DeltaTherm® PHM

RESOL®

Power-to-Heat manager

Manual for the
specialised craftsman

Installation
Operation
Functions and options
Troubleshooting

Heat pump   12:15
▶ Status   Operation
  Power   4000 W
  Operation 33826 h

DeltaTherm® PHM

11212863

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.

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!

Instructions

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

Information about the products

Proper usage

The controller is designed for using excess PV current for the control of up to 3 electric immersion heaters (via auxiliary relays) as well as for the control of a heat pump and / or a wallbox in compliance with the technical data specified 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.

Subject to technical change. Errors excepted.

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.

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.

➔ 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.
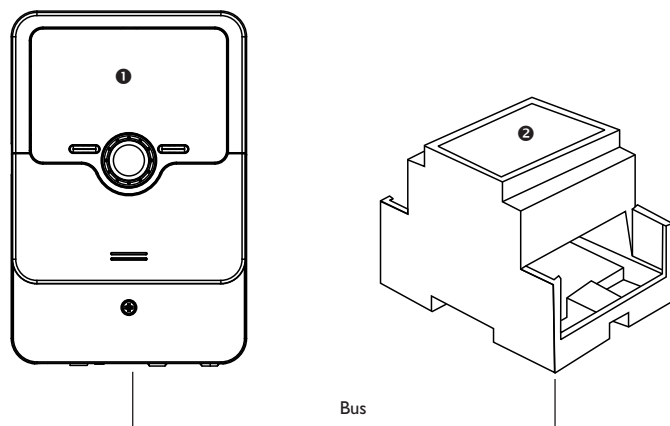
DeltaTherm® PHM

The **DeltaTherm®** PHM is the ideal solution for using excess PV current for the control of different loads. Heat pumps, electric immersion heaters, and charging stations for electric vehicles can be controlled as needed. All the while household power has absolute priority.

Each load can also be supplied with mains current on a time-controlled basis.

Furthermore, the **DeltaTherm®** PHM measures the electric loads at the energy meter which can be visualised via VBus.net.

Included with the DeltaTherm® PHM

❶ Controller (**DeltaTherm®** PHM)
❷ Sensor module (**DeltaTherm®** E sensor) and current sensors

Bus

Contents

1 Overview

- **Increase in self-consumption**
- **Reduction of heating costs**
- **Control of a heat pump**
- **Control of a wallbox**
- **Control of up to 3 electric immersion heaters (via auxiliary relays)**
- **Household current priority**
- **Can be used with all PV systems**
- **Time-controlled backup heating (with mains current)**

Technical data controller

Inputs: 5 Pt1000 temperature sensors (convertible to switch)

Outputs: 3 electromechanical relays, 2 potential-free extra-low voltage relays and 1 0-10 V output (convertible to PWM)

Switching capacity:
1 (1) A 240 V~ (electromechanical relay)
1 (1) A 30 V⎓ (potential-free relay)

Total switching capacity: 3 A 240 V~

Power supply: 100 – 240 V~ (50 – 60 Hz)

Supply connection: type X attachment

Standby: 1.22 W

Mode of operation: type 1.B.C action

Rated impulse voltage: 2.5 kV

Data interface: VBus®, MicroSD card slot

VBus® current supply: 35 mA

Functions: measurement and balancing of the current flow at the energy meter, control of a heat pump, control of up to 3 electric loads (e.g. immersion heaters), control of a wallbox

Housing: plastic, PC-ABS and PMMA

Mounting: wall mounting, also suitable for mounting into patch panels

Indication / Display: full graphic display, control LED (Lightwheel®) and background illumination

Operation: 4 push buttons and 1 adjustment dial (Lightwheel®)

Ingress protection: IP 20 / EN 60529

Protection class: I

Ambient temperature: 0 … 40 °C

Degree of pollution: 2

Dimensions: 110 x 166 x 47 mm

Technical data sensor module

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

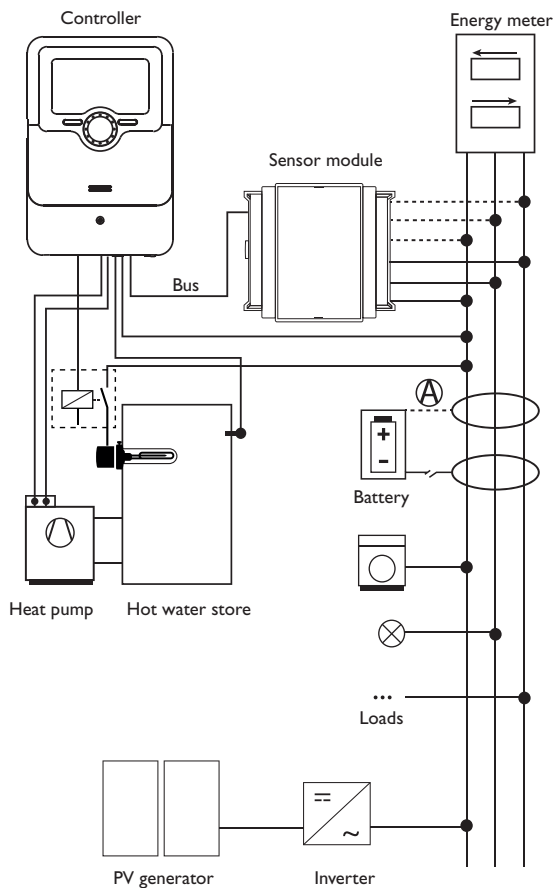**Ingress protection:** IP 20 / EN 60529

Protection class: II

Ambient temperature: 0 … 40 °C

Degree of pollution: 2

Dimensions: 71 x 90 x 58 mm

2   System overview

Controller

Energy meter

Sensor module

Bus

Battery

Heat pump   Hot water store

Loads

PV generator   Inverter

Sensors			Relay		
S1	E.g. temperature immersion heater 1	1 / GND	R1	System dependent	R1 / N / PE
S2	E.g. temperature immersion heater 2	2 / GND	R2	System dependent	R2 / N / PE
S3	E.g. temperature immersion heater 3	3 / GND	R3	System dependent	R3 / N / PE
S4	Switching input SR off	4 / GND	R4	System dependent	R4 / N / PE
S5	Free / switching input	5 / GND	R5	System dependent	R5 / N / PE

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

The sensor module measures the current flow directly at the energy meter. If a sufficiently high power is detected, this PV current can be used for controlling up to 3 electric immersion heaters and for the control of a heat pump and / or a wallbox. Optionally, all loads can also be operated time-controlled with mains current. The immersion heaters can additionally be operated temperature-controlled with mains current.

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

1. Direct use
2. Charging the battery
3. Loading the hot water store
4. Feed-in into the grid

For this purpose, the sensor modules and the battery have to be arranged as shown in the figure. 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 enables remote access to the controller, e.g. in order to switch it off when the battery is in use. If the switching input S4 is closed, all loads switch off regardless of the excess measured.

