

# TACOSOL LOAD TERA & MEGA

TEMPERATURE DIFFERENCE CONTROLLER



## CONTROLLER MANUAL

# Table of content

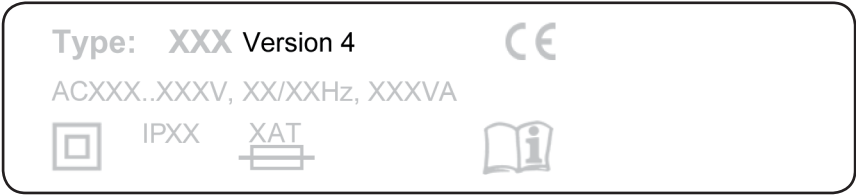
<b>A. - Safety instructions</b>	<b>4</b>	<b>5. - Protections / Protective functions</b>	<b>22</b>
A.1. - EC declaration of conformity	4	5.1. - System protection	22
A.2. - General instructions	4	5.2. - Collector protection	22
A.3. - Explanation of symbols	4	5.3. - Recooling	23
A.4. - Changes to the unit	5	5.4. - Frost Protection	23
A.5. - Warranty and liability	5	5.5. - Seizing protection	23
		5.6. - Collector alarm	23
<b>B. - Description of controller</b>	<b>6</b>	<b>6. - Special functions</b>	<b>24</b>
B.1. - Specifications	6	6.1. - Program selection	24
B.2. - Temperature resistance table for Pt1000 sensors	7	6.3. - Speed control R1 / R2	25
B.3. - About the controller	7	6.3.1. - Modes	25
B.4. - Disposal and pollutants	7	6.3.2. - Purging time	25
		6.3.3. - Sweep time	25
<b>C. - Installation</b>	<b>8</b>	6.3.4. - max. speed	26
C.1. - Electrical connection	8	6.3.5. - min. speed	26
C.2. - Wall instalon	9	6.3.6. - Setpoint	26
C.3. - Installing the temperature sensors	11	6.9. - Heat quantity	27
		6.9.1. - Constant flow	27
<b>D. - Terminal connection</b>	<b>12</b>	6.9.1.1. - Flow sensor (X)	27
D.1. - Terminal connection diagram	12	6.9.1.2. - Return sensor	27
D.2. - Hydraulic variants / systems	13	6.9.1.3. - Anti freeze type	27
		6.9.1.4. - Glycole percentage	27
<b>E. - Operation</b>	<b>14</b>	6.9.1.5. - Flow rate (X)	27
E.1. - Display and input	14	6.9.1.6. - Offset $\Delta T$	27
E.2. - Commissioning help	15	6.10. - Pressure monitor	27
E.3. - Free commissioning	15	6.11. - Sensor calibration	28
E.4. - Menu sequence and menu structure	16	6.12. - Commissioning	28
		6.13. - Factory settings	28
<b>1. - Measurement values</b>	<b>17</b>	6.14. - Start aid function	28
		6.15. - Time and date	29
<b>2. - Statistics</b>	<b>18</b>	6.16. - Daylight saving time	29
2.1. - Operating hours	18	6.17. - Sleep mode	29
2.2. - Heat output	18	6.18. - Temperature unit	29
2.3. - Graphic overview	18		
2.4. - Message log	18	<b>7. - Menu lock</b>	<b>30</b>
2.5. - Reset/clear	18		
		<b>8. - Service values</b>	<b>31</b>
<b>3. - Operating modes</b>	<b>19</b>		
3.1. - Automatic	19	<b>9. - Languages</b>	<b>31</b>
3.2. - Manual	19		
3.3. - Off	19	<b>Z.1. Malfunctions with error messages</b>	<b>32</b>
		<b>Z.2 Replacing the fuse</b>	<b>33</b>
<b>4. - Settings</b>	<b>20</b>	<b>Z.3 Maintenance</b>	<b>34</b>
4.1. - Tmin S (X)	20		
4.2. - Tmax S (X)	20		
4.5. - $\Delta T$ Solar S (X)	20		
4.6. - Priority S(X)	21		
4.7. - T-priority	21		
4.8. - Loading time	21		
4.9. - Increase	21		

**This manual applies to the following hardware versions:**

**Version 3**

- 3 mechanical relays (2 on/off, 1 changeover contact)
- 2 PWM / 0-10V for high efficiency pumps
- 6 PT1000 temperature sensor inputs
- 2 VFS / RPS direct sensor inputs

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



**If the version is not readable here, open the controller’s “Service values” menu. The version is shown in the first line of the service values.**

# Safety instructions

## A.1. - EC declaration of conformity

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

- EC low voltage directive 2014/35/EG
- EC electromagnetic compatibility directive 2014/30/EG

