

**Solar Products**

**Control unit SOLO FS**

Version 01 - Issue 07/2010

Controller SOLO FS Installation and Operating Instructions • Art. No. 257 912

Controller SOLO FS • Art. No. 255 278

Printed in Germany

---

## Dear Customer,

Thank you for choosing our product.

Prior to your first installation, we recommend that you attend a training course at our training centre or, if this is not possible, that you take advantage of on-site training from one of our service technicians.

Before installation, please read carefully the general information and safety guidelines contained in these instructions.

## Correct Usage

The controller SOLO FS is a digital differential temperature controller for basic systems. It is not intended for being used in safety-relevant thermal control circuits. It can be used for solar systems with single-circuit stations, for decanting and for circulation control.

Any other use or use beyond it is not in accordance with regulations. Incorrect usage can result in serious injury or death to the user or a third party and harm the device or system and other material assets. The manufacturer/supplier shall not be liable for any damage arising. The risk is borne by the user alone.

Correct usage also includes observing the installation and operating instructions.

## Notes

The diagrams in these instructions shown only the essential components in order to demonstrate the described functions. They have no claim for completeness so that the installation has to be adapted to the circumstances on site.

The regional, federal, European and international laws and regulations applying and in force for the state in question have to be observed in any case when building the solar system.

The state-of-the-art standards and the recognised safety rules, which are normally defined in form of standards, guidelines, specifications, regulations and technical rules by the regional and federal authorities, power supply companies as well as professional associations and commissions for the special field in question.

The installation may only be carried out by qualified and authorised personnel having a recognised training certificate (issued by a regional or federal authority) for the special field in question.

## Table of contents

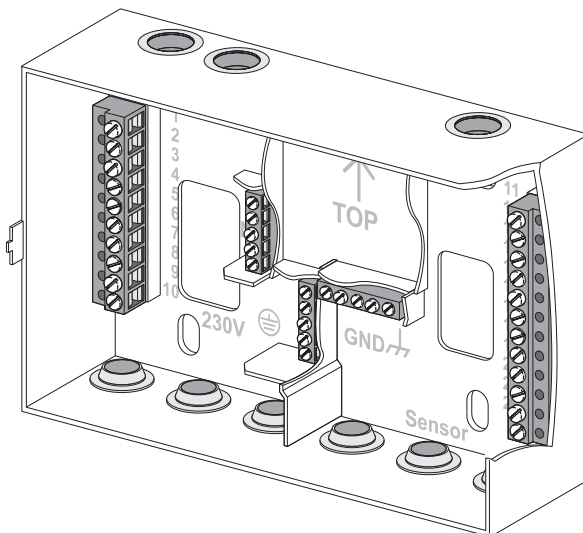
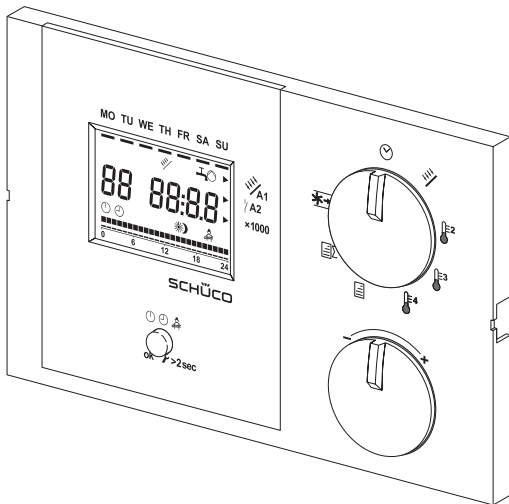
<b>Product Description</b> .....	<b>5</b>
<b>Operating Modes</b> .....	<b>5</b>
Programming mode .....	5
<b>Operating Elements</b> .....	<b>6</b>
Pushbutton .....	6
Pressing shortly .....	6
Pressing longer .....	6
Knob .....	6
Display Selector Switch .....	7
Display .....	7
<b>Installation of the Controller</b> .....	<b>8</b>
<b>Mounting in the Complete Solar Station</b> .....	<b>8</b>
Mounting with External Fixing Plate .....	8
Electrical Connection .....	8
<b>Commissioning / Programming</b> .....	<b>9</b>
Selection of the Pump Level .....	9
<b>System 1: Collector Array - Storage Cylinder</b> .....	<b>10</b>
<b>System 2: Collector Array - Storage Cylinder - Pulse-Controlled Circulation</b> .....	<b>12</b>
<b>System 3: Auxiliary Heating / Thermal Circulation Control</b> .....	<b>14</b>
<b>System 4: Solid Fuel Boiler</b> .....	<b>16</b>
<b>System 5: Decanting / Return Line Temperature Increase</b> .....	<b>18</b>
<b>Controller Functions</b> .....	<b>20</b>
Time .....	20
Day of the week .....	20
Password .....	20
Pump type .....	20
Volume flow control .....	20
Calorimetry and heat quantity calculation .....	21
Solar function .....	21
Circulation .....	22
Pump kick function .....	22
Solid fuel boiler .....	23
Auxiliary heating .....	23
Decanting .....	23
Return line temperature increase .....	23
<b>Error Messages, Causes and Possible Solutions</b> .....	<b>24</b>
<b>"No Flow"</b> .....	<b>25</b>
"Flow Too Low" .....	25
"Volume Flow Sensor" .....	25
"Temperature Sensor" .....	25
<b>Technical Data</b> .....	<b>26</b>
Resistances Pt1000 .....	26

## Product Description

The controller SOLO FS is a digital differential temperature controller. The speed-regulated output to the volume flow control can be parameterised in combination with the solar station type FS.

The controller has a freely accessible display mode and a password-protected programming mode, in which the parameters for the system can be set.

Depending on the system selected, the controller has different parameters by means of which the control behaviour can be adapted to the special requirements of the system.



## Operating Modes

The controller has three different operating modes:

- **Off**  
A1 = open  
A2 = open
- **Auto**  
The controller works in normal operating mode based on the system parameters.
- **Service**  
The outputs are activated with the following parameterised values:

Output	Parameter	
	(P93) = 0	(P93) = 1
A1	P94	P96
A2	100%	

After 30 minutes, the device switches automatically to the **Auto** operating mode.

### Programming mode

The programming mode is accessed if you press the pushbutton more than 2 seconds. If you press the pushbutton again during a longer time, the programming mode is closed. The device switches automatically back after 10 minutes.

