



## Installation and operating instructions

### Temperature difference controller

3 inputs, 1 PWM control signal for an ECM pump

These operating instructions are part of the product.

- ▶ Read the instructions carefully before use,
- ▶ keep them over the entire lifetime of the product,
- ▶ and pass them on to any future owner or user of this product.

**EN**



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# 1 About these instructions

## 1.1 Applicability

These instructions describe the installation, commissioning, function, operation, maintenance and dismantling of the temperature difference controller for controlling an ECM high-efficiency pump within a solar thermal system (ECM = Electronic Commutated Motor). When installing the remaining components, e.g. solar collectors, pump assemblies and storage units, be sure to observe the appropriate installation instructions provided by each manufacturer.

## 1.2 Users

Installation, commissioning, operation, maintenance and dismantling of the controller may only be performed by trained professional personnel. Before commissioning, the controller must be professionally assembled and installed by professional personnel in accordance with the applicable regional and trans-regional regulations as well as the safety instructions and general instructions within these installation and operating instructions. The professional personnel must be familiar with these operating instructions.

Use the controller only after first thoroughly reading and understanding these operating instructions and the safety instructions. Adhere to all safety instructions. In the event of any ambiguities regarding the operation and alteration of parameters or functions, consult professional personnel.

## 1.3 Description of symbols




### 1.3.1 Structure of the warning notices

#### SIGNAL WORD

Type, source and consequences of the danger!

- Measures for avoiding danger.

### 1.3.2 Danger levels in warning notices

Danger level	Likelihood of occurrence	Consequences resulting from non-compliance
 DANGER	Imminent threat of danger	Death, serious bodily injury
 WARNING	Possible threat of danger	Death, serious bodily injury
 CAUTION	Possible threat of danger	Minor bodily injury
CAUTION	Possible threat of danger	Property damage

### 1.3.3 Notes

#### Note

Note on easier and safer working habits.

- Measure for easier and safer working habits

Pictogram with corresponding warning symbol.

### 1.3.4 Other symbols and markings

Symbol	Meaning
✓	Condition for action
▶	Call to action
⇒	Result of action
•	List
<b>Emphasis on issue at hand</b>	Emphasis on issue at hand

## 2 Safety

### 2.1 Proper usage

The temperature difference controller – hereinafter referred to as controller – is an independently installed electronic temperature controller for on-surface installation. The controller may only be used for controlling solar thermal systems within the permissible ambient conditions (see section 12 "Technical data").

### 2.2 Improper usage

The controller must not be operated in the following environments:

- outdoors
- in damp rooms
- in rooms where highly flammable gas mixtures can occur
- in rooms in which the operation of electrical and electronic components may cause dangers to arise

### 2.3 Dangers during assembly / commissioning

The following dangers exist during installation / commissioning of the controller and during operation (in case of installation errors):

- Risk of death by electrocution
- Risk of fire due to short-circuit
- Damage to any of the constructional fire safety measures present in the building due to incorrectly installed cables
- Damage to the controller and connected devices due to improper ambient conditions, inappropriate power supply and connecting prohibited devices or faulty devices and incorrect assembly or installation

Therefore, all safety regulations apply when working on the mains supply. Only electricians may perform work that requires opening the controller (such as connection work).

- ▶ When laying cables, ensure that no damage occurs to any of the constructional fire safety measures in the building.
- ▶ Make sure that the permissible ambient conditions at the mounting location are not exceeded (see section 12).
- ▶ Be sure to comply with the specified degree of protection.
- ▶ Factory labels and markings may not be altered, removed or rendered unreadable.

- ▶ Before connecting the device, make sure that the power supply matches the specifications on the type plate.
- ▶ Make sure that all devices which are connected to the controller conform to the technical data of the controller.
- ▶ Secure the device against unintentional start-up.
- ▶ All work on an open controller must be performed with the mains supply disconnected.
- ▶ Protect the controller against overloading and short-circuiting.

## **2.4 Detecting faults**

- ▶ Check the display regularly.
- ▶ In case of faults, isolate the cause (see section 9).
- ▶ As soon as it becomes evident that safe operation is no longer possible (e.g. visible damage), disconnect the device from the mains supply immediately.
- ▶ Have professional personnel remedy the fault.

## **2.5 Exclusion of liability**

The manufacturer cannot monitor the compliance to these instructions as well as the conditions and methods during the installation, operation, usage and maintenance of the controller. Improper installation of the system may result in damage to property and, as a result, to bodily injury.

Therefore, we assume no responsibility and liability for loss, damage or costs which result from or are

in any way related to incorrect installation, incorrect execution of installation work, improper operation and incorrect usage and maintenance.

Similarly, we assume no responsibility for patent right or other right infringements of third parties caused by usage of this controller.

The manufacturer reserves the right to make changes to the product, technical data or installation and operating instructions without prior notice.



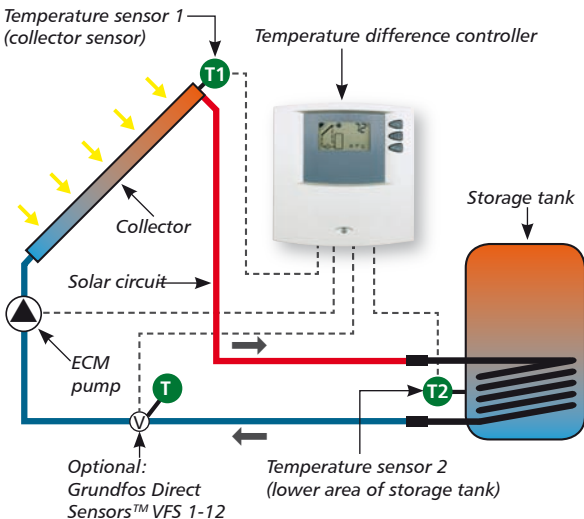
## 3 Description

### 3.1 Controller in the solar circuit

#### 3.1.1 The purpose of the controller

The controller provides speed control of the ECM pump in a solar thermal system (see section 7 "Description of the controller functions").

