

LK TapWater



Beginning with firmware version 2.0

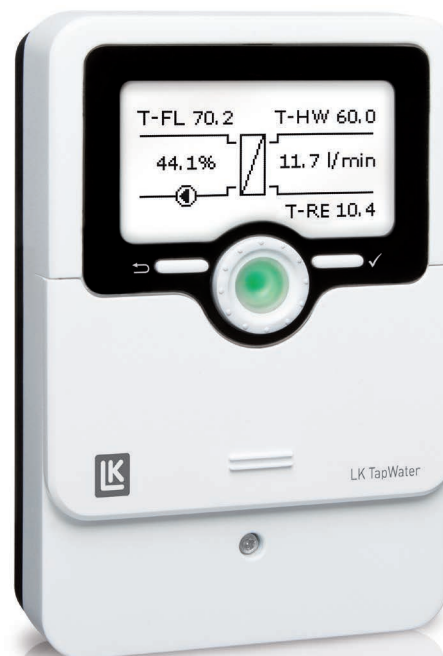
DHW exchange controller

Installation

Operation

Functions and options

Troubleshooting



100000353



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

Thank you for buying this product.

Please read this manual carefully to get the best performance from this unit. Please keep this manual safe.

en

Manual

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!

Subject to technical change. Errors excepted.

Information about the product

Proper usage

The controller is designed for use in a DHW heat exchange module 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.



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.

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.



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.

Data security

We recommend regular backups of the data stored on the device via SD/MicroSD card.

Decommissioning

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

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.

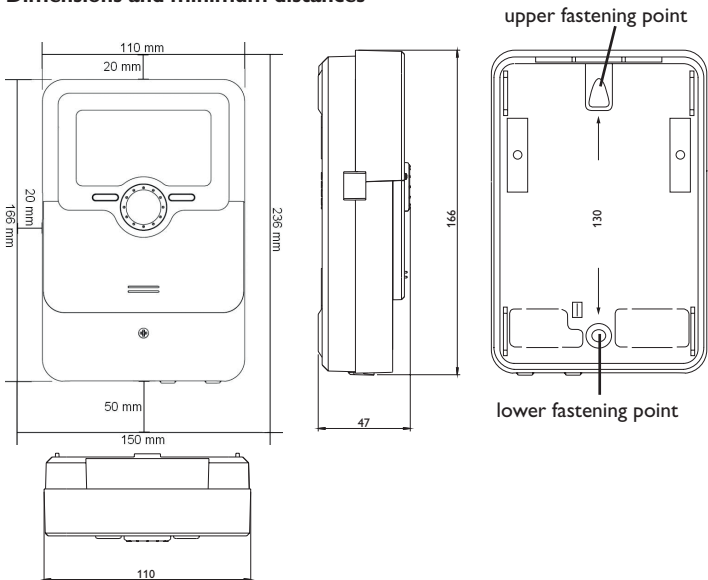
- Texts marked with an arrow indicate one single instruction step to be carried out.
1. Texts marked with numbers indicate several successive instruction steps to be carried out.

1	Overview	5	7	Hot water	24
2	Installation	6	8	Cascade	25
2.1	Mounting	6	9	Optional functions	26
2.2	Electrical connection	6	10	Basic settings	31
2.3	Data communication / Bus	7	11	MicroSD card	31
2.4	MicroSD card slot	7	12	User code	32
3	Operation and function	10	13	Manual mode	33
3.1	Buttons and adjustment dial	10	14	Troubleshooting	34
3.2	Microbuttons for manual mode and emergency operation	10	15	Index	36
3.3	Operating control LED	10			
3.4	Parameterisation mode	10			
3.5	Selecting menu points and adjusting values	11			
3.6	Adjusting the timer	12			
3.7	Adjusting optional functions	14			
4	Commissioning	15			
4.1	Commissioning the single station	15			
4.2	Commissioning the cascade	17			
5	Main menu	19			
5.1	Main menu Single station	19			
5.2	Main menu Station 1	19			
5.3	Menu structure	20			
6	Status	21			
6.1	Status / Overview Single station	21			
6.2	Status / Overview Cascade	22			
6.3	Hot water	22			
6.4	Cascade	22			
6.5	Circulation	22			
6.6	Disinfection	23			
6.7	Stratified return	23			
6.8	Error relay	23			
6.9	Messages	23			
6.10	Device info	24			

1 Overview

- Customised control for systems with or without circulation
- Flexible circulation function for different user profiles, also available with thermal disinfection
- Control of PWM pumps
- Commissioning menu for easy configuration
- Clear system graphic in the status menu
- Cascades of up to 4 DHW exchange controllers or stations

Dimensions and minimum distances



Technical data

Inputs: 6 Pt1000 temperature sensors,
1 flow rate sensor (0-500 Hz interface)

Outputs: 3 semiconductor relays, 2 PWM outputs, 1 potential-free extra-low voltage relay

PWM frequency: 512 Hz

PWM voltage: 11 V

Switching capacity:

1 (1) A 240 V~ (semiconductor relay)

1 (1) A 30 V== (potential-free extra-low voltage relay)

Total switching capacity: 4 A 240 V~

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

Supply connection: type X attachment

Standby: 0.97 W

Mode of operation: type 1.B.C.Y action

Rated impulse voltage: 2.5 kV

Data interface: VBus®, cascade bus, MicroSD card slot

VBus® current supply: 60 mA

Housing: plastic, PC-ABS and PMMA

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

Indication / Display: graphic display, operating control LED (Lightwheel®)

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

Relative humidity: 10... 90 %

Fuse: T4A

Maximum altitude: 2000 m above MSL

Dimensions: 110 x 166 x 47 mm

2 Installation

2.1 Mounting

WARNING! Electric shock!



Upon opening the housing, live parts are exposed!

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



Note

Strong electromagnetic fields can impair the function of the device.

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

Normally, the DHW exchange controller is integrated in a DHW exchange module. The unit 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 or must be equipped with a disconnecting device (fuse) in accordance with the required installation regulations.

Please pay attention to separate routing of sensor cables and mains cables.

2.2 Electrical connection

WARNING! Electric shock!



Upon opening the housing, live parts are exposed!

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

ATTENTION! ESD damage!



Electrostatic discharge can lead to damage to electronic components!

→ Take care to discharge properly before touching the inside of the device! To do so, touch a grounded surface such as a radiator or tap!



Note

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



Note

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

→ Install the mains plug 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!

The controller is equipped with 4 relays in total to which loads such as pumps, valves, etc. can be connected:

- Relays 1 ... 3 are semiconductor relays, designed for pump speed control:

Conductor R1 ... R3

Neutral conductor N

Protective earth conductor \ominus

- Relay 4 is a potential-free low voltage relay



Note

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



Note

The cables of the controller are pre-connected. Chap.2.2 is for information purposes only. Make sure the hydraulic system is properly grounded!

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:

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

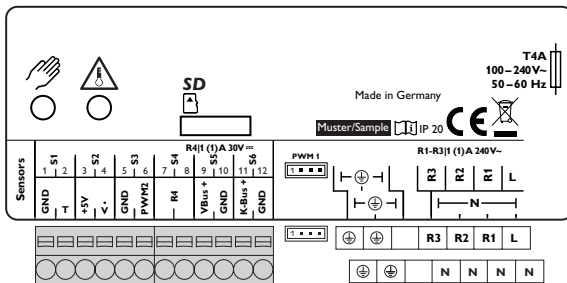
Temperature sensors have to be connected to the terminals S1 to S6 (either polarity).

The cables carry low voltage and must not run together in a cable conduit with cables carrying a voltage higher than 50 V (please pay attention to the valid local regulations). The cable lengths depend on the cross sectional area.