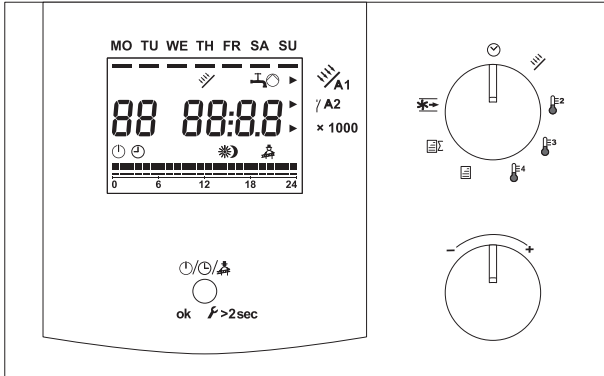
#### Note:

The controller remains active in the selected operating mode, even during the programming mode!

## Operating Elements

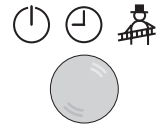
The controller has

- a display
- a display selector switch
- a pushbutton for selecting the operating modes
- a knob



## Pushbutton

The pushbutton has several functions. You can change the operating mode or enter values in the programming mode.



### Pressing shortly

The operating mode changes if the pushbutton is pressed shortly: **Off/Auto/Service**.

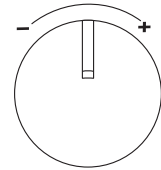
By shortly pressing the pushbutton in programming mode, the displayed value is entered into the parameter.

### Pressing longer

If you press the pushbutton more than 2 seconds, you can switch to the programming mode (and back).

## Knob

The knob serves for changing data in the programming mode. Turn the knob in order to select or set parameters. The values are then applied by pressing the pushbutton.



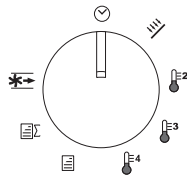
Knob towards the left  
= Decreasing the value



Knob towards the right  
= Increasing the value

## Display Selector Switch

You can choose between eight different display modes by means of the display selector switch:



Display of the time in 24-hours format.



Display of the collector temperature [°C] Input E1



Display of the temperature [°C] Input E2



Display of the temperature [°C] Input E3



Display of the temperature [°C] Input E4



Display of the daily output [kWh]



Display of the total output [kWh] (cumulated daily outputs)



Display of the pump speed [%] and the volume flow [litres/minute] Input E5

## Display

Depending on the position of the selector switch, the corresponding information is displayed on the LC display. In addition, the following status messages are displayed:



Flashing collector:



The system stagnates. The storage cylinder cannot absorb any more heat, the heat transfer fluid evaporates in a controlled way.



The pulse circulation is active.



The output A1 is active. The solar pump is regulated depending on the volume flow.



The output A1 is active. The solar pump is regulated by means of the parameter (P94).



Output A2 is active.

× 1000

Displayed value x 1000



The controller is switched off.



The controller is in automatic mode.



Pump kick function: day function



Pump kick function: night function



The controller is in **service** mode.



Analog display of the collector temperature from 0 °C to 120 °C. A flashing display shows that the programming mode is active.

## Installation of the Controller

### Mounting in the Complete Solar Station

The lower part of the housing of the controller is pre-mounted mechanically and electrically in the solar station. It is connected to the mains by means of a safety plug.



#### **Danger!**

Risk to life and limb due to electrocution!  
Unplug the mains plug before working on the electrical components of the controller!

### Mounting with External Fixing Plate

You need an external fixing plate for operating the controller without solar station. Observe the lengths of the cables to pumps and sensors when positioning the controller so that they can be connected directly to the controller. Use the fixing plate of the controller only for marking the bores and not as drilling jig; the material for fastening has to be provided by the customer.

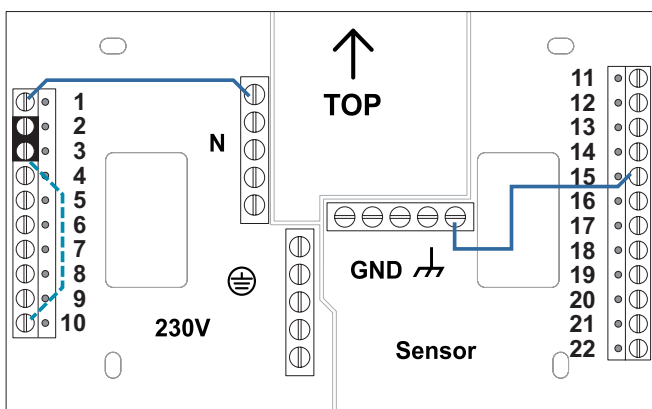
### Electrical Connection

Enter the type of sensor (article no.) and maybe a short additional information (e.g. depth of insertion into the storage cylinder, capacity of the pump, type of cable and lengths, colour change of the cables in case of extensions, etc.) in the table below the parameters or directly in the hydraulic diagram. The layout is documented during commissioning and makes a possible error search easier.



#### **Danger!**

Risk to life and limb due to electrocution!  
Unplug the mains plug before working on the electrical components of the controller!



- Assign the inputs and outputs of the controller according to your selected circuit diagram. Create a bridge between terminal 15 and the ground terminal block, minimum cross section 0.5 mm<sup>2</sup>.



#### **Warning!**

Risk of damage to the environment and the product!  
Observe the polarity of the slow sensor of the solar station type "FS":  
Terminal 14: white (+)  
GND: brown (GND)  
Terminal 21: green (pulse)

- Create a bridge between terminal 1 and the neutral terminal block (N), minimum cross section 1.5 mm<sup>2</sup>.
- Connect the controller to the mains:  
Phase (L): Terminal 2  
Neutral conductor (N): N terminal block  
Protective conductor (PE): PE terminal block



#### **Warning!**

Risk of damage to the environment and the product!  
If you want to use the controller differently, make sure before that the pumps correspond to the technical data of the controller and can be regulated.

## Commissioning / Programming

After having installed the system, connect the controller to the mains.

The software status of the control unit appears in the LCD display for 2 seconds, followed by the pump type detected by the control unit (parameter P92).