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

## A.2. - General instructions

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

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

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

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

## A.3. - Explanation of symbols



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



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



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



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

# Description of controller

## A.4. - Changes to the unit

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



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

## A.5. - Warranty and liability

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

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

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

# Description of controller

## B.1. - Specifications

### Electrical specifications:

Mains voltage	100 - 240VAC
Mains frequency	50 - 60Hz
Power consumption	0,5W - 2,5W
Internal fuse	T2A / 250V slow blow
Protection category	IP40
Protection class	II
Overvoltage Category	II
Degree of Pollution Category	II

	Vers.3
mechanical relay 460VA for AC1 / 460W for AC3	3 (R1-R3)
electronic relay min.5W...max.120W for AC3	-
0-10V output, tolerance 10%, 10 k $\Omega$ load or PWM output freq. 1 kHz, level 10 V	2
PT1000 sensor input measuring range -40°C to 300°C	6
VFS / RPS inputs 0°C-100°C (-25°C /120°C short term)	2
1 l/min - 12 l/min (VFS1-12)	
2 l/min - 40 l/min (VFS2-40)	
5 l/min - 100 l/min (VFS5-100)	
10 l/min - 200 l/min (VFS10-200)	
0-0,6 bar 0-1 bar 0-1,6 bar 0-2,5 bar 0-4 bar 0-6 bar 0-10 bar	

### Network connections

CAN Bus

### Permissible cable length of sensors and appliances:

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

### Real Time Clock

RTC with 24 hour power reserve

### Permissible ambient conditions:

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

### Other specifications and dimensions

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

# Description of controller

## B.2. - Temperature resistance table for Pt1000 sensors

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

## B.3. - About the controller

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

The TSL-TERA can be used as a solar controller for the various system variants illustrated and explained under „D.2. - Hydraulic variants / systems“ on page 13.

Important characteristics of the TSL-TERA:

- Depiction of graphics and texts in a lighted display
- Simple viewing of the current measurement values
- Analysis and monitoring of the system by means of statistical graphics, etc.
- Individual configuration of special functions
- Extensive setting menus with explanations
- Menu block can be activated to prevent unintentional setting changes
- Resetting to previously selected values or factory settings
- A wide range of additional functions are available.

## B.4. - 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.



**Caution**

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

# Installation

## C.1. - Electrical connection



**Danger**

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



**Caution**

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.



**Caution**

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



**Caution**

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



**Caution**

Controller and VFS sensor have to have the same ground potential. The VFS sensor uses a functional earth connector (PELV). The PE-connector of the controller has to be connected to the pipe system near the sensor.



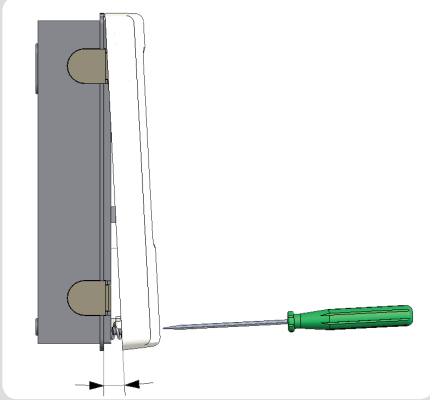
# Installation

## C.2. - Wall installation

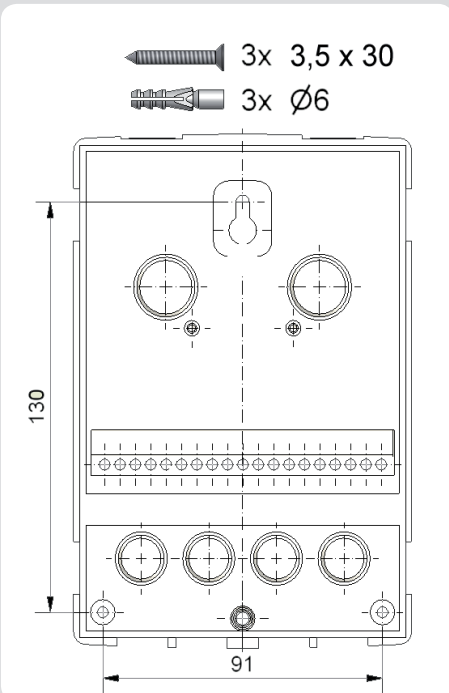


Install the controller only in dry areas and under the ambient conditions described under B.1 "Specifications".

