Thank you for buying this RESOL product.
Please read this manual carefully to get the best performance from this unit.
Please keep this manual safe.
Safety advice
Please pay attention to the following safety advice in order to avoid danger and damage to people and property.

Instructions
Attention must be paid to the valid local standards, regulations and directives!

Information about the product
Proper usage
The solar controller is designed for electronically controlling standard solar thermal systems in compliance with the technical data specified in this manual. Improper use excludes all liability claims.

CE Declaration of conformity
The product complies with the relevant directives and is therefore labelled with the CE mark. The Declaration of Conformity is available on request, please contact the manufacturer.

Note:
Strong electromagnetic fields can impair the function of the controller.
⇒ Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

Target group
These instructions are exclusively addressed to authorised skilled personnel. Only qualified electricians are allowed to carry out electrical works. Initial commissioning must be effected by the system installer or qualified personnel named by the system installer.

Description of symbols
WARNING! Warnings are indicated with a warning triangle! They contain information on how to avoid the danger described.

Signal words describe the danger that may occur, when it is not avoided.
• WARNING means that injury, possibly life-threatening injury, can occur.
• ATTENTION means that damage to the appliance can occur.

Note:
Notes are indicated with an information symbol.
⇒ Arrows indicate instruction steps that should be carried out.

Disposal
• Dispose of the packaging in an environmentally sound manner.
• At the end of its working life, the product must not be disposed of as urban waste. Old appliances must be disposed of by an authorised body in an environmentally sound manner. Upon request we will take back your old appliances bought from us and guarantee an environmentally sound disposal of the devices.

Subject to technical change. Errors excepted.

© 20180802_48005952_DeltaSol_BS2_V2.monen
DeltaSol® BS/2 Solar controller

The RESOL controller for standard solar thermal systems. The DeltaSol® BS controller provides a clear operating concept and is equipped with the illuminated combined display with system-monitoring. Flashing symbols for sensors, pumps and valves enable an immediate allocation of temperatures, temperature differences and active actuators. Thus, adjusting and monitoring the solar system is quick and easy.

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1 Overview

- Drainback option
- Heat quantity measurement
- Commissioning menu
- Unit °F and °C selectable
- HE pump control via adapter

Technical data

Inputs: 4 Pt1000 temperature sensors
Outputs: 1 semiconductor relay
Switching capacity: 1 (1) A 240 V~ (semiconductor relay)
Total switching capacity: 1 A 240 V~
Power supply: 100–240 V~ (50–60 Hz)
Supply connection: type Y attachment
Standby: 0.45 W
Mode of operation: type 1.C.Y action
Rated impulse voltage: 2.5 KV
Data interface: RESOL VBus®
VBus® current supply: 35 mA
Functions: Differential temperature controller with optional add-on system functions. Function control, operating hours counter, heat quantity measurement and speed control
Housing: plastic, PC-ABS and PMMA
Mounting: wall mounting, also suitable for mounting into patch panels
Indication / Display: System-Monitoring-Display for visualisation of systems, 16-segment and 7-segment display, 8 symbols for indication of system status and operating control lamp
Operation: 3 push buttons at the front of the housing
Protection type: IP 20/EN 60529
Protection class: II
Ambient temperature: 0…40 °C
Degree of pollution: 2
Dimensions: 172 x 110 x 49 mm
2 Installation

2.1 Mounting

**WARNING! Electric shock!**
Upon opening the housing, live parts are exposed!
- Always disconnect the device from power supply before opening the housing!

**Note:**
Strong electromagnetic fields can impair the function of the controller.
- Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

The device must only be located in dry interior rooms.
The controller must additionally be supplied from a double pole switch with contact gap of at least 3 mm.
Please pay attention to separate routing of sensor cables and mains cables.
In order to mount the device to the wall, carry out the following steps:
- Unscrew the crosshead screw from the cover and remove it along with the cover from the housing.
- Mark the upper fastening point on the wall. Drill and fasten the enclosed wall plug and screw leaving the head protruding.
- Hang the housing from the upper fastening point and mark the lower fastening point (centres 130 mm).
- Insert lower wall plug.
- Fasten the housing to the wall with the lower fastening screw and tighten.
- Carry out the electrical wiring in accordance with the terminal allocation (see page 6).
- Put the cover on the housing.
- Attach with the fastening screw.

Electrical connection see page 6
### 2.2 Electrical connection

**WARNING!** Electric shock!

Upon opening the housing, live parts are exposed!

> Always disconnect the device from power supply before opening the housing!

**ATTENTION!** ESD damage!

Electrostatic discharge can lead to damage to electronic components!

> Take care to discharge properly before touching the inside of the device!

**Note:**

The pump speed must be set to 100% when auxiliary relays or valves are connected.

**Note:**

Connecting the device to the power supply must always be the last step of the installation!

**Note:**

It must be possible to disconnect the device from the mains at any time.

> Install the mains plug such that it is accessible at any time.

> If this is not possible, install a switch that can be accessed.

**Do not use the device if it is visibly damaged!**

The power supply of the controller must be carried out via an external power switch. The power supply of the device must be 100…240 V~ (50…60 Hz). Attach flexible cables to the housing with the enclosed strain relief and the corresponding screws.