P92 = 0 Asynchronous motor pump, e.g.  
WILO ST 15/x or Grundfos UPS 25/x

P92 = 1 WILO Stratos PARA 15/x  
high efficiency pump

P92 = 2 Grundfos SOLAR PM 15-x  
high efficiency pump

The factory settings for first start-up are the following:




- System 1
- Operating mode "OFF"

 (t>2 s)	Change to the programming mode by pressing the push-button for a longer time. ----- The bar is flashing.
	Set the current time in parameter (P01) using the knob and confirm your entry by pressing the pushbutton shortly.
	Set the current day of the week in parameter (P02).
	Define your system under parameter (P17). Any system change is followed by a restart.
	If the control unit detects a high efficiency pump (P92=1,2) after it has been connected to the mains, volume flow control is activated (P93=1). In this case, set the required volume flow in parameter 96.
	Check, change and document the system parameters.
 (t>2 s)	Finish the programming mode.

You can only choose the pumping level if the volume flow is controlled by means of asynchronous motor pumps:

## Selection of the Pump Level

The speed of the pumps of the solar stations type "FS" can be regulated. The pump should work from 50 to 80 % for the control to function also with larger temperature fluctuations of the heat transfer fluid.

	Switch the pump selector switch to level [II].
	Turn the display selector switch to speed/volume flow.
	Start the pump in <b>Service</b> mode with preset parameters.  Let the system run during minimum three minutes before you adapt the pump level if necessary.

Pump level	Speed n [%]		
	n < 50	50 – 80 %	n > 80
	-1: I	OK: II	+1: III



## Parameter List System 1

P	Function	Setting range		(FACTORY)	System
00	Resets the factory settings (FACTORY)	0 / 1		0	
01	Time	0.00 – 24.00		10.00	
02	Day of the week	MO - SU		MO	
03	Daily output (reset = 1)	0 / 1		0	
04	Total output (reset = 1)	0 / 1		0	
05	Pump kick: switch-on time	0.00 – 24.00		7.00	
06	Pump kick: switch-off time	0.00 – 24.00		22.00	
15	Password entry: access to the following parameters	0000 – 9999		----	
16	Password (entry/change)	0000 – 9999		0000	
17	System	1 – 5		1	
20	Difference for output A1 "ON"	1 – 30	K	6	
21	Difference for output A1 "OFF"	0 – 29	K	3	
30	Minimum collector switch-on temperature	-20 – +90	°C	20	
31	Minimum collector switch-off temperature	-21 – +89	°C	15	
32	Collector cooling function: switch-on temperature	80 – 180	°C	115	
33	Collector cooling function: switch-off temperature	75 – 175	°C	110	
34	Maximum collector switch-off temperature	80 – 180	°C	120	
35	Maximum collector switch-on temperature	70 – 170	°C	105	
60	Maximum storage cylinder charging temperature	5 – 95	°C	85	
61	Collector cooling function: Max. storage cylinder temperature	10 – 95	°C	90	
62	Maximum storage cylinder switch-on temperature	4 – 94	°C	80	
75	Pump kick: break	10 – 60	min	30	
76	Pump kick: OFF (0) / kick interval	0 / 2 – 59	s	0	
77	Pump kick: measuring time for 0.5 K increase	1 – 10	min	1	
80	Calorimetry (ON = 1)	0 / 1		1	
81	Pulse rate	1 – 500	Imp/l		
82	Volume flow for heat quantity calculation	0 – 100	l/min	0	
84	Glycol concentration	0 – 70	%	40	
85	Glycol type (propylene = 0, ethylene = 1)	0 / 1		0	
90	Error messages Er62/Er63 (display inactive = 0 / active = 1)	0 / 1		1	
92	Pump type A1**	0 / 1 / 2**			
93	Operating mode volume flow control (manual = 0 / automatic = 1)	0 / 1		1	
94	N° of revolutions, nominal value (MANUAL)	(5) 30 – 100	%	100	
96	Nominal value of the volume flow (AUTO)	2 – 20	l/min	2.5	
98	Minimum number of revolutions (AUTO)	(5) 30 – 100	%	(5) 30	
99	Maximum number of revolutions (AUTO)	(5) 30 – 100	%	100	

## Electrical Connection

Terminal	Inputs		System
16 / GND	E1	Collector sensor	
17 / GND	E2	Storage cylinder sensor, solar area (below)	
18 / GND	E3	<i>Optional: storage cylinder sensor (above)</i>	
20 / GND	E4	---	
14 white / 21 green / GND brown	E5	<i>Optional: volume flow sensor solar station "FS"</i>	
	Outputs		
5 / N	A1	Solar pump	
9 / N	A2	---	
22 / GND	PWM	<i>Optional: PWM signal for high efficiency pumps (A1)</i>	

\*\*  
P92=0: Asynchronous motor pump  
P92=1: WILO Stratos PARA 15/x high efficiency pump  
P92=2: Grundfos SOLAR PM 15-x high efficiency pump



## Parameter List System 2

P	Function	Setting range		(FACTORY)	System
00	Resets the factory settings (FACTORY)	0 / 1		0	
01	Time	0.00 – 24.00		10.00	
02	Day of the week	MO - SU		MO	
03	Daily output (reset = 1)	0 / 1		0	
04	Total output (reset = 1)	0 / 1		0	
05	Pump kick: switch-on time	0.00 – 24.00		7.00	
06	Pump kick: switch-off time	0.00 – 24.00		22.00	
15	Password entry: access to the following parameters	0000 – 9999		----	
16	Password (entry/change)	0000 – 9999		0000	
17	System	1 – 5		1	
20	Difference for output A1 "ON"	1 – 30	K	6	
21	Difference for output A1 "OFF"	0 – 29	K	3	
30	Minimum collector switch-on temperature	-20 – +90	°C	20	
31	Minimum collector switch-off temperature	-21 – +89	°C	15	
32	Collector cooling function: switch-on temperature	80 – 180	°C	115	
33	Collector cooling function: switch-off temperature	75 – 175	°C	110	
34	Maximum collector switch-off temperature	80 – 180	°C	120	
35	Maximum collector switch-on temperature	70 – 170	°C	105	
52	Circulation pump: switch-off delay	1 – 15	min	5	
53	Circulation pump: restart interlock	1 – 10	min	5	
60	Maximum storage cylinder loading temperature	5 – 95	°C	85	
61	Collector cooling function: Max. storage cylinder temperature	10 – 95	°C	90	
62	Maximum storage cylinder switch-on temperature	4 – 94	°C	80	
75	Pump kick: break	10 – 60	min	30	
76	Pump kick: OFF (0) / kick interval	0 / 2 – 59	s	0	
77	Pump kick: measuring time for 0.5 K increase	1 – 10	min	1	
80	Calorimetry (ON = 1)	0 / 1		1	
81	Pulse rate	1 – 500	Imp/l		
82	Volume flow for heat quantity calculation	0 – 100	l/min	0	
84	Glycol concentration	0 – 70	%	40	
85	Glycol type (propylene = 0, ethylene = 1)	0 / 1		0	
90	Error messages Er62/Er63 (display inactive = 0 / active = 1)	0 / 1		1	
92	Pump type A1**	0 / 1 / 2**			
93	Operating mode volume flow control (manual = 0 / automatic = 1)	0 / 1		1	
94	N° of revolutions, nominal value (MANUAL)	(5) 30 – 100	%	100	
96	Nominal value of the volume flow (AUTO)	2 – 20	l/min	2.5	
98	Minimum number of revolutions (AUTO)	(5) 30 – 100	%	(5) 30	
99	Maximum number of revolutions (AUTO)	(5) 30 – 100	%	100	