### C.2.1.



### C.2.2.



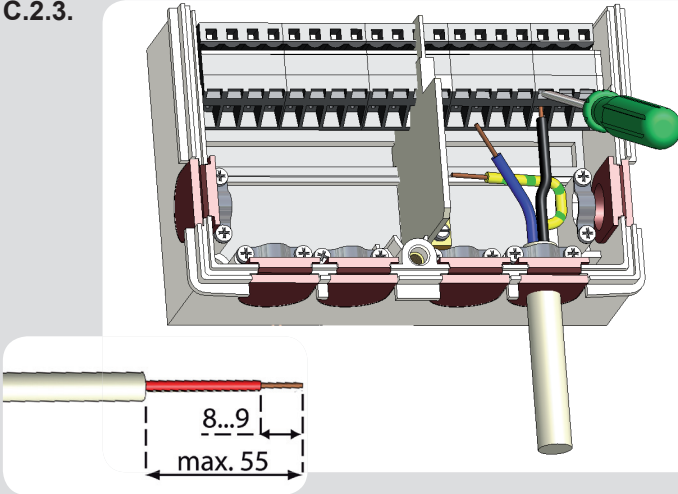
1. Unscrew cover screw completely
2. Carefully pull upper part of housing from lower part.
3. Set upper part of housing aside, being sure not to touch the electronics when doing so.
4. Hold the lower part of the housing up to the selected position and mark the 3 mounting holes. Make sure that the wall surface is as even as possible so that the housing does not become distorted when it is screwed on.
5. Using a drill and size 6 bit, drill 3 holes at the points marked on the wall and push in the plugs.
6. Insert the upper screw and screw it in slightly.
7. Fit the upper part of the housing and insert the other two screws.
8. Align the housing and tighten the three screws.



Controller must be inaccessible from the rear.

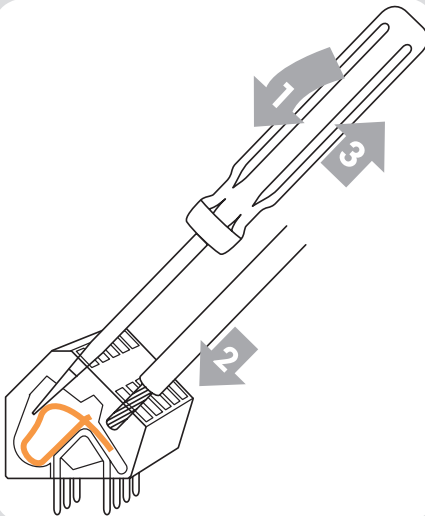
# Installation

## C.2.3.



1. Select necessary program/hydraulics (s. „D.2. - Hydraulic variants / systems“ on page 13)
2. Strip cables by 55mmmax., insert, fit the strain relief devices, strip the last 8-9mm of the wires (Fig. „C.2.3.“)
3. Open the terminals using a suitable screwdriver (Fig. „C.2.4.“) and make electrical connections on the controller
4. Refit terminal connection cover and fasten screw.
5. Switch on mains voltage and place controller in operation.

## C.2.4.



### Instructions for clamps:

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

# Installation

## C.3. - Installing the temperature sensors

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



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



Sensor cables for S1 and S5 can be extended to a maximum of 30m using a cable with a cross-section of at least 0.75mm<sup>2</sup>. Sensor cables for S2 to S4 and S6 can be extended to a maximum of 10m using a cable with a cross-section of at least 0.75mm<sup>2</sup>. Make sure that there is no contact resistance!



Position the sensor precisely in the area to be measured!  
Only use immersion, pipe-mounted or flat-mounted sensor suitable for the specific area of application with the appropriate permissible temperature range.



Connect the VFS sensors with the matching jacks.  
To prevent damage to the Direct Sensors it is highly recommended to install them in to the return.  
When installing the Vortex Flow Sensors (VFS), observe the correct flow direction!

# Installation

## D.1. - Terminal connection diagram



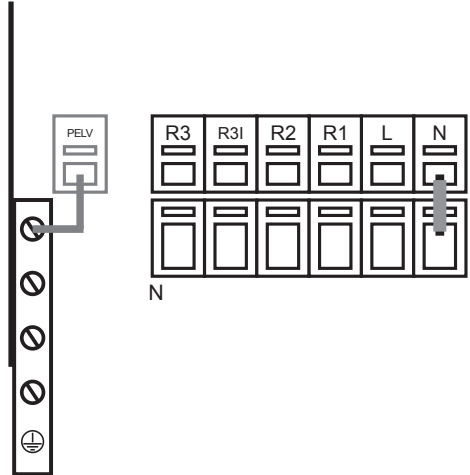
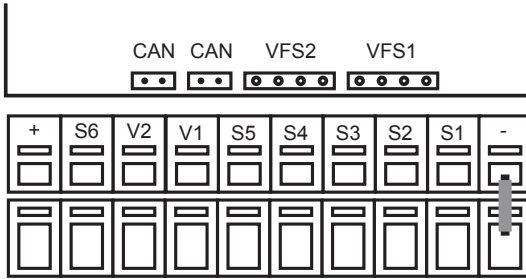
**Caution**

max. 12V



**Danger**

mains side  
100-240VAC



On the circuit board:

TSL-TERA Version V3+V4:

VFS1 Grundfos Direct Sensor

VFS2 Grundfos Direct Sensor

CAN1 CAN Bus

CAN2 CAN Bus

### Low voltage max. 12VAC/DC

Terminal: Connection for:

S1 Temperature sensor 1

S2 Temperature sensor 2

S3 Temperature sensor 3

S4 Temperature sensor 4

S5 Temperature sensor 5

V1 0-10V / PWM signal output  
e.g. for control of High Efficiency  
pumps

TSL-TERA Version V3+V4:

V2 0-10V / PWM signal output  
e.g. for control of High Efficiency  
pumps

S6 Temperature sensor 6

+ 12V power supply

Connection of sensor earth to the grey lower  
terminal block.