The controller is equipped with 1 semiconductor relay to which a load such as a pump, a valve, etc. can be connected:

- Relay 1
  - 18 = Conductor R1
  - 17 = Neutral conductor N
  - 13 = Grounding terminal

The mains connection is at the following terminals:

- 19 = Neutral conductor N
- 20 = Conductor L
- 12 = Grounding terminal

Connect the **temperature sensors** (S1 to S4) to the corresponding terminals with either polarity:

1 / 2 = Sensor 1 (e.g. collector sensor)

3 / 4 = Sensor 2 (e.g. store sensor)

5 / 6 = Sensor 3 (e.g. store sensor top)

7 / 8 = Sensor 4 (e.g. return sensor)

**2.3 Data communication/Bus**

The controller is equipped with a **RESOL VBus®** for data transfer and energy supply to external modules. The connection is to be carried out at the terminals marked **VBus** (any polarity).

One or more **RESOL VBus®** modules can be connected via this data bus, such as:

- RESOL DL2 Datalogger
- RESOL DL3 Datalogger
- VBus® / PWM interface adapter

Furthermore, the controller can be connected to a PC or integrated into a network via the RESOL VBus®/USB or VBus®/LAN interface adapter (not included). Different solutions for visualisation and remote parameterisation are available on the RESOL website www.resol.com.

**Note:**

More accessories on page 25.
2.4 System: Standard solar system with 1 store

The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference (DTO), the solar pump will be activated by the relay and the store will be loaded until the switch-off temperature difference (DTF) or the maximum store temperature (SMX) is reached.

Sensors S3 and S4 can optionally be connected for measurement purposes. S3 can optionally be used as the reference sensor for the store emergency shutdown option (OSEM).

If heat quantity measurement (OHQM) is activated, S4 is to be used as the return sensor.
## Installation Indications, Functions and Options

### Messages

- **Commissioning**
- **Operation and function**

### Display channels

<table>
<thead>
<tr>
<th>Channel</th>
<th>Description</th>
<th>Connection terminal</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INIT x*</td>
<td>ODB initialisation active</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>FLL x*</td>
<td>ODB filling time active</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>STAB x*</td>
<td>ODB stabilisation in progress</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>COL x</td>
<td>Temperature collector</td>
<td>S1</td>
<td>12</td>
</tr>
<tr>
<td>TST x</td>
<td>Temperature store</td>
<td>S2</td>
<td>12</td>
</tr>
<tr>
<td>S3 x</td>
<td>Temperature sensor 3</td>
<td>S3</td>
<td>12</td>
</tr>
<tr>
<td>TSTT x*</td>
<td>Temperature store top</td>
<td>S3</td>
<td>13</td>
</tr>
<tr>
<td>S4 x</td>
<td>Temperature sensor 4</td>
<td>S4</td>
<td>12</td>
</tr>
<tr>
<td>TR x*</td>
<td>Temperature return sensor</td>
<td>S4</td>
<td>13</td>
</tr>
<tr>
<td>n % x</td>
<td>Speed R1</td>
<td>R1</td>
<td>13</td>
</tr>
<tr>
<td>hP x</td>
<td>Operating hours R1</td>
<td>R1</td>
<td>13</td>
</tr>
<tr>
<td>kWh x*</td>
<td>Heat quantity in kWh</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>MWh x*</td>
<td>Heat quantity in MWh</td>
<td>-</td>
<td>13</td>
</tr>
</tbody>
</table>

### Adjustment channels

<table>
<thead>
<tr>
<th>Channel</th>
<th>Description</th>
<th>Factory setting</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT O x</td>
<td>Switch-on temperature difference</td>
<td>6.0 K [12.0 °Ra]</td>
<td>14</td>
</tr>
<tr>
<td>DT F x</td>
<td>Switch-off temperature difference</td>
<td>4.0 K [8.0 °Ra]</td>
<td>14</td>
</tr>
<tr>
<td>DT S x</td>
<td>Set temperature difference</td>
<td>10.0 K [20.0 °Ra]</td>
<td>14</td>
</tr>
<tr>
<td>RIS x</td>
<td>Rise</td>
<td>2 K [4 °Ra]</td>
<td>15</td>
</tr>
<tr>
<td>nMN x</td>
<td>Minimum speed</td>
<td>30 %</td>
<td>15</td>
</tr>
<tr>
<td>S MX x</td>
<td>Maximum store temperature</td>
<td>140 °F [60 °C]</td>
<td>15</td>
</tr>
<tr>
<td>OSEM x</td>
<td>Store emergency shutdown option</td>
<td>OFF</td>
<td>16</td>
</tr>
<tr>
<td>EM x</td>
<td>Collector emergency temperature if ODB is activated:</td>
<td>130 °C [270 °F]</td>
<td>16</td>
</tr>
<tr>
<td>OCC x</td>
<td>Collector cooling option</td>
<td>OFF</td>
<td>16</td>
</tr>
<tr>
<td>CMX x*</td>
<td>Maximum collector temperature</td>
<td>110 °C [230 °F]</td>
<td>16</td>
</tr>
<tr>
<td>OSEM x</td>
<td>System cooling option</td>
<td>OFF</td>
<td>16</td>
</tr>
<tr>
<td>DTSC x</td>
<td>Store cooling option</td>
<td>OFF</td>
<td>17</td>
</tr>
<tr>
<td>OHOL x*</td>
<td>Holiday cooling option</td>
<td>OFF</td>
<td>17</td>
</tr>
<tr>
<td>THOL x*</td>
<td>Holiday cooling temperature</td>
<td>40 °C [110 °F]</td>
<td>17</td>
</tr>
<tr>
<td>OCN x</td>
<td>Collector minimum limitation option</td>
<td>OFF</td>
<td>18</td>
</tr>
<tr>
<td>CMN x*</td>
<td>Collector minimum temperature</td>
<td>10 °C [50 °F]</td>
<td>18</td>
</tr>
<tr>
<td>OFC x</td>
<td>Antifreeze option</td>
<td>OFF</td>
<td>18</td>
</tr>
<tr>
<td>CFR x*</td>
<td>Antifreeze temperature</td>
<td>4.0 °C [40.0 °F]</td>
<td>18</td>
</tr>
<tr>
<td>OHQM x</td>
<td>Heat quantity measurement option</td>
<td>OFF</td>
<td>18</td>
</tr>
<tr>
<td>FMAX x*</td>
<td>Maximum flow rate</td>
<td>6.0 l</td>
<td>18</td>
</tr>
<tr>
<td>MEDT x*</td>
<td>Antifreeze type</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>MED% x*</td>
<td>Antifreeze concentration (only if MEDT = propylene or ethylene glycol)</td>
<td>45 %</td>
<td>18</td>
</tr>
<tr>
<td>ÖDB x</td>
<td>Drainback option</td>
<td>OFF</td>
<td>19</td>
</tr>
<tr>
<td>tDTO x*</td>
<td>ODB switch-on condition - time period</td>
<td>60 s</td>
<td>19</td>
</tr>
<tr>
<td>tFLL x*</td>
<td>ODB filling time</td>
<td>5.0 min</td>
<td>19</td>
</tr>
<tr>
<td>tSTB x*</td>
<td>ODB stabilisation time</td>
<td>2.0 min</td>
<td>19</td>
</tr>
<tr>
<td>MAN1 x</td>
<td>Manual mode R1</td>
<td>Auto</td>
<td>20</td>
</tr>
<tr>
<td>ADA1 x</td>
<td>HE pump control</td>
<td>OFF</td>
<td>20</td>
</tr>
<tr>
<td>LANG x</td>
<td>Language</td>
<td>dE</td>
<td>20</td>
</tr>
<tr>
<td>UNIT x</td>
<td>Temperature unit</td>
<td>°C</td>
<td>20</td>
</tr>
<tr>
<td>RESE x</td>
<td>Reset - back to factory settings</td>
<td></td>
<td>21</td>
</tr>
</tbody>
</table>

