

Heating circuit and solar controller

grandis 650 HK



Installation and operating instructions

English version of original German installation and operating instructions

Version: 1.0

September 2014

Terminology

In order to facilitate the use of the assembly and operating instructions, the following terminology will be used:

- These installation and operating instructions will hereinafter be designated as "Instructions".
- The grandis 650 HK controller will hereinafter be designated as "Controller".
- The thermal solar power plant will hereinafter be designated as "Solar power plant".
- Freely definable Prozeda function modules, complete with selectable inputs and outputs, will hereinafter be designated as "Multi-function controllers" (MFC).
- Prozeda GmbH will hereinafter be designated as the "Manufacturer".

Declaration of conformity

The product complies with the regulatory requirements and standards on CE conformity and therefore carries the CE mark.

This manual is designed to help you use the controller properly, safely and economically.



This manual represents only a part of the installation and operating instructions. Read the document *Menus and controller functions* before making any settings on the controller.

Target group

This manual is addressed to all persons who carry out any of the following tasks:

- Installing the controller
- Connecting the controller
- Putting the controller into operation
- Setting the controller
- Maintaining the solar power system
- Eliminating faults on the controller and the solar power system
- Disposing of the controller

These persons must have the following knowledge and skills:

- Knowledge about establishing electrical connections
- Knowledge about the hydraulic operation of solar power systems
- Knowledge of the applicable regulations at the point of use and the ability to apply them

These persons must have read and understood the contents of this manual.

Availability

This manual is part of the controller. Always keep it in an easily accessible location. Include this manual with the controller should the controller change hands.

If this manual gets lost or becomes unusable, you can contact the manufacturer for a new copy.

Style conventions used in the text


Specific style conventions are assigned to different elements in the manual. This makes it easy to recognise the type of text concerned:

Standard text,

"Menu", "Menu item", "Button designations",

- lists and

➤ actions.

 Notes accompanied by this symbol contain information about how to operate the controller economically.

Style conventions for hazard warnings

This manual makes reference to the following categories of hazard warnings:



DANGER

Information or instructions accompanied by the word DANGER provide a warning about a hazardous situation that will lead to fatal or serious injuries.



WARNING

Information or instructions accompanied by the word WARNING provide a warning about a hazardous situation that may possibly lead to fatal or serious injuries.



CAUTION

Information or instructions accompanied by the word CAUTION provide a warning about a situation that can lead to minor or moderate injuries.

Style conventions for warnings of damage to property or the environment

ATTENTION

Information and instructions of this kind provide a warning about a situation that can lead to damage to property or the environment.

Table of contents

1	Safety	6
1.1	Proper use	6
1.2	Basic safety information	6
2	Description of the controller	8
2.1	Overview.....	8
3	Installing the controller	9
3.1	Fastening the controller	10
4	Connecting the controller	11
4.1	Connecting cables to the controller	11
4.2	Connecting the controller to the power supply.....	13
4.3	Connecting temperature sensors	13
4.4	Assignment of the terminals to the system components.....	14
5	Operating the controller	15
5.1	Description of the display elements	15
5.2	Using the operating buttons.....	17
6	Menus and controller functions	19
7	Restore factory settings	19
8	Networking the controller with other devices	20
9	Faults	21
9.1	Faults with fault message.....	21
9.2	Faults without fault message	24
10	Technical data	26
11	Accessories	27
12	Disposing of the controller	27

1 Safety

This chapter contains information on:

- the proper use of the controller and
- the safe use of the controller.

Read this chapter through carefully before you install, connect or operate the controller.

1.1 Proper use

The controller is used for monitoring and controlling a solar thermal system.

Appropriate use of the controller includes the following requirements:

- Use the controller exclusively in dry rooms in residential, commercial and/or industrial environments.
- Use only sensor connection boxes supplied by the manufacturer.
- Use the RS485 interface (ProBus) only for networking further devices from the manufacturer Prozeda.

The definition of proper use also encompasses observing and complying with all of the information contained in this manual - in particular compliance with all safety information and instructions.

Any other use, or any use exceeding the specifications, will be deemed to be improper use and may lead to personal injury or damage to property and shall render the warranty void.