Dimensions and minimum distances

Upper fastening

130

Lower fastening
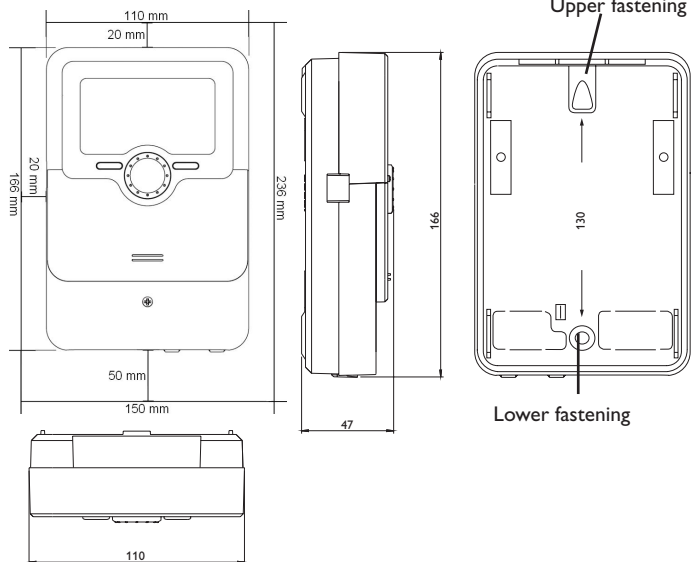
3   Installation

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 device must only be located in dry 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:

➔ 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.

1

2

3

4

5

6
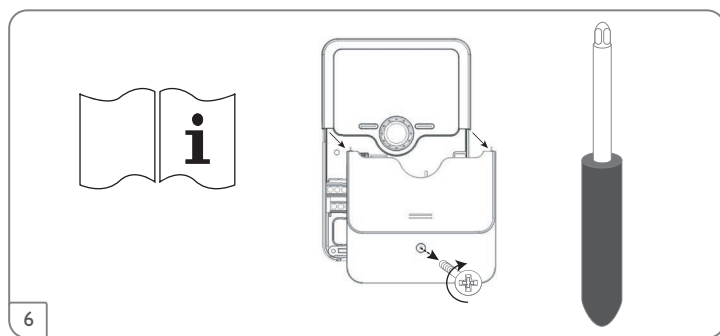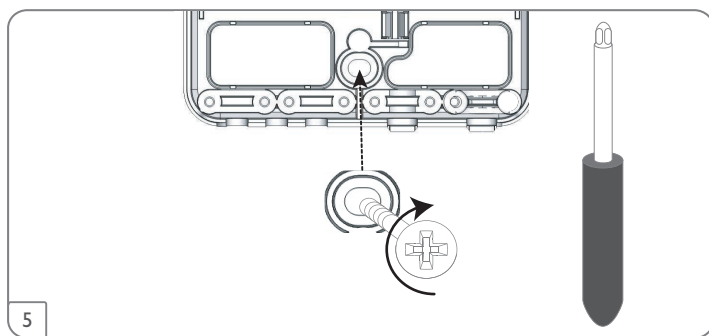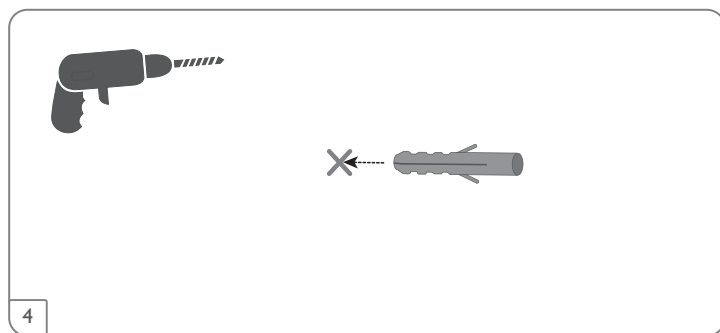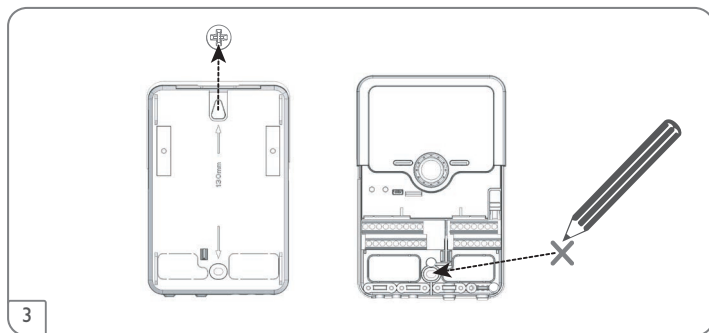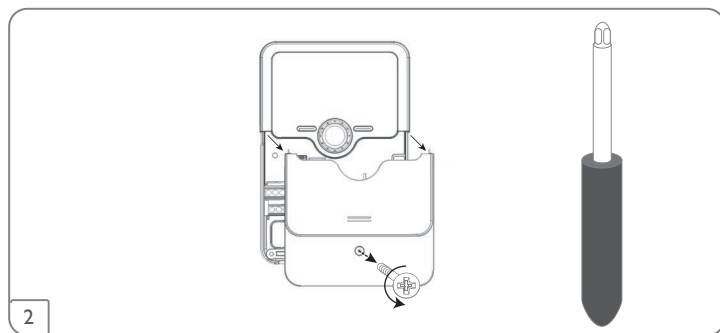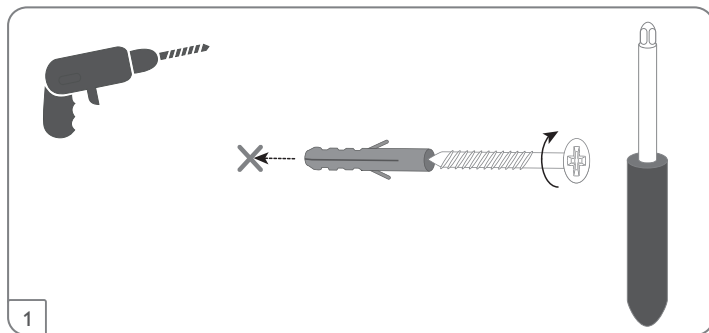
Step-by-step installation:

ATTENTION!	**Damage through overheating!**
☞	Commissioning in a hydraulic system electrically connected, but not filled can lead to damage caused by overheating! ➔ **Make sure the hydraulic system is filled and ready for operation.**

➔ 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.

➔ Connect the current sensors and the conductors of the sensor module in phase directly at the energy meter (see page 18).

➔ Connect the sensor module with the controller by means of the VBus® (see page 18 and page 18).

➔ Establish the power supply of the controller (see page 18).

➔ Run the commissioning menu (see page 19).

➔ Carry out the desired adjustments in the **Load** menu (see page 23).