### Legend:

- **x** Channel is available
- **x*** Channel is available, if the corresponding option is activated.
3 Operation and function

3.1 Buttons

The controller is operated via the 3 push buttons below the display.

**Button 1 (+)** - scrolling forwards, increasing adjustment values.

**Button 2 (-)** - scrolling backwards, reducing adjustment values.

**Button 3 (OK)** - confirming/selecting.

During normal operation, display channels will be displayed.

ieties In order to scroll between display channels, press buttons 1 and 2.

**Access to adjustment channels:**

eties Use button 1 in order to scroll to the last display channel, then press and hold down button 1 for approx. 2 s.

If an adjustment channel is shown on the screen, **SET** will be displayed on the right-hand side next to the channel name.

eties Press button 3 in order to select an adjustment channel.

**SET** starts flashing.

eties Adjust the desired value with buttons 1 and 2.

eties Briefly press button 3.

**SET** permanently appears, the adjusted value has been saved.
### 4.1 System screen

The system selected is indicated in the System-Monitoring-Display. It consists of several system component symbols which are – depending on the current status of the system – either flashing, permanently shown or not indicated.

---

**Collector**

with collector sensor

---

**Temperature sensor**

---

**Store**

with heat exchanger

---

**Pump**

---

### 4.2 Other indications

#### System screen

- Pump symbol is flashing when the relay is active.
- Sensor symbols are flashing, if the corresponding sensor display channel is selected.
- Sensors are flashing quickly in the case of a sensor fault.

#### Operating control LED

- **Green:** Everything OK
- **Red/green flashing:** Initialisation active
- **Red flashing:** Manual mode
- **Sensor fault (sensor symbol is flashing quickly)**

#### Status indications:

<table>
<thead>
<tr>
<th>Permanently shown</th>
<th>Flashing</th>
<th>Status indications:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☺</td>
<td>☺</td>
<td>Relay 1 active</td>
</tr>
<tr>
<td>☺ ☼</td>
<td>☼</td>
<td>Maximum store temperature exceeded</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Store emergency shutdown active</td>
</tr>
<tr>
<td>☾</td>
<td>☽</td>
<td>Collector emergency shutdown active</td>
</tr>
<tr>
<td>☾</td>
<td>☽</td>
<td>Collector cooling active</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>System cooling active</td>
</tr>
<tr>
<td>☾ ☾</td>
<td>☾</td>
<td>Store cooling active</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Holiday cooling option activated</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Holiday cooling active</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Collector minimum limitation active</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Antifreeze function activated</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Antifreeze function active</td>
</tr>
<tr>
<td>☾ + ☾</td>
<td>☾</td>
<td>Manual mode relay 1 ON</td>
</tr>
<tr>
<td>☾</td>
<td>☽</td>
<td>Manual mode relay 1 OFF</td>
</tr>
<tr>
<td>☾</td>
<td>☾</td>
<td>Sensor fault</td>
</tr>
</tbody>
</table>
5 Commissioning

1. forwards (+)
2. backwards (-)
3. SET (selection / confirmation)

→ Connect the device to the mains

The controller runs an initialisation phase in which the operating control LED flashes red/green.

When the controller is commissioned or when it is reset, it will run a commissioning menu. The commissioning menu leads the user through the most important adjustment channels needed for operating the system.