Use of the controller in the following situations in particular is considered to be improper use:

- If you modify the controller independently and without prior authorisation
- If you operate the controller in a humid or wet environment

The manufacturer shall not be liable for damages arising from inappropriate use.

1.2 Basic safety information

This section contains basic safety information relating to working with the controller. You will find additional safety information relating to specific actions and workflows at the beginning of the section concerned.

Preventing risks of explosion

- Never use the unit in areas where there is a risk of explosion.

Preventing risks of fatal injury from electric shocks

- Make sure that all regulations applicable at the point of use are complied with.
- Always make sure that the controller is disconnected from the power supply before carrying out any work on it.
- Make sure that the connections of the protective extra-low voltage areas do not get mixed up with the power supply connections.
- On completion of installation work, refit the terminal cover and tighten the locking screw using a screwdriver.
- Make sure that the electrical connection of the controller can be disconnected from the mains externally if required.
- Make sure that all cables are secured by strain relief devices.
- Use the device only if it is in a fault-free condition.

Preventing risks of fire

- Install the controller on a non-flammable subsurface.

Preventing risks of injury from burns

- Carry out installation work on the solar power system only when it has cooled down.
- The process water can reach very high temperatures. Exercise particular care when configuring settings on the controller.
- Take water samples after completion of the settings and check them using a suitable thermometer.

Preventing damage to property

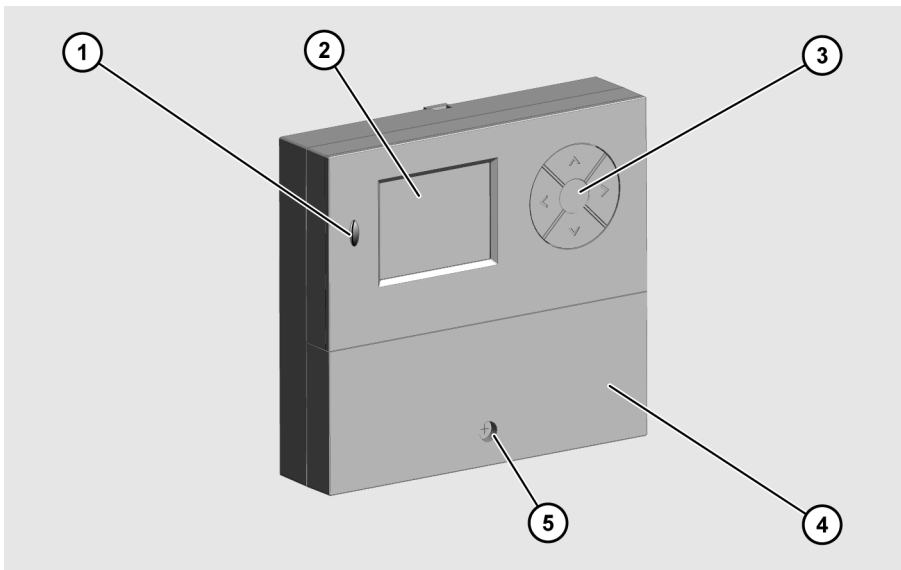
- A damaged controller may cause malfunctions in the system as well as damage to its components. Use the controller only if it is in a fault-free condition.
- Install the controller with due observance of its protection class. Information about this can be found in the chapter *Technical Data* from page 26 onwards.
- Make sure that no moisture gets into the controller.
- If any moisture gets into the controller, disconnect the controller from the power supply.
- Make sure that the maximum permissible ambient temperature is not exceeded. Information about this can be found in the chapter *Technical Data* from page 26 onwards.
- Make sure that all components to be connected to the switching outputs are suitable for an operating voltage of 230 V/50 Hz.

- When in "manual mode", the system must only ever be operated for a short time and only for test purposes.
- Install sensor lines separately from 230 V lines.
- Use only sensor connection boxes supplied by the manufacturer.

2 Description of the controller

The controller is used for monitoring and controlling a solar thermal system. The controller allows the system to be configured in accordance with the local situation at the place of use and with the requirements of the user. In addition, the controller can be used to carry out system protection functions.