### Mains voltage 100-240VAC 50-60Hz

Terminal: Connection for:

R1 Relay 1

R2 Relay 2

R3 Relay 3 (normally open)

R3I Relay 3 (normally closed)

L Netz Außenleiter L

N Netz Neutralleiter N

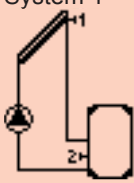
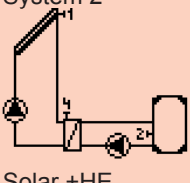
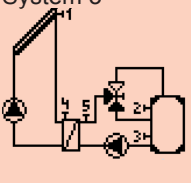
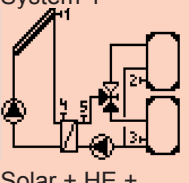
The neutral conductors are connected to the  
lower blue terminals

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

The power supply of HE pumps with 0-10V  
/ PWM pumps can be connected to the  
corresponding relay (V1 -> R1, R2 -> V2), since  
the relays are switched on and off with the  
signal.

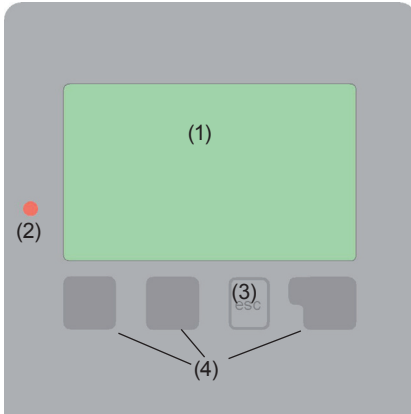
# Installation

## D.2. - Hydraulic variants / systems

	 <p>System 1</p> <p>Solar + storage</p>	 <p>System 2</p> <p>Solar + HE</p>	 <p>System 3</p> <p>Solar + HE + storage + valve</p>	 <p>System 4</p> <p>Solar + HE + 2 storage with valve</p>
S1	Collector	Collector	Collector	Collector
S2	Storage	Storage	Storage top	Storage 1
S3			Storage bottom	Storage 2
S4		Heat Exchanger	Heat Exchanger	Heat Exchanger
S5			Flow	Flow
S6				
VFS1				
VFS2				
R1/V1	Solar pump	Solar pump	Solar pump	Solar pump
R2/V2		Secondary pump	Secondary pump	Secondary pump
R3			Zonevalve	Zonevalve

# Operation

## E.1. - Display and input



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

To change from the overview to the settings menu, press the „esc“ key.

The green status LED (2) lights up when a relay is active, the red LED blinks when an error occurs.

Inputs are made with 4 buttons (3+4), which functions change context sensitive.

The „esc“ key (3) is always used to cancel or exit a menu.

If applicable there will be a request for confirmation as to whether the changes which have been made should be saved.

Examples of display symbols:



Pump (rotates in operation)



Valve (direction of flow in black)



Collector



Storage



Pool



Temperature sensor



Heat exchanger



Load pause (see Load time)



Warning / error message



New information available



Logging is active

More symbols can be found in the chapter „Special functions“

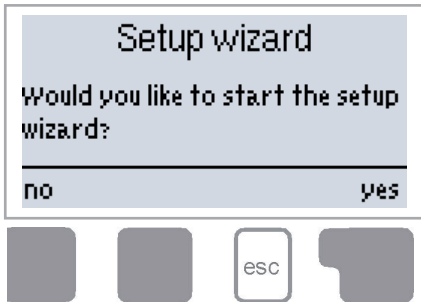
The function of each of the other three keys (4) is shown in the display line directly above the keys; the right-hand key is generally has a confirmation and selection function.

Examples of key functions:

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

# Operation

## E.2. - Commissioning help



The first time the controller is turned on and after the language and time are set, a query appears as to whether you want to parametrise the controller using the commissioning help or not. The commissioning help can also be terminated or called up again at any time in the special functions menu. The commissioning help guides you through the necessary basic settings in the correct order, and provides brief descriptions of each parameter in the display.

Pressing the “esc” key takes you back to the previous value so you can look at the selected setting again or adjust it if desired. Pressing the “esc” more than once

takes you back step by step to the selection mode, thus cancelling the commissioning help. Finally, menu „3.2. - Manual“ on page 19 should be used to test the switch outputs with the consumers connected, and to check the sensor values for plausibility. Then switch on automatic mode.



**Caution**

Observe the explanations for the the individual parameters on the following pages, and check whether further settings are necessary for your application.

