# DeltaTherm® PV

Beginning with firmware version 1.03

## Power-to-Heat controller

## for the direct control of an electric heater

Manual for the specialised craftsman

**Installation**
**Operation**
**Functions and options**
**Troubleshooting**


VBus.net

The Internet portal for easy and secure access to your system data – www.vbus.net

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.

11211343

en

Manual

www.resol.com

## Safety advice

Please pay attention to the following safety advice in order to avoid danger and damage to people and property.
Danger of electric shock:

- When carrying out works, the device must first of all be disconnected from the mains.
- It must be possible to disconnect the device from the mains at any time.
- Do not use the device if it is visibly damaged!

The device must not be used by children or persons with reduced physical, sensory or mental abilities or without any experience and knowledge. Make sure that children do not play with the device!
Only connect accessories authorised by the manufacturer to the device.
Make sure that the housing is properly closed before commissioning the device.
Set the code to the customer code before handing over the controller to the customer.

### 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 authorised skilled personnel.
Authorised skilled personnel are persons who have theoretical knowledge and experience with the installation, commissioning, operation, maintenance, etc. of electric/electronic devices and hydraulic systems and who have knowledge of relevant standards and directives.

### Instructions

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

## Information about the products

### Proper usage

The controller is designed for the direct control of an electric heater for using excess current for heating a water store in compliance with the technical data specified in this manual.

Any use beyond this is considered improper.

Proper usage also includes compliance with the specifications given in this manual.

Improper use excludes all liability claims.

### EU Declaration of conformity

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

**Note**

Strong electromagnetic fields can impair the function of the device.

➔ Make sure the device as well as the system are not exposed to strong electromagnetic fields.

### Scope of delivery

The scope of delivery of this product is indicated on the packaging label.

### Storage and transport

Store the product at an ambient temperature of 0 … 40 °C and in dry interior rooms only.

Transport the product in its original packaging only.

### Cleaning

Clean the product with a dry cloth. Do not use aggressive cleaning fluids.

### Decommissioning

1. Disconnect the device from the power supply.
2. Dismount the device.

**Subject to technical change. Errors excepted.**

### 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.

## Description of symbols

**Warnings are indicated with a warning symbol!**

**Signal words** describe the danger that may occur, when it is not avoided.

**WARNING** **means that injury, possibly life-threatening injury, can occur.**

➔ It is indicated how to avoid the danger described.

**ATTENTION** **means that damage to the appliance can occur.**

➔ It is indicated how to avoid the danger described.

**Note**
Notes are indicated with an information symbol.

➔ Texts marked with an arrow indicate one single instruction step to be carried out.

1. Texts marked with numbers indicate several successive instruction steps to be carried out.

DeltaTherm® PV

The DeltaTherm® PV controller detects excess current, e.g. produced by PV systems, calculates the energy available and redirects it to an electric heater. Thus, excess current can be directly converted into thermal energy and stored.

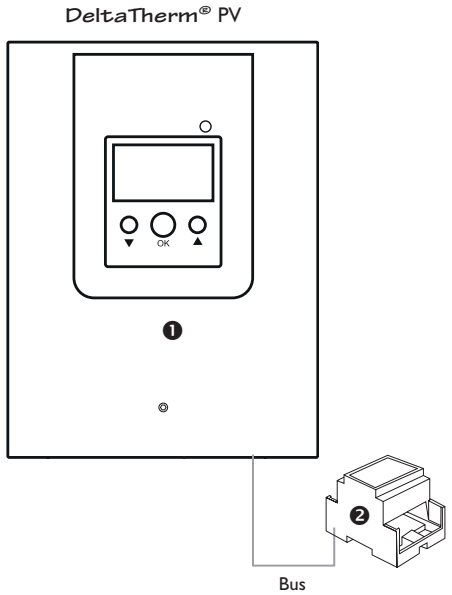
Single-phase electromechanical electric immersion heaters up to 3 kW with an operating voltage of 230 V~ and a thermal cut-out are suitable.

Electronically controlled electric immersion heaters are not suitable.

## Included with the DeltaTherm® PV

❶ Controller with power unit (DeltaTherm® PV)

❷ Sensor module and current sensors (DeltaTherm® E sensor)




## Contents

## 1 DeltaTherm® PV

- **Increase in self-consumption**
- **Stepless control of an electric immersion heater**
- **Household current priority**
- **Suitable for all grid-connected PV systems**
- **0-10 V power control (optional)**
- **Internal backup heating with mains current (optional)**
- **Smart Remote access (optional)**
- **Inverter power limitation (optional)**

### Technical data controller with power unit (DeltaTherm® PV)

**Inputs:** 3 Pt1000 temperature sensors, 2 digital switching inputs, 0-10 V control input
**Outputs:** 2 digital switching outputs, variable power control up to 3 kW (electric immersion heater)
**Power supply:** 100–240 V~ (50–60 Hz)
**Supply connection:** type X attachment
**Standby:** 1.47 W
**Rated impulse voltage:** 2.5 kV
**Data interface:** VBus®
**VBus® current supply:** 35 mA
**Functions:** controller and power controller, backup heating internal, 0-10 V power control, Smart Remote, inverter power limitation
**Housing:** sheet metal, powder-coated
**Mounting:** wall mounting
**Indication / Display:** full graphic display
**Operation:** 3 buttons
**Ingress protection:** IP 20 / EN 60529
**Protection class:** I
**Ambient temperature:** 0 … 40 °C
**Degree of pollution:** 2
**Fuse:** F16A, T16A
**Overvoltage category:** 2
**Maximum altitude:** 2000 m above MSL
**Dimensions:** approx. 226 x 302 x 84 mm

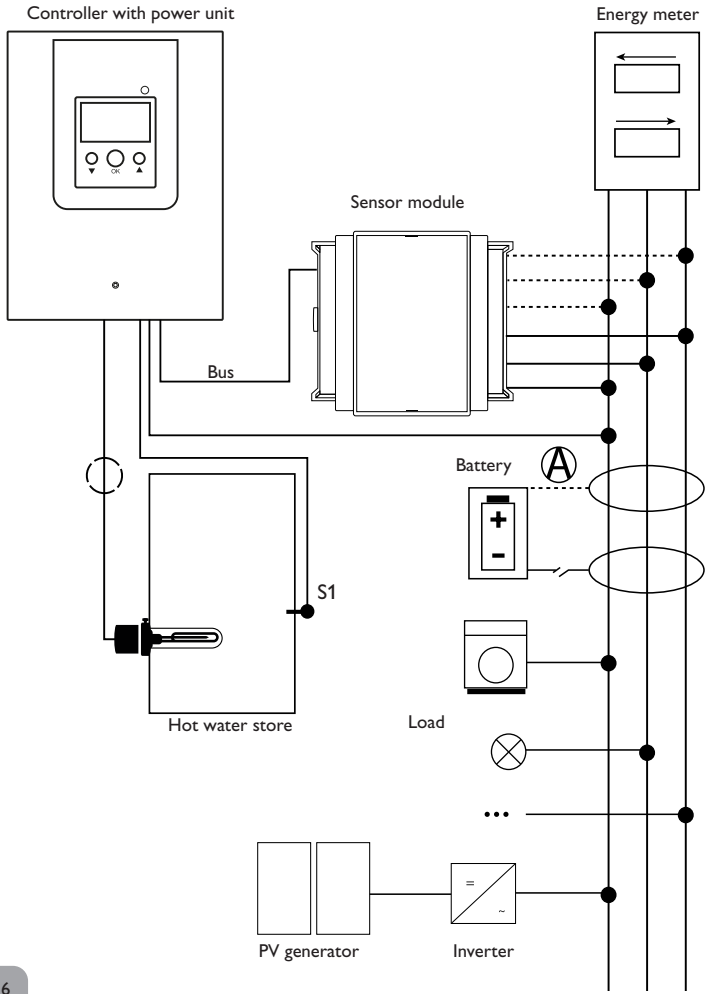
### Technical data sensor module (DeltaTherm® E sensor)

**Inputs:** 3 current inputs and 3 voltage inputs for SW16 current sensors
**Power supply:** 100–240 V~ (50–60 Hz)
**Supply connection:** type Y attachment
**Standby:** < 1 W
**Rated impulse voltage:** 1.0 kV
**Data interface:** VBus®
**Functions:** energy measuring unit
**Housing:** plastic, PC (UL 94 V-0)
**Mounting:** DIN rail in the domestic distribution board
**Indication / Display:** 2 operating control LEDs
**Ingress protection:** IP 20 / EN 60529
**Protection class:** II
**Ambient temperature:** 0 … 40 °C
**Degree of pollution:** 2
**Dimensions:** 71 x 90 x 58 mm

### Technical data current sensor (SW16)

**Nominal current:** 70 A / 23.3 mA (current ratio 3000:1)
**Nominal voltage output:** 0.333 V~
**Insulation voltage:** 600 V~
**Frequency range:** 50 … 400 Hz
**Ambient temperature:** -15 … +60 °C

## 2 System overview




| Sensors | | |
|---|---|---|
| S1 | Temperature store | 1/GND |
| S2 | optional | 2/GND |
| S3 | optional | 3/GND |
| DIn1 | Smart Remote | 9/10 |
| DIn2 | Smart Remote | 11/12 |

| Output | | |
|---|---|---|
| Out1 | Electric immersion heater | Out1/N/⏚ |
| DO1 | Inverter (optional) | 21/22 |

The control unit consists of the controller with power unit and the sensor module.