## Electrical Connection

Terminal	Inputs		System
16 / GND	E1	Collector sensor	
17 / GND	E2	Storage cylinder sensor, solar area (below)	
18 / GND	E3	<i>Optional: storage cylinder sensor (above)</i>	
20 / GND	E4	Pushbutton for activation	
14 white / 21 green / GND brown	E5	<i>Optional: volume flow sensor solar station "FS"</i>	
	Outputs		
5 / N	A1	Solar pump	
9 / N	A2	Circulation pump	
3 / N		Bridge 230 V	
22 / GND	PWM	<i>Optional: PWM signal for high efficiency pumps (A1)</i>	

\*\* P92=0: Asynchronous motor pump  
P92=1: WILO Stratos PARA 15/x high efficiency pump  
P92=2: Grundfos SOLAR PM 15-x high efficiency pump

## System 3: Auxiliary Heating / Thermal Circulation Control

### Description

System 3 is a thermostat with clock timer. It can be selected and parameterised e.g. for the following versions:

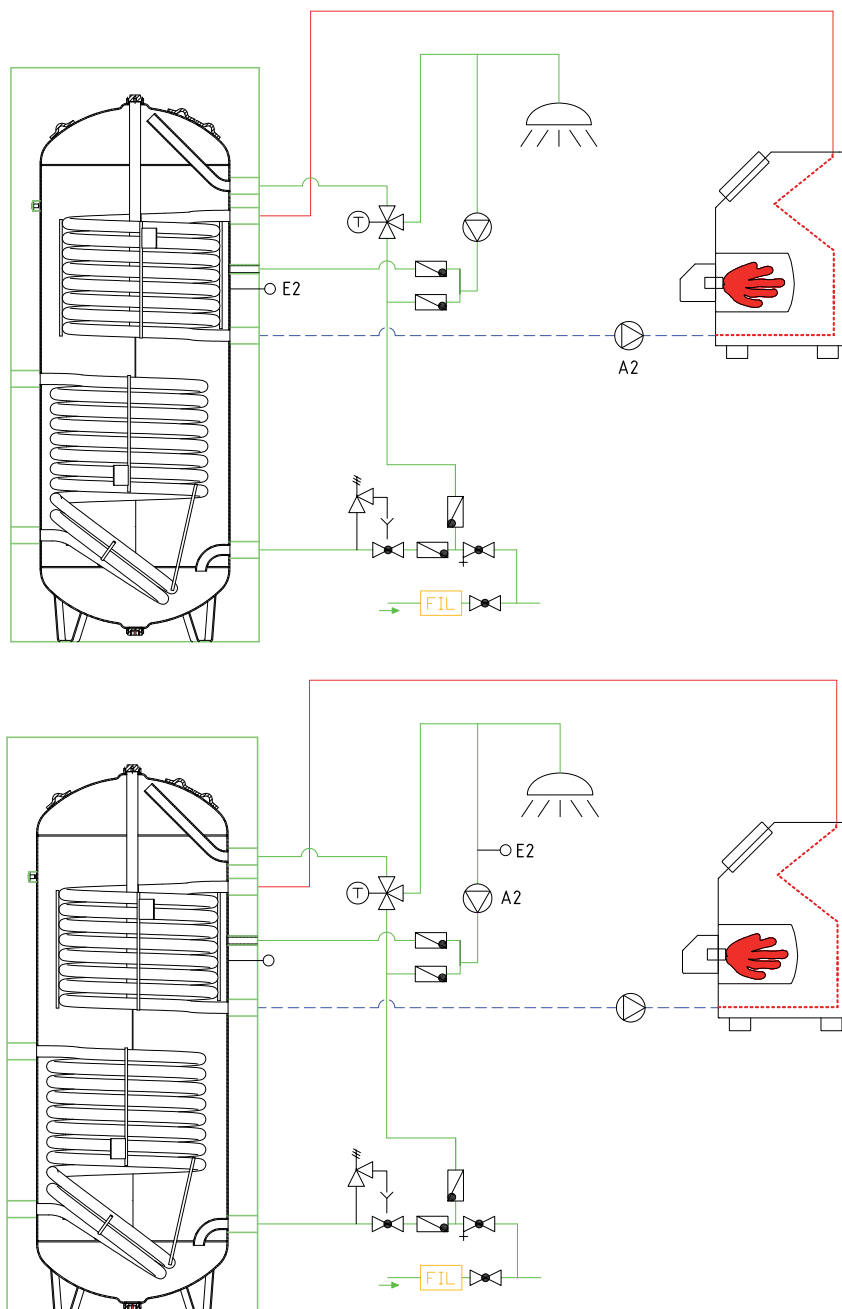
1. Storage cylinder with auxiliary heating
2. Storage cylinder with thermal circulation control

The switch-on temperature (P50) and the switch-off temperature (P51) can be set independently of each other. The output depends on the clock timer and can be released by means of the time frame between switch-on time (P07) and switch-off time (P08).

### Optional Additional Features

Another temperature can be measured by means of an additional temperature sensor (E4) and then displayed on the controller.