#### 3.1.2 The structure of the solar circuit



### 3.1.3 The function of the solar circuit

The controller constantly compares the temperatures between the collector (T1) and the lower area of the storage tank (T2). Once the sun heats the collector and there is a temperature difference of 8 K between the collector and the storage tank, the pump is switched on.

The pump extracts the heat transfer fluid from the lower cooler area of the storage tank and pumps it to the collector. The heat transfer fluid in the collector is heated by the sun and flows back to the storage tank.

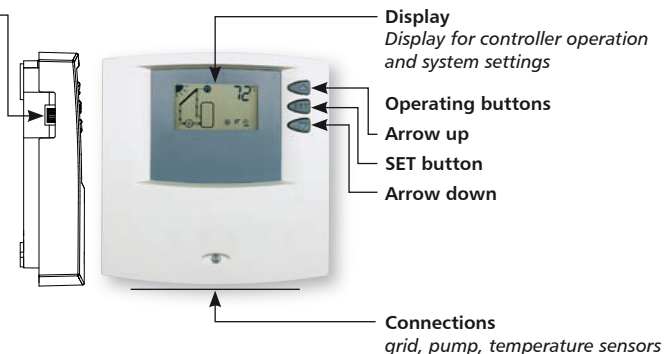
The heat transfer fluid heats the domestic water via a heat exchanger located in the storage tank.

## 3.2 Casing overview

### Operating switch

The following modes of operation can be selected:

- **On**  
for commissioning and functional test
- **Auto**  
for normal operation
- **Off**  
to switch-off the pumps



## 4 Installation

### 4.1 Opening / closing the casing

#### DANGER

##### Risk of death by electrocution!

- ▶ Disconnect the controller from the power supply before opening the casing.
- ▶ Make sure that the power supply cannot be unintentionally switched back on.
- ▶ Do not damage the casing.
- ▶ Only switch the power supply back on after the casing has been closed.

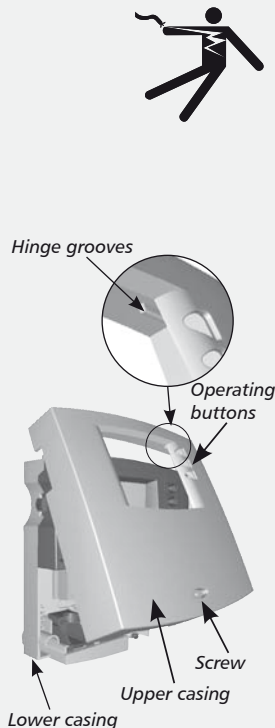
The top of the casing is held in place by two retaining pegs on the upper edge of the bottom half of the casing and fastened with a screw.

#### 4.1.1 Opening the casing

- ▶ Loosen the screw and remove the upper casing in an upwards direction.

#### 4.1.2 Closing the casing

- ▶ Place the upper casing over the lower casing at an angle. Insert the hinge grooves into the retaining pegs of the lower casing.
- ▶ Pivot the upper casing down and feed the operating buttons through the matching holes.
- ▶ Fasten the casing tightly with the screw.



## 4.2 Installation

### WARNING

Risk of electrical shock and fire if mounted in a damp environment!

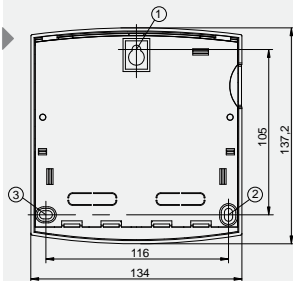
- ▶ Only assemble the controller in an area where the degree of protection is sufficient.

### 4.2.1 Mounting the controller

#### CAUTION

Risk of injury and damage to the casing when drilling!

- ▶ Do not use the casing as a drilling template.
- ▶ Choose a suitable mounting location.
- ▶ Drill the upper fastening hole.
- ▶ Screw in the screw.
- ▶ Remove the upper casing.
- ▶ Hang the casing in the recess ①.
- ▶ Mark the position of the lower fastening holes ②, ③.
- ▶ Remove the casing again.
- ▶ Drill the lower fastening holes.
- ▶ Re-hang the casing in the recess ①.
- ▶ Screw the casing firmly using the lower fastening holes ② and ③.
- ▶ Mount the upper casing.





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### 4.3 Electrical connection

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#### DANGER

##### Risk of death by electrocution!

- ▶ Disconnect the controller from the power supply before opening the casing.
  - ▶ Observe all applicable legal guidelines and regulations of the local electricity supplier.
- 

#### NOTE

The device is to be connected to the grid by means of a plug with grounding contact, or in the case of a fixed electrical installation via a disconnection device for complete disconnection in accordance with the installation guidelines.

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#### 4.3.1 Preparing the cable feed

The cables may enter the device through the rear of the casing or the lower side of the casing.

### Feeding cable through rear of casing (fig. 1):

#### **⚠ WARNING**

Risk of electrical shock and fire due to cables coming loose!

- ▶ Install an external strain relief for the cables.
- ▶ Remove the plastic flaps ⑦ from the rear side of the casing using an appropriate tool.

### Feeding the cable through the lower side of the casing (fig. 2):

#### **⚠ WARNING**

Risk of electrical shock and fire due to cables coming loose!

- ▶ Fasten the cables to the casing using the strain-relief clamps provided.
- ▶ Cut the left and right plastic flaps ⑥ using an appropriate tool and break them out of the casing.

#### 4.3.2 Connecting the cables

- ▶ If a protective conductor is provided or required for the pump, connect the protective conductor to the terminal clamps of the controller. When connecting the protective conductor, observe the following points:
  - Make sure that the grounding contact is also connected to the controller's mains supply side.

#### **NOTE**

Observe the instructions in the ECM pump data sheet.

