

FC4.13 as heat transfer controller

Manual for the
specialised craftsman

Mounting

Connection

Operation

Troubleshooting

Application examples



11208752

Thank you for buying this product.
Please read this manual carefully to get the best performance from this unit.
Please keep this manual carefully.

en
Manual

Safety advice

Please pay attention to the following safety advice in order to avoid danger and damage to people and property.

Instructions

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

Information about the product

Proper usage

The controller is designed for use in the Friwa DHW exchange module in compliance with the technical data specified in this manual.

Improper use excludes all liability claims.

CE-Declaration of conformity

The product complies with the relevant directives and is therefore labelled with the CE mark.



Note:

Strong electromagnetic fields can impair the function of the controller.

- Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

Subject to technical change. Errors excepted.

Target group

These instructions are exclusively addressed to authorised skilled personnel. Only qualified electricians should carry out electrical works. Initial installation must be effected by the system owner or qualified personnel named by the system owner.

Description of symbols

WARNING! Warnings are indicated with a warning triangle!



→ **They contain information on how to avoid the danger described.**

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

- **WARNING** means that injury, possibly life-threatening injury, can occur.
- **ATTENTION** means that damage to the appliance can occur.



Note:

Notes are indicated with an information symbol.

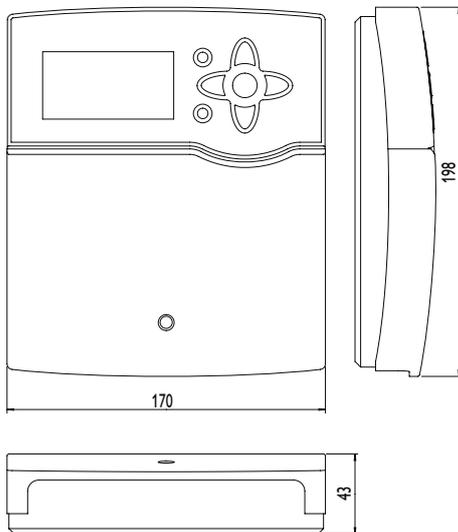
→ Arrows indicate instruction steps that should be carried out.

Disposal

- Dispose of the packaging in an environmentally sound manner.
- Dispose of old appliances 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.

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Overview



Note:

The SD card is not included with the controller.

Technical data

Inputs: 10 inputs for Pt1000 temperature sensors, 1 V40 impulse input, input for 1 analogue Grundfos Direct Sensor™ or 1 FlowSonic ultrasonic sensor (depending on the controller version), 1 input for a CS10 irradiation sensor, 1 FlowRotor input

Outputs:

3 semiconductor relays, 1 potential-free relay, 4 PWM outputs (switchable to 0-10V)

Switching capacity:

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

4 (1) A 24 V~/240 V~ (potential-free relay)

Total switching capacity: 4 A 240 V~

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

Supply connection: type Y attachment

Power consumption: < 1 W (Standby)

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

Rated impulse voltage: 2.5 kV

Data interfaces: VBus®, SD card slot

VBus® current supply: 60 mA

Functions: sliding set value adjustment, circulation, thermal disinfection, comfort function, heat exchanger, stratified return, error relay, blocking protection.

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

Display: full graphic display, control lamp (directional pad) and background illumination

Operation: 7 push buttons at the front of the housing

Protection type: IP 20/EN 60529

Protection class: I

Ambient temperature: 0 ... 40 °C

Degree of pollution: 2

Dimensions: 198 x 170 x 43 mm

1 Heat transfer controller installation

1.1 Mounting

WARNING! Electric shock!



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

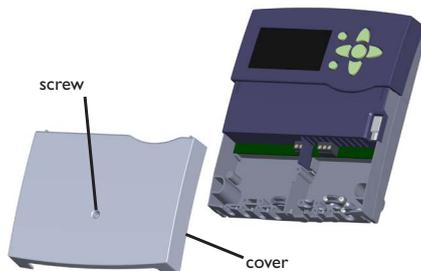
Upon opening the housing, live parts are exposed!

The FC4.13 DHW controller is integrated into the SUS Midi or Maxi heat transfer module respectively. If the controller is to be installed outside of the heat transfer module, please mind the following instructions. The device must only be located in dry interior rooms. The controller must additionally be supplied from a double pole switch with contact gap of at least 3 mm.

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

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

- Unscrew the cross-head 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 points (centres 150 mm).
- Insert lower wall plugs.
- 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 chap. 1.2.
- Put the cover on the housing.
- Attach with the fastening screw.



Note:

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

1.2 Electrical connection

WARNING! Electric shock!



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

L' is a fused contact permanently carrying voltage.

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.**

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.

Relay 4 is a potential-free electromechanical relay.

Conductor R1 ... R4

Neutral conductor N (common terminal block)

Protective earth conductor \oplus (common terminal block)



Note:

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



Note:

In the heat transfer module with this controller, only high-efficiency pumps with a PWM control signal can be used.



Note:

The minimum pump speed must be set to 100% when non-speed-controlled devices such as valves are connected.

**Note:**

The cables of the controller are pre-connected. chap. 1.2 is for information purposes only. Make sure the hydraulic system is properly grounded!

**Note:**

For more details about the initial commissioning procedure see chap. 2.2.

Mains and sensor cables are already connected to the device.

Additional **temperature sensors** (S3 to S10) can be connected to the terminals S3 ... S10 and GND (either polarity).

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

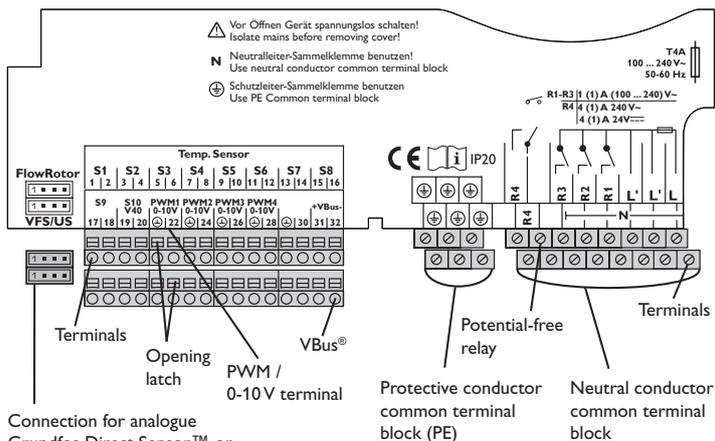
The **mains connection** is at the terminals:

Neutral conductor N

Conductor L

Conductor L' (L' is not connected with the mains cable. L' is a fused contact permanently carrying voltage).

Protective earth conductor Ⓢ (common terminal block)



Connection for analogue Grundfos Direct Sensor™ or FlowSonic ultrasonic sensor respectively

2 Heat transfer controller commissioning

2.1 Factory menu

In the factory menu, the controller can be adjusted to the heat transfer module in which it is integrated (SUS Midi, Maxi). In order to do this, the parameter Hydraulic variant must be adjusted.

WARNING!**Scald danger! System damage!**

Adjusting a wrong hydraulic variant can lead to inadmissibly high water temperatures.

→ **The hydraulic variant must be adjusted by authorised personnel only!**

The hydraulic variant determines the range of available functions and parameters of the controller according to the equipment of the heat transfer module.

2.2 Running the commissioning menu

The commissioning menu is run after the first connection and after every reset. It will request the following basic adjustments:

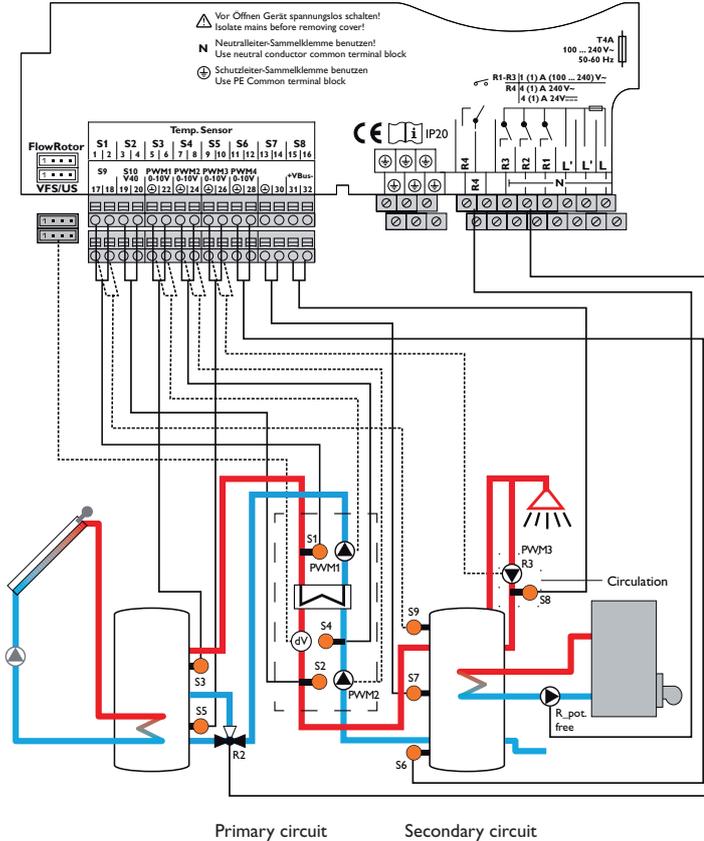
- Menu language
- Time
- Date
- System variant
- Hot water set temperature
- Maximum speed of the primary pump
- Maximum speed of the secondary pump

When the last item **Save** at the end of the commissioning menu is selected, a safety enquiry appears. If the safety enquiry is confirmed, the adjustments are saved.

For further information about the commissioning menu see page 14.

2.2.1 Overview of relay and sensor allocation

Heat transfer controller in heat transfer module with preheating (SUS Sys 1 variant)



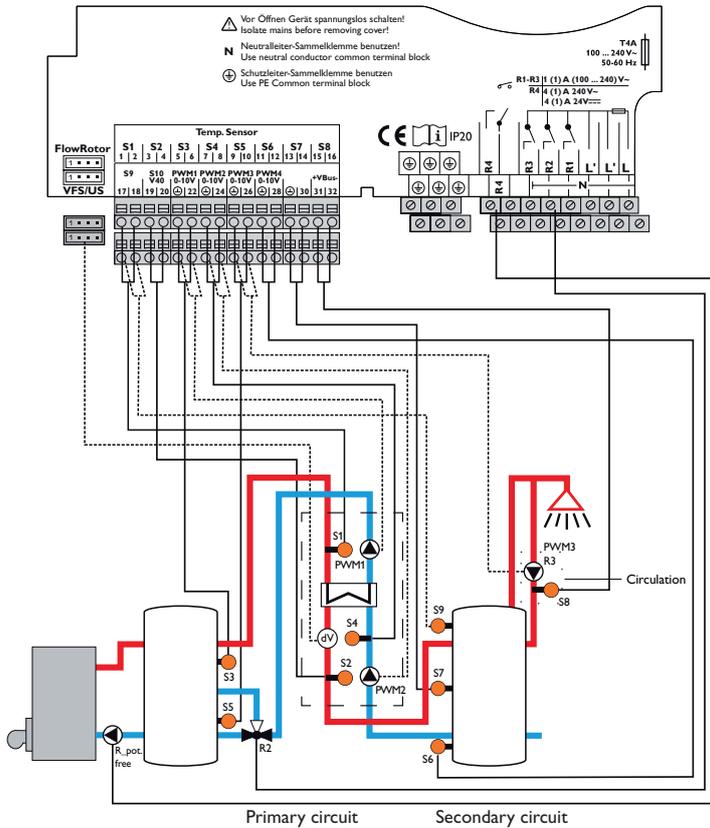
Relay / sensor allocation

Connection terminal	Description	Indication
PWM1	Primary pump	Primary pump
PWM2	Secondary pump	Secondary pump
PWM3	Circulation pump	Circulation pump
S1	Store flow sensor	T-FL
S2	Hot water flow sensor	T-HW
S3	Temperature sensor source, top	T-Source t.
S4	Cold water sensor	T-CW
S5	Temperature sensor source, bottom	T-Source b.
S6	Temperature sensor sink, bottom	T-Sink b.
S7	Temperature sensor sink, centre	T-Sink c.
S8	Circulation return sensor	T-circ RET
S9	Temperature sensor sink, afterheating	T-Sink AH
VFS/US	Flow rate sensor	Flow rate
R2	Stratified return relay	Stratified return
R3	Circulation pump relay	Circulation pump
R_pot.free	Afterheating relay	Afterheating

Not shown in the system graphics

R1	Parallel relay store loading	Parallel relay
----	------------------------------	----------------

Heat transfer controller in heat transfer module with buffer store (SUS Sys 2 variant)



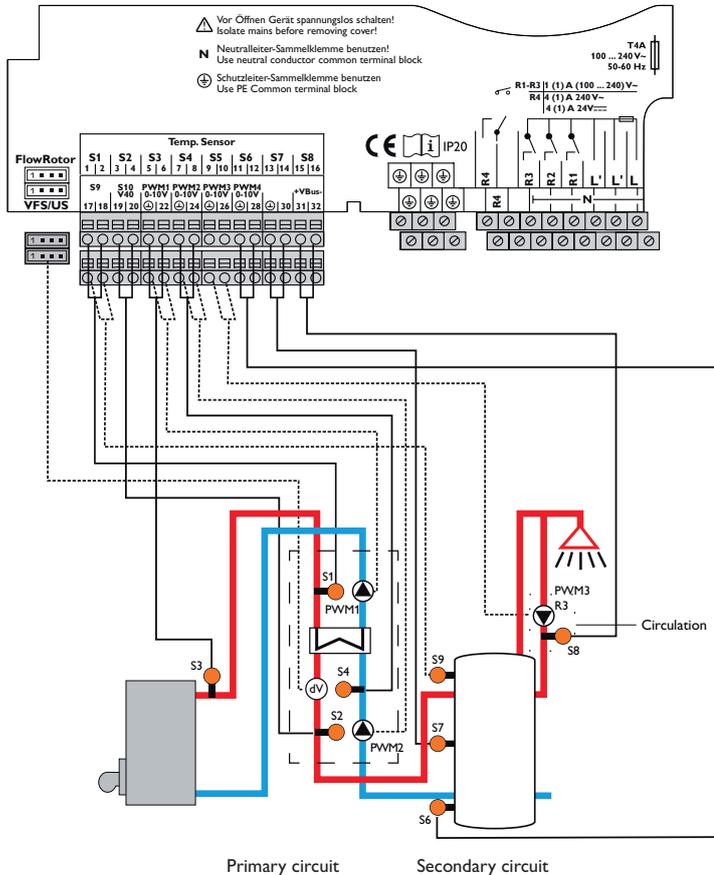
Relay/sensor allocation

Connection terminal	Description	Indication
PWM1	Primary pump	Primary pump
PWM2	Secondary pump	Secondary pump
PWM3	Circulation pump	Circulation pump
S1	Store flow sensor	T-FL
S2	Hot water flow sensor	T-HW
S3	Temperature sensor source, top	T-Source t.
S4	Cold water sensor	T-CW
S5	Temperature sensor source, bottom	T-Source b.
S6	Temperature sensor sink, bottom	T-Sink b.
S7	Temperature sensor sink, centre	T-Sink c.
S8	Circulation return sensor	T-circ RET
S9	Temperature sensor sink, afterheating	T-Sink AH
VFS/US	Flow rate sensor	Flow rate
R2	Stratified return relay	Stratified return
R3	Circulation pump relay	Circulation pump
R_pot.free	Afterheating relay	Afterheating

Not shown in the system graphics

R1	Parallel relay store loading	Parallel relay
----	------------------------------	----------------

Heat transfer controller in heat transfer module without buffer store (SUS Sys 3 variant)



Relay/sensor allocation

Connection terminal	Description	Indication
PWM1	Primary pump	Primary pump
PWM2	Secondary pump	Secondary pump
PWM3	Circulation pump	Circulation pump
S1	Store flow sensor	T-FL
S2	Hot water flow sensor	T-HW
S3	Temperature sensor source, top	T-Source t.
S4	Cold water sensor	T-CW
S6	Temperature sensor sink, bottom	T-Sink b.
S7	Temperature sensor sink, centre	T-Sink c.
S8	Circulation return sensor	T-circ RET
S9	Temperature sensor sink, afterheating	T-Sink AH
VFS/US	Flow rate sensor	Flow rate
R3	Circulation pump relay	Circulation pump
R_pot.free	Afterheating relay	Afterheating
Not shown in the system graphics		
R1	Parallel relay store loading	Parallel relay

2.3 Operation and function

2.3.1 Buttons

The controller is operated via the 7 buttons next to the display. They have the following functions:

button 1 - scrolling upwards

button 3 - scrolling downwards

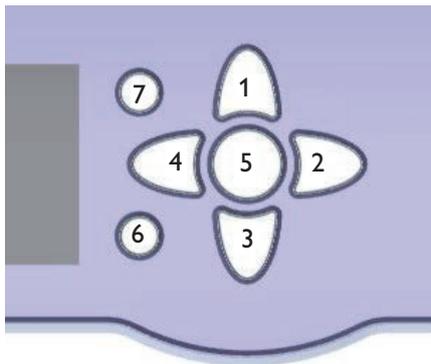
button 2 - increasing adjustment values

button 4 - reducing adjustment values

button 5 - confirming

button 6 - switching to the status menu

button 7 - escape button for changing into the previous menu



2.3.2 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 a few seconds, the display illumination goes out.

Press any key to reactivate the display illumination.

→ In order to scroll through a menu or to adjust a value, press either buttons 1 and 3 or buttons 2 and 4.

→ To open a sub-menu or to confirm a value, press button 5.

→ To enter the status menu, press button 6 – unconfirmed adjustments will not be saved.

→ To enter the previous menu, press button 7 – unconfirmed adjustments will not be saved.

If no button has been pressed within a couple of minutes, the adjustment is cancelled and the previous value is retained.

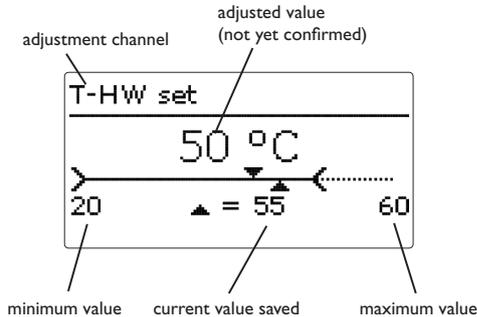
Store loading	
T-Source t.	
▶ S3	96 °C >>>
T-FL	

If the symbol >>> is shown behind a menu item, pressing button 5 will open a new sub-menu.

Meas. / Balance	
▶ □ Sensors	
US	9.6 l/min
S1	63.0 °C

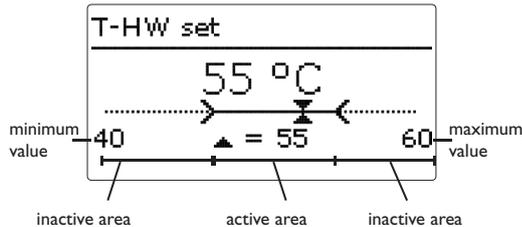
If the symbol □ is shown in front of a menu item, pressing button 5 will open a new sub-menu. If it is already opened, a ein □ is shown instead of the □.

Values and adjustments can be changed in different ways:



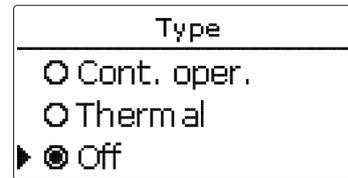
Numeric values can be adjusted by means of a slide bar. The minimum value is indicated to the left, the maximum value to the right. The large number above the slide bar indicates the current adjustment. By pressing buttons 2 or 4 the upper slide bar can be moved to the left or to the right.

Only after the adjustment has been confirmed by pressing button 5 will the number below the slide bar indicate the new value. The new value will be saved if it is confirmed by pressing button 5 again, the controller switches to the previous menu.

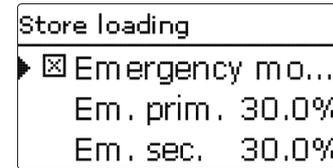


When 2 values are locked against each other, they will display a reduced adjustment range depending on the adjustment of the respective other value.

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 button 5 is pressed, the selection is confirmed and the controller switches to the previous menu.



Some selection possibilities are displayed with checkboxes. When an item has been selected, an x appears inside the checkbox.

Adjusting the timer

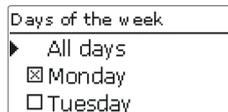
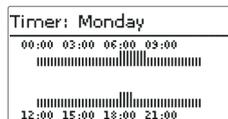
When the **Timer** option is activated, a timer is indicated in which time frames for the function can be adjusted.

First of all, an overview of the current adjustments is displayed. For each day of the week there is an overview display. The display can be switched back and forth between the different days by pressing buttons **2** and **4**.

In order to adjust the timer, press button **5**.

First the individual days of the week or all days of the week can be selected.

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

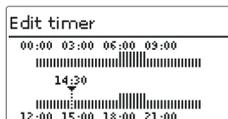


Adding a time frame:

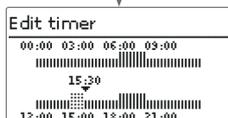
The time frames can be adjusted in steps of 15 min.

In order to add an active time frame, proceed as follows:

➔ Move the cursor to the desired starting point of the time frame by pressing buttons **2** and **4**. Confirm the starting point of the time frame by pressing button **1**.



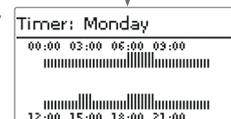
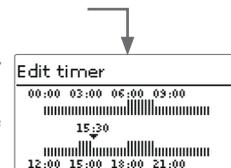
➔ Move the cursor to the desired ending point of the time frame by pressing buttons **2** and **4**.



➔ The end of a time frame can be determined by pressing button **5**.

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

➔ Press button **5** again to get back to the overview of current adjustments.



Removing a time frame:

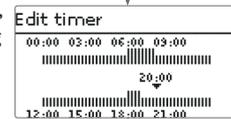
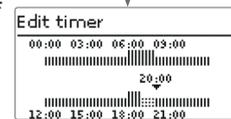
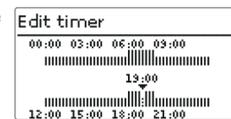
In order to remove an active time frame, proceed as follows:

➔ Determine the point from which on the time frame is to be removed by pressing button **3**.

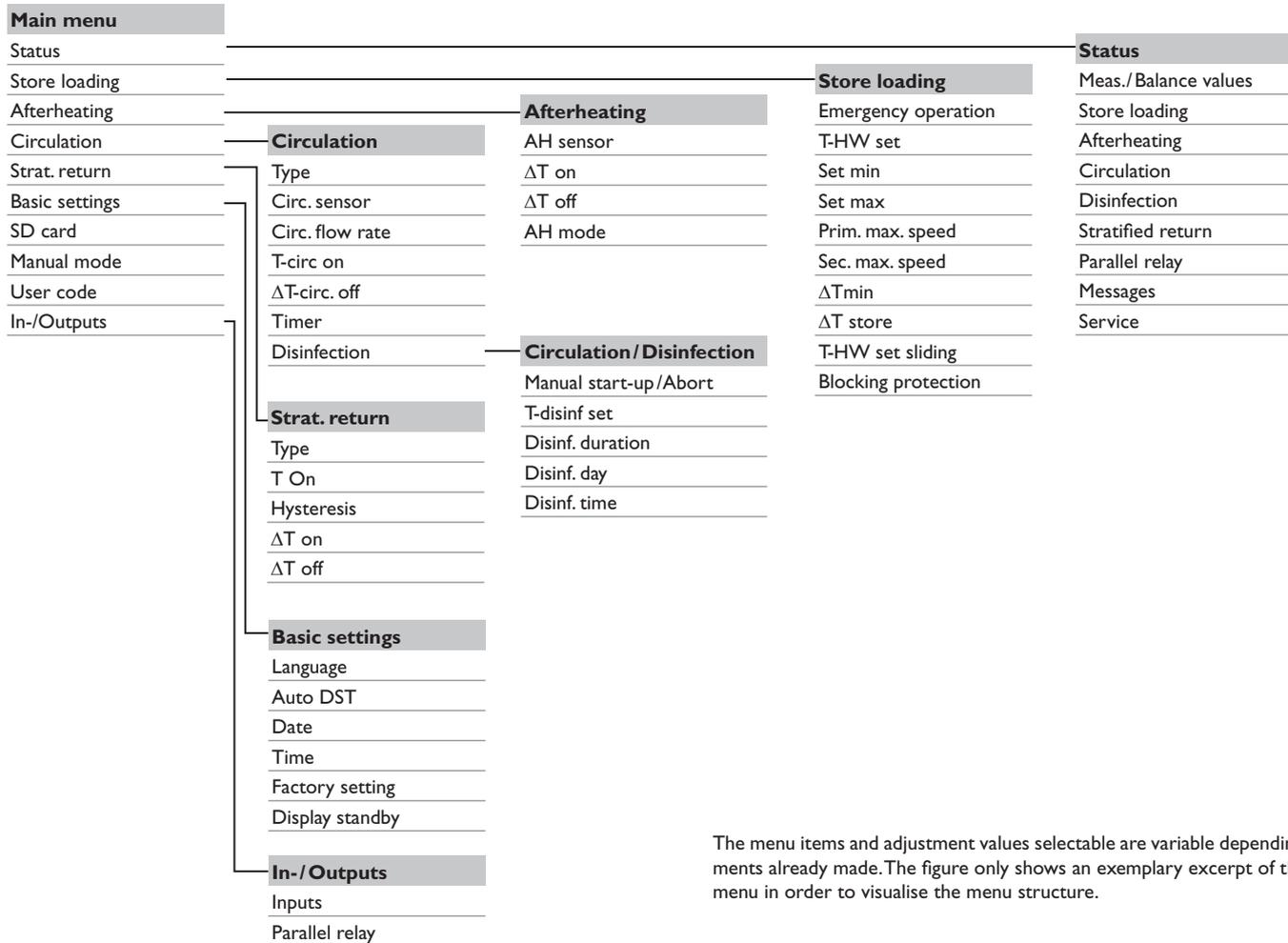
➔ Move the cursor to the desired ending point of the time frame by pressing buttons **2** and **4**.

➔ In order to conclude removing the time frame, press button **5** upon reaching the desired ending point.

➔ Press button **5** again to get back to the overview of current adjustments.



2.3.3 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.

2.4 Commissioning menu

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.

The commissioning menu consists of the following channels which can be entered and adjusted line by line.

1. Language:

→ Adjust the desired menu language.

Basic settings	
▶ Language	English
<input checked="" type="checkbox"/> Auto DST	
Date	09.03.2015

2. Daylight savings time adjustment:

→ Activate or deactivate the automatic daylight savings time adjustment.

Auto DST	
<input checked="" type="radio"/> Yes	
<input type="radio"/> No	

3. Time:

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

Time	
11:31	

4. Date:

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

Date	
?? ?? 2014	

5. Selecting the variant

→ Select the variant of the heat transfer system. For detailed information see page 7.

Variant	
<input type="radio"/> SUS Sys 3	
<input type="radio"/> SUS Sys 2	
<input checked="" type="radio"/> SUS Sys 1	

6. Hot water set temperature / Set temperature secondary circuit flow

→ Adjust the desired set temperature of for loading the secondary store.

For detailed information see page 15.

T-HW set	
55 °C	
20	▲ = 60
60	

7. Maximum speed of the primary and secondary pump

→ Adjust the desired maximum speed of the primary pump.

Prim. max. speed	
85.0%	
1.5	▲ = 100.0
100.0	



Note:

The output of the heat transfer module can only be limited by adjusting the **maximum speed of the secondary pump**.



Note:

Limiting the maximum speed of the primary pump will lead to a smooth start of the pump. Only adjust the default value, if a boiler with low power is directly connected to the station.

→ Adjust the desired maximum speed of the secondary pump.



Note:

The adjustable values of both channels represent the speed of the corresponding pump.

Maximum speed (100%) is reached at 80 to 90% of the PWM signal duty cycle. The minimum value (1.5%) is reached at 10 to 20% of the PWM signal duty cycle.

The duty cycle of the corresponding PWM signal is indicated in the status menu.



Note:

For detailed information see manual of the heat transfer module!

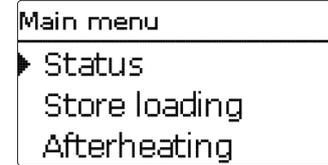
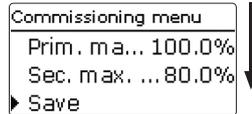
3 Heat transfer controller adjustments

3.1 Main menu

8. Completing the commissioning menu:

- In order to save the adjustments, select Save. The controller is then ready for operation and normally the factory settings will give close to optimum operation.
- In order to get back to the commissioning menu channels, press button .

The adjustments carried out during commissioning can be changed anytime in the corresponding adjustment channel.



In this menu, the different menu areas can be selected. The following menus are available:

Status
Store loading
Afterheating
Circulation
Strat. return
Basic settings
SD card
Manual mode
User code
In-/Outputs

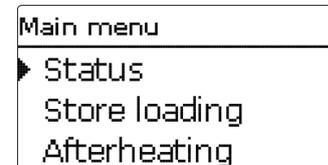


Note:

If no button is pressed for the adjustable time **T-display standby**, the display illumination goes out. After 3 more minutes, the controller switches to the **Status/Store loading** menu.

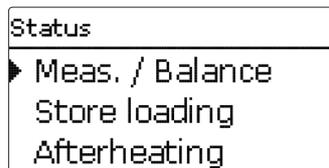
- In order to get from the **Status/Store loading** menu into the main menu, press button  twice!

3.2 Status menu



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

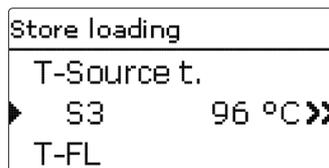
3.2.1 Meas./Balance values



In the **Status/Meas./Balance values** menu, all current measurement values as well as a range of balance values are displayed. Some of the menu items can be selected in order to enter a sub-menu.

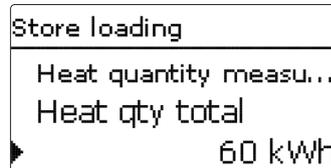


The status of the store loading, the circulation, the disinfection, the stratified return, the allocation of sensors and relays as well as the operating hours counter are indicated.

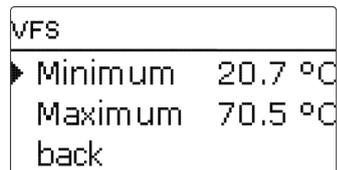


If, for example, **Store loading** is selected, a submenu with the sensors and relays allocated opens. In the submenu, the current temperatures and the current pump speed are indicated.

When a line with a measurement value is selected, another sub-menu will open.

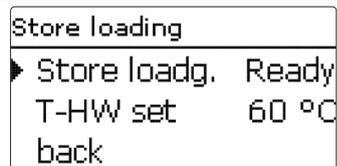


In the **Meas./Balance values/Store loading** menu, information about the heat quantity generated in the secondary circuit is indicated, e.g. the total heat quantity, the heat quantity generated on the current day, the current power and the total draw-off quantity.



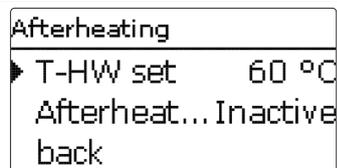
If, for example, **VFS** is selected, a submenu indicating the minimum and maximum values will open.

3.2.2 Store loading



In the **Status/Store loading** menu, the status of the store loading is indicated.

3.2.3 Afterheating



In the **Status/Afterheating** menu, the status of the afterheating is indicated.

3.2.4 Circulation

```
Circulation
┌───────────┴───────────┐
▶ Circulation Active
  Mode      Therm.
  back
```

In the **Status/Circulation** menu, the status of the circulation, the circulation type selected and, if applicable, remaining runtimes and blocking times are indicated.

3.2.5 Disinfection

```
Disinfection
┌───────────┴───────────┐
▶ Disinfection Inactive
  back
```

In the **Status/Disinfection** menu, the status and the progress of the thermal disinfection, different time counters and the number of previous starts are indicated.

3.2.6 Stratified return

In the **Status/Stratified return** menu, the status of the function is indicated.

```
Strat. return
┌───────────┴───────────┐
▶ Stratified re...Active
  back
```

In the corresponding menus, the status values of the function selected are indicated.

3.2.7 Parallel relay

```
Parallel relay
┌───────────┴───────────┐
▶ Parallel relay Inactive
  back
```

In the **Status/Parallel relay** menu, the status of the parallel relay (active or inactive) is indicated.

3.2.8 Messages

```
Messages
┌───────────┴───────────┐
▶ Everything OK
  Version      2.00
                SUS Maxi
```

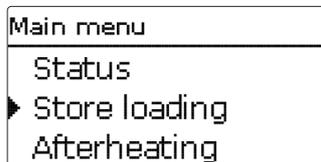
In the **Status/Messages** menu, error and warning messages are indicated. During normal operation, the message **Everything OK** is indicated. A line break or short circuit in a sensor line is indicated as **!Sensor fault**. A precise error code can be found in the Status/Meas.-/Balance values menu. In the case of an error, the LED of the directional pad flashes red in addition.

3.2.9 Service

```
Service
┌───────────┴───────────┐
▶ S1                >>>
  S2                >>>
  S3                >>>
```

In the **Status/Service** menu, each sensor and relay is indicated with the component or function it has been allocated to. Relays and sensor inputs that are not used will not be indicated here.

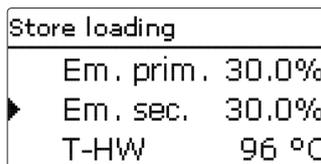
3.3 Store loading



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

- Emergency operation
- Hot water set temperature/Set temperature secondary circuit flow
- Minimum hot water set temperature/minimum set temperature secondary circuit flow
- Maximum hot water set temperature/maximum set temperature secondary circuit flow
- Sliding set value
- Blocking protection

Emergency operation



Main menu/Store loading/Emergency operation

Adjustment channel	Description	Adjustment range/ selection	Factory setting
Emergency operation	Activation of the function	Yes, No	No
Em. prim.	Emergency speed of the primary pump	1.5 ... 100.0%	30.0%
Em. sec.	Emergency speed of the secondary pump	1.5 ... 100.0%	30.0%
T-HW	Indicates the current flow temperature in the secondary circuit for aligning the emergency speed.	-	-

back

The **Emergency operation** function can be used for ensuring the hot water supply and loading of the secondary store in the case of a sensor fault. In this case the pumps will run at the adjustable **Em. prim.** and **Em. sec.** For this purpose, the emergency speed must be aligned with the resulting temperature at the hot water flow sensor in the secondary circuit. The display channel **T-HW** allows this alignment directly in the Store loading menu, as soon as the emergency operation has been activated.

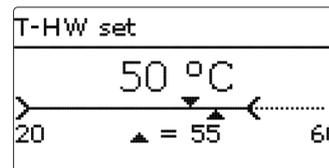


Note:

If a sensor fault inhibiting DHW heating or store loading has occurred, activate the emergency operation in the Emergency mode channel.

In order to ensure a quick entry to emergency operation in the case of an emergency, perform the alignment of the emergency speed as early as possible.

Hot water set temperature/Set temperature secondary circuit flow (T-HW set)



Main menu/Store loading/T-HW set

Adjustment channel	Description	Adjustment range/ selection	Factory setting
T-HW set	Hot water set temperature/Set temperature secondary circuit flow (T-HW set)	20 ... 75 °C	60 °C

This parameter can be used for adjusting the **T-HW set** temperature which is to be reached at the HW flow sensor. This temperature is also used for loading the secondary store. The controller then determines the pump speed of the primary pump such that the temperature at the HW flow sensor in the secondary circuit continuously keeps the required set temperature T-HW set.



Note:

If the SUS Sys 2, 3 variants have been selected and the circulation function is active, **T-HW set** cannot be adjusted to a value smaller than (**T-circ on** + Δ **T-circ off** + hysteresis).

Maximum speed of the primary pump

Store loading
Set max 60 °C
▶ Prim. ma... 100.0%
Sec. max. ... 80.0%

Main menu / Store loading / Prim. max. speed

Adjustment channel	Description	Adjustment range / selection	Factory setting
Prim. max. speed	Maximum speed of the primary pump	1.5 ... 100%	100%

With the parameter **Prim. max. speed** the maximum speed of the primary pump can be adjusted.



Note:

The adjustable value represents the speed of the corresponding pump. Maximum speed (100%) is reached at 80 to 90% of the PWM signal duty cycle. The minimum value (1.5%) is reached at 10 to 20% of the PWM signal duty cycle.

The power of the PWM signal is indicated in the status menu.

Maximum speed of the secondary pump

Store loading
Prim. ma... 100.0%
▶ Sec. max. ... 80.0%
ΔTmin 10 K

Main menu / Store loading / Sec. max. speed

Adjustment channel	Description	Adjustment range / selection	Factory setting
Sec. max. speed	Maximum speed of the secondary pump	1.5 ... 100%	80%

With the parameter **Sec. max. speed** the maximum speed of the primary pump can be adjusted.



Note:

The adjustable values of both channels represent the speed of the corresponding pump.

Maximum speed (100%) is reached at 80 to 90% of the PWM signal duty cycle. The minimum value (1.5%) is reached at 10 to 20% of the PWM signal duty cycle.

The duty cycle of the corresponding PWM signal is indicated in the status menu.

Minimum hot water set temperature

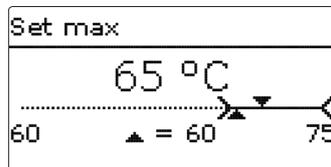
Set min
30 °C
20 ▲ = 20 60

Main menu / Store loading / Set min

Adjustment channel	Description	Adjustment range / selection	Factory setting
Set min	Minimum hot water set temperature	20 ... 75 °C	20 °C

This parameter determines the minimum limitation for the adjustment of the hot water set temperature **T-HW set**.

Maximum hot water set temperature

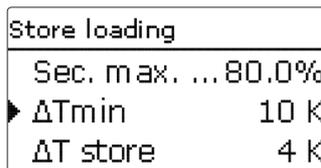


Main menu / Store loading / Set max

Adjustment channel	Description	Adjustment range / selection	Factory setting
Set max	Maximum hot water set temperature	20 ... 75 °C	60 °C

This parameter determines the maximum limitation for the adjustment of the hot water set temperature **T-HW set**.

ΔTmin

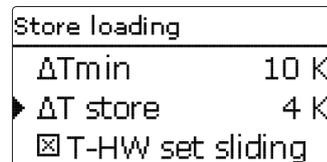


Main menu / Store loading / ΔTmin

Adjustment channel	Description	Adjustment range / selection	Factory setting
ΔTmin	Set temperature difference between between source and sink	5 ... 30 K	10K

The parameter **ΔTmin** determines the set temperature difference, that has to be reached between **T-Source t.** and **T-Sink b.**, in order to activate store loading.

ΔT store



Main menu / Store loading / ΔT store

Adjustment channel	Description	Adjustment range / selection	Factory setting
ΔT store	Set difference between hot water set temperature and store temperature	1 ... 10K	4K

The parameter **ΔT store** determines the set temperature difference, that has to be reached between the temperature at **T-Sink c.** and the adjusted set temperature **T-HW set**, in order to activate store loading.

Sliding set value



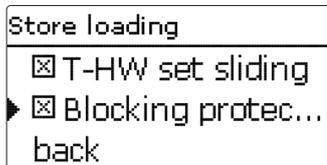
Main menu / Store loading / Sliding set value

Adjustment channel	Description	Adjustment range / selection	Factory setting
T-HW set sl.	Activation of the function back	Yes, No	Yes

When the T-FL temperature measured at the T-FL sensor is insufficient for reaching the T-HW set temperature, **T-HW set** will be decreased dynamically.

The speed of the primary pump will be controlled such that the dynamic set temperature **T-HW set sl.** is held at the **T-HW sensor**.

Blocking protection



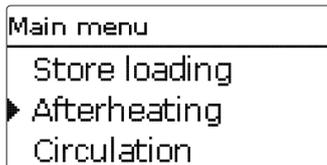
Main menu/Store loading/Blocking protection

Adjustment channel	Description	Adjustment range/ selection	Factory setting
Blocking protection	Activation of the function	Yes, No	No

The **Blocking protection** function can be used for protecting the pumps against blocking after a standstill. Blocking protection is executed daily at 12 o'clock. Depending on the system and the functions activated, it will energise the primary, secondary and circulation pump as well as the valves.

Switch-on time is 4 s. The circulation pump runs first. Then, the primary pump starts. Then, if connected, the valves are switched on one after another. DHW heating and circulation take priority over the blocking protection. In the case of a draw-off, the blocking protection for the corresponding pumps is aborted.

3.3.1 Afterheating



Main menu/Afterheating

Adjustment channel	Description	Adjustment range/ selection	Factory setting
AH sensor	Afterheating sensor selection	S6, S7, S9	S9
ΔT on	Switch-on temperature difference	5 ... 30 K	10 K
ΔT off	Switch-off temperature difference	3 ... 15 K	5 K
AH mode	Afterheating mode selection	Source, Source and sink	Source

back

In the SUS Sys 1 system, the afterheating function is used for heating the secondary store to the temperature (T-HW set + ΔT off), if the temperature at the AH sensor falls below T-HW set.

Permanent afterheating

If the system SUS Sys2 or Sys3 and the AH mode Source have been selected, the afterheating will heat the primary store up to the temperature (T-HW set + ΔT off), as soon as the temperature at sensor S3 falls below (T-HW set + ΔT on).

Demand-dependent afterheating

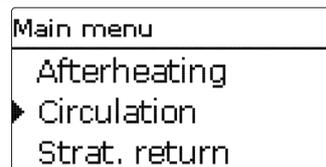
If the system SUS Sys2 or Sys3 and the AH mode Source and sink have been selected, the afterheating will heat the primary store up to the temperature (T-HW set + ΔT off), if the temperature at sensor S3 falls below (T-HW set + ΔT on) and if the temperature at S7 falls below T-HW.



Note:

If the SUS Sys3 variant has been selected, the plate heat exchanger will be supplied with heat directly by a boiler. Select the AH mode Source and sink in order prevent the boiler from being activated with a delay.

3.4 Circulation



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

For the circulation function, 2 different modes are available:

Circulation modes:

- Continuous operation
- Thermal

With the Timer function, time frames can be adjusted in which a certain circulation type is active.

The Timer function works as follows on the different circulation types:

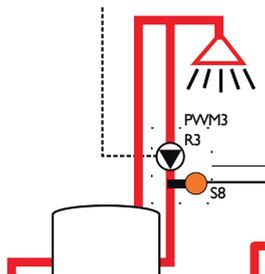
Circulation type	Active inside time frames	Active outside time frames
Thermal	Thermal	No circulation
Continuous operation	Continuous operation	No circulation

When one of the circulation types is selected, the corresponding adjustment channels will appear.



Note:

The circulation function must be activated in order to use the thermal disinfection function.



Continuous operation

The circulation pump is permanently on.

Thermal

If the temperature **T-circ.** at the T-circ. sensor falls below the switch-on temperature **T-circ. on**, the circulation pump will be activated.

If the temperature T-circ. at the T-circ. sensor exceeds the limit value (**T-circ. on** + **ΔT-circ. off**), the circulation pump will be switched off.

Main menu/Circulation

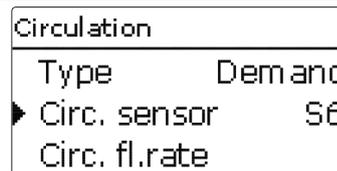
Adjustment channel	Description	Adjustment range/ selection	Factory setting
Type	Circulation type	Off, Demand, Thermal, Therm. + Dem., Cont. oper.	Off
Circ. sensor	Selecting the circulation sensor	S6, S8	S8
Circ. fl. rate	Sub-menu for the manual offset of the circulation flow rate	-	-
T-circ on	Switch-on temperature for the circulation in Thermal type	20 ... 70 °C	40 °C
ΔT-circ off	Switch-off temperature for the circulation in Thermal type	2 ... 10 K	3 K
Timer	Timer	-	-
Disinfection	Sub-menu for the thermal disinfection	-	-



Note:

If the SUS Sys 2, 3 variants have been selected and the circulation function is active, **T-circ on** and **ΔT-circ off** cannot be adjusted to a value higher than (**T-HW set** - **hysteresis**).

3.4.1 Circulation sensor



With the parameter **Circ. sensor**, a sensor input can be allocated for measuring the **T-circ. RET** temperature.

The following functions use the temperature measured at the Circ. sensor:

- Limit temperature (**T-circ. on** + **ΔT-circ. Hysteresis**) ffor the circulation type Thermal

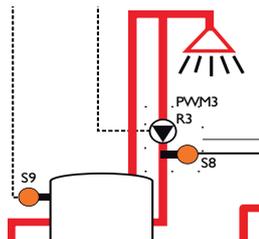
3.4.2 Manual offset of the circulation pump

Circ. fl.rate	0.0 l/min
Circ. speed	80%
▶ ΔT circ. pipe	4.0 K
Circ. fl.r...	4.0 l/min

Main menu / Circulation / Circ. fl. rate

Adjustment channel	Description	Adjustment range/selection	Factory setting
Circ. speed	Circulation pump speed	20 ... 100%	100%
Circ. speed_min	Minimum speed of the circulation pump	10 ... 100%	70%
ΔT-circ. pipe	Indication of temperature loss in the circulation pipe	-	-

back



The temperature loss in the circulation pipe (beginning and end of the circulation pipe) can be reduced by increasing the pump speed **Circ. speed** of the secondary pump.

The current temperature difference between the reference sensors will be indicated as **ΔT circ. pipe**. In order to comply with the DVGW guidelines, this temperature difference should be less than 5 K. If the temperature difference is higher than 5 K, increase the circulation speed.

In the variants, the temperature difference will be calculated as follows:

Variant SUS Sys 1

$\Delta T\text{-circ. pipe} = \text{Temperature at AH sensor} - \text{temperature circulation return sensor T-circ. RET}$

Variants SUS Sys 2, 3

$\Delta T\text{-circ. pipe} = \text{Temperature secondary store sensor T Sink c.} - \text{temperature circulation return sensor T-circ. RET. (S8)}$

3.4.3 Disinfection

Circulation
Timer
▶ Disinfection
back

Main menu / Disinfection

Adjustment channel	Description	Adjustment range/selection	Factory setting
Disinfection	Disinfection	Yes, No	No
Manual start-up	Manual start-up of the disinfection	Start, Abort	-
T-disinf. set	Set temperature for the disinfection	60 ... 75 °C	60 °C
Disinf. duration	Duration of the disinfection	30 ... 240 min	60 min
Disinf. day	Sub-menu for selecting the days for the automatic start-up of the disinfection	-	-
Disinf. time	Time for the automatic start-up of the disinfection	00:00 ... 23:59	01:00

back

This function helps to contain the spread of Legionella in the secondary store and in the circulation pipe. The **Disinfection** function will automatically start, if the adjusted **Disinf. time** on the adjusted **Disinf. day** has been reached.

By means of the menu item **Manual start-up** the disinfection can be started manually at any time.

When the disinfection function starts, the secondary store will be loaded. The circulation pump starts running at **Circ. speed_min**. During disinfection, the speed of the primary pump is controlled such that the temperature **T-Disinf set** is reached and held at the **T-CW sensor** as well as at the **T-circ RET sensor**.

The Disinfection is considered successful when, during the **Disinf. duration**, the required set temperature is kept up at the sensors **T-CW** and **T-circ RET**. The store loading and the circulation pump become inactive and the message **Disinf. successful the {Date}** is indicated.

The highest temperature reached at the **T-circ. RET** sensor is indicated in the message **max temp. at Circ. RET = {max. temp.} °C**.

When the disinfection function is active, it can be aborted by means of the menu item **Abort** at any time.

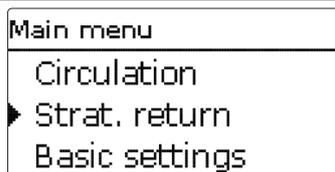
WARNING! Scald danger!

Scalding may occur if T-disinf. set is adjusted to a value higher than 60 °C.

**Note:**

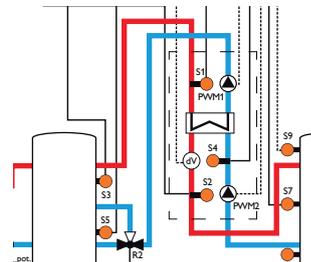
While the thermal disinfection is active, a sufficient temperature in the primary store and heat supply by the boiler must be ensured.

→ Make sure the store is sufficiently heated and the boiler can supply enough heat before disinfection begins.

3.5 Stratified return**Main menu/Circulation/Stratified return**

Adjustment channel	Description	Adjustment range/selection	Factory setting
Stratified return	Activating the function	Yes, No	No
Type	Stratified return mode	Thermostat, Difference	Thermostat
T On	Switch-on temperature for the stratified return mode Thermostat	20 ... 45 °C	35 °C
Hysteresis	Switch-off hysteresis for the stratified return mode Thermostat	0.5 ... 20.0 K	5.0 K
ΔT on	Switch-on temperature difference for the stratified return mode Difference	0.5 ... 20.0 K	10.0 K
ΔT off	Switch-off temperature difference for the stratified return mode Difference	0.5 ... 20.0 K	6.0 K

back



The **Stratified return** function can be used for keeping the temperature stratification inside the primary store from being destroyed while the circulation is running. For this function, 2 different modes are available:

Thermostat mode (switching between two store zones or stores. Using the T-CW sensor):

When the adjustable temperature **T on** is exceeded at the **T-KW (S4)** sensor, the controller energises the relay for the stratified return. The return is fed into the upper store zone or the warmer store respectively.

When the temperature at the T-CW sensor falls below the limit temperature (**T on-hysteresis**), the relay is switched off. The return is fed into the lower store zone or the cooler store respectively.

**Note:**

The 3-port valve has to be mounted such that it is normally open towards the lower store zone or the cooler store respectively.

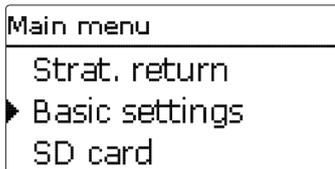
Difference mode (switching between two store zones or stores, using the T-CW sensor and an additional store sensor):

When the temperature difference between the **T-CW (S4)** sensor and the **store sensor in the primary store (S5)** exceeds the adjustable value **ΔT on** the relay for the stratified return is energised. The return is fed into the upper store zone or the warmer store respectively.

When the temperature difference between the T-CW sensor and the store sensor of the primary store falls below the adjustable value **ΔT off**, the relay is switched off. The return is fed into the lower store zone or the cooler store respectively.

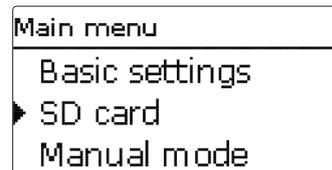
**Note:**

If the Difference mode is adjusted, the controller uses the **S5 sensor input** for measuring the store sensor temperature. The 3-port valve has to be mounted such that it is normally open towards the lower store zone or the cooler store respectively. In order to protect the stratification in the upper store zone or the warmer store respectively, the store sensor must be mounted in the upper store zone or the warmer store respectively.

3.6 Basic settings**Basic settings**

Adjustment channel	Description	Adjustment range/ selection	Factory setting
Language	Selection of the menu language	Deutsch, English, Francais, Espanol, Italiano, Nederlands, Portugues	Deutsch
Auto DST	Automatic daylight saving time adjustment	Yes, No	Yes
Date	Adjustment of the current date	01.01.2001 ... 31.12.2099	01.01.2010
Time	Adjustment of the current time	00:00 ... 23:59	-
T-display standby	Display illumination time	10 ... 300 s	30 s
Factory setting back	back to factory settings	Yes, No	No

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.

3.7 SD card

The controller is equipped with an SD card slot for SD memory cards.

With an SD card, the following functions can be carried out:

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

Firmware updates

When an SD card with a firmware update is inserted, the enquiry **Update?** is indicated on the display. The setting can be changed between **Yes** and **No** by pressing buttons **2** and **4**.

➔ To run the update, select **Yes** and confirm by pressing button **5**.

The update is 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.

➔ To skip the update, select **No**.

The controller commences normal operation.

**Note:**

The controller will only recognise a firmware update file if it is stored in a folder named **FC413** on the first level of the SD card.

➔ Create a folder named **FC413** on the SD card and extract the downloaded ZIP file into this folder.

Starting the logging

➔ Insert the SD card into the slot

➔ Adjust the desired logging type and interval

Logging will start immediately.

Stopping the logging

- ➔ 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.



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 an SD 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 SD card.

Loading controller adjustments

- ➔ To load controller adjustments from an SD card, select the menu item **Load adjustments**.

The File selection window is indicated.

- ➔ Select the desired .SET file.

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

Formatting the SD card

- ➔ Select the menu item **Format card**.

The content of the card will be deleted and the card will be formatted with the FAT file system.



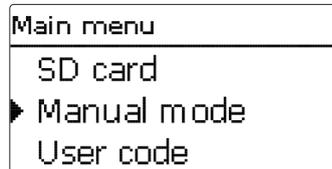
Note:

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

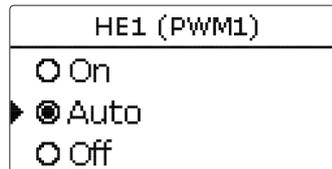
SD card

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

3.8 Manual mode



In the **Manual mode** menu, the operating mode of all relays on the controller and of all PWM outputs in use can be adjusted.



If the operating mode for HE1 or HE2 respectively is set to **On**, **Off** or **Auto**, this will only affect the speed control signal sent to the pump via PWM output 1 or 2 respectively. The 100% power supply to the pump is kept up by the L' connection.

