

# Solar Controller SUNGO S



Figure 1 Solar Controller SUNGO S

## The benefits at a glance

- Large illuminated display to indicate temperature, balance values and system status with clearly visible symbols for easy readability.
- Easy and safe operation via four buttons for vertical and horizontal scrolling through the menus.
- Extensive diagnostics for monitoring system functions, eg. sensor cutoff and monitoring of temperature difference "ΔT too high"
- Integrated security functions such as collector cooling, tank cooling, system protection and vacuum tube collector function.
- Solar charging of 1 tank systems
- Current/reset values
- 3 temperature inputs Pt1000
- 1 output, speed-controlled

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# 1. Technical Description

Solar Controller SUNGO S	
Material	100% recyclable ABS casing for wall mounting
Dimensions (L x H x W in mm)	173 x 138 x 51
Kind of protection	IP40 according to VDE 0470
Rate of radio interference	N according to VDE 0875
Mains supply	230 Volt AC; 50 Hz; -10% to +15%
Max. size of wiring for 230 V-connections	2,5 mm <sup>2</sup> stranded / single
Temperature sensor / Temperature range	Pt1000; 1000 Ω at 0 °C; Range: -30 °C to +225 °C
Strain on sensor	Ensure that the cable does not put strain on the sensor; Do not put any mechanical strain on the sensor if temperature is above 60 °C.
Test voltage	4 kV for 1 min according to VDE 0631
Switching voltage Output parameters of switches	230 Volt AC 1A / 230 VA for cos φ = 0,7-1,0
Fuse, internal	Low current fuse 5 x 20 mm; 2 A/T (2 Ampere, slow)
Operating temperature (inside), storage temp.	0° to +50 °C / -10° to +65 °C
Weight	ca. 360 g

## Solar Charging

The solar circuit pump is switched on and off by means of a temperature difference control. The sensors T1 (collector) and T2 (tank, bottom) are required as control elements. The on/off conditions and the temperature limitation can be variably set in the settings menu. Note: The temperature limitation always affects sensor T2 (tank, lower half).

## Speed Control

The solar circuit pump can be controlled via speed control (in this case impulse packet control). This means that individual sine half-waves in the alternate current are switched on or off depending on the temperature difference. Therefore the speed can be altered within a range of 30-100% which results in longer system run times. The minimum speed can be custom set.

## Sensor T3 (tank, upper half)

Sensor T3 (tank, upper half) is a measuring sensor which indicates the temperature in the upper tank area. It has no switch function and is not monitored by the diagnostics system.

## Balance Values

In addition to the actual values of the sensors T1 (collector) and T2 (tank, lower half) the display also shows balance values which represent the smallest and biggest temperature values for each sensor. When reset the current actual temperature value is displayed.

## Manual Operation

Manual operation allows to manually switch input and output channels on or off. On exiting the manual operation menu the software returns to automatic operation. The manual operation menu can be used for a maximum of 8 hours. After that the software automatically switches back to automatic operation in the information menu.

## Manual Lag Function

In order to check the temperature values in the information menu even when the output channels are set manually, a time lag has to be selected in the manual lag function in the manual operation menu. After exiting the manual operation menu this time span passes once and then is set back to zero. In this mode a blinking symbol for the manual operation is shown in the information menu.

## Collector Cooling

The tank is loaded up to the preset temperature limitation which affects sensor T2 (tank, bottom). If the preset temperature limitation is exceeded output A1 (solar circuit pump) switches off. If the temperature of T1 (collector) then rises above the selectable standard value of 110 °C the solar circuit pump is switched on in order to cool the collector. It switches off again when the temperature at the collector sensor has decreased by 10 K.

This type of intermittent operation of the solar circuit pump means that the collector is never or only rarely in an idle state. If the preset tank temperature limitation is exceeded by 5 K the collector cooling function is suppressed. The system shuts down completely.

## Tank Cooling

Tank cooling means that if necessary the tank temperature can be reduced to a preset lowest switch-off value (e.g. setting for vacations).

When the collector cooling function is activated tank cooling will also become active.

In order for tank cooling to become active the following 3 conditions must be met:

1. Temperature T2 (tank, lower half) must be higher than or equal to the preset tank temperature limitation plus 2 K.
2. Temperature T2 (tank, lower half) must be higher than the preset switch-off value for tank cooling.
3. Temperature T1 (collector) must be lower than temperature T2 (tank, lower half) minus 10 K.

In order for tank cooling to switch off one of the following 2 conditions must be met:

1. Temperature T2 (tank, lower half) is lower than the switch-off value for tank cooling.
2. Temperature T1 (collector) must be higher than temperature T2 (tank, lower half) minus 2 K.

## Vacuum Tube Collector Function

The vacuum tube collector function allows operation of the solar heating system even if sensor T1 (collector) is installed in the connecting pipe of the collector. If the temperature increase at sensor T1 exceeds the preset switch-off value for the collector temperature increase (standard: 1 K) the solar circuit pump is switched on for the duration of a preset lag time (standard: 15 s).