**Commissioning**

1. **Language**
   → Adjust the desired menu language.
   **LANG**
   Language selection
   Selection: dE, En, Fr
   Factory setting: dE

2. **Temperature unit**
   → Adjust the desired unit.
   **UNIT**
   Temperature unit
   Selection: °F, °C
   Factory setting: °C

3. **Maximum store temperature**
   → Adjust the maximum store temperature.
   **SMX**
   Adjustment range: 4 … 95 °C [40 … 200 °F]
   Factory setting: 60 °C [140 °F]

**Note:**
The controller is also equipped with a non-adjustable emergency shutdown, deactivating the system if the store reaches 95 °C [200 °F].
Commissioning

4. Minimum speed
→ Adjust the minimum speed for the corresponding pump.

nMN
Speed control
Adjustment range: 30 … 100 %
Factory setting: 30

Note:
The pump speed must be set to 100 % when auxiliary relays or valves are connected.

Confirmation
Completing the commissioning menu
After the last channel of the commissioning menu has been adjusted and confirmed, the controller asks for confirmation of the adjustments.
→ In order to confirm the adjustments made in the commissioning menu, press button 3.
The controller is then ready for operation and normally the factory settings will give close to optimum operation.

Note:
The adjustments carried out during commissioning can be changed anytime in the corresponding adjustment channel. Additional functions and options can also be activated or deactivated (see page 14).

6 Channel overview

6.1 Display channels

Note:
The displayed values and adjustment channels depend on which options and functions have been selected. Only values and adjustment channels available for the individual settings selected will appear in the menu.

Display of drainback time periods

Initialisation

INIT
ODB initialisation active
Indicates the time adjusted in tDTO, running backwards.

Filling time

FLL
ODB filling time active
Indicates the time adjusted in tFLL, running backwards.

Stabilisation

STAB
ODB stabilisation in progress
Indicates the time adjusted in tSTB, running backwards.
Display of collector temperatures

![COL](image1) 85 °C

**COL**
Collector temperature
Display range: -40 … + 260 °C [-40 … + 500 °F]
Indicates the collector temperature.

Display of store temperatures

![TST](image2) 43.9 °C

**TST**
Store temperature
Display range: -40 … + 260 °C [-40 … + 500 °F]
Indicates the store temperature.

Indication of sensors 3 and 4

![S3, S4](image3) 30.4 °C

**S3, S4**
Sensor temperatures
Display range: -40 … + 260 °C [-40 … + 500 °F]
Indicates the current temperature at the corresponding additional sensor (without control function).
- S3: Temperature at sensor 3
- S4: Temperature at sensor 4

**Note:**
S3 and S4 will only be indicated if the temperature sensors are connected to the corresponding terminals.

Indication of return temperature

![TR](image4) 56.7 °C

**TR**
Return temperature
Display range: -40 … + 260 °C [-40 … + 500 °F]
If the heat quantity measurement is activated, the temperature at sensor S4 will be indicated as TR.

Indication of current pump speed

![n %](image5) 100

**n %**
Current pump speed
Display range: 30 … 100%
Indicates the current pump speed.

Display of heat quantity

![kWh/MWh](image6) 51

**kWh/MWh**
Heat quantity in kWh/MWh
Display channel
Indicates the heat quantity produced in the system. For this purpose, the heat quantity measurement option has to be enabled. The flow rate as well as the values of the reference sensors flow and return are used for calculating the heat quantity supplied. It is shown in kWh in the kWh channel and in MWh in the MWh channel. The overall heat quantity results from the sum of both values.
The accumulated heat quantity can be set back to zero. As soon as one of the display channels of the heat quantity is selected, the symbol \textit{SET} is displayed.

- In order to access the reset mode of the counter, press button 3 for approx. 2 s. \textit{SET} starts flashing and the heat quantity value will be set back to zero.
- In order to finish the reset process, press button 3.
- In order to interrupt the reset process, do not press any button for about 5 s. The display returns to the display mode.

**Operating hours counter**

\begin{figure}[h]
\centering
\includegraphics[width=0.2\textwidth]{hp.png}
\caption{Operating hours counter}
\end{figure}

The operating hours counter accumulates the operating hours of the corresponding relay (hP).

Full hours are displayed.

The accumulated operating hours can be set back to zero. As soon as one of the display channels of the heat quantity is selected, the symbol \textit{SET} is displayed.

- In order to access the reset mode of the counter, press button 3 for approx. 2 s. \textit{SET} starts flashing and the operating hours value will be set back to zero.
- In order to finish the reset process, press button 3.
- In order to interrupt the reset process, do not press any button for about 5 s. The display returns to the display mode.

### 6.2 Adjustment channels

#### $\Delta T$ control

\begin{figure}[h]
\centering
\includegraphics[width=0.2\textwidth]{dtop.png}
\caption{DTO}
\end{figure}

**DTO**

Switch-on temperature difference

- Adjustment range: 1.0 \ldots 20.0 K [2.0 \ldots 40.0 °Ra]
- Factory setting: 6.0 K [12.0 °Ra]

The controller works as a standard differential controller. If the temperature reaches or exceeds the switch-on temperature difference, the pump switches on. When the temperature difference reaches or falls below the adjusted switch-off temperature difference, the respective relay switches off.

