

# Solar Differential Controller DR1

## Installation and Operating Instructions



running hours counter / adjustable: solar protection function, storage tank Tmax, degree-accuracy / sensor monitor / digital LED display / 2-3 PT1000 temperature sensor inputs / 1 relay output with switch-over contact.

### 1. Description of the Controller

The LEDs on the front panel of the DR1 controller indicate the current operational status of the system, whereat the red LED **0** is used as the standby light and the green LED displays whether the relay R1 has switched on the solar pump. The yellow LED points out that the temperature at sensor S2 in the solar storage has exceeded the adjusted value Tmax.

The temperature values of the connected 2-3 sensors are shown through the commutator 'S1 S2 S3' on the LED display. The display of service data and the solar operating hours facilitate the function control of the controller.

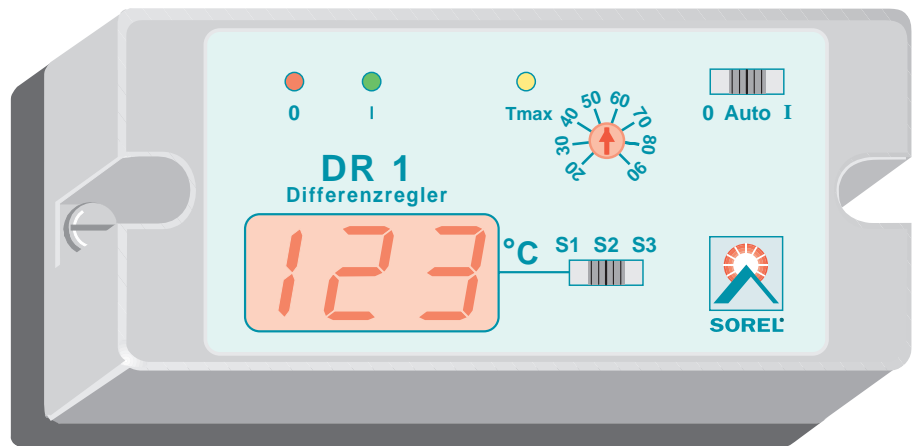
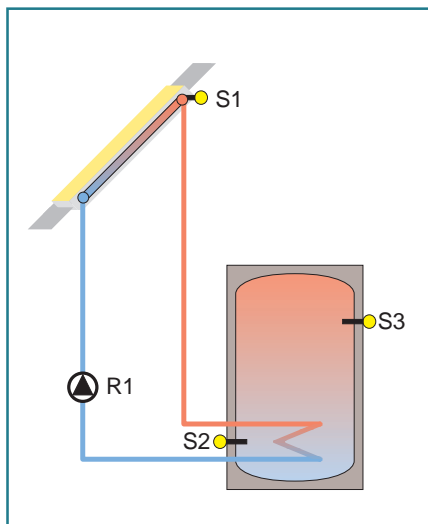
In case of a sensor defect the red LED flashes a signal!

The required degree-accuracy, the requested storage temperature and optionally the switching-on temperature of the solar protection are adjustable at three red setting buttons (potis).

PT1000 sensor - with guaranteed degree-accuracy according to DIN 43760 - provide for precise detection of the temperature difference, which guarantees the controlled switching characteristics within the entire operative range.

Consequently, the conditions for an optimal use of solar energy is ensured with the DR1 controller.

Examples for application:



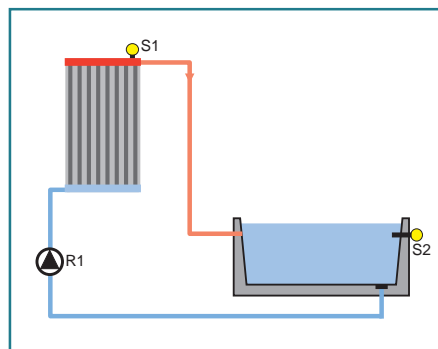
### 2. Description of the Functions

The Controller DR1 compares the collector temperature at sensor S1 with the storage temperature at sensor S2. If the adjusted degree-accuracy S1/S2 is exceeded, the relay R1 switches the solar pump on to collect the solar heat. If the degree-accuracy drops below the half of the adjusted value, the solar pump is switched off.