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!**

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

ℹ	**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. If the mains cable is damaged, it must be replaced by a special connection cable which is available from the manufacturer or its customer service.

Do not use the device if it is visibly damaged!

Attach flexible cables to the housing with the enclosed strain relief and the corresponding screws.

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 controller is equipped with 5 relays in total to which loads can be connected:

• Relays 1…3 are electromechanical relays:
• Conductor R1…R3
• Neutral conductor N
• Protective earth conductor ⏚
• Relays 4 (terminals 7/12) and 5 (terminals 8/13) are potential-free extra-low voltage relays.

Depending on the product version, mains cables and sensor cables are already connected to the device. If that is not the case, please proceed as follows:

Connect the **temperature sensors** to the terminals S1 to S3 and ⏚ (either polarity).

Terminals **S4** and **S5** are switching inputs.

The terminal marked **PWM A/0-10 V** (6) is a control output (convertible).

The terminals marked **SM** (9/14) are the bus input of the sensor module.

The **mains connection** is at the terminals:

Neutral conductor   N
Conductor   L
Protective earth conductor   ⏚

Note

As a load usually has a high power consumption, it must be controlled by means of an auxiliary relay, see page 31.

3.2.1 Loads with high power consumption

Loads whose power consumption exceeds the switching capacity of the relays (e.g. immersion heater), have to be supplied via auxiliary relays with a flyback diode (see accessories page 31). Relays 1 … 3 can be used for switching the auxiliary relays.
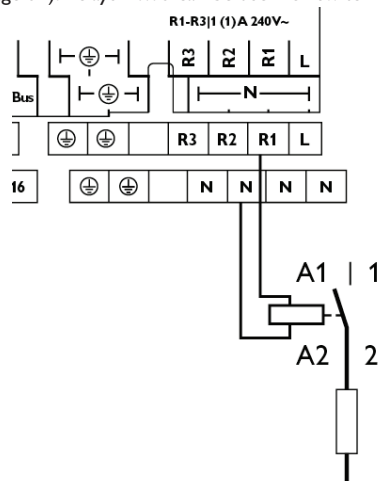
3.2.2 Loads with control input

Relay 1 or 2 can be used for activating a load with control input (e.g. heat pump). This allows the operating modes switch-on recommendation (1 control input) or definite start-up command (2 control inputs) to be triggered at the load.

The 0-10 V/PWM output can be configured and also be assigned as a control signal.
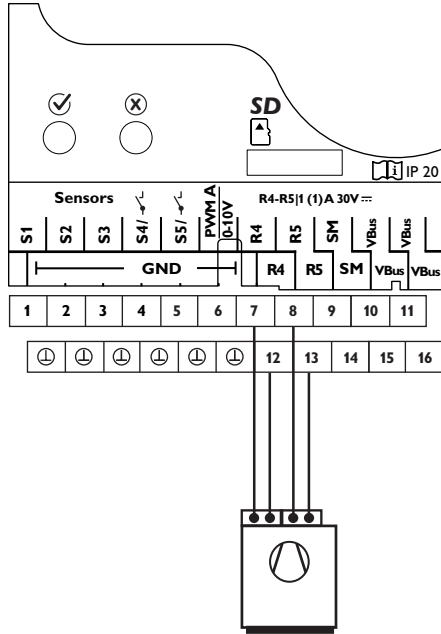
3.2.3 Loads with key switch

Activation of loads with contacts for a key switch (e.g. wallbox) is possible by bridging the contacts with the potential-free extra-low voltage relay R4 or R5. In order to ensure manual activation of the load independent of the controller, the key switch must be installed in parallel to the load.
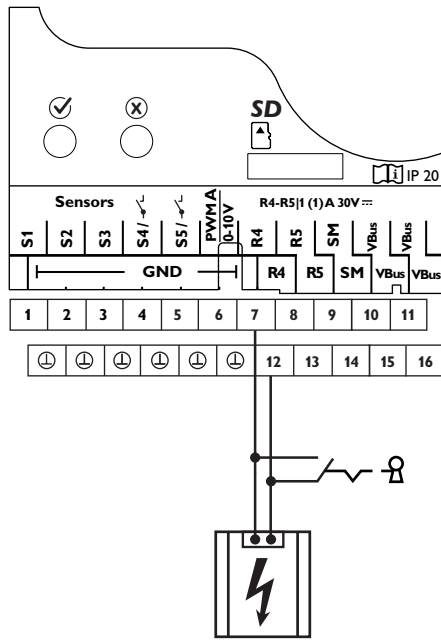
3.3 Data communication / Bus

The controller is equipped with a **VBus**® for data transfer and energy supply to external modules. The connection is to be carried out at the terminals marked **VBus** (10 / 15 and 11 / 16) (either polarity).

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

• DL2 / DL3 Datalogger
• KM2 Communication module
• VBus® / USB or VBus® / LAN interface adapters

Different solutions for visualisation and remote parameterisation are available on the website www.resol.com. On the website, firmware updates are also available.

> **i** **Note**
> For more information about accessories see page 31.

> **i** **Note**
> For more details about the commissioning procedure see page 19.

3.4 Sensor module

Bus cable to the **DeltaTherm**® PHM

Power supply:

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

Current sensors:

Current sensor CTL1
Current sensor CTL2
Current sensor CTL3
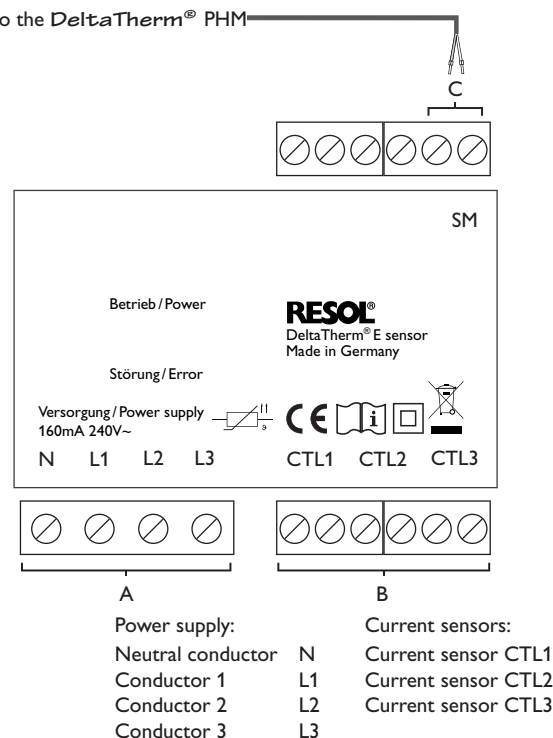
C
Data communication / Bus

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** (9 / 14).

The bus cable can be extended with a two-wire cable. 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 mm^2 and the cable can be extended up to 50 m.

en

Three-phase connection

➜ 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.

➜ 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.

Single-phase connection

➜ 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.

➜ Make sure that no load is installed between the energy meter and the current sensor.