**Note:**

The switch-on temperature difference must be at least 0.5 K [1 °Ra] higher than the switch-off temperature difference.

\begin{figure}[h]
\centering
\includegraphics[width=0.2\textwidth]{dtf.png}
\caption{DTF}
\end{figure}

**DTF**

Switch-off temperature difference

- Adjustment range: 0.5 \ldots 19.5 K [1.0 \ldots 39.0 °Ra]
- Factory setting: 4.0 K [8.0 °Ra]

**Note:**

When the drainback option \textit{ODB} is activated, the values of the parameters \textit{DTO}, \textit{DTF} and \textit{DTS} will be adapted to values suiting drainback systems:

\begin{align*}
\text{DTO} &= 10 \text{ K [20 °Ra]} \\
\text{DTF} &= 4 \text{ K [8 °Ra]} \\
\text{DTS} &= 15 \text{ K [30 °Ra]}
\end{align*}

Adjustments previously made in these channels will be overridden and have to be entered again if \textit{ODB} is deactivated later on.
**Speed control**

**DTS**
Set temperature difference  
Adjustment range: 1.5 … 30.0 K [3.0 … 60.0 °Ra]  
Factory setting: 10.0 K [20.0 °Ra]

**Note:**  
For pump speed control, the operating mode of the corresponding relay must be set to **Auto** (adjustment channel **MAN**).

**RIS**
Rise  
Adjustment range: 1 … 20 K [2 … 40 °Ra]  
Factory setting: 2 K [4 °Ra]

If the temperature difference reaches or exceeds the switch-on temperature difference, the pump switches on at 100% speed for 10 s. Then, the speed is reduced to the minimum pump speed value.

If the temperature difference reaches the adjusted set value, the pump speed increases by one step (10%). The response of the controller can be adapted via the parameter **Rise**. Each time the difference increases by the adjustable rise value, the pump speed increases by 10% until the maximum pump speed of 100% is reached.

If the temperature difference decreases by the adjustable rise value, pump speed will be decreased by one step.

**Note:**  
The set temperature difference must be at least 0.5 K [1 °Ra] higher than the switch-on temperature difference.

**Minimum speed**

**nMN**  
Speed control  
Adjustment range: 30 … 100 %  
Factory setting: 30 %  
If ODB is activated: 50 %

A relative minimum pump speed can be allocated to the output R1 via the adjustment channel **nMN**.

**Note:**  
The pump speed must be set to 100% when auxiliary relays or valves are connected.

**Maximum store temperature**

**SMX**  
Maximum store temperature  
Adjustment range: 4 … 95 °C [40 … 200 °F]  
Factory setting: 60 °C [140 °F]

If the store temperature reaches the adjusted maximum temperature, the store will no longer be loaded in order to avoid damage caused by overheating. A non-adjustable hysteresis of 2 K [4 °Ra] is set for the maximum store temperature.

If the maximum store temperature is exceeded, ☽ is displayed.

**Note:**  
If the collector cooling or the system cooling function is activated, the adjusted maximum store temperature may be exceeded. In order to prevent system damage, the controller is also equipped with an integrated store emergency shutdown, deactivating the system if the store reaches 95 °C [200 °F].
Store emergency shutdown

OSEM
Store emergency shutdown option
Adjustment range: ON, OFF
Factory setting: OFF
This option is used for activating the internal store emergency shutdown for an upper store sensor. If the temperature at the reference sensor exceeds 95 °C [200 °F], the store will be blocked and loading will be stopped until the temperature falls below 90 °C [190 °F].

Note:
S3 is used as the reference sensor.

Collector emergency shutdown

EM
Collector limit temperature
Adjustment range: 80 … 200 °C [170 … 390 °F]
Factory setting: 130 °C [270 °F]
When the collector temperature exceeds the adjusted collector limit temperature, the solar pump (R1) switches off in order to protect the system components against overheating (collector emergency shutdown). If the collector limit temperature is exceeded, △ is displayed (flashing).

Note:
If the drainback option ODB is activated, the adjustment range of EM is changed to 80 … 120 °C [170 … 250 °F]. The factory setting in that case is 95 °C [200 °F].

Cooling functions
In the following the 3 cooling functions – collector cooling, system cooling and store cooling – are described in detail. The following note is valid for all 3 cooling functions:

Note:
The cooling functions will not become active as long as solar loading is possible.

Collector cooling

OCC
Collector cooling option
Adjustment range: OFF / ON
Factory setting: OFF
CMX
Collector maximum temperature
Adjustment range: 70 … 160 °C [150 … 320 °F]
Factory setting: 110 °C [230 °F]
The collector cooling function keeps the collector temperature within the operating range by heating the store. If the store temperature reaches 95 °C [200 °F] the function will switch off for safety reasons.
If the store temperature exceeds the adjusted maximum store temperature, the solar system is switched off. If the collector temperature increases to the adjusted maximum collector temperature, the solar pump is activated until the collector temperature falls below the maximum collector temperature. The store temperature may then exceed the maximum temperature, but only up to 95 °C [200 °F] (emergency shutdown of the store).
If the collector cooling function is active, ⊗ and ☾ are displayed (flashing).

Note:
This function will only be available if the system cooling function (OSYC) is deactivated.
System cooling

**OSYC**
System cooling option  
Adjustment range: OFF / ON  
Factory setting: OFF

**DTCO**
Switch-on temperature difference  
Adjustment range: 1.0 … 30.0 K [2.0 … 60.0 °Ra]  
Factory setting: 20.0 K [40.0 °Ra]

**DT CF**
Switch-off temperature difference  
Adjustment range: 0.5 … 29.5 K [1.0 … 59.0 °Ra]  
Factory setting: 15.0 K [30.0 °Ra]

The system cooling function aims to keep the solar system operational for a longer time. The function overrides the maximum store temperature to provide thermal relief of the collector field and the heat transfer fluid on hot days.

If the store temperature is higher than the adjusted maximum store temperature and the switch-on temperature difference DTCO is reached, the solar pump remains switched on or will be switched on. Solar loading is continued until either the temperature difference falls below the adjusted value DT CF or the collector limit temperature is reached.