During this time the switch-on difference and the solar charge between sensor T1 (collector) and sensor T2 (tank, lower half) has to be activated, otherwise the solar circuit pump will switch off again.

The rise in temperature at sensor T1 (collector) is measured again immediately after the last runtime of the pump.

### **System Messages**

The system messages for interrupted or shorted-out sensors are represented by symbols on the display. For better readability of the system message the display illumination switches on and off every second as long as the error prevails and no key entry is made.

### **Triac**

The Triac is an electronic on/off switch for the 230 V outputs of the SUNGO controllers.

Function: A triac switch consists of 2 diodes which can be switched anti-parallel (= antiparallel thyristors). The thyristors switch through the positive or negative sine half-wave as long as a switch-on difference exists. The triac switch switches off when the temperature falls below the switch-off difference.

## 2. General Safety Guidelines

The following safety advice is designed to protect you from dangers that can arise from improper handling of devices, whether intentional or otherwise. A distinction is made between general advice presented here and specific advice presented throughout the guidelines. Watch out for the symbols!



**DANGER** for danger to the person  
Improper electrical installation of the device can lead to potentially fatal electric shocks as well as other health hazards.



**CAUTION** for danger to property  
This symbol indicates dangers that can result in damage to the components or the function of the control.



**NOTE** for additional information  
This symbol indicates practical advice and tricks of the trade which will be useful for installing and operating the control.

### 2.1 Installer's Qualifications

- Setting up, installation and commissioning of the SUNGO S must be carried out by a qualified installer.
- Please ensure that you comply with national and local regulations.
- Please note that if a complaint is made, the guarantee is only valid if the correct commissioning has been certified by a qualified person in the commissioning report.

### 2.2 Use and Application

#### Function

- Controlling solar thermal systems through the selection of applicable control patterns and additional functions to adapt the control for the required operation of the hydraulic system.
- The control is certified for use in dry rooms only.
- The control can either be integrated into the solar circulation unit or it can be mounted on the wall.

#### Limitations of use

- The control's suitability should be checked before operation commences if it is used for any other purpose than for control's suitability solar thermal systems. If you are unsure you must check with the service of Wagner & Co.
- The use of the control for non-specified operation results in a lapse of the guarantee.

### 2.3 Guidelines for Installation and Operation

- Because Triacs carry 230V current at the case, the mains must be disconnected while any installation and wiring work is carried out.
- The mains must be connected to the control via an external ON/OFF switch outside the solar circulation unit. This is also necessary in order to be able to activate the "Special Function" menu through ON and OFF switching.
- Operating temperatures above 50 °C are not permissible for the control.
- LCD display panels are designed in such a way that a specific reading position is required. When installing the solar circulation unit be careful to place the display so that it is at eye level or slightly higher. This way you can ensure optimal display contrast (for SUNGO S and SL).
- The base of the control is divided into a low voltage section and a 230 V section by a crosspiece. Make sure that you do not confuse these.
- Automatic mode is the default operation mode of the control. Manual mode is only used for testing the different components like the pump and two/three-way valve.
- The system must not be operated if damage to the control, the wiring or the mains is detected.
- The control is fitted with a low-current fuse.
- Collectors and pipe work become very hot during sunny periods. There is a risk of scalding when fitting the collector temperature sensor.



## 3. Installation

### 3.1 Mounting Casing

#### Open the casing

- You require no tools to open the control. The lid snaps into the lower half. You can dislodge and lift up the lid by pulling gently on the side clips.
- The lid arrests automatically when fully opened. You can then comfortably deal with the mounting and wiring.

#### Wall mounting

- Using the supplied drilling template drill out the fixing holes for the control.
- Mount the control to the wall.
- Tighten screws only as far as necessary. Over-tightening may damage the casing!





### Installation in the Solar Circulation Unit

- Affix the SUNGO S with the appropriate screws to the wall mounting bracket of the solar circulation unit.
- Open up the cable ducts next to the centre crosspiece in the bottom of the control.
- Remove outer insulation of the cables in such way that single isolated wires start as they enter the casing from the bottom.
- Hold the connectors with one hand while tightening the screws in order to minimise pressure on the circuit board and to avoid tearing the connectors off.
- Last connection should be to mains.
- If power is switched on now, 230V AC will be present on the casing of the triacs.

## 3.2 Connecting Wires

### Layout of the SUNGO S connections

All connections are made to the circuit board at the bottom of the control. On the right hand side you will find the connections for the sensors (low voltage area) while on the left hand side you will find the connections for mains and switching output A1.

### General connection rules

- If flexible wires are used and the controller is fitted to the wall, wires must be tied externally in such way that strain to the controller is avoided.
- In this case you must tin or crimp the wire ends.
- If required PG9 screws can be fixed at the feed-throughs if the control is mounted to the wall.

### 230 V mains connection

- Mains power is connected from outside the connector via an ON/OFF Switch.
- If the unit is connected with a plug to a socket, the switch can be omitted.
- The unit is laid out for supply of 230V AC/50Hz. Please check that your pump has compatible specifications.
- All earth wires are connected to the PE-connectors.
- The neutral terminals (N) are connected electrically.
- Switch output A1 is a 230 V normally open contact which is activated via speed-control.

### Connecting the temperature sensors

- The wires for the temperature sensors can be extended: Up to 15 m length = 2 x 0.5 mm<sup>2</sup> cable can be used; up to 50 m = 2 x 0.75 mm<sup>2</sup> cable is necessary. For long connections it is recommended to use shielded cable. Do not connect the shielding at the sensor end, just trim and isolate!
- Temperature sensors are without polarity and can be connected any way.
- Sensor wires must be installed away from mains carrying cables.

### Lightning protector module

The SUNGO S is fitted with spike protection on all sensor terminals. Generally, further protection of the cylinder sensors is not required. Sensor T1 (collector) requires installation of sensor connection box SP2 with excess voltage protection.

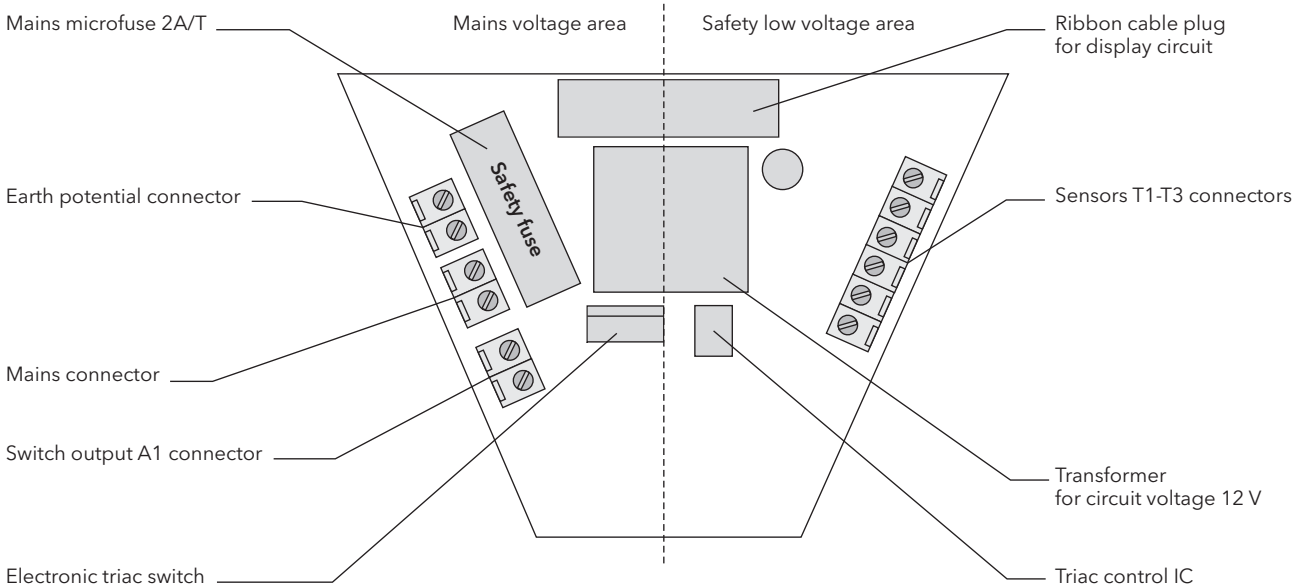


Figure 2 SUNGO S circuit board components

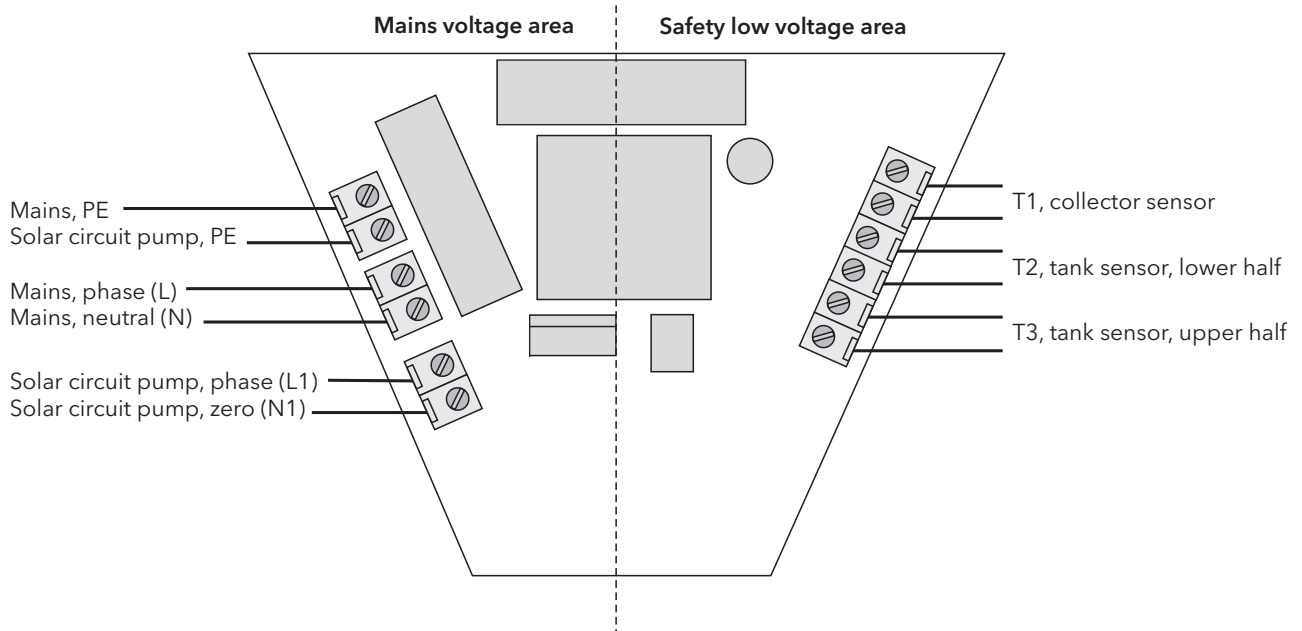
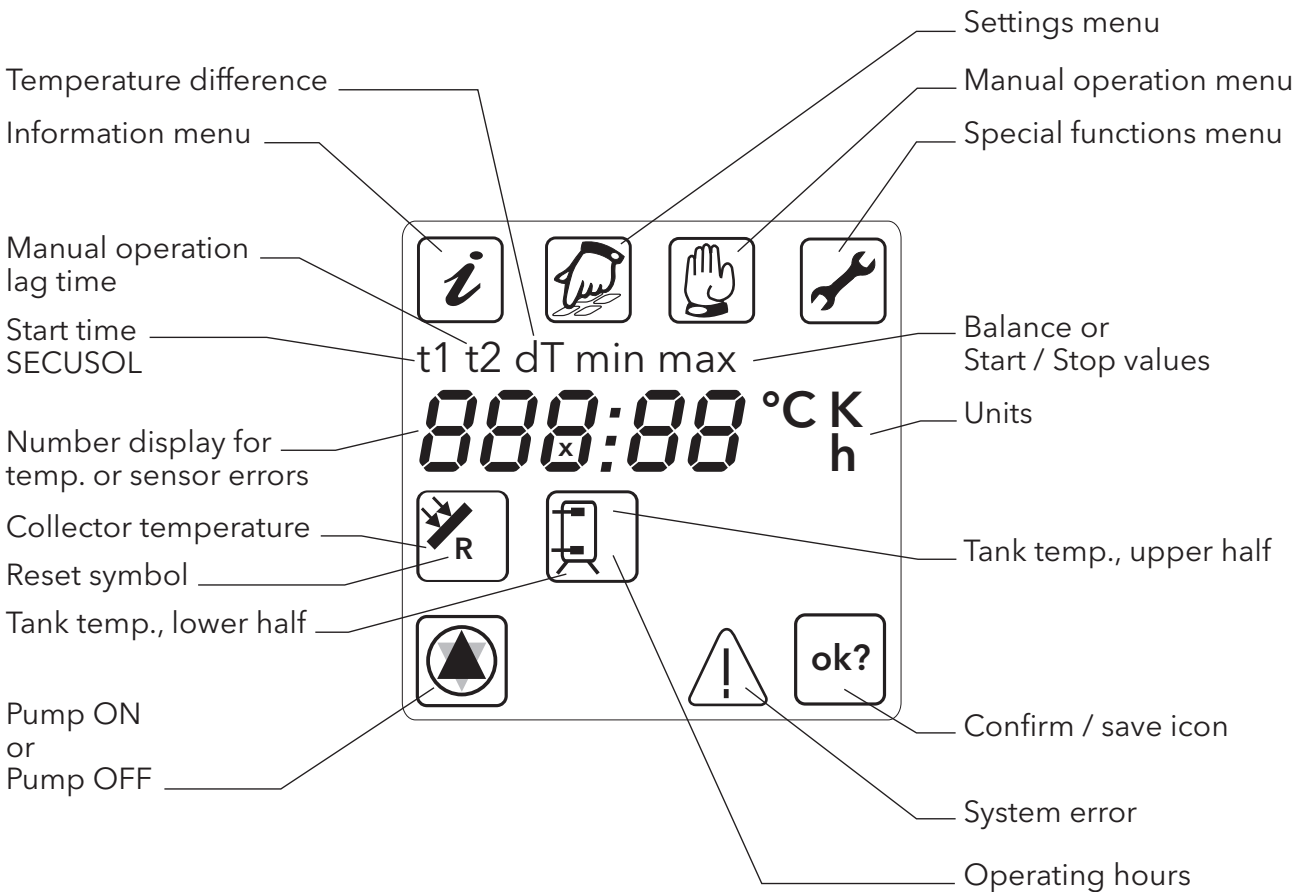
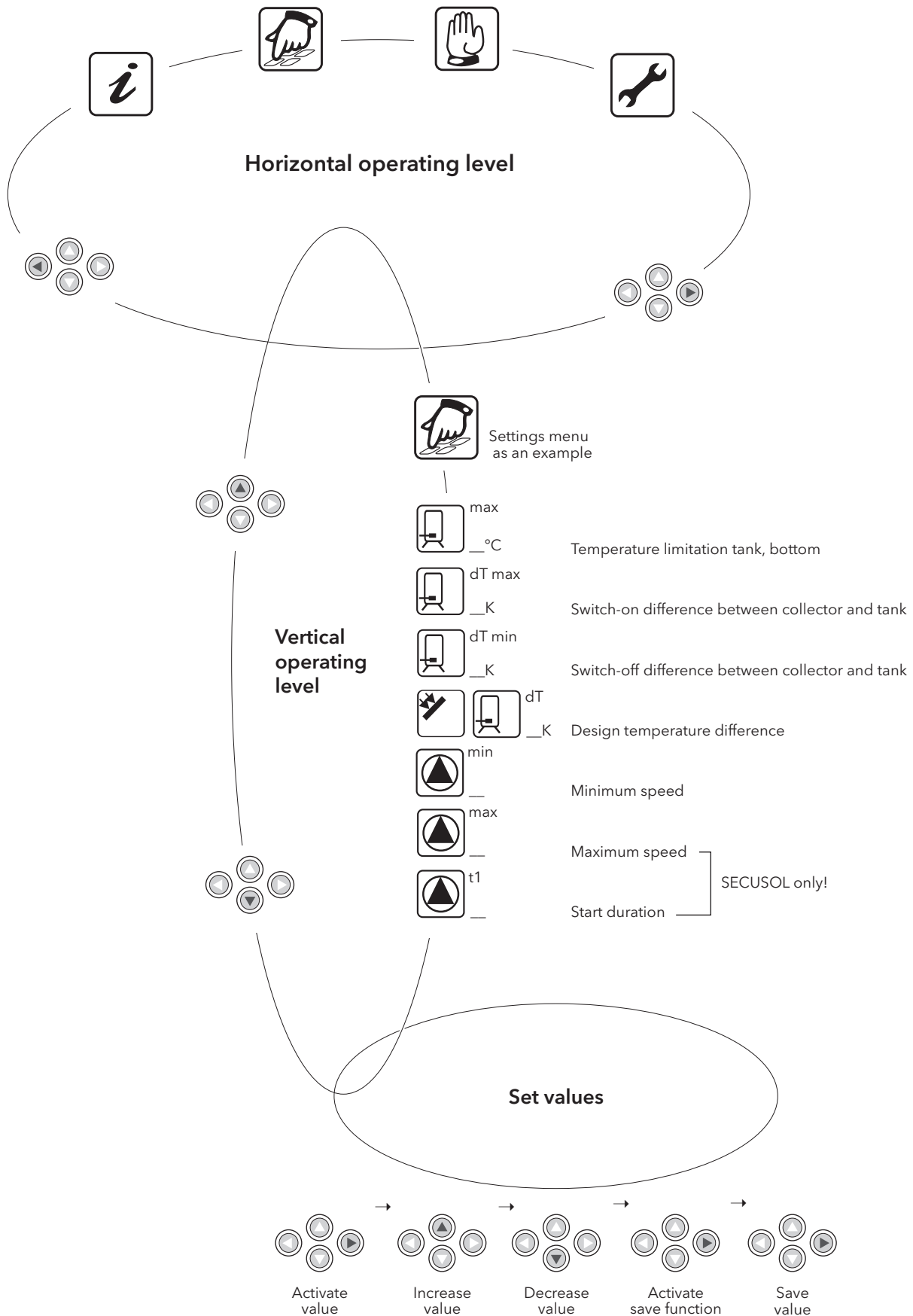


Figure 3 Connections

## 4. Operation

### 4.1 Display and Buttons







## 4.2 Information Menu

Information menu			
Menu item	Description		Display
_ °C	Collector temperature;	Current value	°C
min _ °C	Collector temperature;	Balance value; minimum, resettable	°C
max _ °C	Collector temperature;	Balance value; maximum, resettable	°C
_ °C	Tank temperature, lower half;	Current value	°C
min _ °C	Tank temperature, lower half;	Balance value; minimum, resettable	°C
max _ °C	Tank temperature, lower half;	Balance value; maximum, resettable	°C
_ °C	Tank temperature, upper half 1;	Current value	°C
_ h	Operating hours, total;	Current value	h
R  _ h	Reset operating hours Balance value, display, resettable;	since last reset	h
	Pump symbol idle: Temperature difference between collector and tank is smaller than switch-on difference (solar circuit pump off).	Function display	–
	Pump symbol active: Temperature difference between collector and tank is higher than switch-on difference (solar circuit pump on).	Function display	–

<sup>1</sup> Sensor T3 (tank, upper half) is simply a measuring sensor, therefore it is not monitored by the sensor control.




## 4.3 Settings Menu

Settings menu			
Menu item	Description	Range	Base value
max _ °C	Temperature limitation tank, lower half	15 - 90 °C	85 °C
dT max _ K	Switch-on difference between collector and tank	3 - 40 K	10 K
dT min _ K	Switch-off difference between collector and tank	2 - 35 K	3 K
dT _ K	Design temperature difference the speed control adjusts to	2 - 50 K	10 K
min _	Minimum speed of the solar circuit pump 10% increments	30 - 100%	30%
max _	Maximum speed of the solar circuit pump <b>SECUSOL only!</b>	30 - 100%	100%
t1 _	Charge time (s) of the solar heating system with speed 100%; in 10 s increments <b>SECUSOL only!</b>	20 - 360 s	60 s



## 4.4 Manual Operation Menu

Manual operation menu			
Menu item	Description	Range	Base value
	<i>Off = 0/On = 1</i> Manual switching off and on of the solar circuit pump via output A1	0 - 1	0
t2 min	Activation of manual operation lag time in automatic mode	0 - 600 min	0 min



## 4.5 Special Functions Menu

The special functions menu must be activated **within one minute after switching on the control** in order to change parameters

On exiting the menu the parameters can only be viewed but not changed again. Place the connector in the idle position once again if you need to alter any functions.



Special functions menu				
Menu item	Application	Description	Range	Base value
0	<b>System choice</b>	0 - 1: Standard single-tank system 0 - 2: Cannot be selected! 0 - 3: SECUSOL system (see SECUSOL instructions for further info)	1 or 3	1
1	<b>System Protection</b>	<i>Off = 0/On = 1</i> Activation of system protection. Cannot be activated with SECUSOL!	0 or 1	1
2		System protection start temperature	115 - 200 °C	135 °C
3	<b>Collector Cooling</b>	<i>Off = 0/On = 1</i> Activation of collector cooling. Cannot be activated with SECUSOL!	0 or 1	0
4		Collector cooling start temperature	100 - 150 °C	110 °C
5	<b>Tank Cooling</b>	<i>Off = 0/On = 1</i> Activation of tank cooling. Only possible with collector cooling. Cannot be activated with SECUSOL!	0 or 1	0
6		Switch-off temperature	30 - 90 °C	60 °C
7 - 10	Menu items 7-10 are not available for this control.			
11	<b>Tube collector function</b>	<i>Off = 0/On = 1</i> Activation of vacuum tube collector function	0 or 1	0
12		Run time of solar circuit pump from reaching the switch-on value	1 - 60 s	15 s
13		Switch-on value for temperature increase at sensor T1 (collector)	1.0 - 5.0 K	1.0 K


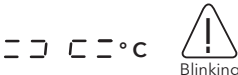
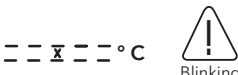




### Only expert personnel

should edit the special functions menu.

Incorrect settings may adversely affect the solar heating system.

## 4.6 Service - System Messages

Display of system information		
Display	Description	Correction
 Blinking	<b>System Messages</b> All system messages are displayed with a blinking caution symbol. In case of sensor errors the sensor in question is also marked with short circuit or interruption symbols.	
 Blinking	<b>Interruption</b> There is no connection between the sensor on the display/the sensor cable and the connector.	<ul style="list-style-type: none"> <li>● Check the resistance value of the sensor and compare it with the resistance table.</li> <li>● Check all contact points up to the sensor.</li> </ul>
 Blinking	<b>Short circuit</b> There is a short circuit on the sensor on the display, the cable or the sensor input on the control.	
  Blinking	<b>dT too high</b> A fixed value of 20 K is added to the temperature difference between collector and tank sensor. The message is displayed if after 30 minutes the total temperature difference has not been reduced.	<ul style="list-style-type: none"> <li>● Check pump/pump connections/cablings.</li> <li>● Check system for air and vent if required.</li> <li>● Check sensors/sensor cables and change sensor if required.</li> </ul>

