Domestic hot water controller FC3.8

6 (8) inputs, 4 outputs (3 relays, 1 potential-free switch output)

Installation and Operation Instructions

Content

General safety instructions

- This document is part of the product.
- Use the device only after reading and understanding this document.
- Keep this document in a safe place for the entire service life of the device.
  Pass this document on to subsequent owners and operators of the device.
- Adhere to all safety instructions. Consult (further) professional personnel in the event of any ambiguities.
- The measures described in this document may only be performed by qualified technical professionals. Exception: End-customers may operate the device when they have previously been trained by a technical professional.
- The domestic hot water module can be damaged by improper operation of the device.
- The device must not be connected to the mains power supply when:
  - the casing is open or damaged.
  - cables are damaged.
- Factory labels and markings must never be altered, removed or rendered unreadable.
- Observe the prescribed conditions of use, see section: *Technical data*.
- This device is not intended for:
  - Children
  - Persons with physical, sensory or mental impairment
  - Persons without sufficient experience or knowledge unless they are instructed in the use of the device, and initially supervised, by a person responsible for their safety.

EC Declaration of Conformity

This product conforms to the applicable European directives with regard to its design and its operating behaviour. This conformity has been verified.
Further information in this regard can be obtained from your dealer.

1 Proper usage

The domestic hot water controller, subsequently referred to as the *controller*, is an independently installed electronic temperature controller for on-surface installation.
The integration into a pump assembly is possible when the technical specifications of the controller are adhered to.
The maintenance-free controller is exclusively intended for the controlling and monitoring of the domestic hot water module WHI freshaqua. Only use original accessories for the controller.

2 About this manual

2.1 Contents

This manual contains all information required by a technical professional for setting up and operating the domestic hot water controller.

2.2 Target audience

The target audience of this manual are technical professionals who:
- have the knowledge of terminology and the skills necessary for setting up and operating domestic hot water stations.
- have the necessary training, knowledge and experience, and knowledge of the applicable regulations in order to evaluate and recognise the dangers inherent in the following work:
  – Installation of electrical equipment
  – Production and connection of data communication cables
  – Production and connection of mains grid power supply cables

3   Installation

ⓘ **Note**
The following section describes only the installation of the controller. Follow the instructions of each respective manufacturer when installing external components (valves etc.)

3.1   Opening/closing the casing

3.1.1   Removing the front panel

▶ Grasp the front panel ① by the grooves at the sides ② and pull forwards ③ (Fig. 1).
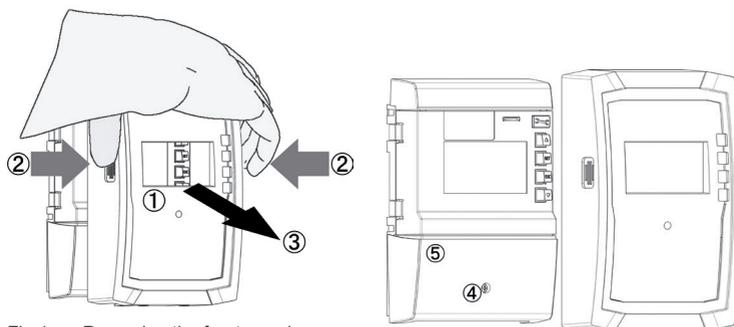
Fig 1:   Removing the front panel

3.1.2   Mounting the front panel

▶ Carefully position the front panel ① and then press it onto the casing until it latches into place.

3.1.3   Removing the terminal cover

⚠ **Danger**
Risk of death by electrocution!
- Disconnect the controller from the power supply before removing the terminal cover.
- Make sure that the power supply cannot be unintentionally switched on when the device is open.

1. Remove the screw ④ (Fig. 1).
2. Remove the terminal cover ⑤.

3.1.4   Mounting the terminal cover

1. Position the cover ⑤.
2. Tighten the screw ④ to a torque of 0.5 Nm.

3.2   Mounting the casing

The controller is firmly attached. Only observe this chapter in case of servicing (change of the controller).

√   The mounting location must satisfy the prescribed conditions of use; more information on this is provided in the *Technical data* section.
√   The mounting surface is vertical and allows good access for installation.

⚠   **Danger**
Risk of death by electrocution!
•   Disconnect the controller from the power supply before opening the casing.
•   Make sure that the power supply cannot be unintentionally switched on when the casing is open.
•   Do not use the casing as a drilling template.