The sensor module measures the current flow directly at the energy meter. If the power generated is high enough, the excess current can be used for electrically heating the water in the store. If the store maximum temperature is reached (S1), loading will stop. Alternatively, power control can take place via an external 0-10 V signal.

Using a battery is possible in this system, but correct functioning cannot be guaranteed in all cases. The PV current is used with the following priorities:

1. Direct consumption
2. Charging the battery
3. Loading a hot water store
4. Grid feed-in

For this purpose, the sensor modules and the battery have to be arranged as shown in the illustration. The current sensor of the battery must not detect the current consumption of the controller and the loads controlled by the controller.

The **SR off** function (see page 21) allows remote access to the controller, e.g. in order to switch it off when the battery is in use. If the switching input is closed, the controller and all loads switch off regardless of the excess measured.

Different optional functions can be activated, see page 23.

- Internal backup heating
- Inverter

# 3 Installation

## 3.1 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 device.

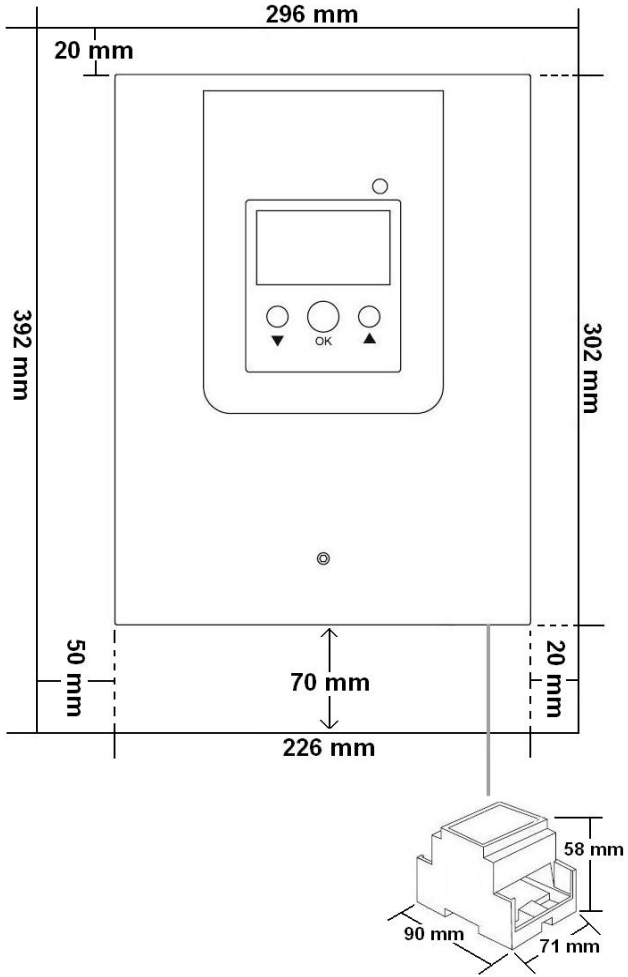
➔ Make sure the device as well as the system are not exposed to strong electromagnetic fields.

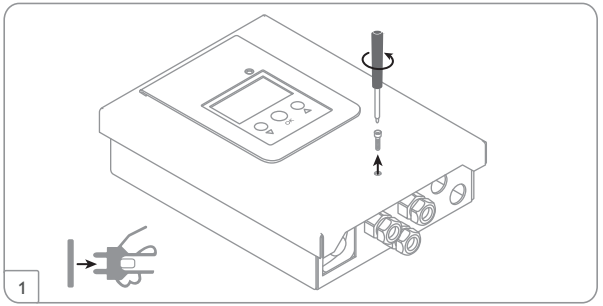
The devices must only be located in dry and dust-free interior rooms.
If the device is not equipped with a mains connection cable and a plug, the device must additionally be supplied from a double pole switch with contact gap of at least 3 mm.
Please pay attention to separate routing of sensor cables and mains cables.

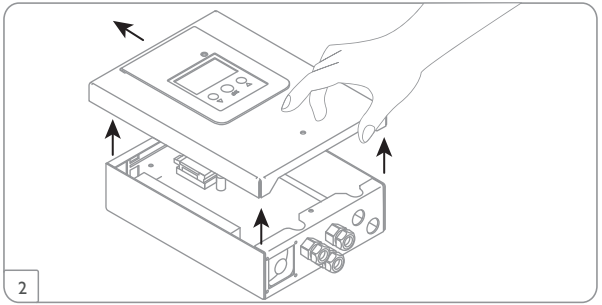
In order to mount the device to the wall, carry out the following steps:

1. Unscrew the screw from the cover and remove it along with the cover from the housing.
2. Mark the upper fastening point on the wall. Drill and fasten the enclosed wall plug and screw leaving the head protruding.
3. Hang the housing from the upper fastening point and mark the lower fastening points (centres 105 mm).
4. Insert lower wall plugs.
5. Fasten the housing to the wall with the lower fastening screws and tighten.
6. Carry out the electrical wiring in accordance with the terminal allocation (see page 9).
7. Put the cover on the housing.
8. Attach with the fastening screw.

**Dimensions and minimum distances**




1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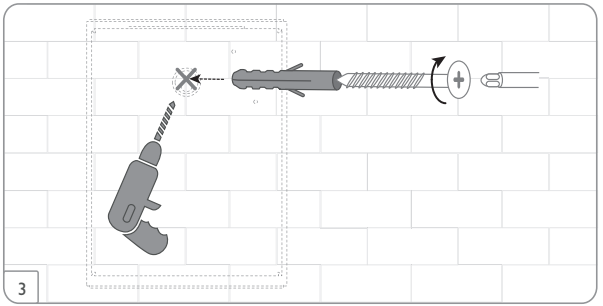
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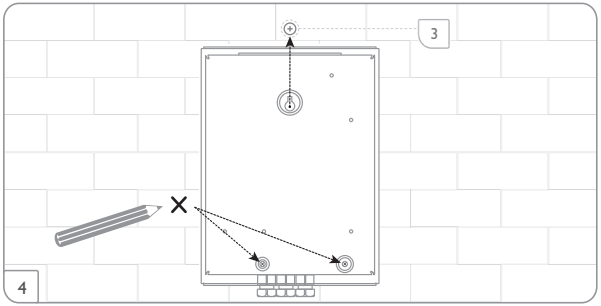
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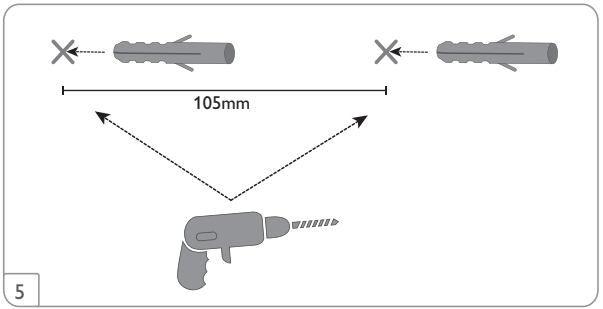
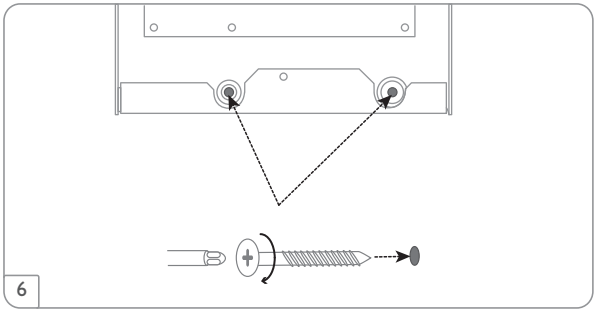
4


105mm
5


6

**Step-by-step installation:**

**ATTENTION!** **Damage through overheating!**

Commissioning the immersion heater in a system electrically connected, but not hydraulically filled can lead to damage caused by overheating!