➜ Short-circuit the connections of CTL2 as well as those of CTL3. The other current sensors are not required.

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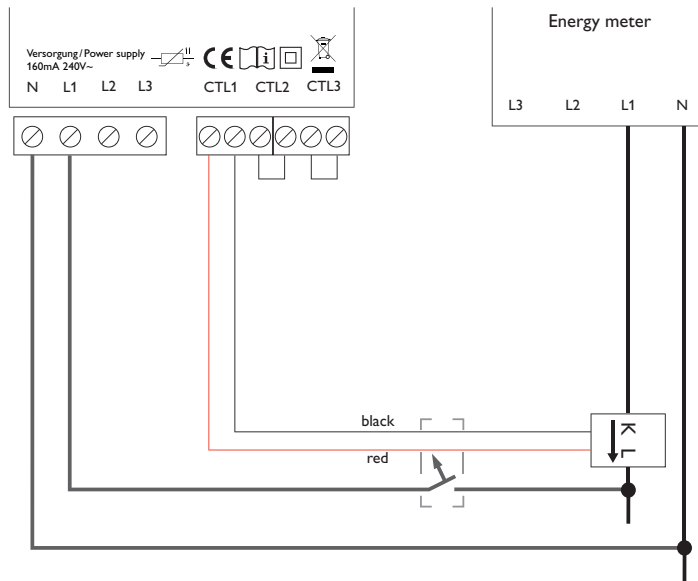
Note
The phase has to be protected by means of a single-phase 16 A circuit-breaker (not included with the device).

3.5   MicroSD 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.
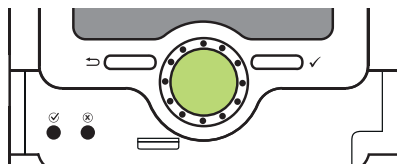
MicroSD card slot

A MicroSD card is not included, but can be purchased from the manufacturer.

> **i** **Note**
> For more information about using a MicroSD card, see page 27.

4   Operation and function of the controller

4.1   Buttons and adjustment dial
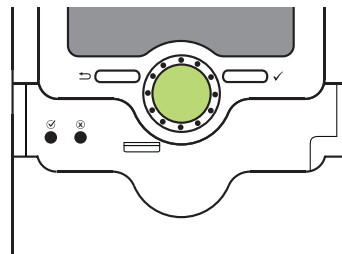
The controller is operated via 2 buttons and 1 adjustment dial (Lightwheel®) below the display:

Left button (⬅) - escape button for changing into the previous menu
Right button (✓) - confirming / selecting
Lightwheel®   - scrolling upwards / scrolling downwards, increasing adjustment values / reducing adjustment values

4.2   Microbuttons for the parameterisation mode

The controller is equipped with 2 microbuttons underneath the slidable housing cover, the slider.

Microbutton ☑: If the microbutton ☑ is pressed for approx. 3 s, adjustments made are saved.

Microbutton ☒: If the microbutton ☒ is pressed for approx. 3 s, adjustments made are discarded.

4.3 Control lamp

The controller is equipped with a multicolour LED in the centre of the Lightwheel®, indicating the following states:

Colour	Permanently shown	Flashing
Green	Everything OK	Manual mode: at least one relay in manual operation
Red		Sensor line break, sensor short circuit, parameterisation mode active
Red / Green		Bus defective / no communication with the sensor module

4.4 Parameterisation mode

After the installer code is entered (see page 28), the controller changes to the parameterisation mode.

i **Note**
In parameterisation mode, the control process stops and the message **Control stopped – Parameterisation active** is indicated.
The LED in the Lightwheel® flashes red.

➔ In order to carry out adjustments in the menu, press the right button (✔).

The controller changes to the main menu in which adjustments on the installer level can be made.

➔ In order to save the adjustments made, press the microbutton ☑ for approx. 3 s or select the menu item **Save** in the main menu.

➔ In order to cancel the parameterisation process and to discard the adjustments made, press the microbutton ⓧ for approx. 3 s.

The controller will leave the installer level and restart.

```
Main menu      E 11:50
  User code
  Inputs
▶ Save
```

4.5 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.

In order to get from the status menu into the main menu, press the left button (⤺)!

Press any key to reactivate the display illumination. In order to scroll through the menu items, turn the Lightwheel®.

```
Status          E 11:22
           Load
▶ Immers. heater  ≫
  Heat pump       ≫
```

If the symbol ≫ is shown behind a menu item, pressing the right button (✓) 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 turning the Lightwheel®, the upper slide bar can be moved to the left or to the right.

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

```
Relay selec.
▶ R1
  R2
  R3
```

```
TOn
      40 °C
     ╞════╦════╡
  20       ▲ = 40        45
```
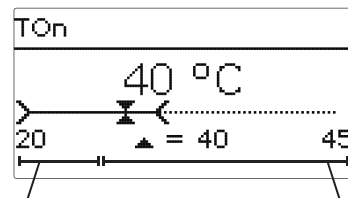
active area   inactive area

When 2 values are locked against each other, they will display a reduced adjustment range depending on the adjustment of the respective other value.

In this case, the active area of the slide bar is shortened, the inactive area is indicated as a dotted line. The indication of the minimum and maximum values will adapt to the reduction.

```
      Priority
   ○ 3
   ○ 2
 ▶ ◉ 1
```

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.

4.6 Adjusting the timer

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

```
▶ Day selection
  Reset
  back
```

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.

```
Day selection
  ☐ Mon-Sun
  ☐ Mon-Fri
  ☐ Sat-Sun
  ☒ Mon
  ☐ Tue
  ☒ Wed
  ☐ Thu
  ☐ Fri
  ☐ Sat
  ☒ Sun
▶ Continue
```

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:

➔ Select **New time frame**.

```
Mon,Wed,Sun
  00  06  12  18
▶ New time frame
  Copy from
```

```
Mon,Wed,Sun
▶ Start          --:--
  Stop           --:--
  back
```

➔ Adjust **Start** and **Stop** for the desired time frame. The time frames can be adjusted in steps of 5 min.

```
Start

  06:00
    ▲
```

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

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

6 time frames can be adjusted per day or combination.

➔ Press the left button (⬅) in order to get back to the day selection.

```
Stop

  08:30
    ▲
```

```
Mon,Wed,Sun
  Start          06:00
  Stop           08:30
▶ Save
```

```
Save

  Save?           Yes
```

```
Mon,Wed,Sun
  00  06  12  18
▶ New time frame
  Copy from
```

```
Mon,Wed,Sun
  00  06  12  18
▶ New time frame
  Copy from
```

```
  Day selection
▶ Mon,Wed,Sun
  Reset
```

Copying a time frame:

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

➔ 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.