## E.3. - Free commissioning

If you decide not to use the commissioning help, you should make the necessary settings in the following sequence:

- Menu 9. Language, page 31
- Menu 6.23 Time and Date, page 29
- Menu 6.1 Programm selection, page 24
- Menu 4. Settings, all values, page 20
- Menu 5. Protective functions, if necessary, page 22
- Menu 6. Special functions, if necessary, page 24

Finally, menu „3.2. - Manual“ on page 19 should be used to test the switch outputs with the consumers connected, and to check the sensor values for plausibility. Then switch on automatic mode.

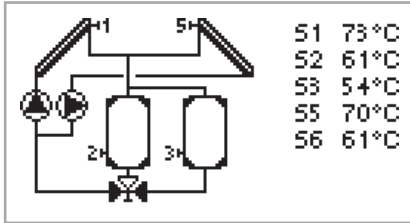


**Caution**

Observe the explanations for the the individual parameters on the following pages, and check whether further settings are necessary for your application.

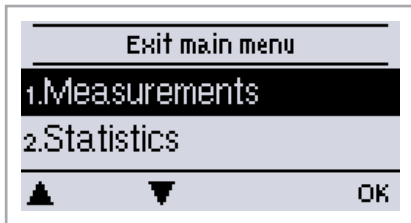
# Operation

## E.4. - Menu sequence and menu structure



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

The up and down buttons are used to scroll through the list of sensors and relays.



You can enter the Main menu by pressing the „esc“ key. The following menus are available:

### 1. Measurements

Current temperature values with explanations

### 2. Statistics

Function control of the system with operating hours, etc

### 3. Operating mode

Automatic mode, manual mode or switch unit off

### 4. Settings

Set parameters needed for normal operation

### 5. Protections

Solar and frost protection, recooling, anti-seizing protection

### 6. Special functions

Program selection, sensor calibration, clock, additional sensor, etc.

### 7. Menu lock

Against unintentional setting changes at critical points

### 8. Service Data

For diagnosis in the event of an error

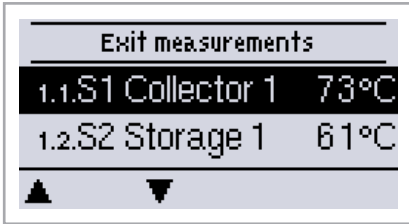
### 9. Language

Language selection



# Measurement values

## 1. - Measurement values



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

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

Selecting "Overview" or "esc" exits the Info mode.



If "--" appears on the display instead of the measurement value, then there may be a defective or incorrect temperature sensor. If the cables are too long or the sensors are not placed optimally, the result may be small deviations in the measurement values. In this case the display values can be compensated for by making entries on the controller. Follow the instructions under „6.7. - Sensor calibration“ on page 28.

What measurement values are displayed depends on the selected program, the connected sensors and the specific device design.

# Statistics

## 2. - Statistics



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

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



**Caution**

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

### 2.1. - Operating hours

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

### 2.2. - Heat output

Display of the heat output of the system. See also „6.5. - Heat quantity“ on page 27

### 2.3. - Graphic overview

This provides a clearly-organised display of the data listed under 2.1-2.2 as a bar graph. Various time ranges are available for comparison. The two left-hand keys can be used to page through the data.

### 2.4. - Message log

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

### 2.5. - Reset/clear

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

# Operating modes

## 3. - Operating modes



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

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

### 3.1. - Automatic

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

### 3.2. - Manual

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



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

### 3.3. - Off



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

# Settings

## 4. - Settings



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



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

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



The following pages contain generally valid descriptions for the settings. Enumerations may vary.

### 4.1. - Tmin S (X)

#### Enable/start temperature at sensor X:

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

*Settings range: 0°C to 99°C / Default setting: 20°C*

### 4.2. - Tmax S (X)

#### Switch-off temperature at sensor X

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

*Settings range: 0°C to 99°C / Default setting: 60°C*



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

### 4.5. - $\Delta T$ Solar S (X)

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

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

*Settings range:  $\Delta T$  from 4°C to 50°C /  $\Delta T$ -Off from 2°C to 49°C*

*Default setting: Depends on selected hydraulic variant*



If the set temperature difference is too small, this may result in ineffective operation, depending on the system and sensor positions. Special switching conditions apply for speed control (see „6.3. - Speed control R1 / R2“ on page 25)!

# Settings

## 4.6. - Priority S(X)

### Priority of Storages X

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.

*Settings range: 1 (highest) - 3 (lowest)*

## 4.7. - T-priority

### Temperature threshold for absolute priority

In systems with multiple storage tanks, charging of the lower-priority storage tank will never take place until this set temperature setpoint at the storage tank sensor of the highest-priority storage tank is exceeded.

*Setting range: from 0°C to 90°C/default setting: 40°C*

## 4.8. - Loading time

### Interruption of charging into the lower priority storage tank

The charging of the lower-priority storage tank is interrupted after the settable time in order to check whether the collector has reached a temperature level that allows charging in the higher-priority storage tank. If so, the priority storage tank is charged.

If not, the increase is measured (see „4.9. - Increase“), to check if charging of the priority storage tank will be possible shortly.