2.1 Overview



- 1 microSD card interface
- 2 Display
- 3 Operating buttons
- 4 Terminal cover
- 5 Locking screw

The display (2) shows the menus for monitoring and controlling the solar power system. The operating buttons (3) allow you to display and change the parameters. For data exchange purposes the controller is equipped with a microSD card interface (1).

3 Installing the controller



DANGER

Risk of fatal injuries due to explosions or fire.

- Never use the controller in areas where there is a risk of explosion.
 - Install the controller on a non-flammable subsurface.
-
-



DANGER

Risk of fatal electric shock when working on the opened controller.

- Make sure that the controller is disconnected from the mains voltage before removing the terminal cover.
 - Make sure that the power supply has been secured to prevent it from being switched on again.
 - Check that the controller is free from voltage.
 - Screw the terminal cover securely back in place when work has been completed.
-
-

ATTENTION

Risk of damage and malfunctions due to improper storage before connection.

- Store the controller at room temperature for at least four hours before connecting it.
-

Select an installation location which meets the following requirements:

- The installation location must be at eye level.
 - The installation location must be close to the storage tank and the solar circuit pump.
 - It must have access to the power supply.
 - There must be sufficient space in front of the controller to allow it to be operated.
 - If you wish to lead cables and lines through the back of the controller, there must be sufficient space for the cable gland.
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3.1 Fastening the controller

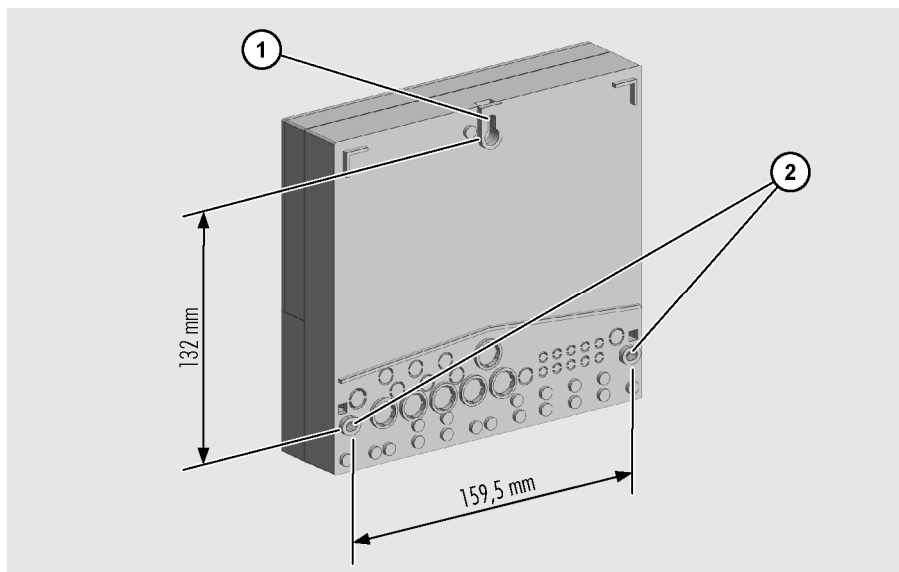
- i** If you wish to lead cables and lines through the back of the controller, you need to do this before you fasten it.
-

ATTENTION

Risk of damage to the controller housing due to screws tightened too firmly.

- Tighten the screws only as firmly as necessary.
-

- Use only suitable screws and dowels for fastening the controller.
- Hang the controller on the top screw by the keyhole (1).
- Fasten the controller with the screws from the inside through the bottom screw holes (2).



4 Connecting the controller



DANGER

Risk of fatal electric shock when working on the opened controller.

- Make sure that the controller is disconnected from the mains voltage before removing the terminal cover.
 - Make sure that the power supply has been secured to prevent it from being switched on again.
 - Check that the controller is free from voltage.
 - Screw the terminal cover securely back in place when work has been completed.
-
-



DANGER

Risk of fatal electric shock due to ripped out cables.

- Make sure that all cables are adequately secured in position by screw clamps.
 - Make sure that there is no pull on the cables.
-
-

ATTENTION

Risk of damage to the controller and the solar power system due to the connection of unsuitable system components.

- Make sure that the operating voltage of the system components matches that of the controller. Information about this can be found in the chapter *Technical Data* from page 26 onwards.
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ATTENTION

Risk of damage and malfunctions due to improper storage before connection.