### Diagram



## Parameter List System 3

P	Function	Setting range		(FACTORY)	System
00	Resets the factory settings (FACTORY)	0 / 1		0	
01	Time	0.00 – 24.00		10.00	
02	Day of the week	MO - SU		MO	
07	Thermostat function: switch-on time	0.00 – 24.00		6.00	
08	Thermostat function: switch-off time	0.00 – 24.00		22.00	
15	Password entry: access to the following parameters	0000 – 9999		----	
16	Password (entry/change)	0000 – 9999		0000	
17	System	1 – 5		1	
50	Switch-on temperature	4 – 94	°C	45	
51	Switch-off temperature	5 – 95	°C	50	

## Electrical Connection

Terminal	Inputs		System
16 / GND	E1	---	
17 / GND	E2	Temperature sensor	
18 / GND	E3	---	
20 / GND	E4	<i>Optional: additional temperature sensor (display)</i>	
	E5	---	
	<b>Outputs</b>		
5 / N	A1		
9 / N	A2	Pump	
3 / N		Bridge 230V	
(9 / 10)	(A2)	<i>(Alternatively: potential-free contact)</i>	

## System 4: Solid Fuel Boiler

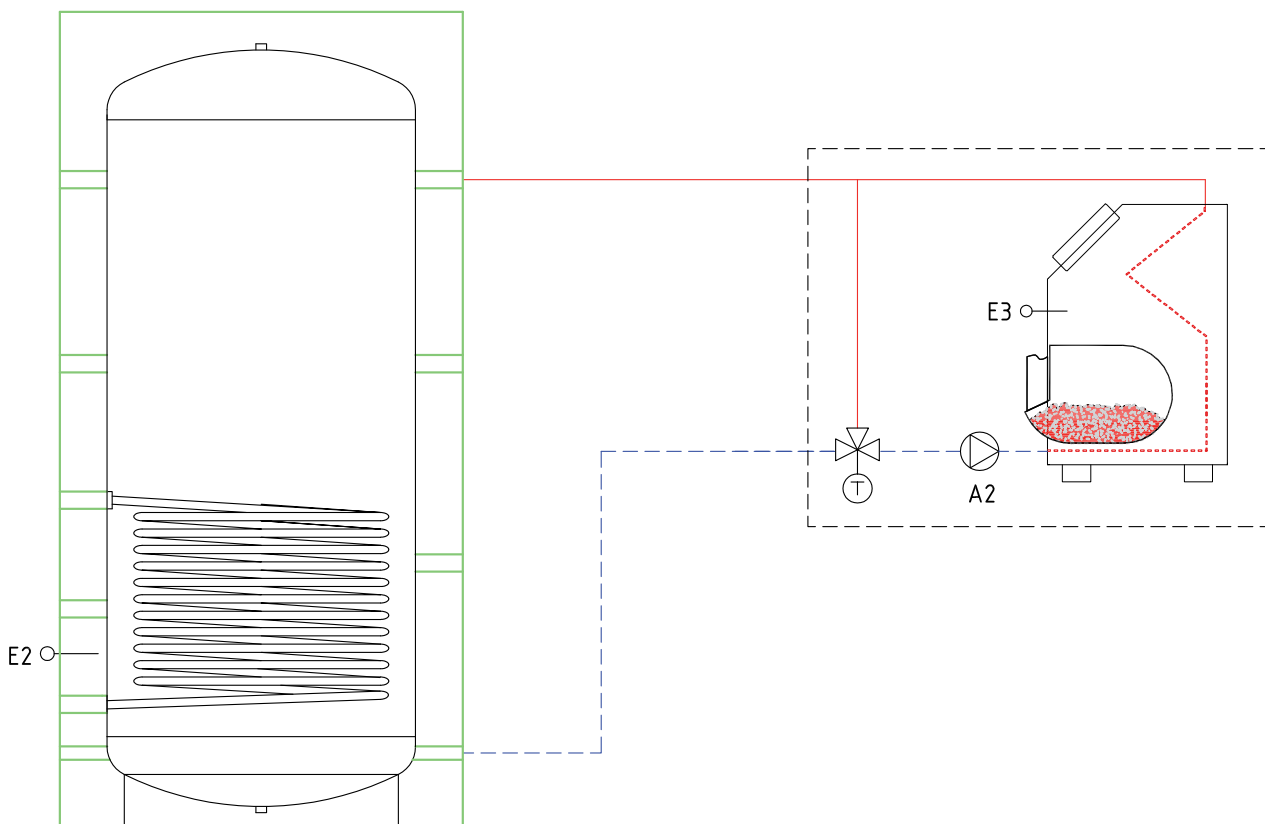
### Description

The system can regulate the storage cylinder loading by a solid fuel boiler. If the solid fuel boiler exceeds the switch-on temperature (P37) and if a minimum temperature difference (P22) between solid fuel boiler and storage cylinder is reached, the storage cylinder is loaded. The storage cylinder loading is limited by the maximum storage cylinder loading temperature and the maximum solid fuel boiler temperature (P36).

### Optional Additional Features

Another temperature can be measured by means of an additional temperature sensor (E4) and then displayed on the controller.

### Diagram



## Parameter List System 4

P	Function	Setting range		(FACTORY)	System
00	Resets the factory settings (FACTORY)	0 / 1		0	
01	Time	0.00 – 24.00		10.00	
02	Day of the week	MO - SU		MO	
15	Password entry: access to the following parameters	0000 – 9999		---	
16	Password (entry/change)	0000 – 9999		0000	
17	System	1 – 5		1	
22	Difference for output A2 "ON"	1 – 30	K	4	
23	Difference for output A2 "OFF"	0 – 29	K	2	
36	Maximum solid fuel boiler temperature (10 K hysteresis)	40 – 140	°C	110	
37	Solid fuel boiler release (switch-on temperature)	5 – 95	°C	60	
38	Solid fuel boiler release: (switch-off temperature)	4 – 94	°C	55	
60	Maximum storage cylinder loading temperature	5 – 95	°C	85	
62	Maximum storage cylinder switch-on temperature	4 – 94	°C	80	

## Electrical Connection

Terminal	Inputs		System
16 / GND	E1	---	
17 / GND	E2	Storage cylinder sensor, solar area (below)	
18 / GND	E3	Temperature sensor for the solid fuel boiler	
20 / GND	E4	<i>Optional: additional temperature sensor (display)</i>	
	E5	---	
	<b>Outputs</b>		
5 / N	A1	---	
9 / N		Charge pump	
3 / 10	A2	Bridge 230 V	