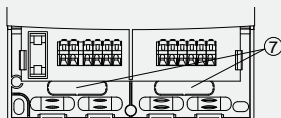


Fig. 1: cable feed from the rear

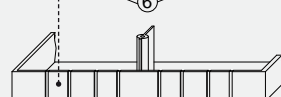
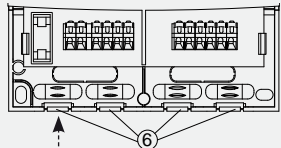
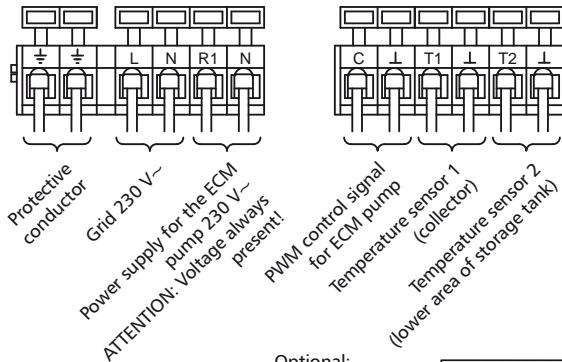


Fig. 2: cable feed from below

- Each terminal may only be connected to a single connecting wire (max 2.5 mm<sup>2</sup>).
- ▶ The spring terminals are approved for connection of cables as follows:
  - single wire (solid): ≤ 2.5 mm<sup>2</sup>
  - fine strand (flexible): ≤ 2.5 mm<sup>2</sup> (the stranded wires must be twisted with 1 twist per 20 mm)
  - fine strand (with core end sleeves): ≤ 1.5 mm<sup>2</sup>
- ▶ Only use the original temperature sensors (Pt1000) that are approved for use with the controller.
- ▶ Observe the following points:
  - Polarity of the sensor contacts is not important.
  - Do not lay sensor cables close to 230 volt or 400 volt cables (minimum separation: 100 mm).
  - If inductive effects are expected, e.g. from heavy current cables, overhead train cables, transformer substations, radio and television devices, amateur radio stations, microwave devices etc. , then the sensor cables must be adequately shielded.
  - Sensor cables may be extended to a maximum length of 100 m.
- ▶ For extension cables, select the following cable cross sections:
  - 0.75 mm<sup>2</sup> up to 50 m long
  - 1.5 mm<sup>2</sup> up to 100 m long
- ▶ Connect the cables in accordance with the terminal plan.
- ▶ Use only the Grundfos Direct Sensor™ VFS 1-12 that is approved for the controller.

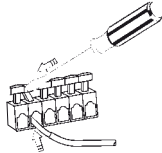
### 4.3.3 Terminal plan



Optional:  
Grundfos Direct  
Sensors™ VFS 1-12



### 4.3.4 Actuating the connecting terminals

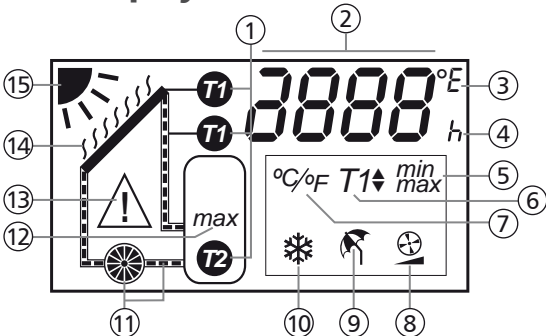


#### NOTE

The connecting terminal may only be actuated with an appropriate tool. An unsuitable tool or too much mechanical pressure can damage or even destroy the connecting terminal.



## 5 Display overview



- ① Temperature sensor symbols  
Top T1 = collector sensor  
Bottom T1 = sensor for tube collector function  
T2 = sensor for lower area of storage tank
- ② Display for temperature values, operating hours and fault symbols, e.g. short circuit, interruption (see page 40) or "SYS" = system error (see page 41)
- ③ Display for temperature unit °C / °F
- ④ ECM pump operating hours
- ⑤ Setting the maximum storage tank temperature (max) and display of min/max temperature values
- ⑥ Tube collector function
- ⑦ Setting the temperature unit °C / °F
- ⑧ Speed control
- ⑨ Holiday function (see page 35)
- ⑩ Anti-freeze function (see page 34)
- ⑪ Symbols for pump operation and heat transfer fluid circulation
- ⑫ Display for "Maximum storage tank temperature has been reached"
- ⑬ Warning sign in the case of a fault e.g. short circuit, interruption (see page 40) or "SYS" = system error (see page 41)
- ⑭ Display when the maximum collector temperature is reached, means possible evaporation of the collector fluid
- ⑮ Display when the switch-on temperature difference is reached, means "sufficient heat available"

## 6 Commissioning

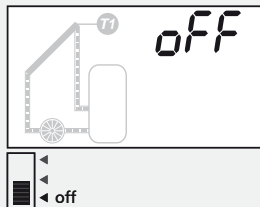
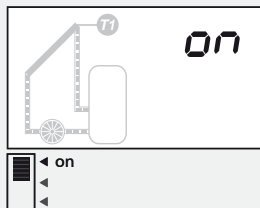
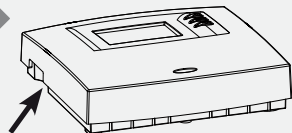
### 6.1 Testing the pump

#### CAUTION

#### Damage to pump caused by dry operation!

- ▶ Make sure that the solar circuit is filled with heat transfer fluid.

- ✓ The controller casing is closed.
- ✓ All connections are properly made.
- ✓ The solar energy system is filled.
- ▶ Connect the mains supply.
- ▶ To switch on the pump, set the operating switch to the upper position (on).
  - ⇒ *The display is lit with a red background.*
  - ⇒ **on** appears in the display. After approx. 3 seconds **on** flashes in alternation with the display.
- ▶ To switch off the pump, set the operating switch to the lower position (off).
  - ⇒ *The display is lit with a red background.*
  - ⇒ **off** appears in the display. After approx. 3 seconds **off** flashes in alternation with the display.