➔ **Make sure the hydraulic system is filled and ready for operation.**

1. Make sure the store is filled and ready for operation.
2. Mount the sensor module on a DIN rail in the domestic distribution board as close as possible to the energy meter. Make sure that no load is installed between the sensor module and the energy meter.
3. Connect the current sensors and the conductors of the sensor module in phase directly at the energy meter (see page 11).
4. Connect the sensor module with the DeltaTherm® PV by means of the bus (SM) (see page 9 and page 12).
5. Establish the power supply of the controller (see page 12).
6. Run the commissioning menu (see page 17).
7. Carry out the desired adjustments in the controller menu (see page 22).

## 3.2 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! To do so, touch a grounded surface such as a radiator or tap!**

**Note**

The connection to the power supply must always be the last step of the installation!

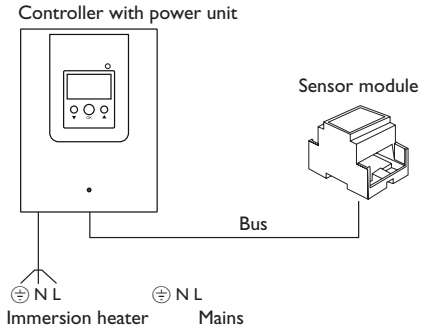
**Do not use the devices if they are visibly damaged!**

The controller is supplied with power via a mains cable. The power supply of the device must be 100–240 V~ (50–60 Hz). The cross section of the cable must be 2.5 mm².

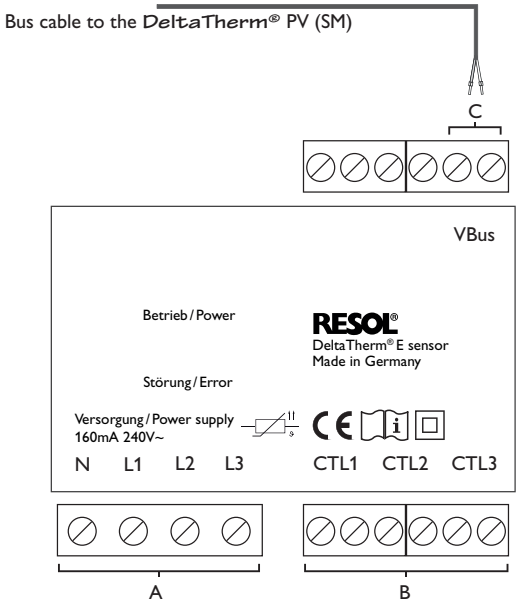
**Note**

Use a **shielded cable** with a cross section of 3 x 2.5 mm² for connecting the electric immersion heater, see page 12.

The cable length must not exceed 5 m.



## Sensor module




A

Power supply:

Neutral conductor N
Conductor 1 L1
Conductor 2 L2
Conductor 3 L3

B

SW16 current sensors:

Current sensor CTL1
Current sensor CTL2
Current sensor CTL3

C

Data communication / Bus

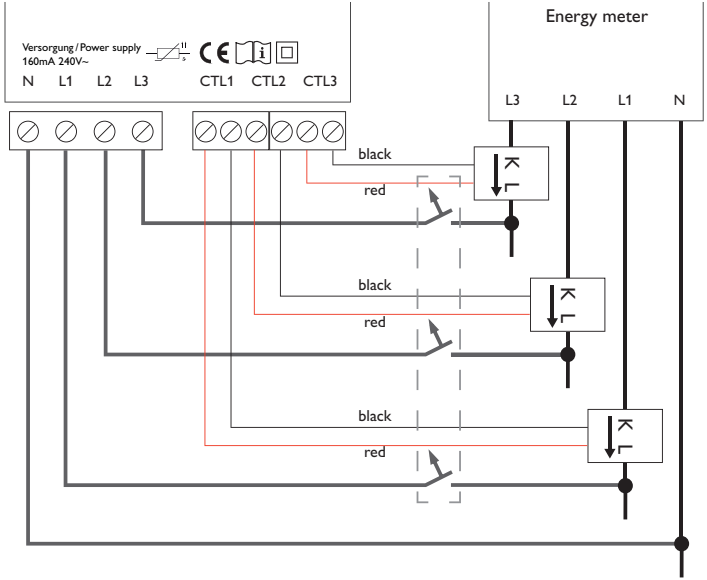
The connection is to be carried out at the terminals marked **SM** (either polarity). The connection to the controller is to be carried out at the terminals marked SM (7 / 8).

The bus cable can be extended with a two-wire cable (bell wire). The cable carries low voltage and must not run together in a cable conduit with cables carrying a higher voltage than 50 V (please pay attention to the valid local regulations). The cross section must be at least 0.5 mm² and the cable can be extended up to 50 m in the case of a single connection.

### Three-phase connection

1. Connect the current sensors and the conductors of the sensor module in phase directly at the energy meter. The arrow indicated on the current sensors must point in the direction of the loads.
2. Make sure that no load is installed between the energy meter and the current sensors.

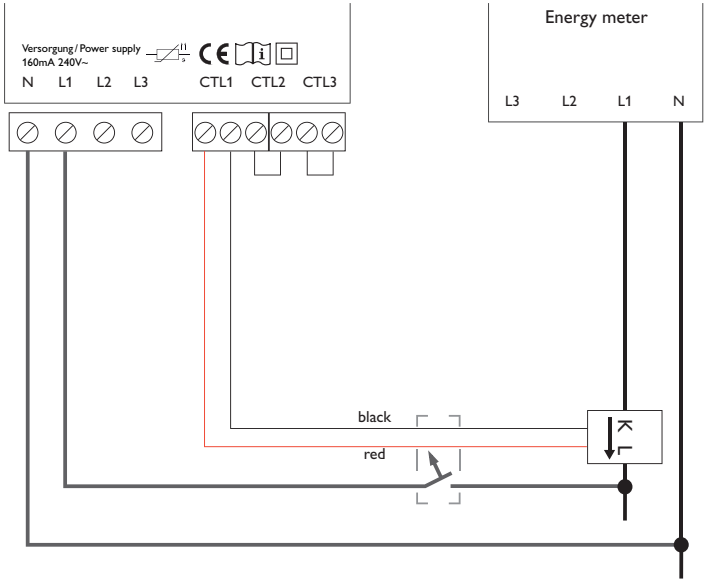
The sensor module adds up the power values of all 3 phases. All 3 phases have to be connected to the sensor module.




**Note**
The 3 phases have to be protected by means of a three-phase 16 A circuit-breaker (not included with the device).