## System 5: Decanting / Return Line Temperature Increase

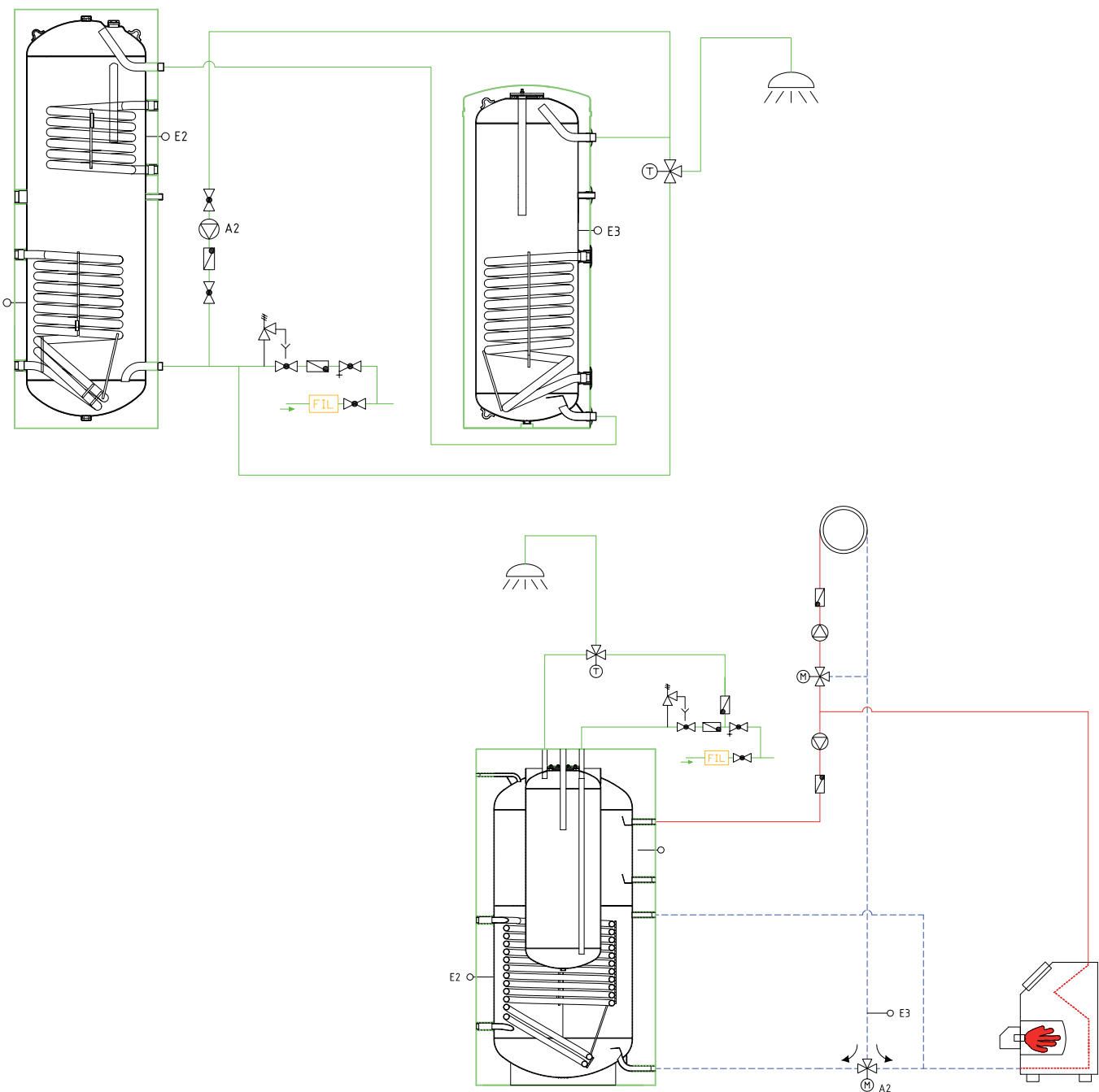
### Description

System 5 can be used for **decanting** between two storage cylinders or as **return line temperature increase**.

### Optional Additional Features

Another temperature can be measured by means of an additional temperature sensor (E4) and then displayed on the controller.

### Diagram



## System 5

P	Function	Setting range		(FACTORY)	System
00	Resets the factory settings (FACTORY)	0 / 1		0	
01	Time	0.00 – 24.00		10.00	
02	Day of the week	MO - SU		MO	
15	Password entry: access to the following parameters	0000 – 9999		----	
16	Password (entry/change)	0000 – 9999		0000	
17	System	1 – 5		1	
22	Difference for output A2 "ON"	1 – 30	K	4	
23	Difference for output A2 "OFF"	0 – 29	K	2	
60	Maximum storage cylinder temperature	5 – 95	°C	85	
62	Maximum storage cylinder switch-on temperature	4 – 94	°C	80	

## Electrical Connection: Decanting

Terminal	Inputs		System
16 / GND	E1	---	
17 / GND	E2	Storage cylinder sensor (above)	
18 / GND	E3	Storage cylinder sensor (centre)	
20 / GND	E4	<i>Optional: additional temperature sensor (display)</i>	
	E5	---	
	Outputs		
5 / N	A1	---	
9 / N	A2	Charge pump / three-way valve	
3 / 10		Bridge 230 V	

## Electrical Connection: Return Line Temperature Increase

Terminal	Inputs		System
16 / GND	E1	---	
17 / GND	E2	Storage cylinder sensor (below)	
18 / GND	E3	Contact sensor return temperature	
20 / GND	E4	<i>Optional: additional temperature sensor (display)</i>	
	E5	---	
	Outputs		
5 / N	A1	---	
9 / N	A2	Charge pump / three-way valve	
3 / 10		Bridge 230 V	

## Controller Functions

### Time

The current time is shown in 24-hours format. You can adjust the time in programming mode by means of parameter (P01).

### Day of the week

The current day of the week is shown in a bar below the inscription. You can adjust the day of the week in programming mode by means of parameter (P02).

**MO TU WE TH FR SA SU**



<b>MO</b>	(Monday)	
<b>TU</b>	(Tuesday)	
<b>WE</b>	(Wednesday)	
<b>TH</b>	(Thursday)	
<b>FR</b>	(Friday)	
<b>SA</b>	(Saturday)	
<b>SU</b>	(Sunday)	

### Password

All controller parameters as of parameter (P16) are protected by a 4-digit password against unintentional modifications (factory setting: 0000).

### Warning!

A forgotten password cannot be restored! However, you can reset the controller to the factory settings and then program it again:

- Change to the programming mode.
- Compare and document all parameters of the system in the parameter table.
- Interrupt the power supply of the controller for approx. 20 seconds by pulling the mains plug or switching off the circuit breaker.
- Keep the pushbutton pressed when switching on again.
- The controller is now reset to the factory settings. Set the parameters again according to your documentation!