If the system cooling function is active, 〇 and ☼ are displayed (flashing).

**Note:**  
This function will only be available, if the collector cooling function (OCC) is deactivated.

Store cooling

**OSTC**
Store cooling option  
Adjustment range: OFF / ON  
Factory setting: OFF

**OHOL**
Holiday cooling option  
Adjustment range: OFF / ON  
Factory setting: OFF

**THOL**
Holiday cooling temperature  
Adjustment range: 20 … 80 °C [70 … 175 °F]  
Factory setting: 40 °C [110 °F]

When the store cooling function is activated, the controller aims to cool down the store during the night in order to prepare it for solar loading on the following day. If the adjusted maximum store temperature SMX is exceeded and the collector temperature falls below the store temperature, the system will be reactivated in order to cool down the store. Cooling will continue until the store temperature has fallen below the adjusted maximum store temperature (SMX) again. A hysteresis of 2 K [4 °Ra] is set for the store cooling function.

Reference threshold temperature differences for the store cooling function are DTO and DT F.

If no DHW consumption is expected for a longer period of time, the additional holiday cooling option OHOL can be activated in order to extend the store cooling function. The adjustable temperature THOL then replaces the maximum store temperature (SMX) as the switch-off temperature for the store cooling function.

When the holiday cooling function is activated, ☼ and ⬇️ (flashing) are shown on the display.

If the holiday cooling function is active, 〇, ☼ and ⬇️ (flashing) are displayed (flashing).
**Collector minimum limitation**

**OCN**
- Collector minimum limitation option
- Adjustment range: OFF/ON
- Factory setting: OFF

**CMN**
- Minimum collector temperature
- Adjustment range: 10.0 ... 90.0 °C [50.0 ... 190.0 °F]
- Factory setting: 10.0 °C [50.0 °F]

If the collector minimum limitation option is activated, the pump (R1) will only be switched on if the adjustable collector minimum temperature is exceeded. The minimum temperature prevents the pump from being switched on too often at low collector temperatures. A hysteresis of 5 K [10 °Ra] is set for this function.

**Note:** If **OSTC** or **OCF** is active, the collector minimum limitation will be overridden. In that case, the collector temperature may fall below **CMN**.

**Antifreeze function**

**OCF**
- Antifreeze option
- Adjustment range: OFF/ON
- Factory setting: OFF

**CFR**
- Antifreeze temperature
- Adjustment range: -40.0 ... +10.0 °C [-40.0 ... +50.0 °F]
- Factory setting: +4.0 °C [+40.0 °F]

The antifreeze function activates the loading circuit between the collector and the store when the temperature falls below the adjusted antifreeze temperature. This will protect the fluid against freezing or coagulating. If the adjusted antifreeze temperature is exceeded by 1 K [2 °Ra], the loading circuit will be deactivated.

- If the antifreeze function is active, ⋄ and ⋆ are displayed (flashing).

**Heat quantity measurement**

**OHQM**
- Heat quantity measurement
- Adjustment range: OFF/ON
- Factory setting: OFF

**FMAX**
- Flow rate in l/min
- Adjustment range: 0.5 ... 100.0
- Factory setting: 6.0

If **OHQM** is activated, the heat quantity gained can be calculated and displayed. Heat quantity measurement is possible if a flowmeter is used.

The heat quantity balancing (estimation) uses the difference between the flow and return temperatures and the entered flow rate (at 100 % pump speed).

- Read the flow rate (l/min) and adjust it in the **FMAX** channel.
- Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

**Heat transfer fluid:**

0: Water
1: Propylene glycol
2: Ethylene glycol
3: Tyfocor® LS/G-LS

**Note:**
- Since this function uses the limited heat quantity of the store, the antifreeze function should only be used in regions with few days of temperatures around the freezing point.
- The antifreeze function will be suppressed if the store temperature falls below +5 °C [+40 °F] in order to protect the store from frost damage.
Drainback option

Note:
A drainback system requires additional components such as a holding tank. The drainback option should only be activated if all components required are properly installed.

In a drainback system the heat transfer fluid will flow into a holding tank if solar loading does not take place. The drainback option initiates the filling process if solar loading is about to start. If the drainback option is activated, the following adjustment can be made.

ODB
Drainback option
Adjustment range: OFF/ON
Factory setting: OFF

Note:
If the drainback option is activated, the cooling functions and the antifreeze function will not be available. If one or more than one of these functions have been activated before, they will be deactivated again as soon as ODB is activated. They will remain deactivated, even if ODB is deactivated later on.

Note:
If the drainback function ODB is activated, the factory settings of the parameters nMN, DTO, DTF and DTS will be adapted to values suiting drainback systems. Additionally, the adjustment range and the factory setting of the collector emergency shutdown will change. Adjustments previously made in these channels will be overridden and have to be entered again if the drainback option is deactivated later on.

Time period – switch-on condition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tDTO</td>
<td>60 s</td>
</tr>
</tbody>
</table>

tDTO
Time period – switch-on condition
Adjustment range: 1 … 100 s
Factory setting: 60 s
The parameter tDTO is used for adjusting the time period during which the switch-on condition must be permanently fulfilled.

Filling time

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tFLL</td>
<td>5.0 min</td>
</tr>
</tbody>
</table>

Filling time
Adjustment range: 1.0 … 30.0 min
Factory setting: 5.0 min
The filling time can be adjusted using the parameter tFLL. During this period, the pump runs at 100% speed.