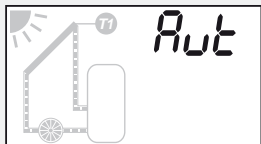


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**CAUTION**

The incorrect operating mode may cause the system to shut down or impair proper functioning!

- ▶ After testing the pump, always set the operating switch to automatic operation.
- ▶ To set the controller to automatic operation, move the operating switch to the middle position (Auto).
  - ⇒ **Aut** is shown in the display for approx. 3 seconds.



## 7 Description of the controller functions

### 7.1 Switch-on / switch-off temperature difference

The controller constantly compares the temperatures between the collector (T1) and the lower area of the storage tank (T2). As soon as the temperature in the collector (T1) is 8 K (constant fixed value) higher than the temperature in the storage tank (T2), the following display appears:

- The sun symbol is displayed

If no safety limits prohibit the pump from operating, the PWM control signal for the pump appears at output C. The display shows this message.

- The pump symbol rotates

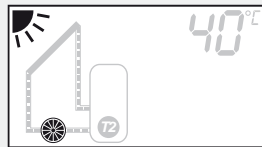
If the temperature difference falls below 4 K (constant fixed value), the PWM control signal for the pump at output C is switched off. The sun symbol is no longer shown on the display.

#### NOTE

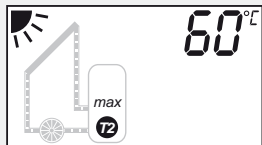
The power supply for the ECM pump at output R1 always remains switched on. The ECM pump is controlled exclusively by the PWM control signal at output C.

### 7.2 Maximum storage tank temperature

The maximum storage tank temperature function is to prevent the hot water tank from overheating. If the



lower area of the storage tank (T2) reaches the set maximum storage tank temperature (factory setting of 60 °C), charging is stopped. A temperature of 3 K below the maximum storage tank temperature must first be reached before charging can be resumed.

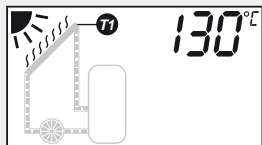


The following displays appear:

- The pump symbol does not move
- The sun symbol is displayed
- The "max" indication flashes in the storage tank symbol

### 7.3 Maximum collector temperature

During periods of high solar irradiance, the temperature (T1) of the heat transfer fluid can exceed 130 °C. The heat transfer fluid evaporates. In this case, the pump is stopped for protection purposes until the temperature drops below 127 °C.



The following displays appear:

- The pump symbol does not move
- The sun symbol is displayed
- The vapour symbol flashes

### 7.4 Tube collector function

Due to its construction, the collector temperature (T1) can only be inaccurately recorded with vacuum tube collectors (in some cases there are no immersion sensors; or the sensor is outside the collector pipe). In these cases, the solar circuit must be briefly activated

at regular intervals to transmit the actual heat from the collector pipe to the sensor (T1). If the tube collector function is activated, the controller automatically switches the pump on every 30 minutes for 30 seconds. The following display appears:

- The bottom temperature sensor, T1, is shown

### 7.5 Anti-freeze function

If the anti-freeze function is activated, the controller switches the pump on as soon as the collector temperature T1 falls below +5 °C. The heat transfer fluid is then pumped through the collector to prevent the system from freezing. If the collector reaches a temperature of +7 °C, the pump is switched off again.

#### CAUTION

#### System can freeze despite the activated anti-freeze function!

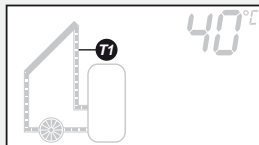
During a power outage, the anti-freeze function does not operate.

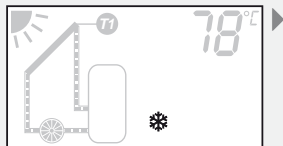
During long-term periods of frost (due to restricted water tank heat storage).

If collectors are mounted in locations exposed to wind.

- ▶ It is recommended to generally use heat transfer fluid with anti-freeze for solar energy systems.

Standard anti-freeze heat transfer fluids for solar





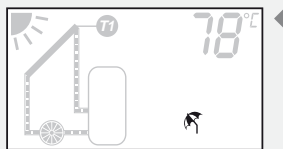
energy systems also contain an additional corrosion inhibitor.

The anti-freeze symbol appears and the display shows the following message.

## 7.6 Holiday function

The holiday function is used to cool down a completely heated storage tank again via the collector. The storage tank can heat up too much, e.g. if no hot water is extracted from the storage tank over an extended period of time (holiday) of intense solar irradiance. A completely heated storage tank subjects the solar system to a higher thermal load.

If the holiday function is activated, the storage tank is cooled as follows: If the storage tank temperature rises to 10 K below the set maximum storage tank temperature, the controller attempts to discharge the lower section of the storage tank to 35 °C (e.g. at night). To do so, the pump is automatically switched on once the collector is 8 K colder than the storage tank. If the temperature difference between the collector and the storage tank is only 4 K, the pump is switched off again.



The following display appears:

- The holiday symbol is displayed

## 7.7 Flow test service function

The flow test service function is used to check the flow rate at maximum pump speed. The pump remains switched on at 100 % performance while the flow test service function is activated.

### NOTE

A Grundfos Direct Sensors™ VFS 1-12 must be connected in order to use the flow test service function. Safety limits (maximum collector temperature, maximum storage tank temperature) are not taken into account while the service function is active.

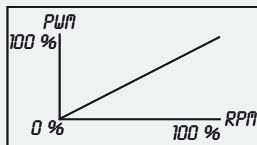
## 7.8 Speed control

The controller provides a PWM control signal for controlling the speed of an ECM pump; see PWM characteristics at the right (RPM = revolutions / minute).

### NOTE

At the factory the controller is set to speed control "on".

The speed control function controls the settings of the solar circuit pump.