*Setting range: from 1 to 90 minutes/default setting: 20 minutes*

## 4.9. - Increase

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

For precise setting of the charging priorities for systems with multiple storage tanks, the necessary temperature increase of the collector at which the interruption of the charging into the lower-priority storage tank is extended by one minute is set here. The interruption is extended because the temperature increase of the collector is expected to enable charging in the higher-priority storage tank soon.

As soon as  $\Delta T$  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.

*Setting range: from 1°C to 10°C/default setting: 3°C*

# Protections

## 5. - Protections / Protective functions



Menu „5. - Protections / Protective functions“ can be used to activate and set various protective functions.



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

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

### 5.1. - System protection

#### Highest Priority Protection

System protection prevents overheating of system components by automatic shutdown of the solar pump. If “SProt Ton” is exceeded for 1 minute at the collector, the pump is switched off and stays off. The pump is activated again when the temperature drops below “SProt Toff”.

*System protection - Settings range: ON / OFF / Default setting: On*

*SP T on - Settings range: 60 °C to 150 °C / Default setting: 120 °C*

*SP T off - Settings range: 50 °C to T on minus 5 °C / Default setting: 115 °C*



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

### 5.2. - Collector protection

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

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

*Collectorprotection - Settings range: On / Off / Default setting: Off*

*CP T on - Settings range: 60°C to 150°C / Default setting: 110°C*

*CP T off - Settings range: 50°C to T on minus 5°C / Default setting: 100°C*

*CP Storage S(x) Max - Settings range: 30°C to 140°C / Default setting: 90°C*



When collector protection is active, and both storage and pool are present, the storage is heated up to „CP Storage S(x) Max“ beyond Tmax S2 (see „4.2. - Tmax S (X)“ on page 20) which can result in scalding and system damage.



System protection has a higher priority than collector protection. Even when the switch on conditions for collector protection are present, the solar pump will be switched off when SP T on is reached.

# Protective functions

## 5.3. - Recooling

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

*Recooling - Settings range: On, Off / Default setting: Off*

*Recooling Tref - Settings range: 0°C to 99°C / Default setting: 70°C*



**Caution**

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

## 5.4. - Frost Protection

A two-stage frost protection function can be activated. In stage 1 the controller switches the pump on for 1 minute every hour if the collector temperature drops below the set value "Frost stage 1".

If the collector temperature drops further to the set value "Frost stage 2" the controller switches the pump on continuously.

If the collector temperature then exceeds the value "Frost stage 2" by 2°C, then the pump switches off again.

*Frost protection setting range: on, off/default setting: off*

*Frost stage 1 setting range: from -25°C to 10°C or off/default setting: 7°C*

*Frost stage 2 setting range: from -25°C to 8°C/default setting: 5°C*



**Caution**

This function causes energy to be lost via the collector! It is normally not activated for solar systems with antifreeze.

Observe the operating instructions for the other system components!

## 5.5. - Seizing protection

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

*Setting range R1: daily, weekly, off/default setting: Off*

*Setting range R2: daily, weekly, off/default setting: Off*

*Setting range R3: daily, weekly, off/default setting: Off*

## 5.6. - Collector alarm

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

*Collector alarm - Settings range: On / Off / Default setting: Off*

*Collector Tmax - Settings range: 60 °C to 299 °C / Default setting: 115 °C*

*Delay settings range: 1 - 60 minutes / Default: 1 minute*

# Special functions

## 6. - Special functions



Menu "7. Special functions" is used to set basic items and expanded functions.



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

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



Caution

The enumeration of the menus may vary from system to system.

### 6.1. - Program selection

The suitable hydraulic variant for the specific application is selected and set here (see „D.2. - Hydraulic variants / systems" on page 13). The associated diagram is displayed.

*Settings range: 1-37 / Default setting: 1*



Caution

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



Caution

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



# Special functions

## 6.3. - Speed control R1 / R2

With speed control the TSL-TERA makes it possible to vary the speed of connected pumps.



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

### 6.3.1. - Modes

The following speed modes are available here:

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

**Mode M1:** After the purging time the controller switches to the set max. speed. If the temperature difference  $\Delta T$  between the reference sensors (collector and storage tank) is less than the set value, then the speed is decreased by one stage after the control time elapses. If the temperature difference between the reference sensors is greater than the set value, then the speed is increased by one stage after the control time elapses. If the controller has adjusted the speed of the pump down to the smallest stage and the  $\Delta T$  between the reference sensors is  $\Delta T$  off, the pump is switched off.

**Mode M2:** After the purging time the controller switches to the set min. speed. If the temperature difference  $\Delta T$  between the reference sensors (collector and storage tank) is greater than the set value, then the speed is increased by one stage after the control time elapses. If the temperature difference  $\Delta T$  between the reference sensors is below the set value, then the speed is decreased by one stage after the control time elapses. If the controller has adjusted the speed of the pump down to the smallest stage and the  $\Delta T$  between the reference sensors is  $T_{\Delta off}$ , the pump is switched off.