### Pump type

Once it has been connected to the mains, the control unit detects the connected pump type. It checks whether the PWM output of the control unit is allocated. If a WILO Stratos PARA 15/x pump is detected on the PWM output, the control unit sets parameter P92=1. If the control unit detects a Grundfos SOLAR PM 15-x pump, parameter P92=2 is set. If neither of the above pumps are detected, the control unit sets the parameter P92=0.

The pump type selected by the control unit appears in the control unit display for 3 seconds when the mains voltage is applied.

In the case of pump type P92=0, the pump is controlled by sine wave control within the context of volume flow control (P93=1). **IMPORTANT:** This type of control is only possible for an asynchronous motor pump. It could damage a high efficiency pump.

The speed of the WILO Stratos PARA 15/x (P92=1) and Grundfos SOLAR PM 15-x (P92=2) high efficiency pumps is regulated by the PWM signal within the context of volume flow control (P93=1).

### Volume flow control

A speed-regulated solar pump keeps the volume flow of the heat transfer fluid constant and optimises the solar output.

The volume flow is measured by the sensor of the solar station type "FS" and compared to the nominal value (P96). The controller adapts the pumping capacity to the specifications. Due to an optimised pump activation, the display of the volume flow can differ up to 10% from the set nominal value (P96).

The automatic volume flow control can be activated by means of parameter (P93). Alternatively, a fixed speed (P94) can be set for the pump capacity.

---

### **Calorimetry and heat quantity calculation**

The measurement of the heat quantity can be parameterised for the solar station type "FS". Depending on whether you measure the volume flow or enter it manually in the controller, it is distinguished between calorimetry (P80=1) and heat quantity calculation (P80=0).

For both versions, the collector sensor (E1) is the reference sensor of the hot flow, the lower storage cylinder sensor (E2) is the reference sensor for the cold return. For a correct calculation, you have to parameterise the type of heat transfer fluid (P85) and the concentration (P84) in the controller.

The daily output is calculated and displayed based on these indications. The total output, which can also be displayed, is obtained by adding the daily outputs.

### **Solar function**

The solar pump is activated by means of a temperature difference regulation between collector and storage cylinder (solar area). The switch-on difference between collector and storage cylinder can be adjusted.

### **Minimum collector temperature**

The collector has to exceed the minimum collector temperature so that the solar function is activated. It is distinguished between the minimum collector switch-on temperature (solar pump not operating (P30)) and the minimum collector switch-off temperature (solar pump operating (P31)). The minimum switch-on temperature must always be higher than the minimum switch-off temperature.

### **Storage charging**

The maximum storage cylinder switch-on temperature (solar area) is the temperature up to which the solar pump is switched on (switch-on temperature (P62)).

When reaching the maximum storage cylinder charging temperature, the solar pump is switched off (P60).

### **Collector emergency switch-off**

On exceeding the maximum collector switch-off temperature (P34), the solar pump is switched off by means of emergency switch-off. As the heat is not longer transported away from the collector, a controlled vaporisation of the heat transfer fluid takes place in the collector. The solar function cannot be reactivated until the temperature falls below the maximum collector switch-on temperature (P35).

### **Collector cooling function**

The collector cooling function delays the vaporisation of the heat transfer fluid. Shortly before reaching the maximum temperature of the collector, the solar pump starts working in order to cool down the heat transfer fluid using the losses occurring in pipelines and storage cylinder.

The collector cooling function is active if the maximum collector switch-off temperature (P34) is higher than the switch-on temperature of the collector cooling function (P32).

The working range of the collector cooling function is set with the parameters switch-on temperature (P32) and switch-off temperature (P33).

The solar function is switched off when reaching the maximum storage cylinder charging temperature (P60). When the collector is approaching its maximum collector switch-off temperature (P34), the collector cooling function is carried out until reaching the maximum storage cylinder temperature (P61).

The temperatures have to be graded as follows:

$$(P33) < (P32) < (P34)$$

$$(P62) < (P60) < (P61)$$

---

## Circulation

---

### Pulse-controlled circulation

A demand button/flow switch gives a drive pulse to the controller, which switches on the circulation pump for a certain time.

### Thermal circulation control

A contact sensor measures the temperature of the circulation and switches on the circulation pump depending on the temperature. The switch-on time can be activated by means of an integrated time switch.

---

## Pump kick function

---

This function is required for solar panels whose collector sensor is in the shadow or if the collector sensor fails.

In order to be able to measure the temperature of the preceding collectors if the collector temperature sensor is in the shadow, the heat transfer fluid is pumped to the sensor. Thus, a temperature, which is actually before the temperature sensor, can be measured.

In case of failure of the collector sensor, you can guarantee the solar function by means of a contact sensor near the collector output. In order to measure the collector temperature, the heat transfer fluid has to be pumped to the more distant contact sensor also in this case.

In order to optimise the power losses due to the pump running time, a time frame is given within which a solar output is expected. The time frame of the pump kick function is defined by switch-on time (P05) and switch-off time (P06).

When the solar pump is switched on for a short time (kick interval (P76)), the controller controls the temperature increase of the contact sensor (measuring time (P77)). If the temperature increase is lower than 0.5 K, the solar pump is switched off again. After a break (kick break (P75)), the process is repeated.

If, during the kick interval, a temperature increase of 0.5 K is measured, the next kick break is skipped. This process is repeated until either the switch-on conditions for the solar function are fulfilled or a temperature increase cannot be measured any longer. Then, the pump kick is continued with the parameterised pulse-break ratio.

---

### **Solid fuel boiler**

An unregulated solid fuel boiler is controlled by means of the combination of solid fuel boiler thermostat, differential temperature control and maximum storage cylinder charging temperature.

### **Auxiliary heating**

The thermostat function controls the auxiliary heating of the hot water zone of the solar storage cylinder. If the storage cylinder temperature falls below the switch-on temperature (P50), e.g. 40 °C, the relay output is activated. Like this, a storage charge pump or an external relay can be activated. If the switch-off temperature (P51), e.g. 45 °C, is reached, the auxiliary heating is deactivated again.

### **Decanting**

In case of systems with existing hot water storage cylinder and additional solar storage cylinder, the solar-heated water is poured from the solar storage cylinder into the existing (conventionally heated) hot water storage cylinder.