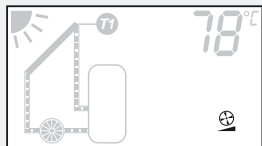


### Speed control "oFF": Control signal as switched output

When switched on, the solar circuit pump runs at maximum speed (100 %) and delivers a constant volume flow.

### Speed control "on": Control signal speed controlled

When switched on, the solar circuit pump runs at a controlled speed in the range of 30 ... 100 % and delivers a regulated volume flow.



The following display appears:

- The speed control symbol is displayed
- The speed control function, however, makes a distinction between the "differential temperature control" and "absolute temperature control":
- **Differential temperature control "diF":**  
The control system attempts to maintain a constant temperature difference between the collector and the storage tank. The solar circuit pump performance is continuously adjusted and the volume flow is increased or reduced, depending on the temperature difference. The specified temperature difference is fixed at 8 K.
  - **Absolute temperature control "AbS"**  
The solar circuit pump is controlled in such a manner that the collector temperature sensor T1 is kept at the absolute temperature as constantly as possible so that the storage tank can

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be charged with the absolute temperature. The desired absolute temperature can be entered in the setup.

## 8 Operation

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### CAUTION

**The incorrect operating mode may cause the system to shut down or impair proper functioning!**

- ▶ Make sure that the operating switch is set to automatic operation.
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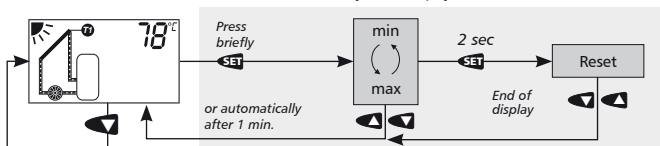
### 8.1 Setting the controller (main menu)

The main menu of the display shows the temperature values of the individual temperature sensors, the flow rate and the operating hours of the pump.

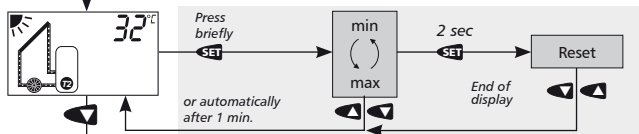
## 8.1.1 Main menu overview

Saved min/max values are deleted and set to the current temperature value

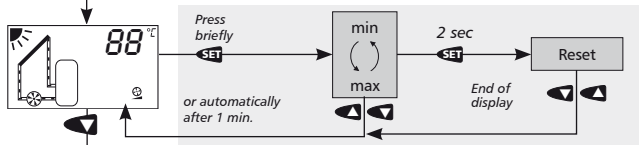
Temperature sensor T1  
with current temperature



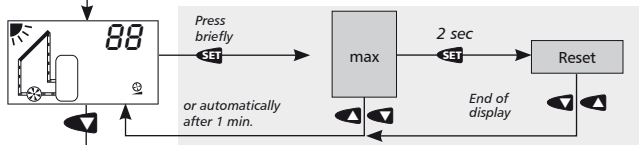
Temperature sensor T2  
with current temperature



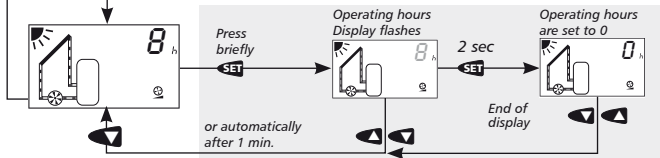
If connected: Grundfos  
Direct Sensors™ VFS 1-12  
with current temperature



If connected: Grundfos  
Direct Sensors™ VFS 1-12  
with current flow rate





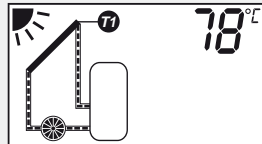
Operating hours of  
the pump



Min/max temperature  
values are shown alter-  
nately on the display

### 8.1.2 Displaying temperature values and flow rate

- ▶ Use the buttons  and  to select the temperature sensor or flow rate sensor (T1, T2, T Grundfos Direct Sensors™ VFS 1-12, Q Grundfos Direct Sensors™ VFS 1-12).
- ⇒ *The selected sensor and the current measured value are shown in the display.*






#### NOTE

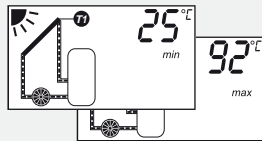
If a Grundfos Direct Sensors™ VFS 1-12 is not connected the displays T (temperature) and Q (flow rate) of the Grundfos Direct Sensors™ VFS 1-12 are skipped.

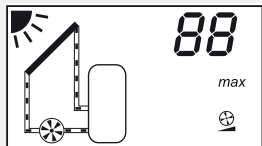
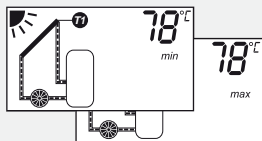
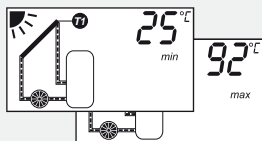
The temperature Grundfos Direct Sensors™ VFS 1-12 is displayed in degrees Celsius without a sensor symbol and with a blinking solar circuit symbol.

The flow rate Grundfos Direct Sensors™ VFS 1-12 is displayed in physical units of [l/min] without a sensor symbol and with a blinking solar circuit symbol.

### 8.1.3 Displaying min / max temperature values

- ✓ *Desired temperature sensor is selected.*
- ▶ Press the  button briefly.
- ⇒ *Min. / max. temperature values are shown alternately on the display.*
- ▶ To exit min/max temperature value settings, press  or  button.





### 8.1.4 Deleting min. / max. temperature values

✓ Desired temperature sensor is selected.

▶ Press the **SET** button briefly.

⇒ *Min. / max. temperature values are shown alternately on the display.*

▶ Press the **SET** button for approx. 2 seconds until the temperature values saved are deleted.

⇒ *The min. / max. temperatures and the current measured temperature appear on the display.*

▶ To exit min. / max. temperature value settings, press **▲** or **▼** button.