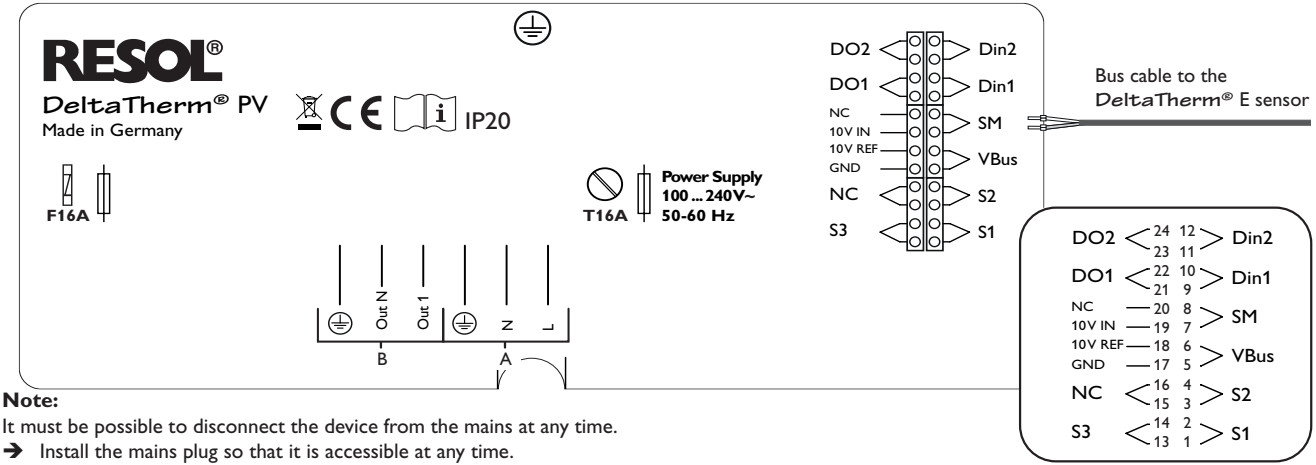
### Single-phase connection

1. Connect the current sensor and the conductor L1 of the sensor module directly at the energy meter. The arrow indicated on the current sensor must point in the direction of the loads.
2. Make sure that no load is installed between the energy meter and the current sensor.
3. Short circuit the connections of CTL2 as well as those of CTL3. The other current sensors are not used.




**Note**
The phase has to be protected by means of a single-phase 16 A circuit-breaker (not included with the device).

## Controller with power unit




**Note:**
It must be possible to disconnect the device from the mains at any time.
➔ Install the mains plug so that it is accessible at any time.
➔ If this is not possible, install a switch that can be accessed.

| Power supply of the controller (A) |
|---|
| Conductor L |
| Neutral conductor N |
| Protective earth conductor ⏚ |
| **Connection of the electric heater (B) (see figure on page 12)** |
| Out 1 |
| Out N |
| Protective earth conductor ⏚ Protective earth conductor and shield |

| 0-10 V switching input | Terminals |
|---|---|
| External power control | 17 / 19 |
| **Temperature sensors** | **Terminals** |
| S1 = temperature store (above the electric immersion heater) | 1 / 2 |
| S2 = temperature sensor 2 (optional) | 3 / 4 |
| S3 = temperature sensor 3 (optional) | 13 / 14 |

| Digital switching inputs | | Terminals |
|---|---|---|
| DIn1 | Smart Remote | 9 / 10 |
| DIn2 | Smart Remote | 11 / 12 |

| Digital switching outputs | | Terminals |
|---|---|---|
| DO1 | inverter | 21 / 22 |
| DO2 | not assigned | 23 / 24 |

**Bus terminals**
The controller is equipped with the **VBus**® for data communication. The connection is to be carried out at the terminal marked **VBus** (either polarity). The sensor module is to be connected to SM (terminals 7 / 8).

| | |
|---|---|
| SM = sensor module | 7 / 8 |
| VBus = e.g. Datalogger | 5 / 6 |

**Note**
For more details about the commissioning procedure see page 17.

## Connection of the electric heater

➔ Use a **shielded cable** with a cross section of 3 x 2.5 mm² and a maximum length of 5 m for connecting the electric immersion heater.

**ATTENTION! Damage to the appliance!**

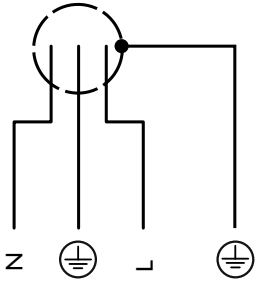
Using a cable longer than 5 m can lead to damage to the device!

➔ **Make sure the cable length does not exceed 5 m.**

**Note**

➔ Connect the shield to the protective earth conductor of the DeltaTherm® PV only. To do so, use the clip inside the housing.

**Do not** connect the shield to the immersion heater.

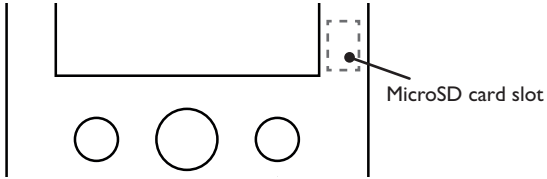



## 3.3 MicroSD card slot of the controller

The controller is equipped with a MicroSD card slot.

With a MicroSD card, the following functions can be carried out:

- Store measurement and balance values onto the MicroSD card. After the transfer to a computer, the values can be opened and visualised, e.g. in a spreadsheet.
- Prepare adjustments and parameterisations on a computer and transfer them via the MicroSD card.
- Store adjustments and parameterisations on the MicroSD card and, if necessary, retrieve them from there.
- Download firmware updates from the Internet and install them on the controller via MicroSD card.

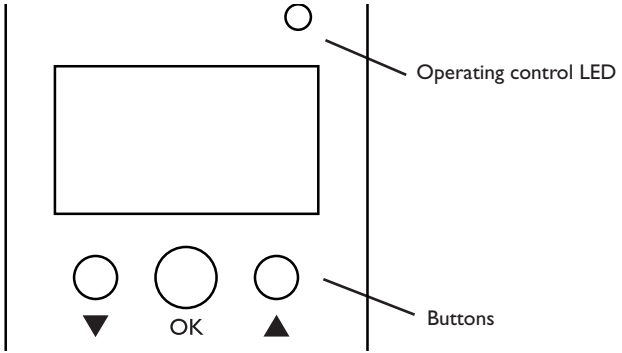



**Note**

For more information about using a MicroSD card, see page 25.

# 4 Operation and function of the controller

## 4.1 Buttons




The controller is operated via the 3 buttons below the display:

Left button (▼) - scrolling downwards / reducing adjustment values
Centre button (OK) - confirming / selecting
Right button (▲) - scrolling upwards, increasing adjustment values

### 4.1.1 Operating control LED

The controller is equipped with a bicolour operating control LED. indicating the following states:

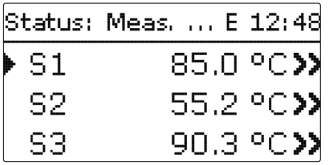
| Colour | Permanently shown | Flashing |
|---|---|---|
| Green | Everything OK | Manual operation of the immersion heater |
| Red | Bus defective / no communication with the sensor module | Sensor line break, sensor short circuit |

### 4.1.2 Selecting menu points and adjusting values

During normal operation of the controller, the display shows the status menu.

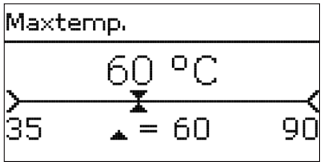
If no button is pressed for 1 min, the display illumination switches off. After 3 more minutes, the controller switches to the status menu.

1. In order to scroll through a menu or to adjust a value, press buttons ▲ and ▼ .
2. To open a submenu or to confirm a value, press the centre button (OK).
3. To enter the previous menu, scroll upwards by pressing button ▲ or scroll downwards by pressing button ▼ until **back** is indicated.
4. Press the centre button (OK).



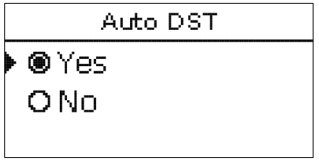

If the symbol ❯❯ is shown behind a menu item, pressing the centre button (OK) will open a new submenu.

Values and options can be changed in different ways:




Numeric values can be adjusted by means of a slide bar. The minimum value is indicated to the left, the maximum value to the right. The large number above the slide bar indicates the current adjustment. By pressing buttons ▼ and ▲, the upper slide bar can be moved to the left or to the right.

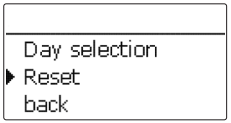
Only after the adjustment has been confirmed by pressing the centre button (OK) will the number below the slide bar indicate the new value. The new value will be saved if it is confirmed by pressing the centre button (OK) again.




If only one item of several can be selected, they will be indicated with radio buttons. When one item has been selected, the radio button in front of it is filled.

### Adjusting the timer

When the **Timer** option is activated, a timer is indicated in which time frames for the function can be adjusted.




In the **Day selection** channel, the days of the week are available individually and as frequently selected combinations.

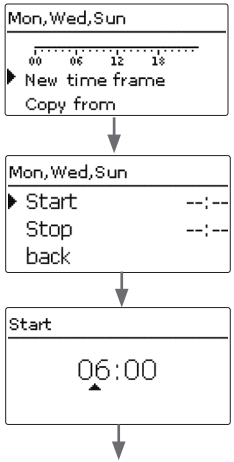
If more than one day or combination is selected, they will be merged into one combination for the following steps.