**Mode M3:** After the purging time the controller switches to the set min. speed. If the temperature at the reference sensor (collector) is greater than the setpoint to be set subsequently, then the speed is increased by one stage after the control time expires. If the temperature at the reference sensor (collector) is less than the setpoint to be set subsequently, then the speed is decreased by one stage after the control time expires.

**Mode M4:**

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

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

*Settings range: M1,M2,M3, M4, Off / Default: Off*

### 6.3.2. - Purging time

During this time period, the pump is running with full speed (100%) to ensure trouble-free startup. After this time has passed, the pump is set to speed control and is set to max. speed or min speed, depending on the speed control variant „6.3.1. - Modes“ on page 25 chosen.

*Settings range: 5 to 600 seconds / Default setting: 8 seconds*

### 6.3.3. - Sweep time

Sweep time determines the inertia of the speed control to prevent strong fluctuations in temperature.

Sweep time is the timespan for a complete change from minimum to maximum pump speed.

*Settings range: 1 to 15 minutes / Default setting: 4 minutes*

# Special functions

## 6.4.1. - max. speed

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

*Settings range: 70% to 100% / Default setting: 100%*



**Caution**

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

## 6.4.2. - min. speed

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

*Settings range: (Speed from „J.14.6. - Speed when „On““ on page 47) to max. speed -5% / Default setting: 30%*



**Caution**

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

## 6.4.3. - Setpoint

This value is the control setpoint for Mode 3 (see „6.3.1. - Modes“ on page 25). If the value at the collector sensor drops below this, the speed is reduced. If it rises above this, the speed is increased.

*Settings range: 0° to 90°C / Default setting: 60°C*

## 6.9. - Heat quantity

### 6.9.1. - Constant flow

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

Example:

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



**Caution**

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

#### 6.9.1.1. - Flow sensor (X)

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

*Settings range: S1-S8, VFS1-2, active collector, active storage/ Default setting: S1*

#### 6.9.1.2. - Return sensor

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

*Settings range: S1-S8, VFS1-2, Aktiver Collector, Active storage/ Default setting: S2*

#### 6.9.1.3. - Anti freeze type

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

*Settings range: Ethylen, Propylen / Default setting: Propylen*

#### 6.9.1.4. - Glycole percentage

The amount of anti freeze agent in the system.

*Settings range: 0-100% / Default setting: 45%*

#### 6.9.1.5. - Flow rate (X)

##### Flow rate that is used to calculate the heat quantity

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

*Settings range: 0-100 l/min / Default setting: 5 l/min*

#### 6.9.1.6. - Offset $\Delta T$

##### Correction value for temperature difference

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

Example:

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

*Settings range: -50 to +50% / Default setting: 0%*

# Special functions

## 6.11. - Sensor calibration

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

*Offset Sensor Settings range: -100 ... +100 / Default setting: 0*



**Caution**

Settings sind nur in Sonderfällen bei Erstinbetriebnahme durch den Fachmann nötig. Falsche Messwerte können zu Fehlfunktionen führen.

## 6.12. - Commissioning

Starting the commissioning help guides you in the correct order through the basic settings necessary for commissioning, and provides brief descriptions of each parameter in the display.

Pressing the "esc" key takes you back to the previous value so you can look at the selected setting again or adjust it if desired. Pressing the "esc" more than once takes you back to the selection mode, thus cancelling the commissioning help.



**Caution**

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

## 6.13. - Factory settings

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



**Caution**

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

## 6.14. - Start aid function

With some solar systems, especially with vacuum tube collectors, it may occur that the measurement value acquisition at the collector sensor occurs too slowly or too inaccurately because the sensor is often not at the hottest location. When the start help is activated the following sequence is carried out:

If the temperature at the collector sensor increases by the value specified under "Increase" within one minute, then the solar pump is switched on for the set "Purging time" so that the medium to be measured can be moved to the collector sensor. If this still does not result in a normal switch-on condition, then the start help function is subject to a 5-minute lockout time.

*Start help setting range: on, off/default setting: off*

*Purging time setting range: 2 ... 30 sec./default setting: 5 sec.*

*Increase setting range: 1°C...10°C/default setting: 3°C/min.*



**Caution**

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

# Special functions

## 6.15. - Time and date

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



**Caution**

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

## 6.16. - Daylight saving time

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

*Default: On*

## 6.17. - Sleep mode

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

*Voreinstellung: Aus*



**Caution**

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

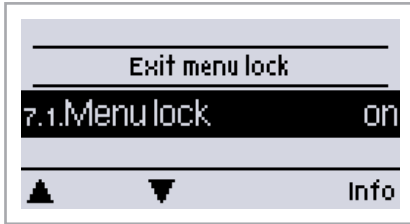
## 6.18. - Temperature unit

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

*Settings range: °F or °C / Default: °C*

# Menu lock

## 7. - Menu lock



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

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

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

1. Measurement values
2. Statistics
- 6.15. Time&date
7. Menu lock
8. Service values

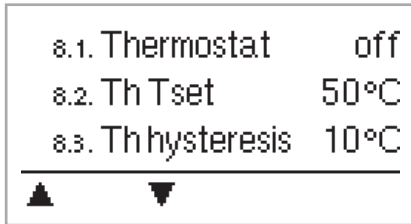
To lock the other menus, select "Menu lock on".