### 8.1.5 Displaying max. flow rate *(only when a Grundfos Direct Sensors™ VFS 1-12 is connected.)*

✓ Flow rate is selected.

▶ Press the **SET** button briefly.

⇒ *The max. flow rate is shown on the display.*

▶ To exit the max. flow rate, press the **▲** or **▼** button.

### 8.1.6 Resetting the max. flow rate *(only when a Grundfos Direct Sensors™ VFS 1-12 is connected.)*

✓ Flow rate is selected.



▶ Press the **SET** button briefly.

⇒ *The max. flow rate is shown on the display.*



▶ Press the **SET** button for approx. 2 seconds until the flow rate value saved is deleted.

⇒ *The display now shows the current measured flow*



rate as the max. flow rate.

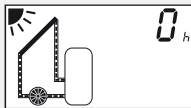
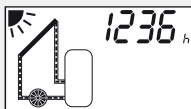
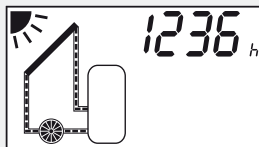
- ▶ To exit the max. flow rate, press the  or  button.

### 8.1.7 Displaying the operating hours of the pump

- ▶ Use the  or  button to select the operating hours of the pump.
- ⇒ *The operating hours of the pump appear on the display.*

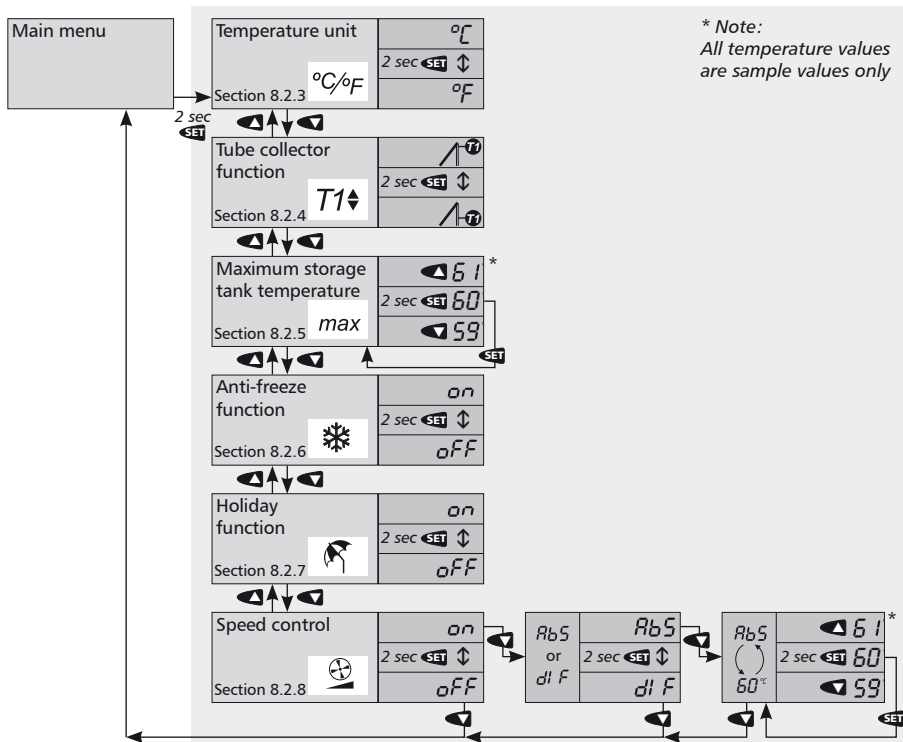
### 8.1.8 Deleting the operating hours of the pump

- ✓ *The operating hours of the pump are selected.*
- ▶ Press the  button briefly.
- ⇒ *The operating hours flash on the display.*
- ▶ Press the  button for approx. 2 seconds until the operating hours are set to "0".
- ⇒ *The display shows "0" operating hours.*



## 8.2 Setting the controller (settings menu)

### 8.2.1 Overview of settings menus



## 8.2.2 Using the settings menus

- ▶ To open the settings menus, press the **SET** button for approx. 2 seconds.
  - ⇨ *Settings menu "Temperature unit" is displayed.*
- ▶ To switch to the next settings menu, press the **▼** button.
- ▶ To exit the settings menus, press the **▼** button again until the temperature sensor and temperature reading (main menu) are shown again.

## 8.2.3 Selecting the temperature unit

- ✓ The settings menu is open.
- ✓ Temperature unit "°C" or "°F" flashes
- ▶ Press the **SET** button for approx. 2 seconds to toggle between "°C" and "°F".
- ▶ To exit the settings menu, press the **▼** button again until the main menu appears.

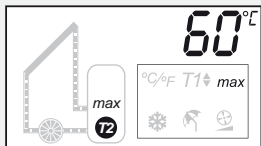
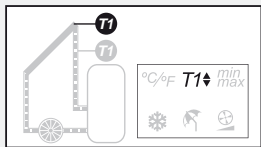


## 8.2.4 Activating the tube collector function

### NOTE

Incorrectly setting the controller can compromise the efficiency of the solar energy system. Therefore, only activate the tube collector function if the construction of the collector does not allow its temperature to be recorded immediately and/or accurately (in some cases there are no immersion sensors; the sensor is outside the collector pipe).





- ✓ The settings menu is open.
- ✓ The Symbols for temperature sensor T1 and tube collector function flash.
- ▶ Press the **SET** button for approx. 2 seconds until top temperature sensor T1 is changed to bottom T1.
- ▶ To exit the settings menu, press the **▼** button again until the main menu appears.

### 8.2.5 Setting the maximum storage tank temperature

#### **⚠ DANGER**

**Risk of scalding due to storage tank temperature of over 60 °C!**

- ▶ Install a thermostatic mixer in the hot water pipe and set to maximum 60 °C.