The last menu item after the list of days is **Continue**. If Continue is selected, the timer menu opens, in which the time frames can be adjusted.

### Adding a time frame:

In order to add a time frame, proceed as follows:

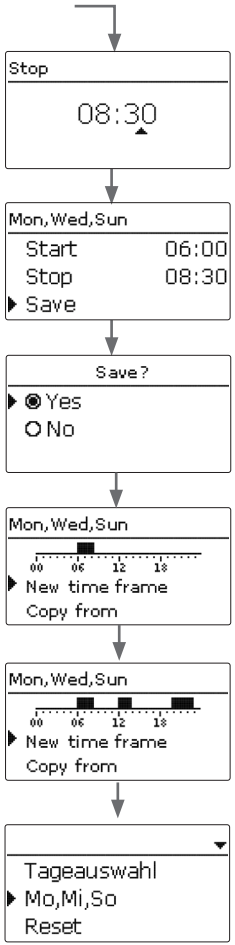
1. Select **New time frame**.




2. Adjust **Start** and **Stop** for the desired time frame.

The time frames can be adjusted in steps of 5 min.

3. In order to save the time frame, select **Save** and confirm the security enquiry with **Yes**.




4. In order to add another time frame, repeat the previous steps.

6 time frames can be adjusted per day or combination.

5. Select **back** in order to get back to the day selection.

## Copying a time frame:

In order to copy time frames already adjusted into another day / another combination, proceed as follows:

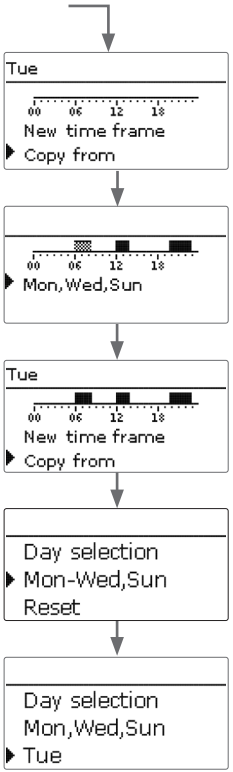
1. Choose the day / the combination into which the time frames are to be copied and select **Copy from**.

A selection of days and / or combinations with time frames will appear.

2. Select the day or combination from which the time frames are to be copied.

All time frames adjusted for the selected day or combination will be copied.

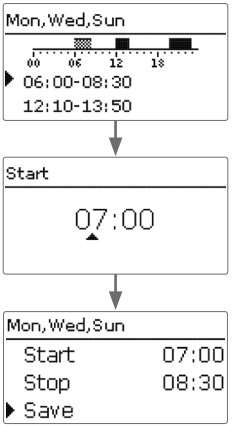
If the time frames copied are not changed, the day or combination will be added to the combination from which the time frames have been copied.




## Changing a time frame:

In order to change a time frame, proceed as follows:

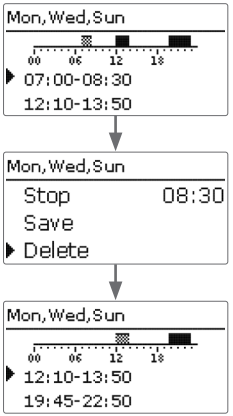
1. Select the time frame to be changed.
2. Make the desired change.
3. In order to save the time frame, select **Save** and confirm the security enquiry with **Yes**.




## Removing a time frame:

In order to delete a time frame, proceed as follows:

4. Select the time frame that is to be deleted.
5. Select **Delete** and confirm the security enquiry with **Yes**.



**Resetting the timer:**

In order to reset time frames adjusted for a certain day or combination, proceed as follows:

1. Select the desired day or combination.

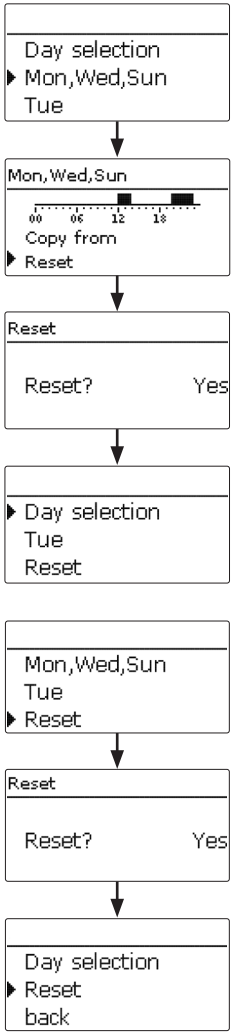
2. Select **Reset** and confirm the security enquiry with **Yes**.

The selected day or combination will disappear from the list, all its time frames will be deleted.

In order to reset the whole timer, proceed as follows:

➔ Select **Reset** and confirm the security enquiry with **Yes**.

All adjustments made for the timer are deleted.




## 4.2 Commissioning

When the hydraulic system is filled and ready for operation, connect the controller to the mains.

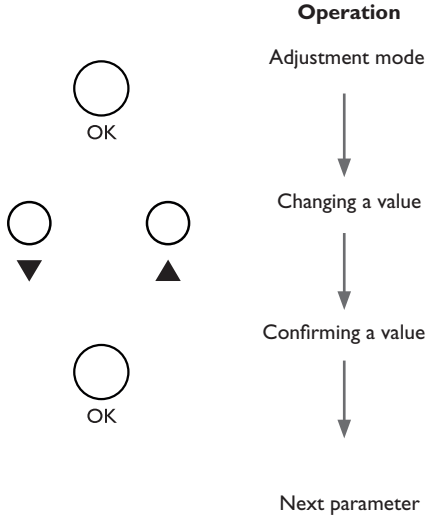
The controller has to be connected to the sensor module by means of the bus (SM).

The controller runs an initialisation phase in which the operating control LED glows red.

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

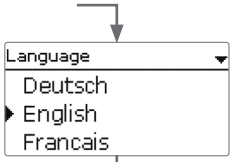
**Commissioning menu**

The commissioning menu consists of the channels described in the following. In order to make an adjustment, adjust the desired value with buttons ▼ and ▲ and confirm with the centre button (OK). The next channel will appear in the display.



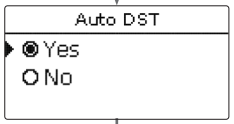
**1. Language:**

➔ Adjust the desired menu language.



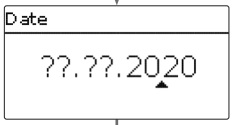

**2. Daylight savings time adjustment:**

➔ Activate or deactivate the automatic daylight savings time adjustment.



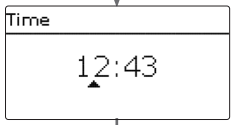

**3. Date:**

➔ Adjust the date. First of all adjust the year, then the month and then the day.



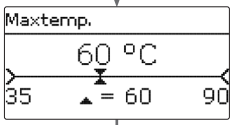

**4. Time:**

➔ Adjust the clock time. First of all adjust the hours, then the minutes.



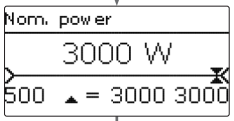

**5. Maximum temperature:**

➔ Adjust the desired maximum temperature.




**6. Nominal power:**

➔ Adjust the nominal power of the electric immersion heater.

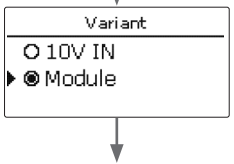



**7. Variant:**

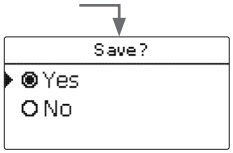
➔ Select the power control variant.

The following settings are available:

- **Sensor module**
- **10V IN** (external 0-10 V power control)




**8. Completing the commissioning menu:**




Lastly a security enquiry will appear. If the security enquiry is confirmed, the adjustments will be saved.

1. In order to confirm the security enquiry, press the centre button (OK).
2. In order to reenter the commissioning menu channels, press button ▼.After you have confirmed the security enquiry, the controller is 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.