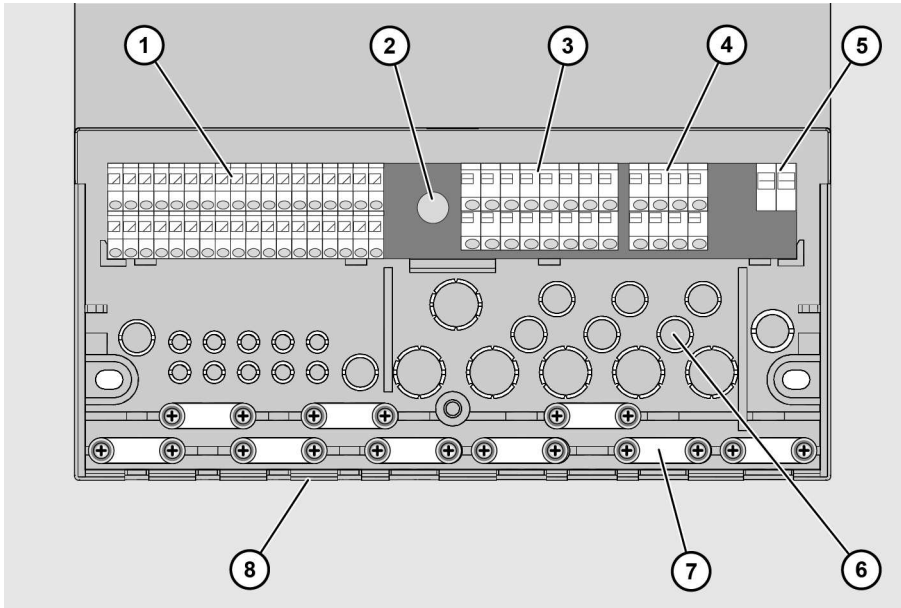
- Store the controller at room temperature for at least four hours before connecting it.
-
-

4.1 Connecting cables to the controller

- Make sure that the cables and the controller are disconnected from the voltage.
- Remove the terminal cover.

Connecting the controller

The following illustration shows the elements of the controller that are important for connection:



Pos.	Description
1	Terminals for extra-low voltage area
2	Fuse
3	Terminals for 230 V area
4	Terminals for protective conductor
5	Terminals for relay contact
6	Cut-out apertures for cable feedthrough at the back
7	Screw clamps for securing the cables
8	Cut-out apertures for cable feedthrough on the underside

- Connect the cables to the corresponding terminals.

Information about connecting the system components to the corresponding terminals can be found in the section *Assignment of the terminals to the system components* from page 14 onwards.

- Screw the terminal cover securely back in place.

4.2 Connecting the controller to the power supply

When making the mains connection, you must ensure that the mains supply can be disconnected at any time. If you make a permanent mains connection, proceed as follows:

- Install a switch on the supply lead of the controller.

If you make the mains connection complete with cable and earthing pin plug, proceed as follows:

- Make sure that the earthing pin plug is easily accessible.
- Plug the earthing pin plug in the plug socket.

4.3 Connecting temperature sensors

ATTENTION

Risk of damage and malfunctions on the controller due to improper connection of the temperature sensors.

- Use only sensor connection boxes supplied by the manufacturer.
- Use only shielded cables for line extensions.
- Connect the shield of the extension cable to a PE terminal.
- Install sensor lines separately from 230 V lines.

Use cables with the following cross-sections for line extensions:

- Up to 15 m: $2 \times 0.5 \text{ mm}^2$
- 15 to 50 m: $2 \times 0.75 \text{ mm}^2$



When connecting the temperature sensors, you do not need to observe polarity for the two wires.

4.4 Assignment of the terminals to the system components

For orientation when assigning the terminals to the switching outputs, various different hydraulic layouts are shown in the following. These show simplified solar circuits that you can use with the controller. The process water circuit is not shown here. For the hydraulic layouts you can select "External heat exchanger" or "Three-way valve for bypass function" as extensions.

You can set the hydraulic layout at:

- Basic settings/Solar circuit/Hydraulic layout

The connections in the following table are options that may be used in all hydraulic layouts:

Terminal	Use
S1 to S10	Connections for PT1000 temperature sensor
S0 + M	Radiation sensor input (white core of the radiation sensor at S0, red core at M)
S4 + S4	Temperature sensor of the collector return line for the "Energy yield measurement" function
S13 + 5V S15 + 5V	Flow sensor for the "Energy output measurement" function
S14 + S15 5V + M	VFS (vortex flow sensor) for the "Flow monitoring" function "Flow" on S14, "Temperature" on S15. Further details can be found in the VFS manufacturer's documentation.
S12 + S13 5V + M	VFS (vortex flow sensor) for the "Flow monitoring" function "Flow" on S12, "Temperature" on S13. Further details can be found in the VFS manufacturer's documentation.
A + B	RS-485 interface (ProBus and ProBusX) Make sure that the polarity of the bus connection is not mixed up (A-A, B-B). Use paired twisted-conductor cables for connection.
HE 1 + M 1	Power control for high-efficiency pump (HE pump) 1 230 V power supply for the pump via switching output R1
HE 2 + M 1	Power control for high-efficiency pump (HE pump) 2 230 V power supply for the pump via switching output R2
HE 3 + M1	Power control for high-efficiency pump (HE pump)







Information about the hydraulic layouts can be found in the document *Hydraulic layouts*.

5 Operating the controller

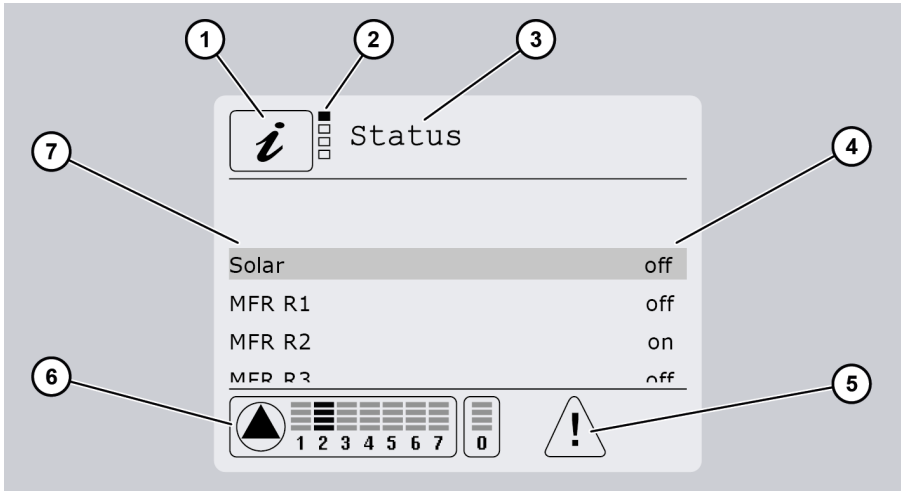
This chapter provides you with an overview of the controller's display elements and operating elements. This is followed by explanations of all the basic actions.

5.1 Description of the display elements

The following menu symbols are displayed in the top part of the display in the main menu:

Main menu	
Symbol	Description
	"Info" menu This is for displaying measurement and output values and status messages.
	"Program" menu This is for displaying and changing parameters.
	"Manual mode" menu This is for switching outputs on and off for test purposes. Only specialist personnel are permitted to make changes to the values in this menu.
	"Basic settings" menu This is for displaying and changing basic settings. Only specialist personnel are permitted to make changes to the values in this menu.

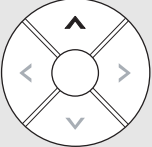
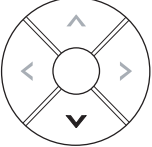
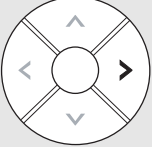
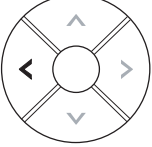
The menu symbol (1), menu level (2) and the name of the active menu level (3) are displayed in the top part of the display. The middle part of the display shows menu items in list form. The names of the menu items (7) are displayed on the left-hand side. On the right-hand side you will see the current values or status messages (4) for each of the menu items. The selected line will have a gray background. The bottom part of the display shows basic system functions and messages from the controller. The following illustration shows a display screen by way of illustration:



Pos.	Description
1	Active menu (In this case: "Info" menu)
2	Display for the menu level (In this case: Level 1)
3	Name of the active menu level
4	Current value or status
5	Fault symbol: This symbol is displayed flashing in the event of a fault.
6	Pump symbol and switching outputs: The pump symbol rotates whenever the pump is switched on. There is a bar display above each switching output showing the current control power
7	Menu items

5.2 Using the operating buttons

The operating buttons allow you to navigate in the menus and make changes to values. The following table explains the functions of the operating buttons:

Operating buttons	Function
	<p>Move up in the list. Increase the displayed value.</p>
	<p>Move down in the list. Call up the selected menu. Reduce the displayed value.</p>
	<p>Move to the right in the main menu. Select or activate a menu item. Confirm a change to a value.</p>
	<p>Move to the left in the main menu. Cancel the activation of a menu item. Any value changes that have not been confirmed will be discarded. The value that is currently set will be displayed. Return to the main menu. In the case of fault messages: Switch off the warning signal.</p>

Navigating in the menus

- To switch to the main menu, press **<** as often as required until the main menu is displayed.
- Use **<** or **>** to select the required menu.

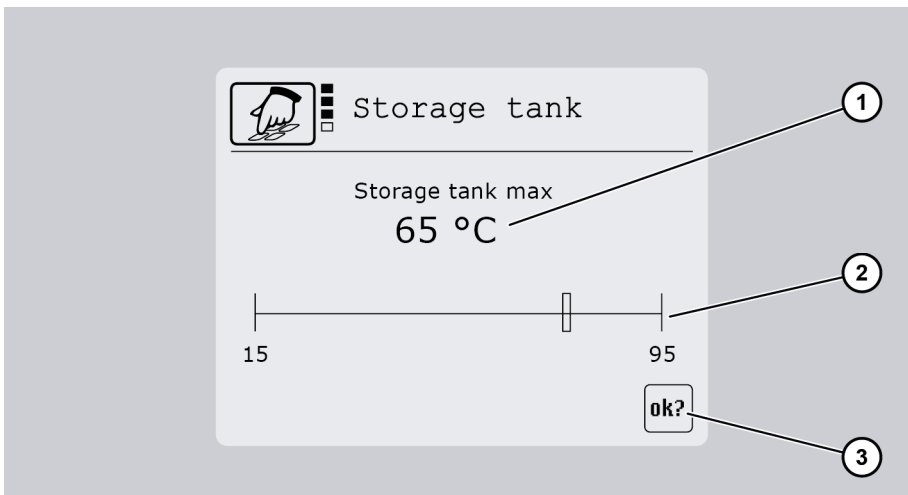
The selected menu symbol flashes.

- To display the various different menu items, select **∇** or **▲**.
- To display a menu item, select **>**.
- To exit a menu item, select **<**.

Changing values

- To activate a menu item, select **>**.

The "Change value" display screen will be displayed. The value will be displayed as a figure (1) and as a bar display (2). The bar display shows the setting range (In this case: 15–95 °C).



- To increase the value, select **▲**.
- To reduce the value, select **∇**.
- To abort the change to a value, select **<**.
- To confirm the entry, select **>**.

The value stops flashing. The OK symbol (3) will be displayed and will flash.

- To cancel the entry, select < .
- To re-confirm the entry, select > .

The value will be saved and the overview will be displayed.

- ⓘ If you press the ^ or v buttons once, the value will be increased or reduced in steps. If you keep these buttons pressed, the value will be increased or reduced on a continuous basis.

6 Menus and controller functions

Information about the menus and the various controller functions can be found in the document *Menus and controller functions*.

7 Restore factory settings

ATTENTION

Risk of loss of current settings due to incorrect restoration of the factory settings.

- Before restoring the factory settings, make sure that you no longer require the current settings.
- If necessary, save the current settings to a microSD card before restoring the factory settings.

The factory settings are the parameters that were preset ex works.

- In order to restore the factory settings, select the value "Load" in the "Basic settings/System/Factory settings" menu item.

The factory settings will be restored.

8 Networking the controller with other devices

The RS-485 interface (ProBus and ProBusX) allows you to connect the controller to other devices in a network. By networking (with the conexio 600 or conexio 200 web module) you can use the following additional functions via a PC, tablet PC, smartphone etc.:

- Viewing the controller's data on another device (monitoring)
- Operating the controller from another device (remote control).