- ✓ The settings menu is open.
- ✓ The Symbols for maximum storage tank temperature and temperature sensor T2 flash.
- ▶ Press the **SET** button for approx. 2 seconds until the temperature indicator flashes.
- ▶ Change the maximum storage tank temperature using the **▼** or **▲** buttons.
- ▶ To save the value, press the **SET** button.
- ▶ To exit the settings menu, press the **▼** button again until the main menu appears.

## 8.2.6 Activating the anti-freeze function

### CAUTION

**System can freeze despite the activated anti-freeze function!**

During a power outage, the anti-freeze function does not operate.

During long-term periods of frost (due to restricted water tank heat storage).

If collectors are mounted in locations exposed to wind.

- ▶ If frost is expected for a long period of time, only operate the system with anti-freeze heat transfer fluid for solar thermal systems.

For further information see section 7.5.

### NOTE

Incorrectly setting the controller can compromise the efficiency of the solar energy system.

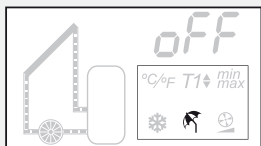
- ▶ Only activate the anti-freeze function for solar energy systems that are not filled with anti-freeze.

- ✓ The settings menu is open.
- ✓ The symbol for anti-freeze function flashes.
- ▶ Press the **SET** button for approx. 2 seconds to toggle between "oFF" and "on".
- ▶ To exit the settings menu, press the **◀** button again until the main menu appears.



## 8.2.7 Activating the holiday function

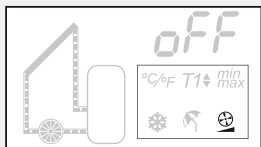
- ✓ The settings menu is open.
- ✓ The holiday function symbol flashes.
- ▶ Press the **SET** button for approx. 2 seconds to toggle between "oFF" and "on".
- ▶ To exit the settings menu, press the **◀** button again until the main menu appears.



## 8.2.8 Activating the speed control

- ✓ The settings menu is open.
- ✓ The speed control symbol flashes.
- ▶ Press the **SET** button for approx. 2 seconds to toggle between "oFF" and "on".

Depending on the "oFF" or "on" setting, the following setting options are available:



- ⇨ *The display shows "oFF":*
- ▶ To exit the settings menu, press the **◀** button. The main menu appears.








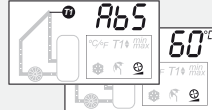
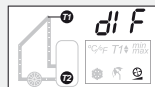
- ⇨ *The display shows "on":*
- ▶ Press the **◀** button to access the settings menu in order to select speed control.
- ⇨ *"diF" or "AbS" flashes on the display.*

The speed control function makes a distinction between the "absolute temperature control (AbS)" and "differential temperature control (diF)".

- ▶ Press the **SET** button for approx. 2 seconds to toggle between "AbS" and "diF".

Depending on the "AbS" or "diF" setting, the following setting options are available:

- ⇒ *The display shows the setting "diF":*
  - ▶ To exit the settings menu, press the  button. The main menu appears.
- ⇒ *The display shows the setting "AbS":*
  - ▶ Press the  button to set the temperature value.
    - ⇒ *Temperature and "AbS" flash alternately.*
  - ▶ Press the **SET** button for approx. 2 seconds until only the temperature indicator flashes.
  - ▶ Change the temperature using the  or  buttons.
  - ▶ To exit the settings menu, press the  button. The main menu appears.





### 8.2.9 Activating the flow test service function

The operation switch must be set to AUTO (middle position) in order to activate the flow test service function.

- ▶ Press the  and  buttons simultaneously for 2 seconds.

⇒ "on" and the current flow rate in [l/min] are displayed alternately.

#### Ending the flow test service function:

Briefly press the  or  buttons or the controller automatically exits back to automatic operation after 5 minutes.

---

#### NOTE

The flow test service function can only be activated when a Grundfos Direct Sensors™ VFS 1-12 is connected.

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## 9 Maintenance

The controller was conceived for years of continuous trouble-free operation. Nevertheless, faults may occur. Maintenance may only be performed by professional personnel.

The fault is usually not in the controller but rather in the peripheral system components. The following description covers the most common problems encountered with the controller.

- ▶ Only send in the controller, with a precise fault description, if none of the following faults are present.

### 9.1 Causes of problems

#### WARNING

**Risk of death by electrocution!**

- ▶ Disconnect the controller from the power supply before opening the casing.

**Controller does not appear to function at all.**

Secondary symptoms	Possible cause / remedy
<ul style="list-style-type: none"> <li>• The controller display is blank</li> </ul>	No power supply present <ul style="list-style-type: none"> <li>▶ Have professional personnel check the fuse and the supply cable.</li> </ul>



The pump, which is connected to the controller, is not running, although its switch-on conditions have been fulfilled.

Secondary symptoms	Possible cause / remedy
<ul style="list-style-type: none"> <li>• The pump symbol rotates in the display</li> </ul>	Pump connection cables not connected or interrupted. <ul style="list-style-type: none"> <li>▶ Have professional personnel check the cables.</li> </ul>
<ul style="list-style-type: none"> <li>• The pump symbol does not rotate</li> <li>• "max" in the tank symbol blinks</li> </ul>	Storage tank full
<ul style="list-style-type: none"> <li>• The pump symbol does not rotate</li> <li>• Symbol for evaporating collector fluid flashes</li> </ul>	Collector fluid evaporates
<ul style="list-style-type: none"> <li>• The pump symbol does not rotate</li> <li>• Display is lit with a red background</li> <li>• <b>OFF</b> flashes</li> </ul>	Operating switch is set to "Off" <ul style="list-style-type: none"> <li>▶ Use the operating switch to set the controller to automatic operation.</li> </ul>

## Short-circuit symbol and warning sign appear.

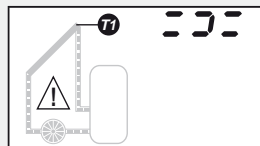
Secondary symptoms	Possible cause / remedy
<ul style="list-style-type: none"> <li>The pump symbol does not rotate</li> <li>Display background alternately flashes red and yellow</li> <li>Pump stops in the case of a short-circuit (only applies to T1 or T2)</li> </ul>	<p>Short-circuit in the temperature sensor or its supply cable</p> <ul style="list-style-type: none"> <li>Have professional personnel check the temperature sensor supply cable and the connections to the controller.</li> </ul>

## NOTE

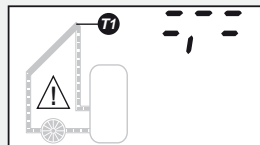
The pump does not stop running in the case of a short-circuit in the Grundfos Direct Sensors™ VFS 1-12 T or Q.