Stabilisation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tSTB</td>
<td>2.0 min</td>
</tr>
</tbody>
</table>

Stabilisation
Adjustment range: 1.0 … 15.0 min
Factory setting: 2.0 min
The parameter tSTB is used for adjusting the time period during which the switch-off condition will be ignored after the filling time has ended.
Operating mode

**MAN**
Operating mode
Adjustment range: OFF, Auto, ON
Factory setting: Auto

For control and service work, the operating mode of the relay can be manually adjusted. For this purpose, select the adjustment channel **MAN** in which the following adjustments can be made:

- **OFF**: Relais off
- **Auto**: Relay in automatic operation
- **ON**: Relais on

⚠ (flashing) + ☛ + ⬃

**Note:**
Always adjust the operating mode back to **Auto** when the control and service work is completed. Normal operation is not possible in manual mode.

HE pump control

**ADA1**
HE pump control via adapter
Adjustment range: ON, OFF
Factory setting: OFF

This option is used for controlling a high-efficiency pump via a VBus®/PWM adapter. The power supply of the pump is carried out via the semiconductor relay (R1). For pump speed control with activated ADA1 option, the relay is switched on or off (no burst control). Temperature dependent speed information is transmitted via the VBus®. The relay will remain deactivated for 1 hour after its switch-off conditions have been fulfilled (pump protection).

Language

**LANG**
Language selection
Selection: dE, En, Fr
Factory setting: dE

In this adjustment channel the menu language can be selected.
- dE: German
- En: English
- Fr: French

Unit

**UNIT**
Temperature unit selection
Selection: °F, °C
Factory setting: °C

In this adjustment channel, the display unit for temperatures and temperature differences can be selected. The unit can be switched between °C/K and °F/°Ra during operation.

Temperatures and temperature differences in °F and °Ra are displayed without units. If the indication is set to °C, the units are displayed with the values.
Reset

RESE
Reset function
By means of the reset function, all adjustments can be set back to their factory settings.

➤ In order to carry out a reset, press button 3
All adjustments that have previously been made will be lost! For this reason, a security enquiry will appear after the reset function has been selected.
Only confirm the security enquiry if you are sure you want to set back all adjustment to the factory setting.

Security enquiry

➤ In order to confirm the security enquiry, press button 3.

Note:
After a reset, the commissioning menu will start again (see page 11).
7 Troubleshooting

If a malfunction occurs, the display symbols will indicate an error code.

![Image of T4A fuse]

Operating control LED is permanently off.

**Check the power supply of the controller. Is it disconnected?**

- **no**
- **yes**

**The fuse of the controller could be blown.** The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.

**Check the supply line and reconnect it.**

The symbol ⚠ is indicated on the display and the symbol ␣ flashes.

Sensor fault. An error code instead of a temperature is shown on the sensor display channel.

- **888.8**
- **- 88.8**

Cable is broken. Check the cable.

Short circuit. Check the cable.

Disconnected Pt1000 temperature sensors can be checked with an ohmmeter. Please check the resistance values correspond with the table.

<table>
<thead>
<tr>
<th>°C</th>
<th>°F</th>
<th>Ω</th>
<th>°C</th>
<th>°F</th>
<th>Ω</th>
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<tr>
<td>-10</td>
<td>14</td>
<td>961</td>
<td>55</td>
<td>131</td>
<td>1213</td>
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<tr>
<td>-5</td>
<td>23</td>
<td>980</td>
<td>60</td>
<td>140</td>
<td>1232</td>
</tr>
<tr>
<td>0</td>
<td>32</td>
<td>1000</td>
<td>65</td>
<td>149</td>
<td>1252</td>
</tr>
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<td>41</td>
<td>1019</td>
<td>70</td>
<td>158</td>
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<tr>
<td>50</td>
<td>122</td>
<td>1194</td>
<td>115</td>
<td>239</td>
<td>1442</td>
</tr>
</tbody>
</table>

Resistance values of Pt1000 sensors

Note:
For answers to frequently asked questions (FAQ) see www.resol.com.
Pump is overheated, but no heat transfer from the collector to the store, flow and return have the same temperature; perhaps also bubbling in the lines.

- **Air or gas bubbles in the system?**
  - no
  - yes

- **Are the valves or the non-return valves defective or is the dirt trap blocked?**
  - no
  - yes

- **Temperature difference at the controller too small?**
  - no
  - yes

- **Wrong position of collector sensors?**
  - no
  - yes

- **Plausibility control of the option tube collector function**

Vent the system; increase the system pressure to a static primary pressure of at least plus 0.5 bar [7.25 psi]; if necessary continue to increase the pressure; switch the pump on and off for a short time.

- **Clean the dirt trap or replace defective component**

Pump starts for a short moment, switches off, switches on again, etc.

- **Switch-on temperature difference ΔTon too large?**
  - no
  - yes

- **Non-ideal position of the collector sensor (e.g. flatscrew sensor instead of sensor in immersion sleeves).**
  - no
  - yes

- **Mount the collector sensor at solar flow (warmest collector output); use immersion sleeve of the respective collector.**

Put the solar pump (R1) into the manual mode On for a short time during irradiation. Check whether the collector temperature significantly increases.

- **Switch-on temperature difference ΔTon too large?**
  - no
  - yes

- **Change ΔTon and ΔToff correspondingly.**

The temperature difference between store and collector increases enormously during operation; the collector circuit cannot dissipate the heat.

- **Collector circuit pump/zone valve defective?**
  - no
  - yes

- **Heat exchanger calcified?**
  - no
  - yes

- **Heat exchanger blocked?**
  - no
  - yes

- **Heat exchanger too small?**
  - yes

- **Replace with correctly sized one.**

Check or replace, if necessary

- **Decalcify it**

Clean it
Stores cool down at night.