Other system problems without a display symbol		
Description	Possible Cause	Correction
Display blank	- No mains connection.	<ul style="list-style-type: none"> <li>● Connect control.</li> <li>● Switch off and on via external switch.</li> <li>● Check fuses.</li> </ul>
	- Internal fuse out of order.	<ul style="list-style-type: none"> <li>● Check internal fuse and replace if necessary with 2 Amp/slow.</li> <li>● Check solar pump for sort circuiting.</li> </ul>
	- Control defect.	<ul style="list-style-type: none"> <li>● Phone Wagner &amp; Co Solartechnik (+49 6421/8007-0).</li> </ul>
The control is not working.	<ul style="list-style-type: none"> <li>- The control is put to manual operation.</li> <li>- Switch-on conditions not reached.</li> </ul>	<ul style="list-style-type: none"> <li>● Exit the "Manual operation" menu.</li> <li>● Wait until switch-on conditions are reached.</li> </ul>
Pump symbol turns but pump does not work	<ul style="list-style-type: none"> <li>- Connection to pump broken.</li> <li>- Pump ceased.</li> <li>- No power on terminal A1.</li> </ul>	<ul style="list-style-type: none"> <li>● Check cable to pump.</li> <li>● Free pump.</li> <li>● Phone Wagner &amp; Co Solartechnik (+49 6421/8007-0).</li> </ul>
Temperature display fluctuates strongly in short period of time.	<ul style="list-style-type: none"> <li>- Sensor cable has been installed close to a mains cable.</li> <li>- Long connections without shielded wires.</li> <li>- Control defect.</li> </ul>	<ul style="list-style-type: none"> <li>● Change routing of wire or use shielded wire.</li> <li>● Protect the sensor cables with shielding.</li> <li>● Phone Wagner &amp; Co Solartechnik (+49 6421/8007-0).</li> </ul>

## 4.7 Service - Sensor Control

Resistance values for Pt1000-sensors in relation to the temperature												
-10 °C	0 °C	10 °C	20 °C	30 °C	40 °C	50 °C	60 °C	70 °C	80 °C	90 °C	100 °C	110 °C
961 Ω	1000 Ω	1039 Ω	1078 Ω	1117 Ω	1155 Ω	1194 Ω	1232 Ω	1271 Ω	1309 Ω	1347 Ω	1385 Ω	1423 Ω
The working condition of the sensor can be checked with this table and an Ohm meter.												