Example: up to 100 m at 1.5 mm², up to 50 m at 0.75 mm². The cables can be extended with a two-wire cable.

Connect the flow rate sensor either to the terminals **T** and **V** with correct polarity.

The terminals marked **PWM** are control outputs for a high-efficiency pump.



2.3 Data communication / Bus

The controller is equipped with the **VBus® (21/22)** for data transfer with and energy supply to external modules. The connection is to be carried out at the terminals marked **VBus** (any polarity). One or more **VBus®** modules can be connected via this data bus.

If a **cascade** is installed, the following section is valid additionally:

All cascade controllers are equipped with a cascade bus for data communication with each other. The connection is to be carried out at the terminals marked **K-Bus (23/24)** with correct polarity.

2.4 MicroSD card slot

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

Connect the permanent phase of the line valve along with the power supply of the controller to L. Connect the switching phase of the line valve to R3.

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

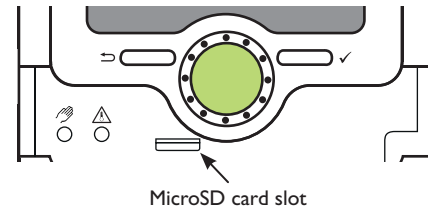
The **mains connection** is at the terminals:

Neutral conductor	N
Conductor	L
Protective earth conductor	⊕



Note

For more details about the commissioning procedure see page 15.



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

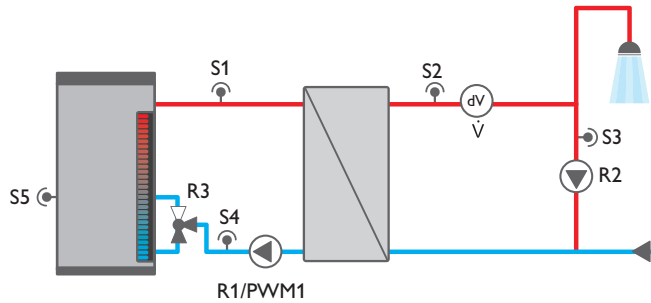


Note

For more information about using a MicroSD card, see page 31.

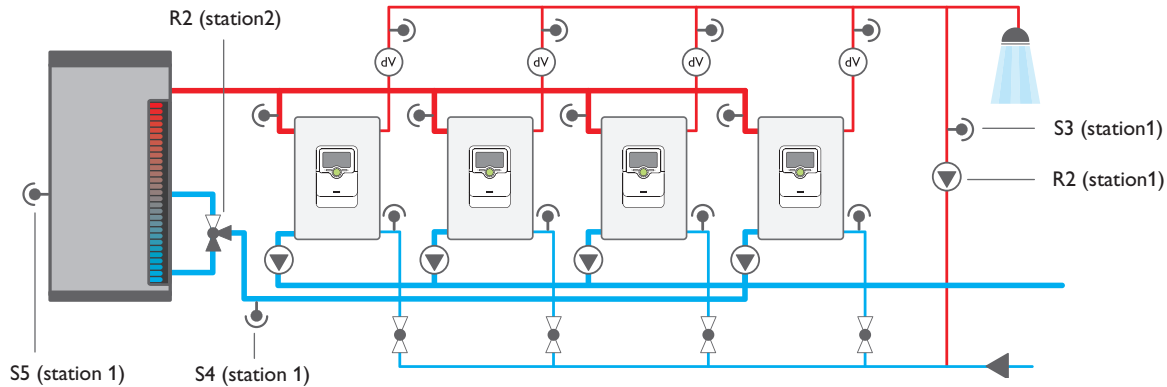
2.4.1 Overview of relay and sensor allocation

Single station



Connection terminal	Single station
S1 (1/2)	Flow primary circuit
S2 (3/4)	DHW
S3 (5/6)	Circulation
S4 (7/8)	Stratified return source
S5 (9/10)	Stratified return store
\dot{V}	DHW flow rate
R4 (19/20)	Error relay
VBus (21/22)	Visualisation
K-Bus (23/24)	not used
PWM1 (connector)	Speed primary pump
R3	Stratified return
R2	Circulation
R1	Primary pump

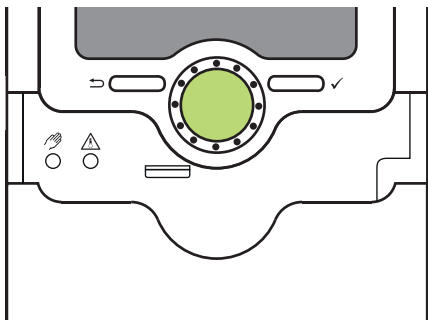
Cascade



Connection terminal	Station 1	Station 2	Station 3/4
S1 (1/2)	Flow primary circuit	Flow primary circuit	Flow primary circuit
S2 (3/4)	DHW	DHW	DHW
S3 (5/6)	Circulation	-	-
S4 (7/8)	Stratified return source	-	-
S5 (9/10)	Stratified return store	-	-
\dot{V}	DHW flow rate	DHW flow rate	DHW flow rate
PWM2	Speed circulation	-	-
R4 (19/20)	Error relay	-	-
VBus (21/22)	Visualisation	-	-
K-Bus (23/24)	Cascade bus	Cascade bus	Cascade bus
PWM1 (connector)	Speed primary pump	Speed primary pump	Speed primary pump
R3	Line valve	Line valve	Line valve
R2	Circulation	Stratified return	-
R1	Primary pump	Primary pump	Primary pump

3 Operation and function

3.1 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

3.2 Microbuttons for manual mode and emergency operation




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

Microbutton : If the microbutton  is briefly pressed, the controller changes to the manual mode menu (see page 33).

Microbutton : The microbutton  is used for activating the emergency operation (see page 25).

3.3 Operating control LED

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

Colour	Permanently shown	Flashing
	Everything OK	A note is available (see page 23), manual mode active
		Disturbance or warning exists (see page 23), error relay active
	Parameterisation active	Storage active

3.4 Parameterisation mode


After the installer code is entered (see page 32), the controller changes to the parameterisation mode.



Note

In parameterisation mode, the control process will stop and the message **Control stopped – Parameterisation active** will be indicated.

The LED in the Lightwheel® will glow yellow.

1. 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.
 2. In order to save the adjustments made, press the microbutton  approx. 3 s or select the menu item **Save** in the main menu.
- In order to cancel the parameterisation process and to discard adjustments made, press the left button (←) for approx. 3 s.

The controller will leave the installer level and restart.

3.5 Selecting menu points and adjusting values

During normal operation of the controller, the display is in the main menu.

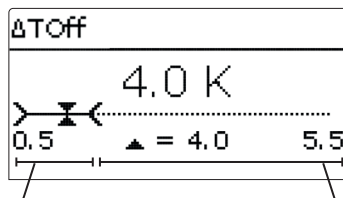
If no button is pressed for 2 min, the display switches to standby mode. After further 10 s, the display illumination switches off.

- ➔ 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®.

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.

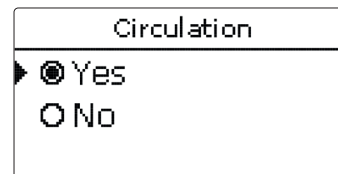


active area

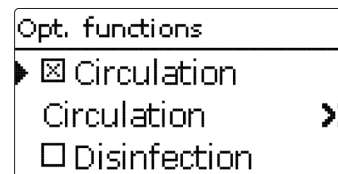
inactive area

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.



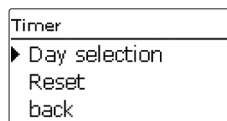
If only one item of several can be selected, they will be indicated with radio buttons. When one item has been selected, the radio button in front of it is filled.



If more than one item of several can be selected, they will be indicated with checkboxes. When an item has been selected, an x appears inside the checkbox.

3.6 Adjusting the timer

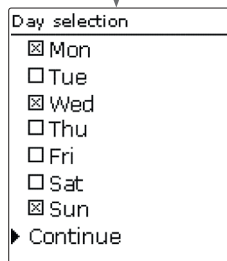
With the **Timer** time frames for the function can be adjusted.



In the **Day selection** channel, the days of the week are available.

If several days are selected, they will be merged into one combination for the following steps.

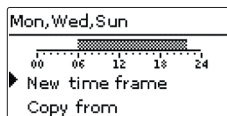
The last menu item after the list of days is **Continue**. If **Continue** is selected, the timer menu opens, in which the time frames can be adjusted.



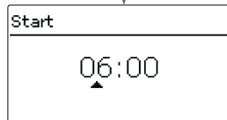
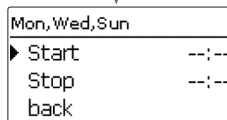
Adding a time frame:

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

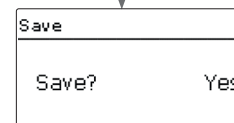
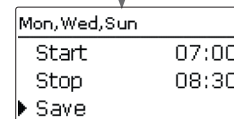
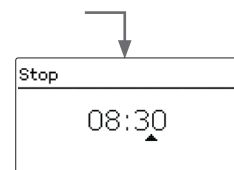
1. Select **New time frame**.



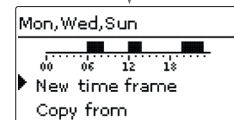
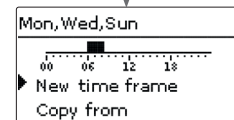
2. Adjust **Start** and **Stop** for the desired time frame. The time frames can be adjusted in steps of 10 min.



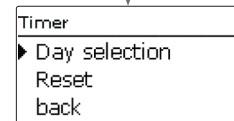
3. In order to save the time frame, select **Save** and confirm the security enquiry with **Yes**.



4. In order to add another time frame, repeat the previous steps.
- 6 time frames can be adjusted per day or combination.



5. Press the left button (←) in order to get back to the day selection.



Copying a time frame:

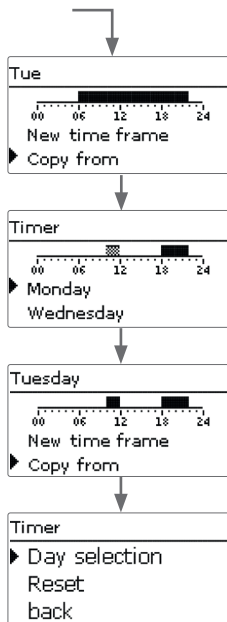
In order to copy time frames already adjusted into another day / other days, proceed as follows:

1. Choose the days(s) into which the time frames are to be copied and select **Copy from**.

A selection of days with time frames will appear.

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

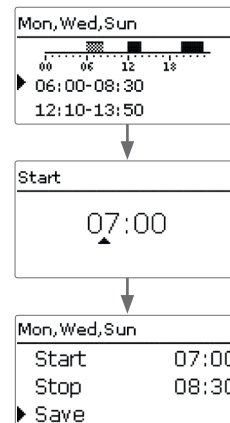
All time frames adjusted for the selected day will be copied. Existing time frames will be overwritten.



Changing a time frame:

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

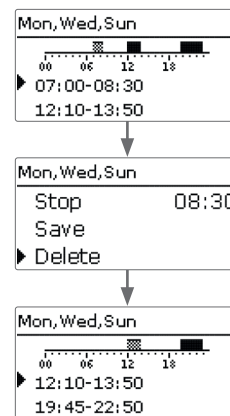
1. Select the time frame to be changed.
2. Make the desired change.
3. In order to save the time frame, select **Save** and confirm the security enquiry with **Yes**.



Removing a time frame:

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

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



Resetting the timer:

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

1. Select the desired day.

Timer
Day selection
▶ Monday
Tuesday

Monday
00 06 12 18 24
Copy from
▶ Reset

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

Reset
Reset? Yes

Monday
00 06 12 18 24
Copy from
▶ Reset

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

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

Timer
Sunday
▶ Reset
back

Reset
Reset? Yes

All adjustments made for the timer are deleted.

Timer
Sunday
▶ Reset
back

3.7 Adjusting optional functions

Opt. functions
▶ <input type="checkbox"/> Circulation
<input type="checkbox"/> Stratified return
<input type="checkbox"/> Blocking protect.


In the **Optional functions** menu, optional functions can be selected and adjusted.

Circulation
▶ <input checked="" type="radio"/> Yes
<input type="radio"/> No

→ In order to activate a function, select the desired function and confirm the enquiry with **Yes**.

Opt. functions
▶ <input checked="" type="checkbox"/> Circulation
Circulation >>
<input type="checkbox"/> Disinfection

When a function has been activated, an x within the checkbox and a new menu line with the symbol >> appear. When this menu item is selected, a submenu opens in which all adjustments required can be made.

→ In order to save the adjustments, select **Save** in the main menu or press and hold down the microbutton  for approx. 3 s.

→ In order to delete a function, select the function in the **Optional functions** menu and answer the enquiry with **No**.

4 Commissioning

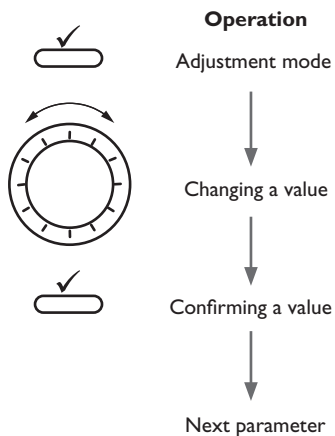
When the hydraulic system is filled and ready for operation, connect the controller to the mains.

The controller runs an initialisation phase in which the Lightwheel® glows green.

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

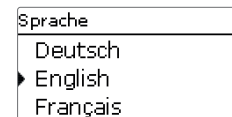
The commissioning menu consists of the channels described in the following. In order to make an adjustment, adjust the desired value with the Lightwheel® and confirm with the right button (✓). The next channel will appear in the display.



4.1 Commissioning the single station

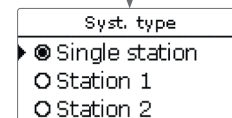
1. Language:

→ Adjust the desired menu language.



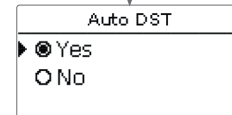
2. System type:

→ Select the system type **single station**.



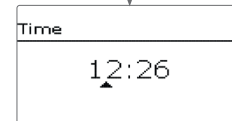
3. Daylight savings time adjustment:

→ Activate or deactivate the automatic daylight savings time adjustment.



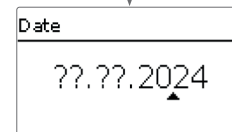
4. Time:

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



5. Date:

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



6. Set hot water temperature:

→ Adjust the desired set hot water temperature.

For further information, see page 24.

7. Circulation:

1. Activate or deactivate the circulation.



Note

For circulation, the circulation sensor S3 is required.

If **Yes** is selected, the offset starts immediately.

For more information about circulation, see page 26.



Note

No draw-off may be carried out during the offset. All ball valves of the station must be fully opened (normal position).

The current temperature difference between the hot water sensor and the return sensor is indicated in the centre of the display.

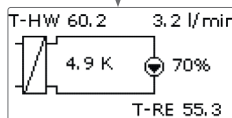
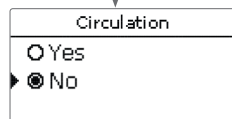
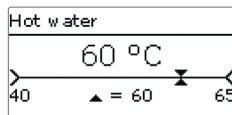
The optimum temperature difference is approx. 5 K.

2. Adjust the speed with the Lightwheel®.

3. If the desired temperature difference is reached, confirm the offset with the right button (✓).

For more information about the offset, see page 27.

The factory set circulation type is **Duration**. It can be changed in the menu **Opt. functions/Circulation** (see page 26).



8. Stratified return:

→ Activate or deactivate the stratified return.



Note

The Thermal type requires the stratified return source sensor S4. The Difference type additionally requires the stratified return store sensor S5.

9. Completing the commissioning menu:

→ In order to save the adjustments, select the menu item **Save**.

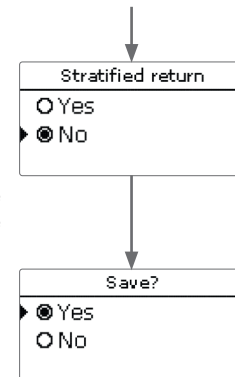
The controller is then ready for operation and normally the factory settings will give close to optimum operation of the system.



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.

Set the code to the customer code before handing over the controller to the customer (see page 32).



4.2 Commissioning the cascade

Station 1 is the cascade master, stations 2 to 4 are cascade slaves. The commissioning menu has to be run on each controller, beginning with the cascade master (station 1). The adjustments made at station 1 will be adopted by the other stations automatically.

4.2.1 Cascade Master

1. Language:

→ Adjust the desired menu language.

2. System type:

1. Adjust the system type **Station 1**.

2. Activate or deactivate further cascade stations.

3. Daylight savings time adjustment:

→ Activate or deactivate the automatic daylight savings time adjustment.

4. Time:

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

Sprache

Deutsch
▶ English
Français

Syst. type

Single station
▶ Station 1
 Station 2

Station 2

▶ Yes
 No

Auto DST

▶ Yes
 No

Time

12:26

5. Date:

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

6. Set hot water temperature:

→ Adjust the desired set hot water temperature.

For further information, see page 24.

7. Circulation:

1. Activate or deactivate the circulation.



Note

For circulation, the circulation sensor S3 is required.

If **Yes** is selected, the offset starts immediately.

For more information about circulation, see page 26.



Note

No draw-off may be carried out during the offset. All ball valves of the station must be fully opened (normal position).

The current temperature difference between the hot water sensor and the return sensor is indicated in the centre of the display.

The optimum temperature difference is approx. 5 K.

2. Adjust the speed with the Lightwheel®.

3. If the desired temperature difference is reached, confirm the offset with the right button (✓).

For more information about the offset, see page 27.

The factory set circulation type is **Duration**. It can be changed in the menu **Opt. functions/Circulation** (see page 26).

Date

?? ?? 2024

Hot water

60 °C

40 ▲ = 60 ▼ 65

Circulation

Yes
▶ No

T-HW 60.2 3.2 l/min

4.9 K 70%

T-RE 55.3

8. Stratified return:

→ Activate or deactivate the stratified return.

For more information about the stratified return, see page 29.

Stratified return
<input type="radio"/> Yes
<input checked="" type="radio"/> No

Save?
<input checked="" type="radio"/> Yes
<input type="radio"/> No



Note

The Thermal type requires the stratified return source sensor S4. The Difference type additionally requires the stratified return store sensor S5.

9. Completing the commissioning menu:

→ In order to save the adjustments, select the menu item **Save**.

The controller is then ready for operation and normally the factory settings will give close to optimum operation of the system.

4.2.2 Cascade slaves

1. Language:

→ Adjust the desired menu language.

Sprache
Deutsch
▶ English
Français

2. System type:

→ Adjust the system type **Station 2**.

Syst. type
<input type="radio"/> Single station
<input type="radio"/> Station 1
▶ <input checked="" type="radio"/> Station 2

3. Completing the commissioning menu:

→ In order to save the adjustments, select the menu item **Save**.

The controller is then ready for operation and normally the factory settings will give close to optimum operation of the system.

Save?
▶ <input checked="" type="radio"/> Yes
<input type="radio"/> No

→ If further cascade stations have been activated, run the commissioning menu of the corresponding stations (**Station 3 ... 4**).



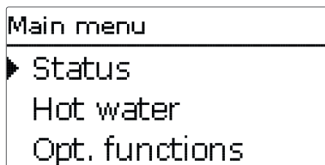
Note

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.

Set the code to the customer code before handing over the controller to the customer (see page 32).

5 Main menu

5.1 Main menu Single station



In this menu, different menu areas can be selected.

The following menus are available:

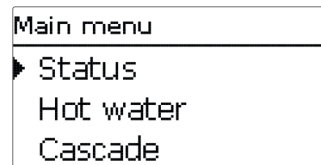
Status
Hot water
Optional functions
Basic setting
SD card
User code
Manual mode



Note

If no button is pressed for 2 min, the display switches to standby mode. After further 10s the display illumination switches off.

5.2 Main menu Station 1



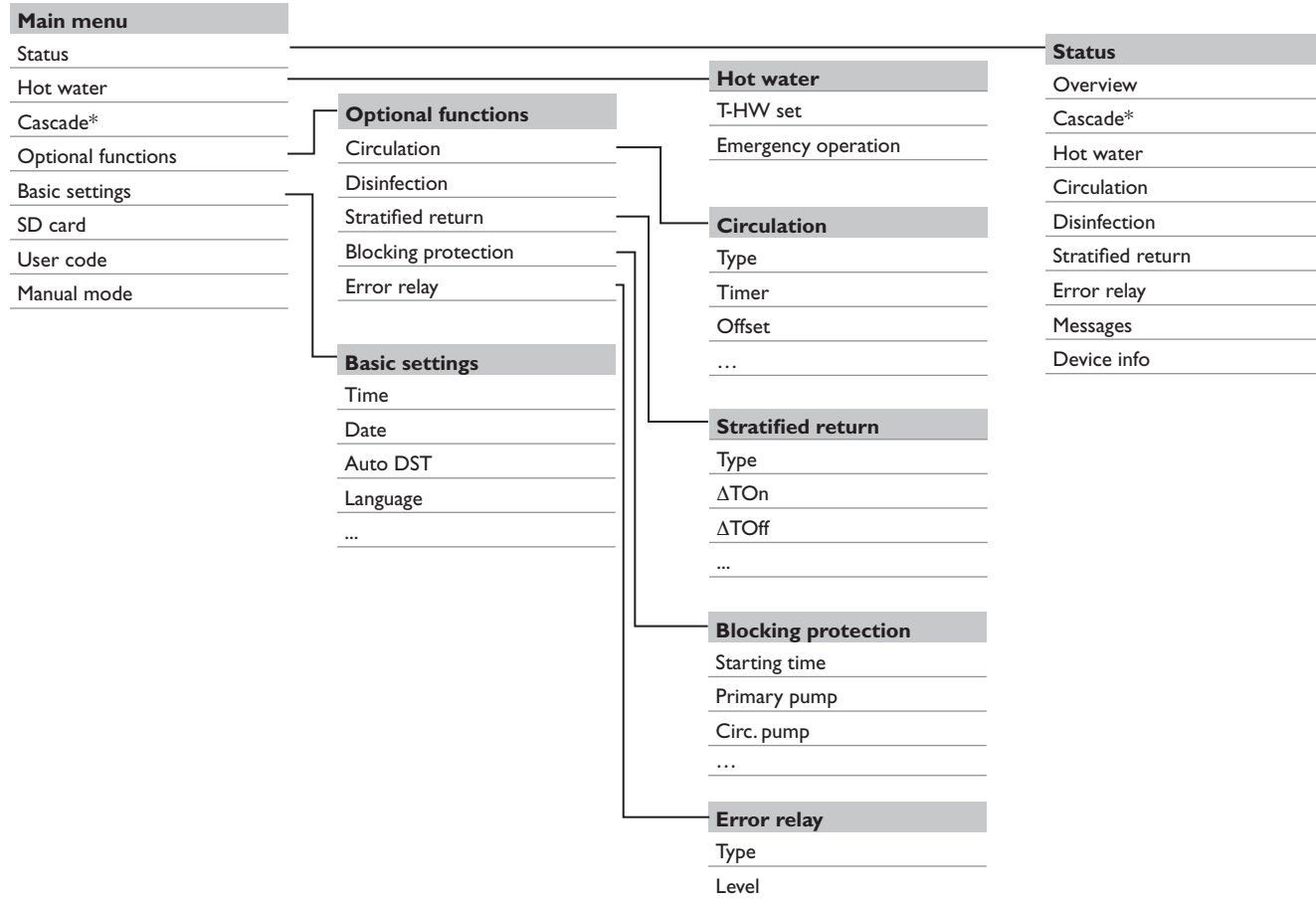
In this menu, different menu areas can be selected.

The following menus are available in cascade operation:

Status
Hot water
Cascade*
Optional functions
Basic setting
SD card
User code
Manual mode

In cascade operation, all adjustments have to be carried out at the cascade master (station 1). Stations 2 to 4 are cascade slaves and receive all information from the cascade master on which all important adjustments have to be made. The menus are available for the slaves in an shortened form.

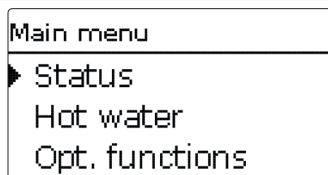
5.3 Menu structure



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.

* Available for System type Station 1 only

6 Status

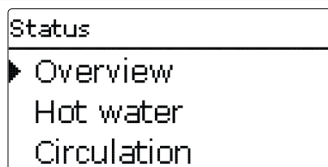


In the status menu of the controller, the status messages for every menu area can be found.

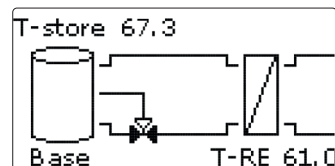
Overview of displayed values

Display	Description
T-store	Store temperature stratified return
Base / Centre	Position of the valve stratified return
T-RE	Return temperature
T-FL	Flow temperature primary circuit
T-HW	Hot water temperature
T-HW set	Set hot water temperature
Fl.rate	Flow rate hot water
Primary p.	Speed primary pump
Circ. pump	Speed circulation pump
Valve	Valve stratified return

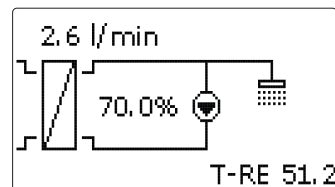
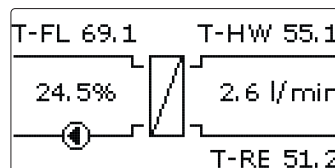
6.1 Status / Overview Single station



In the **Status / Overview** menu, all current measured values are indicated in a clear system graphic. Depending on the adjustments already made, the system graphic consists of up to 3 parts:

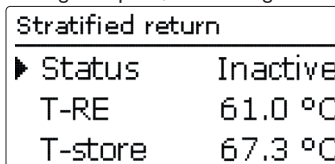


The first part shows the primary circuit with the corresponding values.



The second part shows the heat exchanger and the third part the secondary circuit with the corresponding values.

➔ In order to scroll through the parts, turn the Lightwheel® clockwise.



The information given in the system graphic can also be indicated as a text.

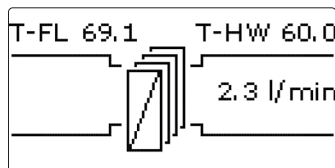
➔ For this purpose, select the desired part and press the right button (✓).

➔ In order to get back to the graphic, press the left button (←).

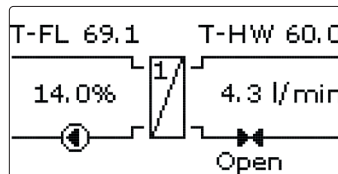
6.2 Status / Overview Cascade

Status
▶ Overview
Cascade
Hot water

In the **Status / Overview** menu, all current measured values of the stations are indicated in a clear system graphic.



→ In order to show the values of the corresponding station, turn the Lightwheel® clockwise.



Cascade
▶ Basic load Station 1
T-FL 69.1 °C
T-HW 60.2 °C

The information of the corresponding station can also be indicated as a text.

→ For this purpose, press the right button (✓).

→ In order to get back to the graphic, press the left button (↶).

6.3 Hot water

Hot water
▶ Status Active
T-HW set 60 °C
T-FL 69.1 °C

The **Status / Hot water** menu indicates the status of the DHW heating.

6.4 Cascade*

Cascade
▶ Basic load Station 1
T-FL 69.1 °C
T-HW 60.0 °C

* Available for System type **Station 1** only

The **Status / Cascade** menu indicates different status information of the cascade.

The overview indicates the highest temperatures of the cascade as well as the overall flow rate.

→ In order to show the values of the individual stations, turn the Lightwheel® clockwise and select the desired station.

6.5 Circulation

Circulation
▶ Status Active
T-RE 55.1 °C
Fl.rate 3.2 l/min

The **Status / Circulation** menu indicates status information of the function.

6.6 Disinfection

Disinfection	
▶ Status	Inactive
back	

The **Status / Disinfection** menu indicates status information of the function.

6.7 Stratified return

The **Status / Stratified return** menu indicates status information of the function.

Stratified return	
▶ Status	Inactive
T-RE	61.0 °C
T-store	67.3 °C

6.8 Error relay

The **Status / Error relay** menu indicates if the potential-free error relay is active or inactive.

Error relay	
▶ Status	Off
back	

6.9 Messages

Messages
▶ Everything OK
back

In the **Status/Messages** menu, error and warning messages are indicated.

During normal operation, the message **Everything OK** is indicated.

A line break or short circuit in a sensor line is indicated as **!Sensor fault**. In the case of an error, the LED of the Lighthwheel® flashes red in addition.

Messages are divided into Notes, Disturbances and Warnings. A **Note** is for information purposes only. In the case of a **Disturbance**, the corresponding function or station fails. In the case of a **Warning**, station 1 indicates an error because of a station failure.

Message	Category	Cause / description
!Blocking protect.	Note	Blocking protection for an output active
!Manual mode	Note	At least one relay in manual operation
!Casc. config.	Note	Incorrect cascade configuration
!Control stopped	Note	Parameterisation mode active
!Controller variant	Note	Different station variants available
!Circ. offset	Note	Circulation offset has not been completed
!Date/Time	Disturbance	Real time clock failed
!T-RE	Disturbance	
!T-store	Disturbance	
!T-FL	Disturbance	Sensor fault (line break, short circuit or no sensor available)
!T-HW	Disturbance	
!Flow rate	Disturbance	
!Valve open	Disturbance	Flow at the station detected, although there should be none
!Disinfection	Warning	No return sensor circulation available
!Single controller	Warning	Incorrect cascade configuration

Message	Category	Cause / description
!Stratified return	Warning	Failure Station 2
!Software update	Warning	Different software variants used in the cascade
!Timeout Station 1 ... 4	Warning	No K-Bus signal available, station failure
!Valve closed	Warning	No flow at the station
!HW emerg. op.	Warning	Emergency operation active
!Circulation pump	Warning	No flow rate measured, although the circulation pump is running

6.10 Device info

Device info	
▶ Software	2.00
Hardware	
back	

The **Status/Device info** menu indicates information about soft- and hardware.

7 Hot water

Hot water	
▶ T-HW set	60 °C
Emerg. op.	Off
back	

In this menu, all adjustments for the DHW heating can be made. The following parameters and functions are available:

- Set hot water temperature
- Emergency operation

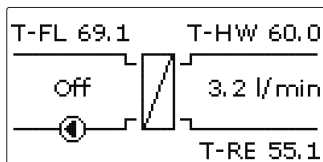
Set hot water temperature

T-HW set	
	60 °C
> 40	▲ = 60 ▼
	< 65

Main menu / Hot water / T-HW set

Adjustment channel	Description	Adjustment range / selection	Factory setting
T-HW set	Set hot water temperature	40...65°C	60°C

This parameter can be used for adjusting the set hot water temperature which is to be reached at the hot water sensor. The controller then controls the speed of the primary pump so that the temperature at the hot water sensor in the secondary circuit continuously keeps the required set hot water temperature.



Main menu / Hot water / Emerg. op.

This function can be used for ensuring the hot water supply in the case of a sensor failure. In this case, the primary pump will permanently run at the adjustable emergency speed. For this purpose, the emergency speed must be aligned with the resulting hot water temperature. The display channel **T-HW** allows this alignment directly in the emergency operation adjustment channel, as soon as the emergency operation has been activated.

→ In order to set the emergency speed, turn the Lightwheel® and confirm the adjustment with the right button (✓).



Note

If a sensor failure inhibiting DHW heating has occurred, activate the emergency operation in the **Emergency operation** channel.



Note

In cascade operation the emergency operation can be activated for stations 1 to 4 individually.

Cascade	
▶ Thresh. on	90%
Thresh. off	30%
<input checked="" type="checkbox"/> Station 2	

The **Cascade** menu is only available if the system type **Station 1** has been selected.

Main menu / Cascade

Adjustment channel	Description	Adjustment range / selection	Factory setting
Thresh. on	Threshold for activating the next station of the cascade	21 ... 100%	90%
Thresh. off	Threshold for deactivating the station of the cascade that has been activated at last.	10 ... 47%	40%
Station 2	Option Station 2 in the cascade		
Station 3	Option Station 3 in the cascade		
Station 4	Option Station 4 in the cascade		
back			

The parameter **Thresh. on** is used for adjusting the percentage of the maximum flow quantity that has to be exceeded for switching on the next station. The parameter **Thresh. off** is used for adjusting the percentage of the maximum flow quantity that has to be fallen below for switching off the station activated at last. In order to prevent a further station from being switched on and off too often, reduce the value **Thresh. off**.

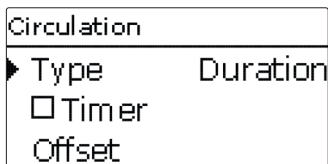
With the parameters **Station 1** to **Station 4** the number of stations in the cascade can be adjusted.

In cascade operation, all adjustments have to be carried out at the cascade master (station 1). Stations 2 to 4 are cascade slaves and receive all information from the cascade master on which all important adjustments have to be made. The menus are available for the slaves in an shortened form.

9 Optional functions

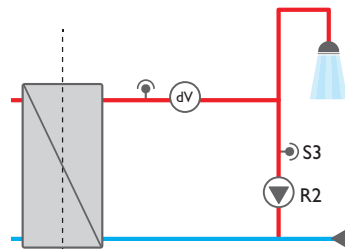
In this menu, optional functions can be selected and adjusted.

Circulation



Main menu / Opt. functions / Circulation

Adjustment channel	Description	Adjustment range / selection	Factory setting
Circulation	Activation of the function	Yes, No	No
Type	Variant	Therm+Dem., Demand, Thermal, Duration, Off	Duration
Timer	Timer option	Yes, No	No
TO _{on}	Switch-on temperature	10 ... 59 °C	55 °C
TO _{off}	Switch-off temperature	11 ... 60 °C	58 °C
Runtime	Circulation pump runtime	01:00 ... 15:00 min	03:00 min
Break time	Circulation pump break time	10 ... 60 min	30 min
Offset	Circulation pump offset	-	-
ΔT pipe	Indication of the temperature drop between the hot water sensor and the return sensor	-	-
Fl.rate	Indication of the circulation flow rate value stored	-	-
back			



Example with a Grundfos Direct Sensor™
Secondary circuit

Running an offset:

If the circulation was activated in the commissioning menu, the offset has already been carried out. If the function has been activated after the commissioning, the offset must be started manually.



Note

No draw-off may be carried out during the offset. All ball valves of the station must be fully opened (normal position).
The offset has to be run only once, e.g. during commissioning.

➔ In order to run an offset, select the parameter **Offset**, see page 27.

The **Circulation** function can be used for controlling a circulation pump.

For the control logic, 5 variants are available:

- Thermal
- Duration
- Demand
- Off
- Thermal+Demand



Note

For all circulation types, the circulation sensor S3 is required.

If one of the variants is selected, the corresponding adjustment channels will appear.

Each variant has a timer by means of which time frames for the operation of the function can be adjusted. Within the adjusted time frames the variants work as follows:

Thermal

The temperature at the return sensor is monitored. The circulation pump switches on, if the temperature falls below the adjusted switch-on temperature. If the temperature exceeds the switch-off temperature, the circulation pump switches off.

Duration

The circulation pump switches on within the adjusted time frames, outside of them it switches off.

Demand

When a draw-off impulse (draw-off 1 - 4 s) is detected at the flow rate sensor, the controller switches on the circulation pump. The circulation pump remains switched on for the adjusted runtime. If the circulation pump has been running and the runtime has elapsed, each further draw-off impulse is ignored for the break time and the circulation pump remains switched off.

Off

The circulation pump is switched off.

Thermal + Demand

The temperature at the return sensor is monitored. The circulation pump switches on, if the temperature falls below the adjusted switch-on temperature and if a draw-off impulse (draw-off 1 - 4 s) is detected at the flow rate sensor. The circulation remains switched on for the adjusted runtime. If the switch-off temperature is exceeded during this period, the circulation pump switches off. If the circulation pump has been running and the runtime has elapsed, each further draw-off impulse is ignored for the break time and the circulation pump remains switched off.



Note

For information on timer adjustment see page 12.



Note

In cascade operation, only the types **Duration**, **Thermal** and **Off** are available.

Circulation pump offset

When the hydraulic connection of the station has been established, carry out an offset.



The temperature drop between the hot water sensor and the return sensor can be reduced by increasing the circulation pump speed. The current temperature difference between the hot water sensor and the return sensor is indicated as ΔT pipe.

The optimum temperature difference is approx. 5 K.

1. Select the menu item **Offset**.
2. In the submenu **Offset**, select the menu item **Speed**.

Offset	
▶ Speed	70 %
ΔT pipe	4.9 K
Fl.rate	3.2 l/min

3. Adjust the speed with the Lightwheel®.

T-HW 60.2	3.2 l/min
	4.9 K
	 70%
T-RE 55.3	

4. If the desired temperature difference is reached, confirm the offset with the right button (✓).

Disinfection	
▶ Set temp.	60 °C
Runtime	60 Min
Duration	5 Min

Main menu / Opt. functions / Disinfection

Adjustment channel	Description	Adjustment range / selection	Factory setting
Disinfection	Activation of the function	Yes, No	No
Start?	Manual start of the disinfection		
Set temp.	Set temperature for the disinfection	60 ... 75 °C	60 °C
Runtime	Runtime of the disinfection function	30 ... 240 min	60 min
Duration	Duration of the disinfection	1 ... 20 min	5 min
Hysteresis	Hysteresis for the disinfection	1 ... 5 K	5 K
Overrun	Overrun time of the pump	0 ... 60 min	10 min
Time	Time for the automatic start of the disinfection	01:00 ... 23:00	01:00
Monday ... Sunday	Submenu for selecting the days for the automatic start of the disinfection	Monday ... Sunday	all

back

This function helps to contain the spread of Legionella in hot water and circulation pipes in the secondary circuit of the heat exchanger. The **Disinfection** function starts automatically, if the adjusted time at the adjusted day is reached.

The function can also be started manually via the menu item **Start?**

If the disinfection starts, the circulation pump switches on.

The circulation pump remains active for the adjustable runtime.

During disinfection, the speed of the primary pump is controlled so that the adjustable set temperature is maintained at the hot water sensor. The progress of the disinfection is indicated in % in the status menu.

The disinfection is considered successfully completed, if during the adjusted runtime the temperature at the return sensor has continuously exceeded the value **Set temperature - Hysteresis** for the entire adjusted duration. The date of the last disinfection is indicated in the status menu.

After disinfection has ended, the circulation pump remains switched on for the adjusted overrun time. When the **Disinfection** function is active, it can be cancelled by means of the menu item **Cancel?** at any time.

WARNING! Scald danger!



Scalding may occur if the set temperature is adjusted to a value higher than 60 °C.

→ Make sure that no water is drawn off by non-professionals during disinfection.



Note

While the disinfection is active, a sufficiently high store temperature must be ensured.

→ Make sure the store is sufficiently heated before disinfection begins.



Note

In cascade operation, the progress is divided among the individual stations, beginning with the numerically smallest. Only if all stations available have run the disinfection, will the disinfection process be considered successfully completed.



Note

The disinfection function is only available, if the circulation function is activated.

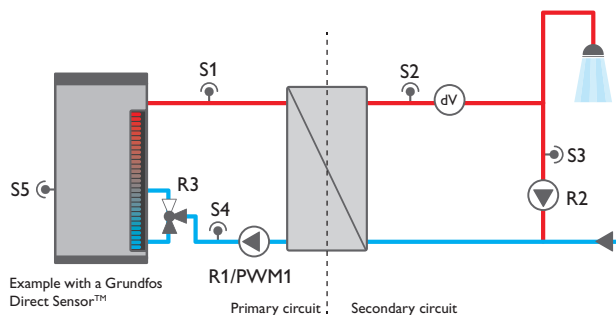
Stratified return

Stratified return	
Type	Thermal
TOn	35 °C
Toff	30 °C

Main menu / Opt. functions / Stratified return

Adjustment channel	Description	Adjustment range / selection	Factory setting
Stratified return	Activation of the function	Yes, No	No
Type	Variant	Thermal, Difference	Thermal
TOn	Switch-on temperature (Thermal)	20... 45 °C	35 °C
Toff	Switch-off temperature (Thermal)	19... 44 °C	30 °C
Δ TOn	Switch-on temperature difference (Difference)	0.5... 20.0 K	10.0 K
Δ Toff	Switch-off temperature difference (Difference)	0.5... 20.0 K	6.0 K

back



This function can be used for keeping the temperature stratification inside the store from being destroyed.

For this function, 2 variants are available:

Type Thermal:

If the adjustable switch-on temperature is exceeded at the return sensor, the controller switches on the relay for the stratified return. The return is then fed into the upper store zone.

If the temperature at the return sensor falls below the switch-off temperature, the relay switches off. The return is then fed into the lower store zone.

Type Difference:

If the temperature difference between the return sensor and the store sensor exceeds the adjustable value switch-on temperature difference, the relay for the stratified return switches on. The return is then fed into the upper store zone.

If the temperature difference between the return sensor and the store sensor falls below the adjustable value switch-off temperature difference, the relay switches off. The return is then fed into the lower store zone.



Note

The controller uses the **sensor input S5** for measuring the temperature at the store sensor.

The 3-port valve has to be mounted in a way so that the flow direction is towards the lower store zone when the valve is without current. In order to protect the stratification in the upper store zone, the store sensor has to be mounted in the lower store zone.



Note

In cascade operation, the stratified return valve has to be connected to R2 of station 2.

Blocking protection

```

Blocking protect.
└─ Start. time 00:30
   └─  Primary p.
      └─  Circ. pump
  
```

Main menu / Opt. functions / Blocking protect.

Adjustment channel	Description	Adjustment range / selection	Factory setting
Blocking protect.	Activation of the function	Yes, No	No
Start. time	Starting time of the function	00:00 ... 23:50	00:30
Primary p.	Blocking protection primary pump	Yes, No	Yes
Circ. pump	Blocking protection circulation pump	Yes, No	Yes
Stratified return	Blocking protection stratified return valve	Yes, No	Yes
Line valve*	Blocking protection line valve	Yes, No	Yes
back			

* Available for system type **Station 1** only

This function can be used for protecting the selected pumps and valves against blocking after a standstill. The blocking protection will be carried out for the relays selected one after the other each day at the adjusted starting time.



Note

In cascade operation, the blocking protection will be carried out for all stations successively.

Error relay

```

Error relay
└─ Type Normal
   └─ Level Disturb.
      └─ back
  
```

Main menu / Opt. functions / Error relay

Adjustment channel	Description	Adjustment range / selection	Factory setting
Error relay	Activation of the function	Yes, No	No
Type	Error relay type	Inverted, Normal, Off	Off
Level	Error category of the message	Disturb., Warning, Note	Disturb.
back			

This function can be used for operating a relay in the case of an error. Thus, e.g. a signalling device can be connected in order to signal errors.

If the **Normal** type is selected, the controller switches the potential-free relay when a fault occurs.

If the **Inverted** type is selected, the relay always remains switched on as long as no fault occurs. If a fault occurs, the controller switches off the potential-free relay.

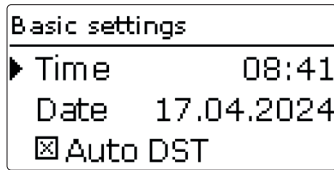
By means of the parameter **Level**, the error category of the message can be selected, see page 23. Depending on the selection made, the following messages are indicated:

Disturb. = Disturbances

Warning = Disturbances + warnings

Note = Disturbances + warnings + notes

10 Basic settings



Main menu / Basic settings

Adjustment channel	Description	Adjustment range / selection	Factory setting
Time	Adjustment of the current time	00:00 ... 23:59	-
Date	Adjustment of the date	01.01.2001 ... 31.12.2099	01.01.2010
Auto DST	Automatic daylight saving time adjustment	Yes, No	Yes
Language	Selection of the menu language	Deutsch, English, Français, Español, Italiano	Deutsch
Disp. standby	Adjustment of the display standby	10 ... 300 s	120 s
Alarm level	Adjustment of the alarm level	Disturb., Warning, Note	Disturb.
Type	System type for the controller	Single station, Station 1, Station 2, Station 3, Station 4	Single station
Reset	back to factory setting	Yes, No	No

back

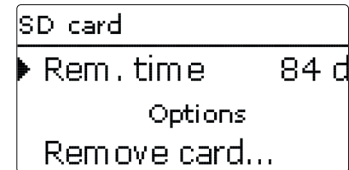
In this menu, all basic parameters for the controller can be adjusted. Normally, these settings have been made during commissioning. They can be subsequently changed in this menu.



Note

In cascade operation, a reset can be carried out on every station controller.

11 MicroSD 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.



Note

The MicroSD card used must be formatted in FAT32.

Running firmware updates

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

→ In order to run an update, select **Yes**.

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



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.



Note

The controller will only recognise a firmware update file if it is stored in a folder named **RESOL\Fresh** on the first level of the MicroSD card.

→ Create a folder named **RESOL\Fresh** on the MicroSD card and extract the downloaded ZIP file into this folder.

Starting the logging

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

Logging will start immediately.

Completing the logging process

1. Select the menu item **Remove card...**
2. 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.



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 a 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

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

The **file selection** window will appear.