Operating modes for HE1 and HE2:

- On = 100% power supply via L', 100% pump speed signal via PWM output
- Auto = 100% power supply via L', flexible pump speed signal via PWM output
- Off = 100% power supply via L', 0% pump speed signal via PWM output

The operating mode can be selected for each individual relay, too. The following modes are available for all relays:

- Off = Relay is switched off (manual mode)
- Auto = Relay is in automatic mode
- On = Relay active at 100% speed (manual mode)



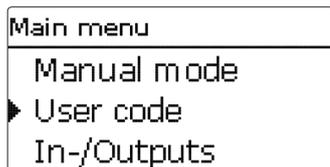
Note:

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

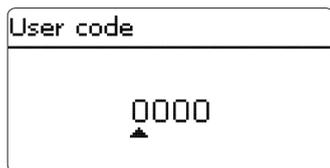
Manual mode

Adjustment channel	Description	Adjustment range/ selection	Factory setting
All relays...	Operating mode of all relays	Auto, Off	Auto
Controller			
HE1	Operating mode of the primary pump	On, Auto, Off	Auto
HE2	Operating mode of the secondary pump	On, Auto, Off	Auto
HE3	Operating mode of the circulation pump	On, Auto, Off	Auto
Relay (1...4)	Operating mode of the individual relays	On, Auto, Off	Auto

3.9 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 expert level, the expert user code must be entered: Expert user code: 0262

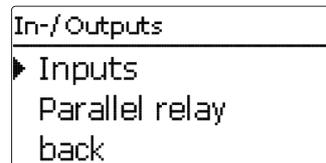


Note:

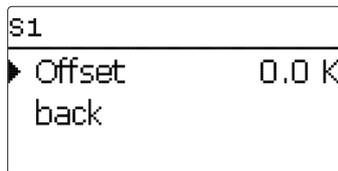
For safety reasons, the user code should generally be set to the customer code before the controller is handed to the customer!

Customer user code: 0000

3.10 Inputs



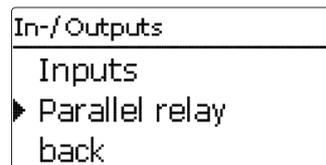
In the **Inputs** menu, sensor offsets can be adjusted.



Inputs

Adjustment channel	Description	Adjustment range/ selection	Factory setting
S1...S9	Sensor offset submenus	-	-
Offset	Sensor offset	-15.0...+15.0 K	0.0 K

3.11 Parallel relay



Parallel relay

Adjustment channel	Description	Adjustment range/ selection	Factory setting
Parallel relay	Activation of the function	Yes, No	Yes
back			

With the **Parallel relay** function, e.g. an additional 2-port valve in the secondary circuit can be controlled.

The parallel relay will be energised in parallel to the primary and secondary pump.

4 Heat transfer controller data communication

4.1 Data communication/Bus

The controller is equipped with a **VBus**[®] for data transfer with and energy supply to external modules. The connection is carried out at the two terminals marked **VBus**[®] and **GND** (either polarity). One or more **VBus**[®] modules can be connected via this data bus, such as:

- AM1 Alarm Module
- Datalogger

WARNING! Electric shock!



L' is a fused contact permanently carrying voltage.

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

4.2 SD memory card slot

The controller is equipped with an SD card slot.

With an SD card, the following functions can be carried out:

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

An SD card is not included with the controller.

For more information about using an SD card, see page 25.

5 Troubleshooting

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



Directional pad flashes red.

Sensor fault. The error code **!Sensor fault** is displayed instead of a temperature 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 controller 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 button . Display illuminated?

no

yes

Controller has been in standby, everything o.k.

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.

System vented?

no

Vent the system.

Draw-off amount is too small.

Sufficient system pressure in the secondary circuit?

yes

no

Check system pressure in the secondary circuit; if necessary, increase pressure.

Plate heat exchanger calcified?

yes

Clean the secondary side of the plate heat exchanger; if necessary, replace the plate heat exchanger.

Draw-off temperature is too low.

Is the HW set temperature high enough?

yes

no

Increase the adjustment value for the HW set temperature.

Pressure loss in the primary circuit too high?

yes

Check the pipework of the primary circuit; change if necessary.

DHW heating does not work

Controller in operation?

yes

no

Check the controller; Check the fuse of and the power supply to the controller.

System vented?

yes

no

Vent the system.

Has the FlowSonic ultrasonic sensor in the HW flow been connected correctly? Does it work faultlessly? Has the Pt1000 temperature sensor in the store flow been connected correctly? Does it work faultlessly?

yes

no

Check the FlowSonic ultrasonic sensor including its cable; if necessary, replace the sensor. Check the Pt1000 temperature sensor including the sensor cable; if necessary, replace the sensor.

Has the temperature sensor in the store flow been connected correctly? Does it work faultlessly?

yes

no

Check the Pt1000 temperature sensor including the sensor cable; if necessary, replace the sensor.

Does the primary pump work faultlessly?

no

Check the primary pump including its cable; dismount and replace the pump if necessary.

Message on the display	Cause	Related function	Required for re-commissioning	Standalone controller	Cascade controller
!Sensor fault	Temperature sensor fault	- Function using this sensor	After repair, the function will automatically be reactivated and the error message deleted.	Yes	Yes
!T-FL	T-ST_FL sensor fault	- Sliding set temperature - Cold start function - Comfort function	After repair, the function will automatically be reactivated and the error message deleted.	Yes	Yes
!T-HW	T-HW sensor fault	- DHW heating and store loading - Cold start function - Circulation - Thermal disinfection - Heat quantity measurement	After repair, the function will automatically be reactivated and the error message deleted.	Yes	Yes
!T-CW	T-CW sensor fault	- Circulation - Heat quantity measurement - Thermal disinfection	After repair, the function will automatically be reactivated and the error message deleted.	Yes	Yes
!Flow rate	Flow rate sensor fault	- DHW heating and store loading - Circulation - Thermal disinfection - Heat quantity measurement	After repair, the function will automatically be reactivated and the error message deleted.	Yes	Yes
!Primary circuit	Fault in the primary circuit (primary pump fault)	- DHW heating and store loading - Cold start function - Comfort function	After repair, the function will automatically be reactivated and the error message deleted.	No	Yes
!Circulation pump	Circulation pump fault	- Circulation (if Circ.pump = active)	After repair, the error message will automatically be deleted.	Yes	Yes
!T-FL too low	Store flow temperature too low for reaching the hot water set temperature	-	After repair, the error message will automatically be deleted.	No	Yes
!Cont. pump operation	Primary pump permanently on	- DHW heating and store loading - Cold start function - Comfort function	➔ After repair, manually acknowledge the error message. After repair, the functions will automatically be activated, the module be available for cascade operation and the error message deleted.	Yes	Yes
No message on the display	Overtemperature protection function	- DHW heating and store loading	If T-HW > T-HW set, the primary pump will automatically be activated.	Yes	Yes
Emergency operation	Emergency operation of the primary pump has been activated by user and pump is active in emergency mode	- DHW heating and store loading	➔ Deactivate emergency mode.	Yes	Yes

Message on the display	Cause	Related function	Required for re-commissioning	Standalone controller	Cascade controller
Blocking protection active	Blocking protection activated and currently active for pumps and valves	-	→ Deactivate blocking protection.	Yes	Yes
Desinf. successful the [##.##.##]	Disinfection function completed successfully, disinfection temperature for required disinfection duration reached	-	-	Yes	Yes
Disinf.temp. for [## Min.] exceeded	During and after completion of the disinfection, the temperature at the Circ. RET sensor exceeds the value (T-Disinf. set -5 K) for the defined duration.	-	-	Yes	Yes
max. temp at Circ. RET [## °C]	Disinfection function completed successfully, indication of the highest measured temperature at the Circ. RET sensor.	-	-	Yes	Yes
Everything OK	-	-	-	Yes	Yes

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