## 5. Application examples

### 5.1 Standard Single-Tank System

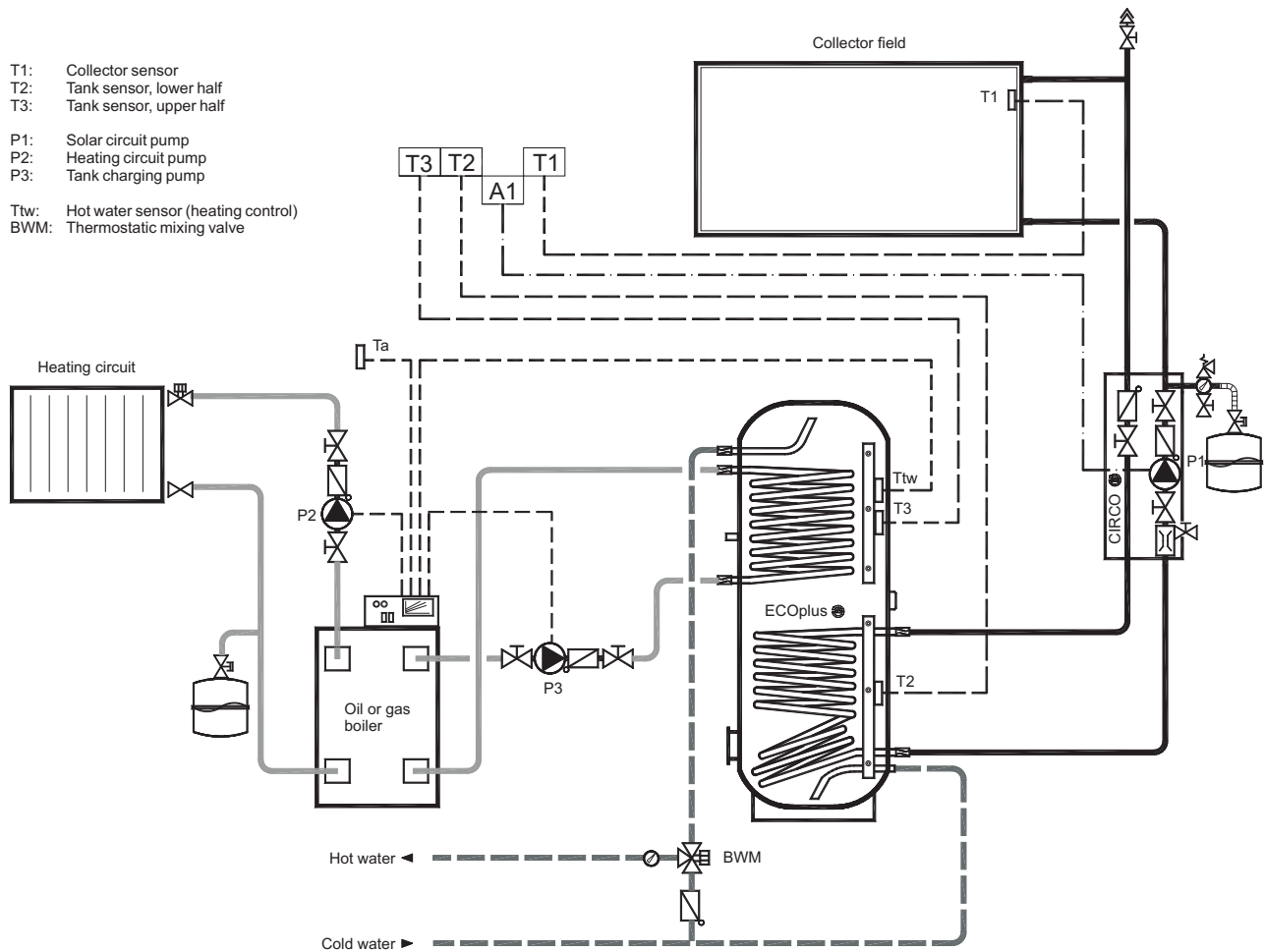


Figure 4 Standard single-tank system controlled by SUNGO S

## 5.2 SECUSOL System

- T1: Collector sensor
- T2: Tank sensor, lower half
- T3: Tank 1 sensor, upper half (optional)
  
- P1: Solar circuit pump
- P2: Heating circuit pump
- P3: Tank charging pump
  
- T<sub>hw</sub>: Hot water sensor (heating control)
- BWM: Thermostatic mixing valve

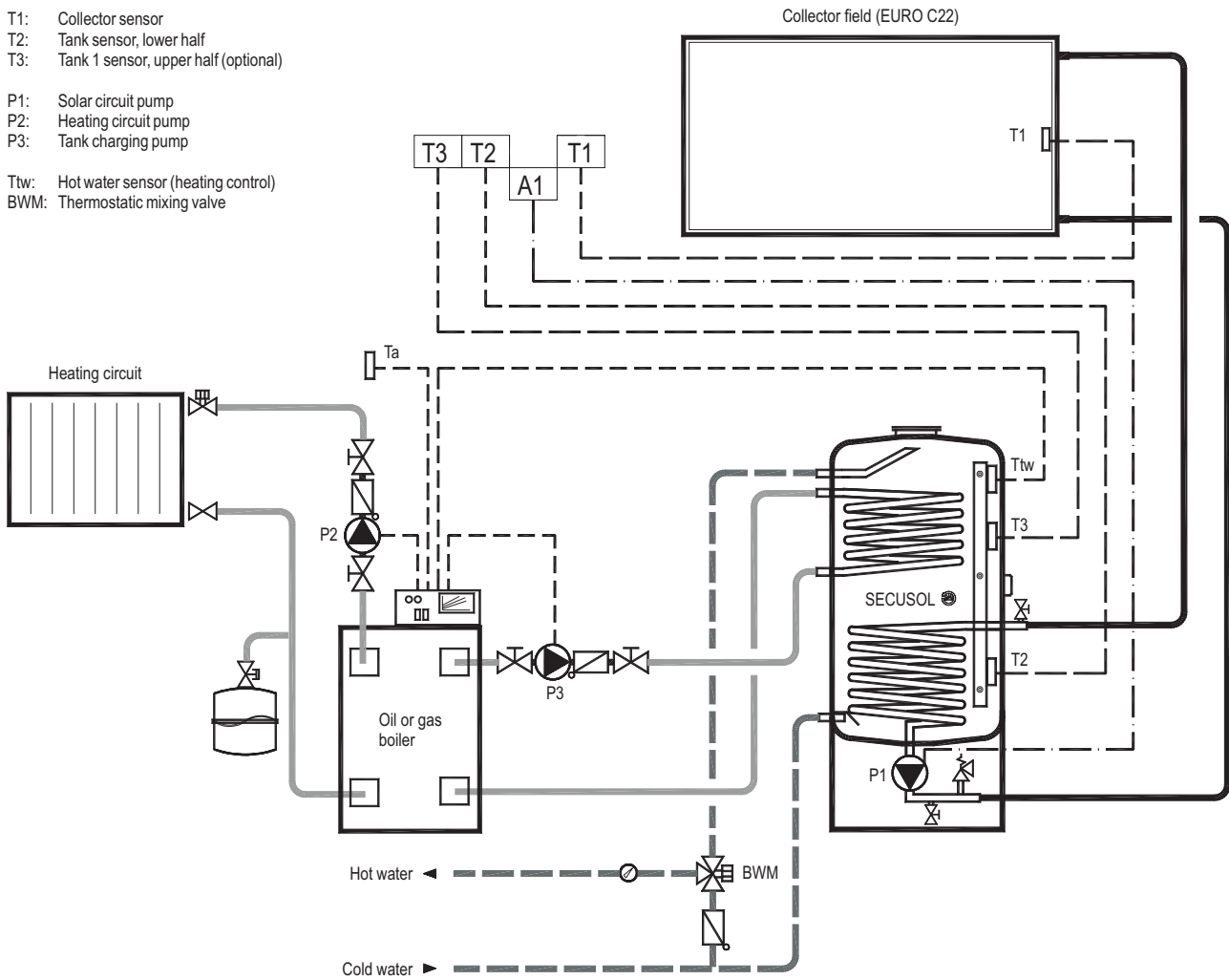


Figure 5 SECUSOL system controlled by SUNGO S