The manufacturer can provide further details.



These functions are available for device version V1.10 and higher of the conexio 200 web module.

9 Faults

ATTENTION

Risk of damage to the system if faults are remedied incorrectly.

- Make sure that faults are only ever remedied by specialist personnel.

There are two categories of system faults:

- Faults that are detected by the controller and trigger a fault message
- Faults that are not detected by the controller and do not trigger a fault message

9.1 Faults with fault message

In the event of faults with fault messages, the fault symbol will start flashing in the bottom part of the display. The backlighting will flash simultaneously. The acoustic warning signal will be sounded as well if it is active.

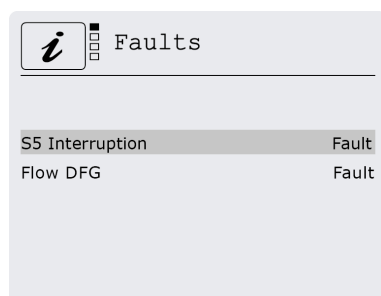
- To switch off the flashing of the backlighting and the acoustic warning signal, press the operating button. < .

The acoustic warning signal is activated and deactivated in the following menu item:

- Program/System/Warning signal

Displaying fault messages

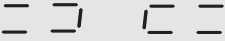

- To display the fault message, go to the "Info" - "Fault" menu.

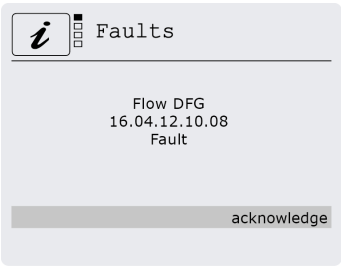


All the faults which have occurred are displayed here. Clicking with the right-hand mouse button allows you to display the time and date. When the fault is no longer present, "Fault OK" will be displayed. You can delete the message with "Reset".

Faults

The table below shows the faults with fault messages:

Fault message	Possible cause	Action
<p>Interruption</p> <p>Additional symbol indicator in "Info"/"Solar circuit"</p> 	<p>A sensor line is interrupted.</p>	<p>Make sure that the sensor line is intact.</p>
<p>A sensor is faulty.</p>	<p>Check the sensor resistance.</p> <p>If necessary, replace the sensor.</p>	
<p>Short circuit</p> <p>Additional symbol indicator in "Info"/"Solar circuit"</p> 	<p>A short circuit has occurred in the sensor line.</p>	<p>Make sure that the sensor line is intact.</p>
<p>A sensor is faulty.</p>	<p>Check the sensor resistance.</p> <p>If necessary, replace the sensor.</p>	
<p>Circulation fault</p> <p>Malfunctioning flow (temperature difference between the collector and storage tank is too high)</p> <p>This message will not lead to the pump being turned off.</p> <p>The message will be reset automatically when the fault is no longer present.</p>	<p>Faulty pump connection line.</p>	<p>Make sure that the pump wiring is intact.</p>
	<p>Faulty pump.</p>	<p>Replace the pump.</p>
	<p>Air in the system.</p>	<p>Vent the system.</p>
	<p>Faulty sensor line.</p>	<p>Make sure that the sensor line is intact.</p>
	<p>Faulty sensor.</p>	<p>Check the sensor resistance.</p> <p>If necessary, replace the sensor.</p>

Fault message	Possible cause	Action
 <p>The fault message "Flow VFS" will be displayed if a VFS sensor is connected.</p>	A sensor line is faulty.	Make sure that the sensor line is intact.
	Faulty pump connection line.	Make sure that the pump wiring is intact.
	A pump is faulty.	Replace the pump.
	There is air in the system.	Vent the system.

9.2 Faults without fault message

The table below shows the faults without fault messages:

Fault	Possible cause	Action
No indication on the display.	There is no mains voltage.	Switch on the controller or connect the controller to the mains voltage. Make sure that the main fuse for the mains connection is switched on.
	The controller's fuse is faulty.	If necessary, replace the controller's fuse. Use a type 2A/T fuse.
		Check the 230 V components for a short circuit. In the event of a short circuit, contact the manufacturer.
	The controller is faulty.	Contact the manufacturer.
The pump fails to switch on.	Manual mode has been activated.	Exit manual mode.
	The preconditions for the pump to be switched on have not been met.	Wait until the preconditions for the pump to be switched on have been met.
	The temperature limit for a storage tank (95 °C) has been exceeded.	Make sure that the wiring is intact. Make sure that the system components are intact.