➔ 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.

```
Tue
  ┌─────────────────────┐
  00  06  12  18
New time frame
▶ Copy from
```

```
  ┌─────────────────────┐
  00  06  12  18
▶ Mon,Wed,Sun
```

```
Tue
  ┌─────────────────────┐
  00  06  12  18
New time frame
▶ Copy from
```

```
Day selection
▶ Mon-Wed,Sun
Reset
```

```
Day selection
Mon,Wed,Sun
▶ Tue
```
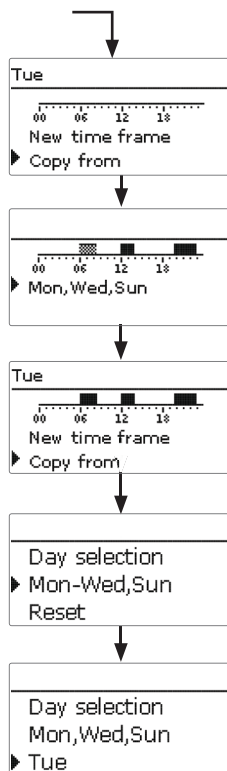
Changing a time frame:

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

➔ Select the time frame to be changed.
➔ Make the desired change.

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

```
Mon,Wed,Sun
  00  06  12  18
▶ 06:00-08:30
  12:10-13:50
```

```
Start

   07:00
```

```
Mon,Wed,Sun
  Start        07:00
  Stop         08:30
▶ Save
```
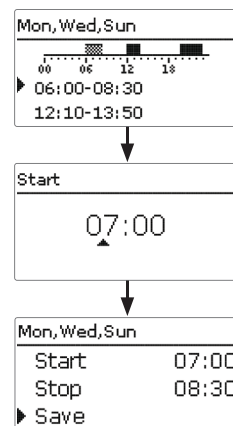
Removing a time frame:

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

➔ Select the time frame that is to be deleted.

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

```
Mon,Wed,Sun
  00  06  12  18
▶ 07:00-08:30
  12:10-13:50
```

```
Mon,Wed,Sun
  Stop         08:30
  Save
▶ Delete
```

```
Mon,Wed,Sun
  00  06  12  18
▶ 12:10-13:50
  19:45-22:50
```
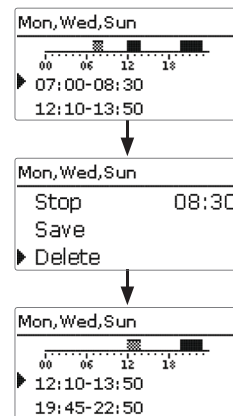
Resetting the timer:

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

➔ Select the desired day or combination.

```
Day selection
▶ Mon,Wed,Sun
  Tue
```

```
Mon,Wed,Sun        ▲
                   ▼
 ┄┄┄┄┄█┄┄┄█┄┄┄┄
 00   06  12  18
Copy from
▶ Reset
```

```
Reset

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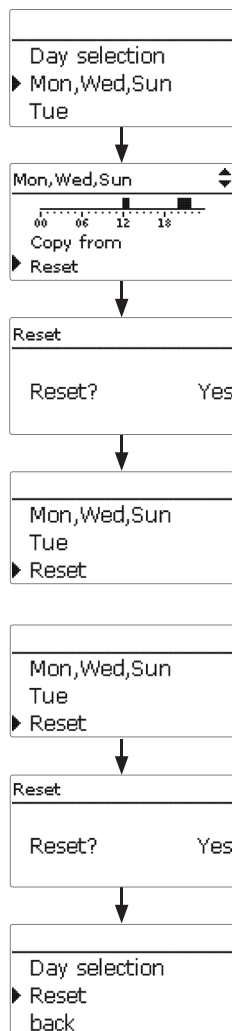
➔ Select **Reset** and confirm the security enquiry with **Yes**.

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

```
Mon,Wed,Sun
Tue
▶ Reset
```

In order to reset the whole timer, proceed as follows:
➔ Select **Reset** and confirm the security enquiry with **Yes**.

```
Mon,Wed,Sun
Tue
▶ Reset
```

```
Reset

Reset?          Yes
```

All adjustments made for the timer are deleted.

```
Day selection
▶ Reset
  back
```

4.7   Menu structure

Main menu
Status
Load
Basic settings
SD card
User code
Inputs

Load
Electric immersion heater
Heat pump
Wallbox

Basic settings
Language
Auto DST
Time
Date
Reserve
Delay
Reset

The menu items and adjustment values selectable are variable depending on adjustments already made. The figure only shows an exemplary excerpt of the complete menu in order to visualise the menu structure.

5   Commissioning

When the system is ready for operation, establish the power supply of the controller.

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

The controller runs an initialisation phase in which the Lightwheel® flashes 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 the Lightwheel® and confirm with the right button (✔). The next channel will appear in the display.

Operation

Adjustment mode

Changing a value

Confirming a value

Next parameter
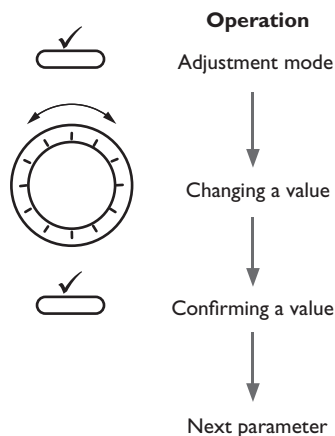
1. Language:

➔ Adjust the desired menu language.

2. Daylight savings time adjustment:

➔ Activate or deactivate the automatic daylight savings time adjustment.

3. Time:

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

4. Date:

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

5. Save adjustments:

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

➔ In order to confirm the security enquiry, press the right button (✔).

➔ In order to get back to the adjustment channels of the commissioning menu, press the left button (⬑).

Language
Deutsch
English
▶ Français

Auto DST
▶ ◉ Yes
○ No

Time
12:01

Date
??.??.2019

Save?
▶ ◉ Yes
○ No

Main menu   E 11:48
Status
▶ Load
Basic settings

6. Activate load:

Up to 5 loads can be activated and adjusted, see chap. 8 on page 23.

```
Load             E 11:48
▶ Add new function
  back
```

7. Completing the commissioning menu:

➔ In order to save the adjustments made, press the microbutton ⊘ for approx. 3 s or select the menu item **Save** in the main menu.

➔ In order to discard the adjustments made, press the microbutton ⊗ for approx. 3 s.

If the adjustments are saved by selecting **Save**, the controller leaves the installer level and restarts, see chap. 4.4 on page 14.

```
Main menu         E 11:50
  User code
  Inputs
▶ Save
```
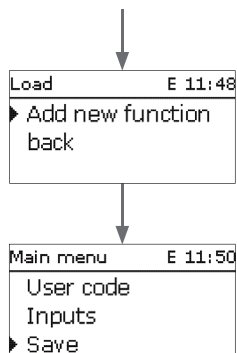
ℹ Note

The adjustments carried out during commissioning can be changed anytime in the corresponding adjustment channel. Additional functions and options can also be activated and adjusted.

6   Main menu

```
Main menu         E 12:01
▶ Status
  Load
  Basic settings
```
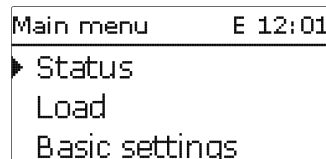
In this menu, different menu areas can be selected.

• Status
• Load
• Basic settings
• SD card
• User code
• Inputs

➔ Select the menu area by means of the Lightwheel®.

➔ Press the right button (✓) 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.

➔ In order to get from the status menu into the main menu, press the left button (⬑)!

7   Status

The status menu indicates status messages of the controller and the loads as well as the measured/balance values and messages.

7.1   Controller

```
Status          E 12:02
      Controller
▶  Status        Ready
   Power           0 W
```

The **Status / Controller** menu indicates status messages based on all loads.
The **Power** is the sum of all switched power values (adjusted values) of the loads for automatic mode or mains operation.
The **Excess** is the remaining power which is fed into the grid. Negative values mean that mains current is used.

Display	Description
Ready	No load in operation, excess too low
Off	No load in operation, at least 1 load ready and outside the timer / 1 immersion heater in Max. temp.
On	At least 1 load in operation (Excess)
Use of mains c.	At least 1 load in mains operation / backup heating
Error	Sensor / sensor module defective
Deactivated	All loads deactivated / no load configured
SR off	Remote access off, all loads off

7.2   Loads

```
Status          E 12:02
        Load
▶  Immers. heater  ≫
   Heat pump       ≫
```

The **Status / Loads** menu indicates all current values of the loads (power, temperatures).

Display	Description
Status	Functional state
Ready	No load in operation, excess too low
Heating / Operation	Load in operation (Excess)
Backup heating / Mains oper.	Load in backup heating / mains operation
Max. temp.	Maximum temperature exceeded (immersion heater)
Error	Sensor defective (immersion heater)
Off	Load outside the timer or remote access off
Power	Heating power / charging power
Store	Store temperature (immersion heaters)
Heating / Operation	Operating hours of the heating / operation
Backup heating / Mains oper.	Operating hours of the backup heating / mains operation

7.3   Measured / Balance values

```
Status: Meas. ... E 12:03
▶ S1        52.0 °C ⟫
  S2        38.0 °C ⟫
  S3        77.0 °C ⟫
```

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

Display	Description
S1 … S3	Temperature S1 … S3
S4, S5	Switching status S4, S5
Output A	Operating status 0-10 V/PWM output
R1 … R5	Operating status relays 1… 5
Excess W	Excess power in W

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

```
S1
▶ Minimum    20.0 °C
  Maximum    85.0 °C
  back
```

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

7.4   Messages

```
Status: Messages   12:05
▶ Everything OK
  Version        1.xx
  back
```

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 description of the fault condition.

Display	Description
!Sensor module	Bus communication interrupted (sensor module)
!Sensor fault S1 … S3	Sensor defective

In case of an error, the control LED flashes and a message is indicated in the status display. If a sensor is defective, the corresponding load switches off and an error message appears. Loads that are not affected continue their operation.
If the bus communication is defective, the control LED flashes red / green. Automatic operation of the loads stops, backup heating / main operation continues.
After the error has been eliminated and acknowledged, the message disappears.

8   Loads

```
┌─────────────────────────────────┐
│ Load                      12:05 │
├─────────────────────────────────┤
│ ▶ Immers. heater                │
│   Heat pump                     │
│   Wallbox                       │
└─────────────────────────────────┘
```

In this menu, up to 5 loads can be activated and adjusted.
- Immersion heater (1 … 3)
- Heat pump
- Wallbox

In the **Add new function** menu, different preprogrammed functions / loads can be selected. When a load 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 **Load** menu above the menu item **Add new function**.

> **i** **Note**
> The following menu items are available in all load menus and will therefore not be explained in the individual load descriptions.

The parameter **Power** can be used for adjusting the switch-on threshold of the load. This value may correspond to the power consumption of the load. If a sufficiently high power is available as excess power for operating the load, the load switches on or is activated for operation respectively.

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

In the **Output** submenu, a relay and / or signal output can be allocated to each load. All adjustments required for the outputs can be made in this menu. If the **Relay** option is activated, a relay can be allocated to the output selection. If the **PWM/0-10 V** option is activated, a PWM/0-10 V output can be allocated to the output selection. In the **Signal** channel, a selection between a PWM and a 0-10 V signal can be made.

In the **Profile** channel, characteristic curves for solar and heating pumps can be selected. If the **Inverted** option is activated, the output will operate vice versa.

In the **Manual mode** adjustment channel, the operating mode of the output can be selected:

On = Output is switched on (manual mode)

Auto = Output is in automatic mode

Off = Output is switched off (manual mode)

> **i** **Note**
> After service and maintenance work, the operating mode must be set back to **Auto**. In manual mode the control logic is overridden.

The parameter **Priority** can be used for defining the priority of each load (1 = highest priority, 6 = lowest priority). If the conditions for operating the load with the highest priority are not met, the load next in priority is operated. If the excess power falls below 0 or below the reserve respectively during operation, or if the conditions of a load of higher priority are met, loads of less priority switch off one after the other.

Each load can be reheated or operated with mains current (submenu **Backup heating** or **Mains oper.** respectively). When the **Timer** option is activated, a timer is indicated in which time frames for the function can be adjusted.

At the end of each 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**.

With the menu item **Funct.** a function already saved can be temporarily deactivated or re-activated respectively. In this case, all adjustments will remain stored.

> **i** **Note**
> For information on timer adjustment see page 16.
> For each load, time frames are preset.

Smart Remote
The **SR off** function is used for switching off all loads via the S4 switching input (see page 5), regardless of whether they are in excess operation or in mains operation / backup heating.

8.1 Electric immersion heater

```
Immers. heater
▶ Sensor          S1
  TMax         60 °C
  Hysteresis     5 K
```

If the adjusted power is available as excess power, the electric immersion heater can be operated. The sensor selected monitors the temperature at the electric immersion heater. If the adjusted maximum temperature is reached or exceeded, the electric immersion heater switches off. If the temperature exceeds the maximum temperature by the adjusted hysteresis, the electric immersion heater switches on again. If the sensor is defective, the electric immersion heater switches off. Furthermore, outputs as well as a priority can be allocated to the electric immersion heater (see above). Mains operation is also possible (see above). For this purpose, time frames as well as a switch-on and a switch-off temperature can be adjusted.