2. Select the desired .SET file.

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



Note

To safely remove the MicroSD card, always select the menu item **Remove card...** before removing the card.



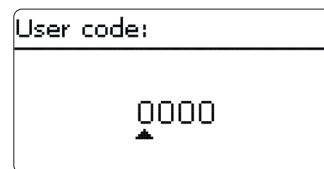
Note

In cascade operation, the **SD card** menu will be available on each station controller. In order to log cascade values, store or load controller adjustments, insert a MicroSD card into each controller of the cascade.

Main menu / SD card

Adjustment channel	Description	Adjustment range / selection	Factory setting
Remove card...	Safely remove card	-	-
Save adjustments	Save adjustments	-	-
Load adjustments	Load adjustments	-	-
Logging int.	Logging interval	00:01 ... 20:00 (mm:ss)	01:00
Logging type	Logging type	Cyclic, Linear	Linear

12 User code



In this 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

If the installer user code has been entered, the controller changes to the parameterisation mode, see page 10.



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

13 Manual mode

Manual mode	
▶ Primary p.	Auto
Circ. pump	Auto
Line valve	Auto

In this menu, the operating mode of all relays used can be adjusted.

Auto = Relay in automatic mode

0... 100% = Pump running at adjusted speed (manual mode)

Centre / Base = Valve in adjusted position

Open / Closed* = Valve open or closed

Error / OK = Error relay in **Error** or **OK** mode



Note

After service and maintenance work, the relay mode must be set back to **Auto**. Otherwise normal operation will not be possible.

Main menu / Manual mode

Adjustment channel	Description	Adjustment range / selection	Factory setting
Primary p.	Operating mode selection for the primary pump	Auto, 0... 100%	Auto
Line valve*	Operating mode selection for the line valve	Auto, Open, Closed, Off	Auto
Circ. pump	Operating mode selection for the circulation pump	Auto, 0... 100%	Auto
Strat.ret.	Operating mode selection for the stratified return valve	Off, Centre, Base, Auto	Auto
Error relay	Operating mode selection for the error relay	Error, OK, Auto	Auto

* Available in cascade operation only



Note

In cascade operation, adjust the manual mode of the relays at the corresponding station.

14 Troubleshooting

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

The Lightwheel® flashes red.

Sensor fault. The message **!Sensor fault** 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.

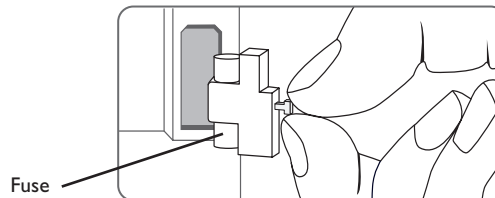
°C	Ω Pt1000	°C	Ω Pt1000
-10	961	55	1213
-5	980	60	1232
0	1000	65	1252
5	1019	70	1271
10	1039	75	1290
15	1058	80	1309
20	1078	85	1328
25	1097	90	1347
30	1117	95	1366
35	1136	100	1385
40	1155	105	1404
45	1175	110	1423
50	1194	115	1442

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.

The display is permanently off.

Press the right button (✓). Display illuminated?

no

yes

Controller has been in standby, everything OK

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

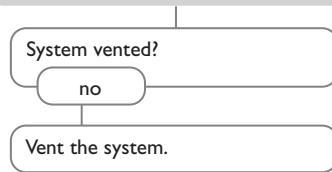
no

yes

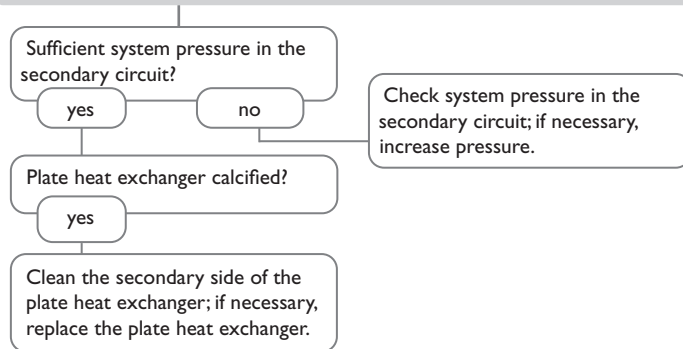
The fuse of the controller could be blown. The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.

Check the supply line and reconnect it.

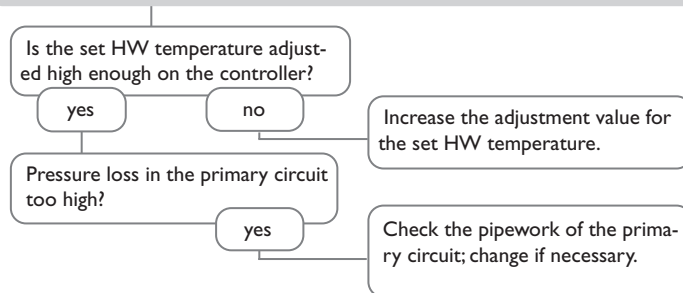
Pump noise can be heard, bubbling in the pipes.



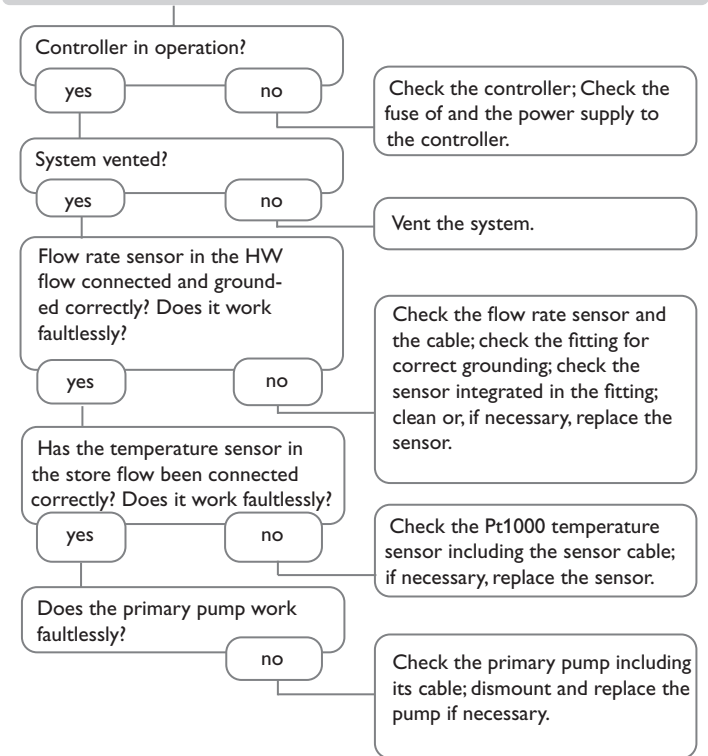
Draw-off amount is too small.



Draw-off temperature is too low.



DHW heating does not work



15 Index

B		O	
Blocking protection	30	Operating control LED	10
C		Operating mode, relays	33
Circulation	26	S	
Commissioning menu	15	Sensor fault, error message	23
Controller adjustments, loading of	32	Set hot water temperature	24
D		Stratified return	29
Data logging	32	T	
E		Technical data	5
Electrical connection	6	Troubleshooting	34
Emergency speed	25	U	
Error relay	30	User code	32
F			
Firmware updates	31		
Fuse, replacing of	34		
L			
Lightwheel®	10		
M			
Manual mode	10, 33		
Measured values	21, 22		
Microbuttons	10		
MicroSD card	31		
MicroSD card slot	7		
Mounting	6		

Distributed by:

LK Armatur AB

Garnisonsgatan 49
SE-254 66 Helsingborg
Sweden

LK Armatur Deutschland GmbH

Alte Reichsstraße 15
DE-32549 Bad Oeynhausen
Deutschland