Fault	Possible cause	Action
<p>The pump symbol rotates without the pump actually running.</p>	<p>The connection to the pump has been interrupted.</p>	<p>Make sure that the cable connection to the pump is intact.</p>
	<p>The pump has seized up.</p>	<p>Make sure that the pump is running.</p>
	<p>There is no voltage at the pump output.</p>	<p>Contact the manufacturer.</p>
<p>The temperature display fluctuates strongly at short intervals.</p>	<p>The sensor lines have been installed close to 230 V lines.</p>	<p>Install the sensor lines at the greatest possible distance from the 230 V lines. Make sure that the sensor lines are shielded.</p>
	<p>The extensions of the sensor lines have not been shielded.</p>	<p>Make sure that the sensor lines are shielded.</p>
	<p>The controller is faulty.</p>	<p>Contact the manufacturer.</p>

10 Technical data

Autonomous electronic temperature difference controller, continuous operation	
Housing material	100% recyclable ABS housing
Dimensions L x W x D in mm	176 × 162 × 44
Protection class	IP30 according to DIN 40050, EN 60529
Operating voltage	AC 230 voltage, 50 Hz, -10 to +15%
Power consumption	< 2 W
Max. line cross-section for 230 V connections	2,5 mm ² finely stranded/single core
Inputs S1–S10 (protected by varistors)	For temperature sensors PT 1000 (1 kΩ at 0 °C)
Input S0	For radiation sensor type PSF
Other inputs	VFS (vortex flow sensor) DFG (impeller flow sensor) Minimum measurable flow: 20 litres/hour Maximum measurable flow: 72,000 litres/hour
Measuring range (temperature)	-30 °C to +250 °C
Interfaces	RS 485 for ProBus
Output R1–R7	Electronic semiconductor relay (Triac) with zero-cross switch, opto-decoupled, 230 V AC, 50 Hz, min. 10 mA, max. 150 W, with cos φ ≥ 0.9
Total output of all outputs	Max. 300 W
Output R0	Relay, potential-free normally open contact, max. 250 V AC / 1 A, also suitable for protective extra-low voltage
Control output for HE pump	PWM signal: 1 kHz, ViL < 0.5 V DC, ViH > 9 V DC, 10 mA max. Analog signal (not for HE3): 0 ... +10 V DC +/- 3%, 10 mA max.
Display	Backlit LCD display
Type 1 action	Type 1.B and type 1.Y
Software class	A
Protection	Microfuse TR 5 type 372, 4 A/T (4 ampere, slow)
Ambient temperature	0 to +40 °C
Storage temperature	-10 to +60 °C

11 Accessories

The following accessories are available for this controller:

- microSD card
- conviso software
- conexio 200 and 600 web module
- Flexbox



Use only microSD cards from the manufacturer. The manufacturer cannot provide a guarantee that any other microSD cards will work.

The conviso software allows you to display the data stored on the microSD card on a standard commercially available PC.

The conexio web module allows you to display the controller's data on another system (monitoring) via the Internet. In addition, it allows you to operate the controller from another system (remote control) via the Internet. The conexio web module can be obtained from the manufacturer.

The following accessories are available for the solar power system:

- Temperature sensor PT1000
- Yield measurement set (incl. pipe contact sensor)
- Sensor connection box (additional surge protection against indirect lightning)
- Immersion sleeves.

12 Disposing of the controller

The environmentally-friendly disposal of electronic assemblies, recyclable materials and other unit components is regulated by national and regional laws.

- Contact the competent local authority for detailed information on disposal.
- Dispose of lithium batteries in accordance with the statutory regulations.
- Dispose of all components in accordance with statutory regulations.



These instructions were prepared by a technical documentation office certified by DocCert-System.



Address of manufacturer

Prozeda GmbH

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D-91330 Eggolsheim

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