```
Immers. heater
  ☒ Backup heating
▶ TOn           40 °C
  TOff          45 °C
```

Load / Add new function / Immers. heater (1 … 3)

Adjustment channel	Description	Adjustment range / selection	Factory setting
Power	Switch-on threshold	0 … 30000W	3000W
Timer	Timer option	Yes, No	No
Sensor	Reference sensor	S1 … S3	S1
TMax	Maximum temperature	25 … 90 °C	60 °C
Hysteresis	Re-energise hysteresis	1 … 10 K	5 K
Output	Output selection submenu		
Relay	Relay option	Yes, No	Yes
Relay	Relay selection	R1 … R5	-
PWM/0-10 V	PWM/0-10 V option	Yes, No	No
Output	Signal output selection	A	A
Signal	Signal type	0-10 V, PWM	0-10 V
Profile	Curve	Solar, Heating	Solar
Inverted	Inverted switching option	Yes, No	No
Manual mode	Operating mode of the output	On, Auto, Off	Auto
Priority	Priority of the load	1 … 5	-
Backup heating	Operation of the load with mains current	Yes, No	No
TOn	Switch-on temperature	20 … 85 °C	40 °C
TOff	Switch-off temperature	25 … 89 °C	45 °C
Timer	Timer option	Yes, No	No
Funct.	Activation / Deactivation	Activated, Deactivated	Activated
Save function / Delete function	Save / Delete function	-	-

ℹ️ **Note**
For information on timer adjustment see page 16.
Timer factory settings:
Excess operation Mon−Sun, 09:00−15:00
Backup heating: Mon−Sun, 19:00−22:00

8.2   Heat pump

```
┌─────────────────────────┐
│ Heat pump               │
│                         │
│▶ Power        4000 W    │
│  Tolerance       2%     │
│  Monit.        300 s    │
└─────────────────────────┘
```

If the adjusted power is available as excess power, the heat pump can be operated. For this purpose, the power plus an adjustable **Tolerance** must be available without any interruption for the adjusted monitoring period. The parameter **tMin on** can be used for adjusting a minimum runtime for which the heat pump remains switched on, even if the required excess falls below the adjusted power. The parameter **tMin off** can be used for adjusting a minimum break time for which the heat pump remains switched off after the operation has ended, even if the required excess plus the tolerance is available again. Furthermore, up to 2 outputs can be allocated to the heat pump which enable the operating modes switch-on recommendation (1 relay) or definite start-up command (2 relays). A priority can also be allocated (see above). Mains operation is also possible (see above). For this purpose, time frames can be adjusted.

```
┌─────────────────────────┐
│ Heat pump               │
│                         │
│▶ Output 1        R4     │
│  Output 2        A      │
│  Priority        1      │
└─────────────────────────┘
```

Load / Add new function / Heat pump

Adjustment channel	Description	Adjustment range / selection	Factory setting
Power	Switch-on threshold	0 … 30000 W	4000 W
Tolerance	Tolerance related to the power	0 … 100 %	2 %
Monit.	Monitoring period	0 … 1800 s	300 s
tMin on	Minimum runtime	0 … 1800 s	600 s
tMin off	Minimum break time	0 … 1800 s	600 s
Timer	Timer option	Yes, No	No
Output 1, 2	Output selection submenu		
Relay	Relay option	Yes, No	Yes
Relay	Relay selection	R1 … R5	-
PWM/0-10 V	PWM/0-10 V option	Yes, No	No
Output	Signal output selection	A	A
Signal	Signal type	0-10 V, PWM	0-10 V
Profile	Curve	Solar, Heating	Solar
Inverted	Inverted switching option	Yes, No	No
Manual mode	Operating mode of the output	On, Auto, Off	Auto
Priority	Priority of the load	1 … 5	-
Mains oper.	Operation of the load with mains current	Yes, No	No
Timer	Timer option	Yes, No	Yes
Funct.	Activation / Deactivation	Activated, Deactivated	Activated
Save function / Delete function	Save / Delete function	-	-

> **ℹ Note**
> For information on timer adjustment see page 16.
> Timer factory settings:
> Excess operation Mon − Sun, 09:00 − 15:00
> Mains operation: Mon − Sun, 19:00 − 22:00

8.3   Wallbox

```
Wallbox
▶ Power        4000 W
  Tolerance       2%
  Monit.        300 s
```

If the adjusted power is available as excess power, the wallbox can be operated. For this purpose, the power plus an adjustable **Tolerance** must be available without any interruption for the adjusted monitoring period. The parameter **tMin on** can be used for adjusting a minimum runtime for which the wallbox remains switched on, even if the required excess falls below the adjusted power. The parameter **tMin off** can be used for adjusting a minimum break time for which the wallbox remains switched off after the operation has ended, even if the required excess plus the tolerance is available again. Furthermore, outputs as well as a priority can be allocated to the wallbox (see above). Mains operation is also possible (see above). For this purpose, time frames can be adjusted.

```
Wallbox
  ☒ Mains oper.
  ☒ Timer
▶   Timer         »
```

Load /Add new function /Wallbox

Adjustment channel	Description	Adjustment range / selection	Factory setting
Power	Switch-on threshold	0…30000W	4000W
Tolerance	Tolerance related to the power	0…100%	2%
Monit.	Monitoring period	0…1800 s	300 s
tMin on	Minimum runtime	0…1800 s	600 s
tMin off	Minimum break time	0…1800 s	600 s
Timer	Timer option	Yes, No	No
Output	Output selection submenu		
Relay	Relay option	Yes, No	Yes
Relay	Relay selection	R1…R5	-
PWM/0-10 V	PWM/0-10 V option	Yes, No	No
Output	Signal output selection	A	A
Signal	Signal type	0-10 V, PWM	0-10 V
Profile	Curve	Solar, Heating	Solar
Inverted	Inverted switching option	Yes, No	No
Manual mode	Operating mode of the output	On, Auto, Off	Auto
Priority	Priority of the load	1…5	-
Mains oper.	Operation of the load with mains current	Yes, No	No
Timer	Timer option	Yes, No	Yes
Funct.	Activation / Deactivation	Activated, Deactivated	Activated
Save function / Delete function	Save / Delete function	-	-

> **Note**
> For information on timer adjustment see page 16.
> Timer factory settings:
> Excess operation Mon−Sun, 09:00−15:00
> Mains operation: Mon−Sun, 19:00−22:00

9 Basic settings

```
Basic settings      12:06
▸ Language     English
  ☒ Auto DST
  Time            12:06
```

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
Time	Adjustment of the current time	00:00 … 23:59	-
Date	Adjustment of the date	01.01.2001 … 31.12.2099	-
Reserve	Reserve not used for loads	0 … 9000 W	100 W
Delay	Delay for switching loads on and off	1 … 10 s	2 s
Reset	back to factory setting	Yes, No	No

The **Reserve** is an adjustable excess power which is fed into the grid and not used for the loads. The reserve can be used, e.g. in large PV systems, in order to start operating the loads at a later point in time. This reduces power peaks at noon. If the system is additionally equipped with a battery, the reserve can be increased in order to give priority to the battery.

The **Delay** is an adjustable waiting time. After this time has elapsed, loads are switched on or off. The delay prevents loads with small switching thresholds from being switched on and off too often.

10 MicroSD card