Collector circuit pump runs during the night?
- no
- yes

Collector temperature at night is higher than the outdoor temperature.
- no
- yes

Sufficient store insulation?
- yes
- no

Insulation close enough to the store?
- yes
- no

Are the store connections insulated?
- yes
- no

Warm water outflow upwards?
- no
- yes

Does the DHW circulation run for a very long time?
- no
- yes

Circulation pump and blocking valve should be switched off for 1 night; less store losses?
- yes
- no

Check the controller.

Check the non-return valves in the flow and the return pipe for functional efficiency.

Increase insulation.

Replace insulation or increase it.

Insulate the connections.

Change connection and let the water flow sideways or through a siphon (downwards); less store losses now?
- no
- yes

Use the circulation pump with timer and switch-off thermostat (energy-efficient circulation).

Check whether the pumps of the after-heating circuit run at night; check whether the non-return valve is defective; problem solved?
- yes
- no

Further pumps which are connected to the solar store must also be checked.

Clean or replace it.

The gravitation circulation in the circulation line is too strong; insert a stronger valve in the non-return valve or an electrical 2-port valve behind the circulation pump; the 2-port valve is open when the pump is activated, otherwise it is closed; connect pump and 2-port valve electrically in parallel; activate the circulation again. Deactivate pump speed control!

The solar circuit pump does not work, although the collector is considerably warmer than the store.

Is the display working?
- yes
- no

Does the pump start up in manual operation?
- no
- yes

Is the pump current enabled by the controller?
- no
- yes

Controller fuse ok?
- no
- yes

Is the pump stuck?
- yes
- no

Turn the pump shaft using a screwdriver; now passable?
- no
- yes

Controller might be defective - replace it.

Replace fuse

Pump is defective - replace it.
8 Accessories

Sensors

Overvoltage protection device

SD3 Smart Display / GA3 Large Display

AM1 Alarm Module

DL2 Datalogger

VBus® / USB & VBus® / LAN & VBus® / PWM interface adapters
8.1 Sensors and measuring instruments

Sensors
The product range includes high-precision platinum temperature sensors, flatscrew sensors, outdoor temperature sensors, indoor temperature sensors, cylindrical clip-on sensors, also as complete sensors with immersion sleeve.

Overvoltage protection device
In order to avoid overvoltage damage at collector sensors (e.g. caused by local lightning storms), we recommend installing the RESOL SP10 Overvoltage protection.

8.2 VBus® accessories

SD3 Smart Display / GA3 Large Display
The RESOL SD3 Smart Display is designed for simple connection to RESOL controllers via the RESOL VBus®. It is used for visualising data issued by the controller: collector temperature, store temperature and energy yield of the solar thermal system. The use of high-efficiency LEDs and filter glass assures a high optical brilliance. An additional power supply is not required. One module is required per controller. The GA3 is a completely mounted large display module for visualisation of collector- and store temperatures as well as the heat quantity yield of the solar system via one 6-digit and two 4-digit 7-segment displays. An easy connection to all controllers with a RESOL VBus® is possible. The front plate is made of antireflective filterglass and is printed with a light-resistant UV-lacquering. The universal RESOL VBus® allows the parallel connection of 8 large displays as well as additional VBus® modules.

AM1 Alarm Module
The AM1 Alarm Module is designed to signal system failures. It is to be connected to the VBus® of the controller and issues an optical signal via the red LED if a failure has occurred. The AM1 also has a relay output, which can e.g. be connected to a building management system (BMS). Thus, a collective error message can be issued in the case of a system failure.

DL2 Datalogger
This additional module enables the acquisition and storage of large amounts of data (such as measuring and balance values of the solar system) over a long period of time. The DL2 can be configured and read-out with a standard Internet browser via its integrated web interface. For transmission of the data stored in the internal memory of the DL2 to a PC, an SD card can be used. The DL2 is appropriate for all controllers with RESOL VBus®. It can be connected directly to a PC or router for remote access and thus enables comfortable system monitoring for yield monitoring or for diagnostics of faults.

8.3 Interface adapters

VBus®/USB & VBus®/LAN & VBus®/PWM interface adapters
The VBus®/USB interface adapter is the interface between the controller and a personal computer. With its standard mini-USB port it enables a fast transmission of system data for processing, visualising and archiving data via the VBus®. The RESOL ServiceCenter software is included. The VBus®/LAN interface adapter is designed for the direct connection of the controller to a PC or router. It enables easy access to the controller via the local network of the owner. Controller access and data charting can be effected from every workstation of the network by means of the RESOL ServiceCenter Software. The VBus®/LAN interface adapter is suitable for all controllers equipped with a RESOL VBus®. The RESOL ServiceCenter software is included. The VBus®/PWM interface adapter enables the speed control of a high-efficiency pump via a PWM or 0-10 V signal. The adapter receives speed information of the controller via the VBus®. The speed will be transformed into a PWM or direct-current voltage signal and distributed to corresponding terminals.
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Important note
The texts and drawings in this manual are correct to the best of our knowledge. As faults can never be excluded, please note:
Your own calculations and plans, under consideration of the current standards and directions should only be basis for your projects. We do not offer a guarantee for the completeness of the drawings and texts of this manual - they only represent some examples. They can only be used at your own risk. No liability is assumed for incorrect, incomplete or false information and / or the resulting damages.

Note
The design and the specifications can be changed without notice. The illustrations may differ from the original product.

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