To enable the menus again, select "Menu lock off".

*Setting range: on, off/default setting: off*

# Service values, Languages

## 8. - Service values



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

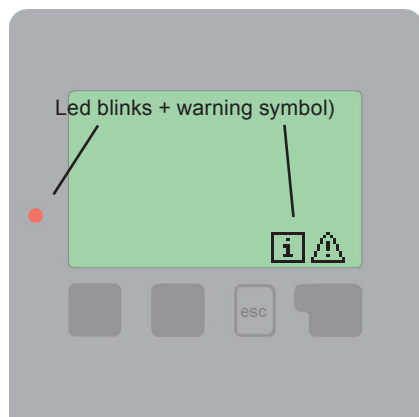
## 9. - Languages



Menu “9. Language” can be used to select the language for the menu guidance. This is queried automatically during initial commissioning. The choice of languages may differ, however, depending on the device design.

# Malfunctions

## Z.1. Malfunctions with error messages



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

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



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

### Possible error messages:

### Notes for the specialist:

Sensor x defective

Means that either the sensor, the sensor input at the controller or the connecting cable is/was defective.  
(Resistance table see „B.2. - Temperature resistance table for Pt1000 sensors“ on page 7)

Collector alarm

Means that the collector has fallen/fell below the temperature set under menu „5.6. - Collector alarm“ on page 23

Restart

Means that the controller was restarted, for example due to a power failure. Check the date & time!

Time & Date

This message appears automatically after a mains failure because the time&date have to be checked, and reset if necessary.

No flow

Is displayed when  $\Delta T$  between storage and collector is  $50^{\circ}$  or higher for 5 minutes without interruption.

Frequent on / off

A relay was switched on and off more than 5 times within 5 minutes.

AL failed

Is displayed when AL ref- $5^{\circ}\text{C}$  was not measured for the set AL residence time at the AL sensor.



# Malfunctions

## Z.2 Replacing the fuse



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

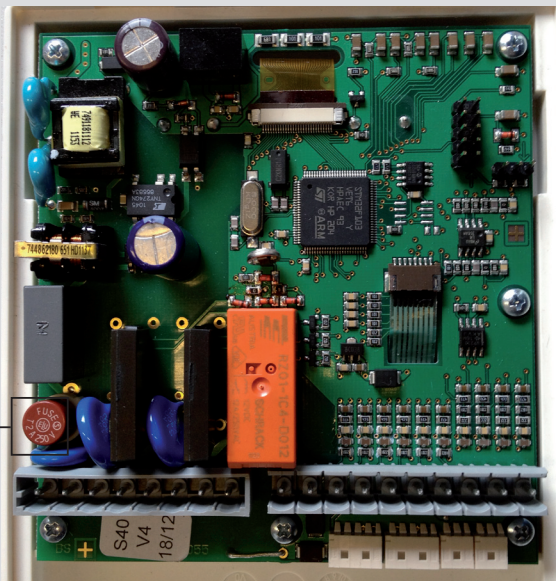


Only use the supplied spare fuse or fuses of the same design with the following specifications: T2A / 250V .

If the mains voltage is switched on and the controller still does not function or display anything, then the internal device fuse may be defective. In that case, open the device as described under C, remove the old fuse and check it. Exchange the defective fuse for a new one, locate the external source of the error (e.g. pump) and exchange it. Then first recommission the controller and check the function of the switch outputs in manual mode as described under „3.2. - Manual“ on page 19

### Z.2.1

Fuse



## Z.3 Maintenance



### Caution

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

Performing maintenance:

- Check the date and time (see „6.15. - Time and date“ on page 29)
- Assess/check plausibility of analyses (see „2. - Statistics“ on page 18)
- Check the error memory (see „2.4. - Message log“ on page 18)
- Verify/check plausibility of the current measurement values (see „1. - Measurement values“ on page 17)
- Check the switch outputs/consumers in manual mode (see „3.2. - Manual“ on page 19)
- Possibly optimise the parameter settings

## Useful notes/tips and tricks



Instead of setting the flow rate for the system using a flow rate limiter, it is better to adjust the flow rate using the switch on the pump and by means of the "max. speed" setting on the controller (see „6.3.4. - max. speed" on page 26). This saves electricity!



The service values (see „8. - Service values" on page 31) include not only current measurement values and operating states, but also all of the settings for the controller. Write down the service values at least 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 down the service values (see „8. - Service values" on page 31.) at the time that the suspected malfunction occurs. Send the service value table with a brief description of the error to the specialist or manufacturer.



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

Hydraulic variant set:

Commissioned on:

Commissioned by:

Notes:

Your specialist dealer:

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.

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