## Interruption symbol and warning sign appear.

Secondary symptoms	Possible cause / remedy
<ul style="list-style-type: none"> <li>The pump symbol does not rotate</li> <li>Display background alternately flashes red and yellow</li> <li>Sun symbol goes out</li> <li>Pump stops in the case of an interruption (only applies to T1 or T2)</li> </ul>	<p>Temperature sensor T1 or T2 or its supply cable is interrupted</p> <ul style="list-style-type: none"> <li>Have professional personnel check the temperature sensor supply cable and the connections to the controller.</li> </ul>

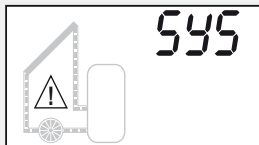


*Short-circuit and warning sign (example)*



*Interruption and warning sign (example)*





*SYS-display  
and warning sign (example)*

## NOTE

The pump does not stop running in the case of an interruption in the Grundfos Direct Sensors™ VFS 1-12 T or Q.

**"SYS" and the warning sign flash in the controller display.**

### Possible cause / remedy

SYS means there is a system error. This means that despite the pump running, a temperature difference exceeding 80 K between the collector and the storage tank was recorded.

The following causes are possible:

- The pump is faulty or not correctly connected
- The isolating valve in the solar circuit is closed
- Air is in the solar circuit.

Since a standard circulation pump cannot eliminate air bubbles inside the piping system, the heat transfer medium circuit comes to a standstill.

- ▶ Have professional personnel check the solar energy system to prevent damage.
- ▶ Once the fault has been remedied, press any button to acknowledge the fault message.

## 9.2 Testing the temperature sensor

### 9.2.1 Safety

Only professional personnel may test the temperature sensor.

### 9.2.2 Testing the resistance values

#### DANGER

##### Risk of death by electrocution!

- ▶ Disconnect the controller from the power supply before opening the casing.

The temperature is recorded by type Pt1000 resistance sensors. The resistance value of the sensor changes depending on the temperature. A potentially defective sensor can be checked using an ohmmeter.

#### Measuring resistance values

- ▶ Disconnect the corresponding temperature sensor from the controller.
- ▶ Measure the resistance value. The typical resistance values, depending on the temperature, are listed in the following table. Please note that small deviations are permissible.



Temperature sensor resistance values						
Temperature [°C]	-30	-20	-10	0	10	20
Resistance [Ω]	882	922	961	1000	1039	1078
Temperature [°C]	30	40	50	60	70	80
Resistance [Ω]	1117	1155	1194	1232	1271	1309
Temperature [°C]	90	100	110	120	130	140
Resistance [Ω]	1347	1385	1423	1461	1498	1536
Temperature [°C]	150	160	170	180		
Resistance [Ω]	1573	1611	1648	1685		

## 10 Dismantling and disposal



### DANGER

**Risk of death by electrocution!**

- ▶ Disconnect the controller from the power supply before dismantling it.
- ▶ To dismantle the controller, follow the installation instructions in the reverse order.
- ▶ Dispose of the controller in accordance with the local regulations.

## 11 Legal guarantee

In accordance with German statutory regulations, there is a 2-year legal guarantee on this product for the customer.

The seller will remove all manufacturing and material faults that occur in the product during the guarantee period and affect the correct functioning of the product. Natural wear and tear does not constitute a malfunction. No legal guarantee can be offered if the fault can be attributed to third parties, unprofessional installation or commissioning, incorrect or negligent handling, improper transport, excessive loading, use of improper equipment, faulty construction work, unsuitable construction location or improper operation or use. Legal guarantee claims shall only be accepted if notification of the fault is provided immediately after it is discovered. Guarantee claims are to be directed to the seller.

**The seller must be informed before guarantee claims are processed. For processing a guarantee claim an exact fault description and the invoice / delivery note must be provided.**

The seller can choose to fulfil the legal guarantee either by repair or replacement. If the product can neither be repaired nor replaced, or if this does not occur within a suitable period in spite of the specification of an extension period in writing by the customer, the reduction

in value caused by the fault shall be replaced, or, if this is not sufficiently taking the interests of the end customer into consideration, the contract is cancelled.

Any further claims against the seller based on this guarantee obligation, in particular claims for damages due to lost profit, loss-of-use or indirect damages are excluded, unless liability is obligatory by law.

## 12 Technical data

Temperature difference controller	
Operational voltage	230 V~ (+/- 15 %), 50 Hz
Controller's own consumption	≤ 1 W
Inputs	2 x temperature recording (Pt1000) 1 x Grundfos Direct Sensors™ VFS 1-12 input (flow rate and temperature)
Output	R1: Triac switched output for permanently supplying power to the ECM pump C: PWM control signal for pump speed: 8 mA, 5 V, 250 Hz Characteristic curve: 0 % PWM = pump off 100 % PWM = maximum speed
Switch-on temperature difference	8 K
Switch-off temperature difference	4 K
Display	LCD display
Degree of protection	IP 20 / DIN 40050
Permitted ambient temperature	0 °C to +45 °C
Installation	Wall mounting
Weight	250 g

Casing	recyclable 3-piece plastic casing
Dimensions L x W x H [mm]	137 x 134 x 38
Temperature sensors	Pt1000, silicone cable, 1.5 m (measuring range up to +180 °C)
Fuse	1.6 AT, 3.9 A <sup>2</sup> s



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