```
SD card             12:06
▸ Rem. time       66 d
        Options
  Remove card...
```

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.

Firmware updates

When an MicroSD card with a firmware update is inserted, the enquiry **Update?** is indicated on the display.

➔ To run the update, select **Yes** and confirm by pressing the right button (✔).

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.

> **ℹ Note**
> Only remove the card when the initialisation phase has been completed and the main menu is indicated on the controller display!

➔ To skip the update, select **No**.

The controller starts normal operation.

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

Starting the logging

➔ Insert the MicroSD card into the slot.
➔ Adjust the desired logging type and interval.

Logging will start immediately.

Completing the logging process

➔ Select the menu item **Remove card...**

➔ After **Remove card** is displayed, remove the card from the slot.

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

> ℹ️ **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 appears.

➔ Select the desired .SET file.

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

➔ In order to save the adjustments made, press the microbutton ☑ for approx. 3 s or select the menu item **Save** in the main menu.

The controller will leave the installer level and restart, see page 14.

> ℹ️ **Note**
> To safely remove the MicroSD card, always select the menu item **Remove card...** before removing the 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 interval	Interval for data logging	00:01 … 20:00 (mm:ss)	01:00
Logging type	Logging type	Cyclic, Linear	Linear

11 User code
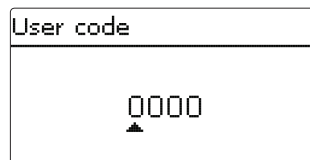
In the **User code** menu, a user code can be entered. Each number of the 4-digit code must be individually adjusted and confirmed. After the last digit has been confirmed, the menu automatically jumps to the superior menu level.

To access the menu areas of the installer level, the installer user code must be entered:

Installer: 0262

After the installer code is entered, the controller changes to the parameterisation mode, see page 14.

> ℹ️ **Note**
> For safety reasons, the user code should generally be set to the customer code before the controller is handed to the customer!
> Customer: 0000

12   Inputs

```
┌─────────────────────────────┐
│ Inputs                      │
│                             │
│ ▶ S1                     ≫  │
│   S2                     ≫  │
│   S3                     ≫  │
└─────────────────────────────┘
```

In this submenu, the type of the sensor connected can be adjusted for each individual input. The following types can be selected:

S1 … S5 : Switch, Pt1000, None

ATTENTION!	**System damage!**
☞	Selecting the wrong sensor type will lead to unwanted control behaviour. In the worst case, system damage can occur! ➔ **Make sure that the right sensor type is selected!**

If **Pt1000** is selected, the channel **Offset** will appear, in which an individual offset can be adjusted for each sensor.

If **Switch** is selected, the **Inverted** option will appear and can be used for inverting the behaviour of the switch.

Inputs

| Adjustment channel	Description	Adjustment range / selection	Factory setting
S1 … S5	Sensor input selection	-	-
Type	Sensor type selection (S1 … S5)	Switch, Pt1000, None	Pt1000 (S1 … S3) Switch (S4, S5)
Offset	Sensor offset (only if Type = Pt1000)	-15.0 … +15.0 K	0.0 K
Inverted	Switch inversion (only if Type = Switch)	Yes, No	No

13 Troubleshooting

If a malfunction occurs, a message will appear on the display of the controller.

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

The controller is protected by a fuse. The fuse holder (which also holds the spare fuse) becomes accessible when the cover is removed. To replace the fuse, pull the fuse holder from the base.
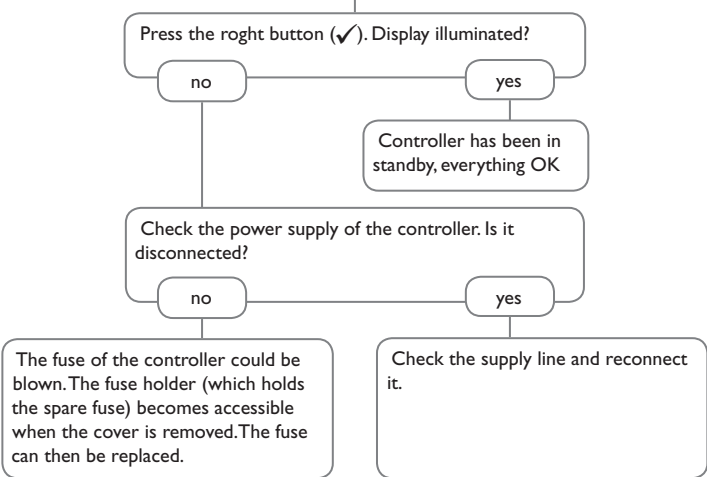

Fuse
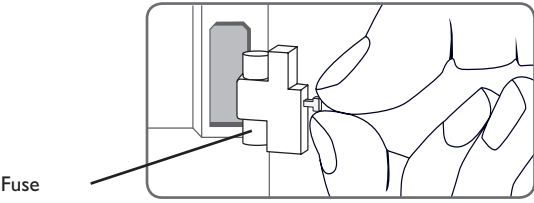
Lightwheel® flashes red.

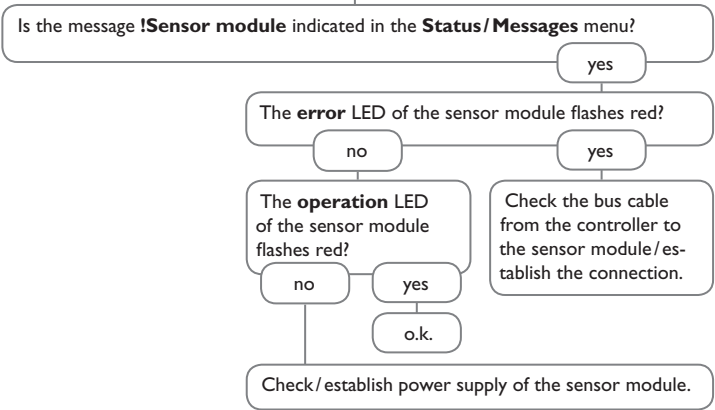Sensor fault. An error code instead of a temperature is shown on the sensor display channel.

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

The display is permanently off.

Press the roght button (✓). Display illuminated?
- no
- yes → Controller has been in standby, everything OK

Check the power supply of the controller. Is it disconnected?
- no → 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.
- yes → Check the supply line and reconnect it.

Lightwheel® flashes red / green.

Is the message **!Sensor module** indicated in the **Status / Messages** menu?
- yes → The **error** LED of the sensor module flashes red?
  - no → The **operation** LED of the sensor module flashes 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.

14   Accessories

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

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

VBus®/USB & VBus®/LAN interface adapters

With the RESOL VBus®/USB interface adapter, the controller can be connected to the USB port of a PC via the VBus®.

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.

VBus.net

The internet portal for easy and secure access to your system data. VBus.net is all about the data of your controller. Live data of your system, customised filter settings and much more await you.

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.

HR230 Auxiliary relay

Single-phase, suitable for all RESOL controllers

15   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.

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