If the adjusted Tmax value is exceeded in the lower storage range at S2, the solar pump is switched off by R1, independent of the degree-accuracy.

To extend the service life of the solar control, the controller DR1 is equipped with an adjustable solar protection function. When the selected temperature value is exceeded at the collector, R1 switches the solar pump on, until the temperature at the collector has dropped for 10K. At this it should be noted, that the storage is heated up over the adjusted Tmax value!

To protect the storage, the solar protection function is switched off, if the temperature at storage sensor S2 has reached 95°C.



### 3. Operating Modes

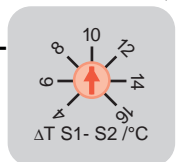
Through the operating modes switch, the solar control is manually changeable:

**0** = off, **Auto** = normal operation, = R1 on  
Note: The position of the slide switch = pump continuous operation may only be switched on under supervision of the specialist for control or adjustment works - red LED flashing!

### 4. Settings

On the back-side of the pluggable controller module, a red switch is located, whose arrow is adjusted to the requested **degree-accuracy** value S1/S2 of 4-16K by means of a screwdriver.

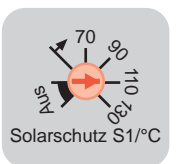
( suggestion: 10K )



Through the second switch on the back-side, the activation of the solar protection function is specified.

By turning the adjusting arrow to the left onto 'off', the **solar protection function** is switched off. In the scaled range of 60-130°C, the activation of the solar protection function is selectable.

( Suggestion: 110°C or 'off' )  
After attaching the controller module onto the base plate, the value for solar storage charge Tmax of 20-90°C has to be adjusted. ( suggestion: 60°C )  
( hysteresis: 20-39°C=1K, 40-90°C=4K )



### 5. Service Values

Continuous display through shifting the operating mode switch to 'Auto':  
P = parameter resp. adjust values  
F = sensor values  
H = operating hours of the solar pump.

Subject to technical changes. Illustrations do not claim completeness.

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## Continuation to 5. Service Values

Explanation and order of the displayed values:

- P0 = programme version included in the controller  
 P1 = adjusted storage Tmax value in °C  
 P2 = selected degree-accuracy in °C  
 P3 = selected switch-on point of the solar protection function in °C  
 P4 = (only service value for the manufacturer)  
 F1 = temperature at the collector sensor S1 in °C  
 F2 = temperature in the lower storage range at S2  
 F3 = temperature at sensor S3 in °C  
 H1 = solar pump hours x 10.000 (reading example 00)  
 H2 = solar pump hours x 100 ( " 20)  
 H3 = solar pump hours x 1 ( " 30)  
 (sum of the solar operating hours = 2030)

## 6. Installation of the DR1 controller

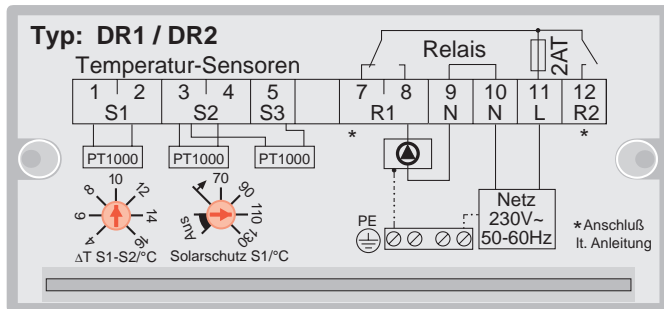
### 6.1 Wall installation

Simple wall installation of the device base by two-point attachment by means of attachment screws (4x60) and wall plugs (M6), hole spacing: 85mm.