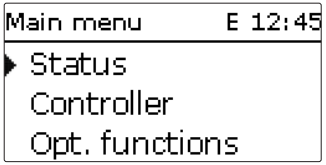
**Set the code to the customer code before handing over the controller to the customer (see page 27).**

## 4.3 Menu structure

- **Main menu**
  - Status
  - Controller
  - Variant
  - Optional functions
  - Basic settings
  - SD card
  - Manual mode
  - User code
- **Status**
  - Controller
  - Meas. / Balance values
  - Messages
- **Controller**
  - Maximum temperature
  - Hysteresis
  - Nominal power
  - Reserve
- **Optional functions**
  - Internal backup heating
  - Inverter
- **Basic settings**
  - Language
  - Auto DST
  - Date
  - Time
  - Reset
- **SD card**
  - Remove card...
  - Save adjustments
  - Load adjustments
  - Logging interval
  - Logging type
- **Manual mode**
  - Electric immersion heater
  - Fan

The menu items and adjustment values selectable are variable depending on adjustments already made.

## 4.4 Main menu




In this menu, different menu areas can be selected.

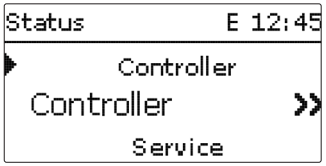
The following menus are available:

- Status
- Controller
- Variant
- Optional functions
- Basic settings
- SD card
- Manual mode
- User code

1. Select the menu area by pressing buttons ▼ and ▲.
2. Press the centre button (OK) in order to enter the selected menu area.

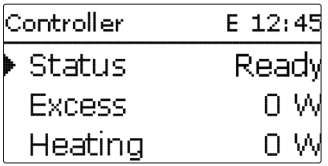
If no button is pressed for 1 min, the display illumination switches off. After 3 more minutes, the controller switches to the status menu.

## 4.5 Status




In the status menu of the controller, controller status messages as well as measurement / balance values and messages can be found.

### 4.5.1 Controller



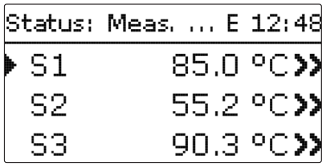

In the **Status / Controller** menu, all current controller values (power values, temperatures, etc.) are indicated.
The power supplied to the electric immersion heater by the power unit is displayed as **Heating**.
The **Excess** is the remaining power which is fed into the grid. Negative values mean that mains current is used.

| Display | Description |
|---|---|
| Status | Function status (see below) |
| Booster | Function status booster (internal backup heating) |
| DCIn | Input voltage (10 V IN variant) |
| Heating | Heating power |
| Excess | Excess power |
| Inv. limit | Power limitation inverter active / inactive |
| Store | Temperature store (S1) |
| Sensor 2 | Temperature sensor 2 (S2) |
| Sensor 3 | Temperature sensor 3 (S3) |
| RPM | Fan speed |

In the following table, the possible function statuses are listed and explained.

| Display | Description |
|---|---|
| Ready | Heating not in operation, excess too low |
| Heating | Heating in operation (excess) |
| Backup heating | Heating in operation (backup heating) |
| Max. temp. | Maximum temperature exceeded (immersion heater) |
| Error | Sensor defective (immersion heater) |
| SR off | Remote access off |
| SR Plus | Remote access backup heating |
| SR on | Remote access on |

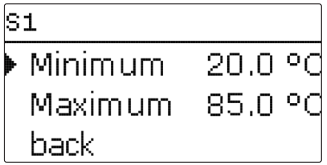
### 4.5.2 Measured / Balance values




In the **Status / Meas. / Balance values** menu, all current measurement values as well as a range of balance values are displayed.

| Display | Description |
|---|---|
| S1 … S5 | Temperature S1 … S5 (S4, S5: temperature in the controller) |
| DIn1, DIn2 | Digital switching inputs (Smart Remote) |
| DO1, DO2 | Digital switching outputs (inverter) |
| Immers. heater | Operating status of the power stage of the electric heating |
| Heating h | Operating hours of the electric heater |
| Heating Wh | Heating energy in Wh |
| Backup heating h | Operating hours of the internal backup heating |
| Backup heating Wh | Backup heating energy in Wh |
| Excess Wh | Excess energy in Wh |

When a line with a measurement value is selected, another submenu will open.




If, for example, **S1** is selected, a submenu indicating the minimum and maximum values will open.

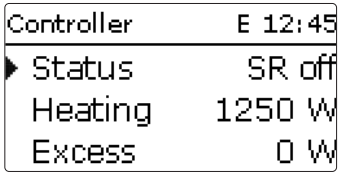
### 4.5.3 Messages


In the **Status / Messages** menu, error and warning messages are indicated.
During normal operation, the message **Everything OK** is indicated.
A message consists of a short text about the fault condition.

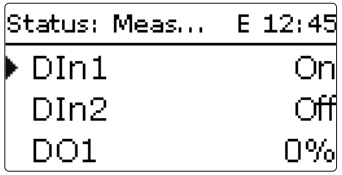
| Display | Description |
|---|---|
| !Sensor module | Bus communication interrupted (sensor module) |
| !Sensor fault | Sensor defective |
| !Fan | Fan defective |

In case of an error, the control LED starts flashing red and a message is indicated in the status display. In case of a sensor or fan error, the system will switch off and a message will appear on the display.
If the bus communication is defective, the control LED is red.
After the error has been removed, the error message will disappear.

## 4.6 Smart Remote




The **Smart Remote** function is used for remote access to the controller via a 4-state signal.




DIn1 and DIn2 of the controller are digital switching inputs. The switching states are **On** (contact closed) and **Off** (contact open).

| Mode | DIn1 | DIn2 |
|---|---|---|
| SR off | On | Off |
| Normal operation | Off | Off |
| SR Plus | Off | On |
| SR on | On | On |

The **Smart Remote** function is automatically deactivated when the power control is carried out via the sensor module variant.

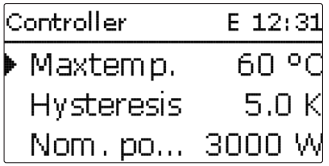
In the **SR off** operating status, the electric heating is switched off regardless of the excess measured. The internal backup heating and the booster are blocked.

During **normal operation**, the automatic control is carried out depending on the excess measured and with optional internal backup heating.

In the **SR Plus** operating status, the electric heating is operated at nominal power regardless of the timer and the excess measured. Operation is stopped when the switch-off temperature of the internal backup heating is reached at the allocated sensor. Without internal backup heating, operation is stopped when the store maximum temperature is reached at S1.

In the **SR on** operating status, the electric heating is operated at nominal power regardless of the timer and the excess measured until the store maximum temperature is reached at S1.

## 4.7 Controller menu



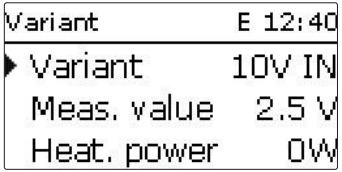

In this menu, all adjustments for the *DeltaTherm*® PV can be made.
The maximum temperature and the nominal power have already been adjusted during commissioning.

| Adjustment channel | Description | Adjustment range / selection | Factory setting |
|---|---|---|---|
| Max. temp. | Maximum temperature | 35 … 90 °C | 60 °C |
| Hysteresis | Hysteresis maximum temperature | 1 … 10 K | 5 K |
| Nom. power | Nominal power | 500 … 3000 W | 3000 W |
| Reserve | Reserve which is not used for heating | 0 … 9000 W | 100 W |

If the temperature at store sensor S1 falls below the value [Max. temp. - Hysteresis], the electric heating is enabled. If the store temperature reaches the adjusted maximum temperature, the store will no longer be loaded in order to avoid damage caused by overheating.

The **Reserve** is an adjustable excess power which is fed into the grid and not used for heating. The reserve can be used, e.g. in large PV systems, in order to start the heating at a later point in time. This reduces power peaks at noon.

## 4.8 Variant menu



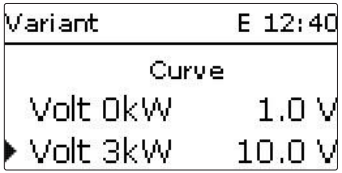

In this menu, the characteristic curve for the power control is adjusted. The source for the power control of the electric immersion heater has already been adjusted in the commissioning menu.