The charge pump is switched if the temperature difference of 4 K between the upper part of the solar storage cylinder and the reference sensor of the existing storage cylinder is exceeded and the temperature falls below (P68), e.g. 60 °C, in the second storage cylinder at the same time.





It is switched off again when the temperature difference is lower than 2 K or the maximum storage cylinder temperature of (P67), e.g. 65 °C, in the second storage cylinder is exceeded.

### **Return line temperature increase**

In case of solar systems with combination storage cylinder and supplementary heating, the solar energy from the combination storage cylinder is used for increasing the temperature in the boiler return line. If there is a difference in temperature between the return flow of the heating circuit and the base of the solar storage cylinder, a 3-way valve is activated so that the lower part of the combination storage cylinder runs in series to the heating return flow.

If the lower part of the combination storage cylinder is 4 K warmer than the return of the heating circuit, the colder return water is led into the lower part of the combination storage cylinder and the solar-heated water is led to the boiler. If this temperature difference is inferior than 2 K, the three-way valve is deactivated again.

## Error Messages, Causes and Possible Solutions

Message	Cause	Explanation
Er 62	The collector temperature was much higher than the storage cylinder temperature. ( $T_{kol} > T_{sp} + 60K$ )	<div style="border: 1px solid black; padding: 5px; display: inline-block;">  <div style="margin-left: 10px;"> <p>Change to the operating mode "OFF" by shortly pressing the pushbutton.</p> <p>The error message is acknowledged.</p> </div> </div> <p>The volume flow in the solar circuit is insufficient:</p> <ul style="list-style-type: none"> <li>• "No Flow"</li> <li>• "Flow Too Low"</li> </ul>
Er 63	Between 1:00 and 4:00 a.m.: $T_{kol} > 45\text{ °C}$	<div style="border: 1px solid black; padding: 5px; display: inline-block;">  <div style="margin-left: 10px;"> <p>Change to the operating mode "OFF" by shortly pressing the pushbutton.</p> <p>The error message is acknowledged.</p> </div> </div> <ul style="list-style-type: none"> <li>• Wrong time set: check/adjust</li> <li>• E1 and E2 changed: check the sensors and change their positions</li> <li>• Check valve defective: replace it</li> </ul>
Er 71	E1 delivers undefined values.	The output A1 (solar pump) is switched off.
Er 79	E2 delivers undefined values.	The error message cannot be acknowledged, the display only shuts off after the error has been eliminated. (In order to do this, interrupt the power supply to the controller during approx. 20 seconds)
Er 72	E3 delivers undefined values.	
Er 64	E5 has not delivered any measured value for 30 seconds	<p>The output A1 (solar pump) is switched off.</p> <p>The error message cannot be acknowledged, the display only shuts off after the error has been eliminated. (In order to do this, interrupt the power supply to the controller during approx. 20 seconds)</p> <ul style="list-style-type: none"> <li>• "Volume flow sensor"</li> <li>• "No Flow"</li> <li>• "Flow Too Low"</li> </ul>
Er 81	EEPROM	<p>All outputs are switched off.</p> <p>Send the controller to the manufacturer; please enclose a list with the system parameters you have set.</p>
Er 198	The volume flow cannot be reached. (The nominal value is too high).	<div style="border: 1px solid black; padding: 5px; display: inline-block;">  <div style="margin-left: 10px;"> <p>Change to the operating mode "OFF" by shortly pressing the pushbutton.</p> <p>The error message is acknowledged.</p> </div> </div> <p>"Flow Too Low"</p>
Er 199	The volume flow cannot be reached. (The nominal value is too low).	<div style="border: 1px solid black; padding: 5px; display: inline-block;">  <div style="margin-left: 10px;"> <p>Change to the operating mode "OFF" by shortly pressing the pushbutton.</p> <p>The error message is acknowledged.</p> </div> </div> <p>The minimum pump capacity (P98) is still too high for the parameterised nominal value.</p> <p>Switch to a lower pump level or increase the nominal value.</p>

## "No Flow"

- Look through the inspection window of the volume flow sensor to check whether the turbine wheel is turning.

YES: The controller does not receive any signals from the sensor  
see "**Volume Flow Sensor**"

NO: No Flow:

- Check whether the stop valve is closed.
- Check whether the pump is running in manual mode.



### **Danger!**

Risk to life and limb due to electrocution! Unplug the mains plug before working on the electrical components of the controller! Any work on the electrical components must be carried out only by a trained electrician.

- Test the pump without the controller. If the pump works (the turbine wheel is moving), the controller is defective. Otherwise, the pump has to be replaced.

## "Flow Too Low"

- Check all stop valves. Maybe not all stop valves are **completely** open and thus hinder the circulation.
- Choose a higher pump level.
- Check the nominal value of the volume flow parameter (P96) and define a smaller value.

## "Volume Flow Sensor"

- Look through the inspection window of the volume flow sensor to check whether the turbine wheel is turning.

NO: see "**No Flow**"

YES: The controller does not receive any signals from the sensor.



### **Danger!**

Risk to life and limb due to electrocution! Unplug the mains plug before working on the electrical components of the controller!

- Check the sensor lines for damage and wrong terminals.
- If you are not able to detect a defect, please change the volume flow sensor.

## "Temperature Sensor"



### **Danger!**

Risk to life and limb due to electrocution! Unplug the mains plug before working on the electrical components of the controller!

- Check the sensor lines for damage and wrong terminals.
- Block the sensor and measure the temperature-dependent resistance (see Technical Data: Pt1000).

## Technical Data

Ambient temperature	
Operation:	0 - 50 °C
Storage/transport:	-30 - 60 °C

Degree of protection (according to EN 60529)	IP 40
Protection class (according to EN 60730)	II, protected
Supply voltage	230 V, 50 Hz
Power consumption	5 VA

Inputs	
E1 - E3	Pt1000
E4	Pt1000 / sensor
E5	Flow sensor 14: white GND: brown (GND) 21: green

Outputs	
A1	Triac, 230 V / 1,2A
A2	Relay, 230 V / 2 A

### Resistances Pt1000

°C	-50	-40	-30	-20	-10	0	10
Ω	803	843	882	922	961	1000	1039
°C	20	30	40	50	60	70	80
Ω	1078	1117	1155	1194	1232	1270	1309
°C	90	100	110	120	130	140	150
Ω	1347	1385	1422	1461	1492	1536	1573