### 6.2 Electrical Connection

The Installation must only be carried out by a qualified specialist according to the VDE regulations resp. the locally valid security rules.

bottom view:



The *grounding terminal strip* must imperatively be connected to the protective conductors of the mains supply. The lines of the temperature sensors should be laid in a sufficient distance of some cm to the mains supply. The lines of the temperature sensors can on request be extended by means of 2x1,5<sup>2</sup> cables up to 50m without influencing the measuring precision appreciably. Special care must be taken that the connection of the extensions does not show any contact transition. The wires must be connected according to terminal assignment in the following order:

Firstly all grounding wires (green/yellow) must be connected to the 4-pole **PE terminal strip**.

### Sensor terminal (5V)

- 1/2 S1 collector sensor  
 3/4 S2 storage sensor below  
 3/5 S3 storage sensor above  
 (only display function)

### Mains terminal 230V/50Hz

- 7 R1 ( break contact )  
 8 R1 solar pump  
 9 N neutral conductor  
 10 N neutral conductor mains  
 11 L phase conductor mains  
 12 (free)

### 6.3 Safety Note

When working on the controller and the connected consumers all poles of the mains voltage must be switched off first, as residual currents flow through the electronic wiring of the devices.

## 7. Temperature sensors with Pt1000

Correct installation and proper placement of the sensors is one critical factor for the overall function of the system. Press-on sensors and immersion sensors with immersion sleeves 60mm and 150mm as per our delivery program are suitable for all controllers. The mutually agreed tapering construction of the immersion sensors and immersion sleeves is advantageous for the registration of the measured value from the peak of the sensor. Care must be taken that during installation the temperature sensors are actually installed in the area to be measured and that the sensor cables, if possible, run inside tube heat insulation in a length of approx. 20 cm measured from the measuring point and consequently are protected against cooling. This in particular applies for the collector sensor. The temperature sensor live lines are to be separated from the mains lines to avoid glitches such as induction. The safety regulations of the VDE 0100 part 410 for low voltage ( up to 5 Volt ) for the low voltage lines should be noticed.

## 8. Setting into operation

**Caution: The controller under no circumstances replaces safety devices. Measures such as protection against frost, scalding, overpressure etc. must be provided on the installation side, if necessary.**

Before plugging the main module onto the wall base ( **with no voltage applied!** ), the setting of the two lower pots has to be checked and adjusted to the device. The two adjustment pots (**ΔT** and **solar protection**) are installed on the underside of the main module to avoid unintentional adjustment. For normal operation put slide switch onto position **Auto**.

Note: The slide switch position = pump continuous operation may only be switched on under supervision of the specialist for control or adjustment works. The red LED flashes as a warning signal. For better control, the service values are, as described under 5., displayed once when setting into operation.

## 9. Notes on failures

**Before opening the controller turn off main voltage!**

The controller is protected with a 2AT fine-wire fuse. This fuse can be checked and replaced, if necessary, after switching off the power and detaching the plug-in module from the ( with no voltage applied! ) wall base and removing the rear panel. The function of the temperature sensors can be checked with a resistance measuring as per the table. In case of a faulty sensor at S1 or S2 the red LED flashes and the temperature display of this sensor amounts to -40°C or 180°C.

### Temperature-Resistance table for Pt1000 sensors

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

10m sensor cable 2x0,75<sup>2</sup> = approx. 0,1°C temperature measuring error

## 10. Specifications

- Base unit: plug-in case  
 Dimensions: 112 x 52 x 106 (W x H x D)  
 System of protection: IP40 / DIN 40050 CE  
 Operating voltage: 230 V +/- 10% / 50-60 Hz  
 Power consumption: approx. 2 VA  
 Switched power: 400VA  
 Fuse: 2AT  
 Ambient temp.: 0 to 40°C  
 ΔT-Adjustment: 4 to 16K  
 Solar protection: Off / 60°C-130°C  
 Tmax Storage: 20 to 90°C  
 Measuring range: -40 to 180°C  
 Sensors: PT1000 accuracy acc. to DIN EN60751

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Consulting and Sales:

Your heating specialist: