "See " Wall Installation " on page 10", remove the old fuse, check it and replace if necessary.

Then first recommission the controller and check the function of the switch outputs in manual mode as described.

Maintenance

 In the course of the general annual maintenance of your heating system, the functions of the controller should also be checked by a specialist and the settings should be optimized if necessary.

Performing maintenance:

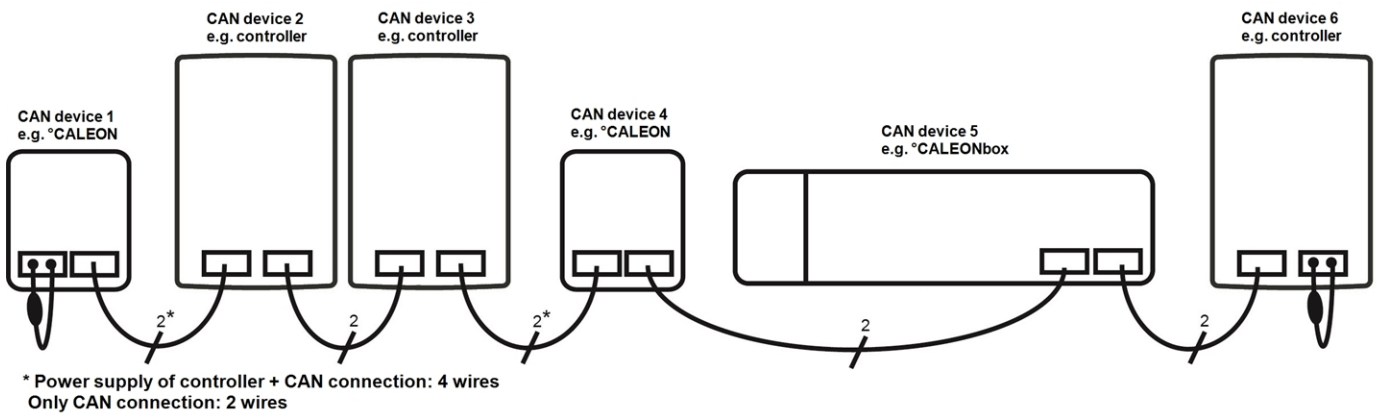
- Check the date and time See " Time & Date " on page 28
- Assess/check plausibility of statistics See " Statistics " on page 14
- Check the error memory See " Notifications " on page 14
- Verify/check plausibility of the current measurement values See " Measurement values " on page 13
- Check the switch outputs/consumers in manual mode See " Manual " on page 15
- Possible optimization of the parameters setting (**only on customers request**)

Possible error messages

Possible error messages	Notes for the specialist
Sensor x defective	Means that either the sensor, sensor entrance on the controller or the connecting wire was defective (See " Temperature Resistance Table for Pt1000 Sensors " on page 11).
Collector alarm	Means that the temperature on the collector set under "Collector protection" was exceeded.
Restart	Means that the controller was restarted, for example, due to a power outage. Check date & time!
Time & Date	This display appears automatically after a longer network disruption, because the time & date must be examined and, if applicable, adjusted.
No flow	If ΔT between store and collector is 50°C or more for 5 minutes, this message is displayed.
Frequent on / off	A relay was switched on and off more than 5 times within 5 minutes.
Anti-legionella failed	Anti-legionella failed appears if at least anti-legionella $T_{\text{soil}} -5^{\circ}\text{C}$ could not be held at the anti-legionella sensor for the set exposure time.

Additional Information




CAN bus



1. The CAN devices are connected in series with the CAN bus cable.
2. The first and last CAN device in this connection in series must be fitted with terminating resistance.

The wiring of the two CAN sockets is arbitrary.

Tips

-  The service values 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 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.
-  To protect against loss of data, record any statistics and data of particular importance at regular intervals.

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.

Date and time of installation:

Name of installation company:

Space for notes:

Your specialist dealer:

Manufacturer:

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