**Note**
The **Variant** menu is only available when the variant **10V IN** has been selected in the commissioning menu.

| Adjustment channel / Indication | Description | Adjustment range / Indication range / Selection | Factory setting |
|---|---|---|---|
| Variant | Power control source indication | - | 10V IN |
| Meas. value | Signal indication | 0.0 … 10.0 V | - |
| Heat. pow. | Heat energy indication | 1 … 3000 W | - |
| Curve | Curve submenu | - | - |
| Volt 0kW | Lower voltage | 0.0 … 9.0 V | 1.0 V |
| Volt 3kW | Upper voltage | 1.0 … 10.0 V | 10.0 V |

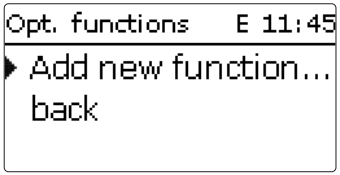
### 10V IN

With the **10V IN** variant, the power control takes place via an external 0-10 V signal. The signal is issued at the terminals 17 and 19.




The parameters **Volt 0kW** and **Volt 3kW** can be used for adjusting the power control curve.

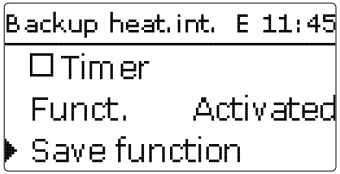
**Note**
Since there is no communication with the sensor module in this variant, no excess is measured and balanced.



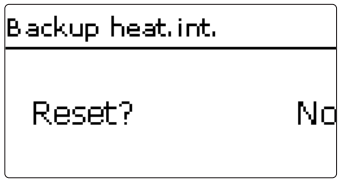

In this menu, optional functions can be selected and adjusted for the arrangement.
By selecting **Add new function...**, different pre-programmed functions can be selected.


When a function is selected, a submenu opens in which all adjustments required can be made.

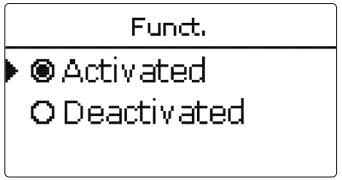
When a function has been adjusted and saved, it will appear in the **Opt. functions** menu above the menu item **Add new function**.
This allows an easy overview of functions already activated.




At the end of each optional function submenu, the menu items **Funct.** and **Save function** are available.
In order to save a function, select **Save function** and confirm the security enquiry by selecting **Yes**. In functions already saved, the menu item **Delete function** will appear instead.
In order to delete a function already saved, select **Delete function** and confirm the security enquiry by selecting **Yes**.

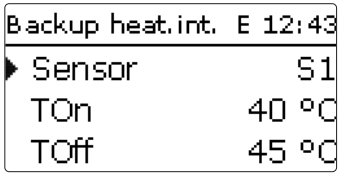



If the menu item **Delete function** is confirmed by pressing the right button (✓), a security enquiry appears. The left and the right button can be used for changing between **Yes** and **No**. If **Yes** has been selected and confirmed by pressing the right button (✓), the function is deleted and available under **Add new function** again.




With the menu item **Funct.**, an optional function already saved can be temporarily deactivated or re-activated respectively. In this case, all adjustments remain stored, the allocated relays remain occupied and cannot be allocated to another function.

**Internal backup heating**



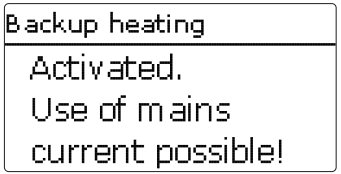

**Opt. functions /Add new function/ Backup heat. int.**

| Adjustment channel | Description | Adjustment range / selection | Factory setting |
|---|---|---|---|
| Sensor | Reference sensor | S1 … S3 | S1 |
| TOn | Switch-on temperature | 20 … 74 °C | 40 °C |
| TOff | Switch-off temperature | 21 … 75 °C | 45 °C |
| Timer | Timer option | Yes, No | No |
| Funct. | Activation / Deactivation | Activated, Deactivated | Activated |
| Save function / Delete function | Save / Delete function | - | - |

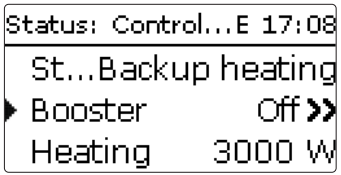
The **internal backup heating** function is used for operating the electric heating for backup heating with current from the mains. To do so, the power unit is switched on. The switch-on and switch-off temperatures **TOn** and **TOff** are used as reference parameters.

**If** the temperature falls below the adjusted threshold **TOn**, the electric immersion heater and the relay are switched on. They switch off, if the temperature exceeds **TOff**.

The reference sensor can be adjusted. When the maximum temperature is exceeded at S1, backup heating is interrupted. When the function is saved, the message **Use of mains current possible** appears.




The message also appears when the booster is activated. In the status menu, a **Booster** is offered that can be used for backup heating up to **TOff** outside the time frames.




The internal backup heating is balanced seperately.

**Note:**
For information on timer adjustment see page 15.

**Inverter**

This function is used for operating the inverter at reduced power, if the excess exceeds a threshold. The operation is specified by a switching signal.

**Opt. functions / Add new function / Inverter**

| Adjustment channel | Description | Adjustment range / selection | Factory setting |
|---|---|---|---|
| Power | Nominal power of the inverter | 0.0 … 100.0 kW | 5.0 kW |
| Limitation | Threshold limit | 0 … 100 % | 70 % |
| Monitoring | Monitoring period | 1 … 60 min | 10 min |
| Funct. | Activation / Deactivation | Activated, Deactivated | Activated |
| Save function / Delete function | Save / Delete function | - | - |

The parameter **Power** can be used for adjusting the nominal power of the inverter. The threshold is calculated from the adjustable **limitation** in relation to the power of the inverter.

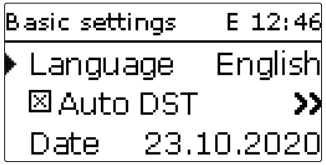
Threshold = power x limitation

If the average threshold value is continuously exceeded during the adjustable **monitoring period**, the signal is switched via the digital switching output DO1. If the value falls below the average value during the monitoring time, DO1 switches off.

**Note:**
This function is only available, if the variant **Sensor module** has been selected in the **Variant** menu.

The control unit reduces the feed-in power of the PV system into the public grid. If the store is fully loaded (Max. temp.), the full inverter power is available for grid feed-in. With this function this power can be limited.

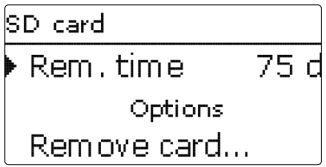
## 4.10 Basic settings




In the Basic settings menu, all basic parameters for the controller can be adjusted. Normally, these settings have been made during commissioning. They can be subsequently changed in this menu.

| Adjustment channel | Description | Adjustment range / selection | Factory setting |
|---|---|---|---|
| Language | Selection of the menu language | Deutsch, English, Français, Español, Italiano | Deutsch |
| Auto DST | Daylight savings time selection | Yes, No | Yes |
| Date | Adjustment of the date | 01.01.2001 … 31.12.2099 | 01.01.2017 |
| Time | Adjustment of the current time | 00:00 … 23:59 | - |
| Reset | back to factory setting | Yes, No | No |

## 4.11 MicroSD card




**SD card**

| Adjustment channel | Description | Adjustment range / selection | Factory setting |
|---|---|---|---|
| Rem. time | Remaining logging time | - | - |
| Options | | | |
| Remove card... | Safely remove card | - | - |
| Save adjustments | Save adjustments | - | - |
| Load adjustments | Load adjustments | - | - |
| Logging int. | Interval for data logging | 00:01 … 20:00 (mm:ss) | 01:00 |
| Logging type | Logging type | Cyclic, Linear | Linear |
| Update | Firmware update | Yes, No | No |

The controller is equipped with a MicroSD card slot for MicroSD memory cards. With a MicroSD card, the following functions can be carried out:

- Logging measurement and balance values. After the transfer to a computer, the values can be opened and visualised, e.g. in a spreadsheet.
- Store adjustments and parameterisations on the MicroSD card and, if necessary, retrieve them from there.
- Running firmware updates on the controller.

1. To safely remove the MicroSD card, always select the menu item **Remove card...** before removing the card.
2. Wait until **Remove card** is displayed.

**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! To do so, touch a grounded surface such as a radiator or tap!**

**Note:**
The MicroSD card slot will only be accessible after the housing is opened.

In order to insert or remove the SD card, proceed as follows:

1. Disconnect the device from the power supply.
2. Unscrew the screw from the cover and remove it along with the cover from the housing.
3. Insert the MicroSD card into the slot or remove the MicroSD card from the slot, respectively.
4. Put the cover on the housing.
5. Attach with the fastening screw.
6. Establish the power supply.

**Running firmware updates**

When a MicroSD card with a firmware update is inserted, the **menu item Update appears**.

➔ In order to run an update, select **Yes** and confirm with the centre button (OK).

The update will run automatically. The indication **Please wait...** and a progress bar will appear on the display. When the update has been completed, the controller will automatically reboot and run a short initialisation phase.

➔ To skip the update, select **No**.

**Note:**
The controller will only recognise a firmware update file if it is stored in a folder named **PVE** on the first level of the MicroSD card.
➔ Create a folder named **PVE** on the SD card and extract the downloaded ZIP file into this folder.

**Starting the logging**

➔ Adjust the desired logging type and interval.

Logging will start immediately.

**Completing the logging process**

➔ In order to stop the logging, remove the MicroSD card from the device. To do so, follow the instructions described above.

When **Linear** is adjusted in the logging type adjustment channel, data logging will stop if the capacity limit is reached. The message **Memory capacity** will be displayed.

If **Cyclic** is adjusted, the oldest data logged onto the SD card will be overwritten as soon as the capacity limit is reached.

**Note:**
Because of the increasing size of the data packets, the remaining logging time does not decrease linearly. The data packet size can increase, e.g. with the increasing operating hours value.

**Storing controller adjustments**

➔ To store the controller adjustments on the MicroSD card, select the menu item **Save adjustments**.

While the adjustments are being stored, first **Please wait...**, then **Done** will be indicated on the display. The controller adjustments are stored as a .SET file on the MicroSD card.

**Loading controller adjustments**

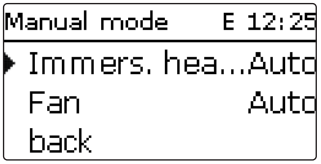
➔ To load controller adjustments from a MicroSD card, select the menu item **Load adjustments**.

The File selection window will appear.

➔ Select the desired .SET file.

While the adjustments are being loaded, first **Please wait...**, then **Done** will be indicated on the display.

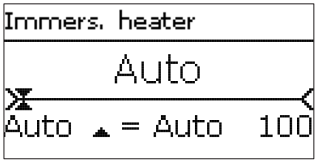
## 4.12 Manual mode




**Manual mode**

| Adjustment channel | Description | Adjustment range / selection | Factory setting |
|---|---|---|---|
| Immers. heater | Manual mode selection for the power unit (electric immersion heater), modulating | Auto, 0 … 100 % (in steps of 10 %) | Auto |
| Fan | Manual mode selection for the fan | On, Auto, Off | Auto |

In the **Manual mode** menu, the operating mode of the electric immersion heater can be adjusted.




**ATTENTION!**

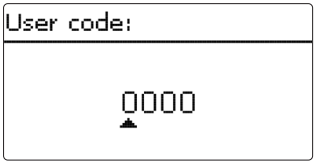
**Damage through overheating!**
The manual mode > 0 % of the electric immersion heater in a system electrically connected, but not hydraulically filled can lead to damage caused by overheating!
➔ **Make sure the hydraulic system is filled and ready for operation.**

An operating mode can be selected for the power unit (electric immersion heater).

The following options are available:
Auto = Power unit is in automatic mode
0% = Power unit is switched off
100% = Power unit is switched on at 100%
The power of the modulating stage can be set to the manual mode in steps of 10 %.

**Note:**
After service and maintenance work, the relay mode must be set back to **Auto**. Normal operation is not possible in manual mode.

### 4.13 User code




The access to some adjustment values can be restricted via a user code (customer).
1. Installer **0262** (Factory setting)
All menus and adjustment values are shown and all values can be altered.

If the installer user code is active, an **E** is displayed next to the clock time.

2. Customer **0000**
The installer level is not shown, adjustment values can be changed partly.

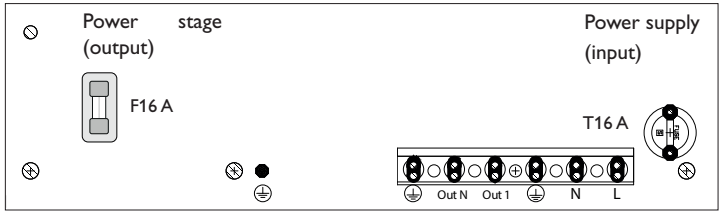
For safety reasons, the user code should generally be set to the customer code before the controller is handed to the customer!

➔ In order to restrict the access, enter 0000 in the **User code** menu item.

## 5 Troubleshooting

If a malfunction occurs, a message will appear on the display of the controller (see page 21).

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




Controller with power unit

The controller with power unit is protected by two fuses (16 A). The fuse holders become accessible after the cover is removed. To replace the fuse (T16A), unfasten the fuse holder using a screw driver and pull it from the base.
To replace the fuse (F16A), pull the fuse holder from the base.

The **error** LED of the sensor module is flashing red.

Operating control LED of the controller is permanently red?

- no
- yes

Is the message **!Sensor module** indicated in the **Status / Messages** menu?

- no
- yes

Is **DCIn** instead of **Excess** indicated in the status menu?

- yes

Carry out a reset and adjust the parameter **Variant** to **Sensor module**.

Check the bus cable from the controller to the sensor module / establish the connection.

The operating control LED flashes red and an error is indicated in the status menu.

Is the message **!Sensor fault** indicated in the **Status / Messages** menu?

- no
- yes

Is the message **!Fan** indicated in the **Status / Messages** menu?

- yes

Check fan (connection); replace it, if necessary.

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

Short circuit or line break. Disconnected temperature sensors can be checked with an ohmmeter. Please check if the resistance values correspond with the table.

| °C | Ω Pt1000 | °C | Ω Pt1000 |
|---|---|---|---|
| -10 | 961 | 55 | 1213 |
| -5 | 980 | 60 | 1232 |
| 0 | 1000 | 65 | 1252 |
| 5 | 1019 | 70 | 1271 |
| 10 | 1039 | 75 | 1290 |
| 15 | 1058 | 80 | 1309 |
| 20 | 1078 | 85 | 1328 |
| 25 | 1097 | 90 | 1347 |
| 30 | 1117 | 95 | 1366 |
| 35 | 1136 | 100 | 1385 |
| 40 | 1155 | 105 | 1404 |
| 45 | 1175 | 110 | 1423 |
| 50 | 1194 | 115 | 1442 |

## Operating control LED is permanently red.

Is the message **!Sensor module** indicated in the **Status / Messages** menu?

yes

The **error** LED of the sensor module is flashing red?

no

The **operating** LED of the sensor module is flashing red?

no

Check / establish power supply of the sensor module.

yes

o.k.

yes

Check the bus cable from the controller to the sensor module / establish the connection.

## The display is permanently off.

Press the any button. Display illuminated?

yes

Controller has been in standby, everything OK

no

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

yes

Establish the power supply.

no

The 16 A fuse of the power supply (right) is defective. The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.

## Status display **Excess** fluctuates quickly between positive and negative values.

The 16 A fuse of the power stage (left) is defective. The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.

## Heating power too low or no heating power available.

Is **Max. temp.** indicated in the status menu?

yes

Is the store maximum temperature exceeded?

no

A temperature threshold has been exceeded in the controller / cooling element. As soon as the device has cooled down, it will heat with the heating power available.

no

Is **Power red.** indicated in the status menu?

yes

Is a fan speed < 2800 indicated in the **Controller** status menu?

yes

Check / clean fan.

no

A temperature threshold has been exceeded in the controller / cooling element. As soon as the device has cooled down, it will heat with the heating power available.

## 6 Accessories

**Electric immersion heater**

For mounting into the store.

**DL3 Datalogger**

For visualisation via VBus.net, incl. SD card, mains adapter, network and VBus® cable.

**DL2 Datalogger**

For visualisation via VBus.net, incl. SD card and network cable, mains adapter and VBus® cable pre-connected.

**KM2 Communication module**

Communication module incl. service CD, network cable and mains adapter, VBus® cable pre-connected.

**VBus.net**

The www.VBus.net visualisation portal – your system data displayed as live data, diagrams and tables.

# 7 Index

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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.

**Imprint**