1.   If necessary, remove the terminal cover.
2.   Screw in the screw for the upper mounting hole ❶ (Fig. 2) until the screw head has a clearance of 5 ... 7 mm from the mounting surface.
3.   Hang the controller on the screw by the upper mounting hole and align it vertically.
4.   Mark the position of the lower mounting hole ❷ through the casing.
5.   Remove the controller and prepare the mounting hole for the lower screw.
6.   Hang the controller by the upper mounting hole ❶ and then fasten the screw in the lower mounting hole ❷.
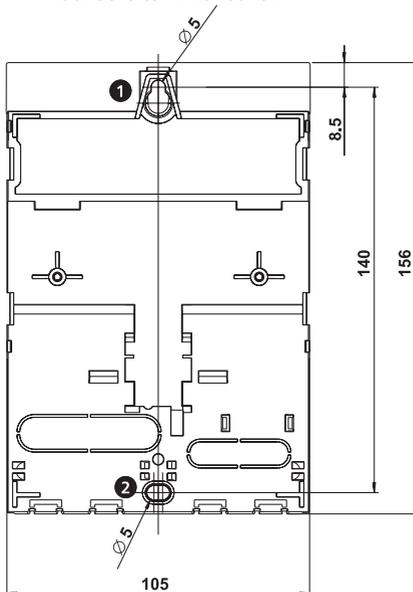7.   Mount the terminal cover.

Fig 2:   Rear side of the controller with the upper ❶ and lower mounting holes ❷

3.3   Establishing the electrical connections

Danger
Risk of death by electrocution! Make sure that the following conditions are satisfied when performing the work described in this section:
- All cables leading to the controller must be disconnected from the power supply and it must be ensured that they cannot be unintentionally reconnected during installation.
- The protective earth conductors (PE) from the mains cable and pump and valve cables must be connected to the protective *earth conductor terminal block*.
- All cables must be laid so that persons cannot stand on them or trip over them.
- The cables must satisfy the requirements listed in the *Technical data* section.
- The local power supply must match the specifications on the type plate of the controller.
- The power supply cable is to be connected to the mains power as follows:
  – using a plug connected to a wall mains socket *or*
  – via an isolating mechanism allowing complete isolation in the case of permanent wiring.
- The power supply cable must be laid in conformance to all applicable legal guidelines and regulations of the local electricity supplier.

Caution
Danger of damage and malfunction.
- Connect only components that do not overload the controller inputs and outputs; more information is provided on the type plate and in the *Technical data* section.

Note
- Any connection polarity may be used for the $1 - 4$ and R_s signal inputs and outputs.
- Only type Pt1000 temperature sensors may be used.
- Lay the sensor cables at least 100 mm away from any power supply cables.
- Use shielded sensor cables when inductive sources are present, e.g. high-voltage lines, radio transmitters, microwave devices.
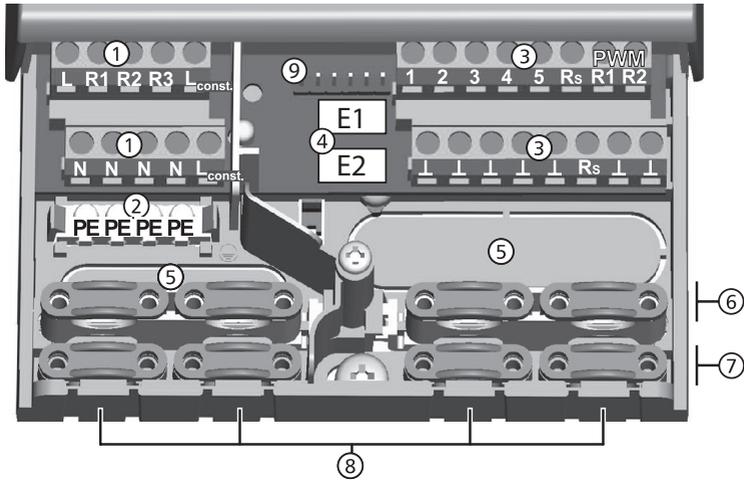
3.3.1 Position of the connection terminals

Fig 3:   Terminal clamps in the lower part of the controller (terminal cover removed)

①	*Power connection* terminal block:	
	L	1x phase conductor (mains input)
	$R1, R2$	2x output (TRIAC, for pumps or valves)
	$R3$	1x output (relay, for pumps or valves)
	$L_{const.}$	2x phase conductor (outputs, permanent voltage)
	N	4x neutral conductor (common neutral conductors for mains power input and outputs)
	ⓘ **Note** The outputs $R1$ and $R2$ are protected by an electronic fuse.	
②	*Protective conductor* terminal block:	
	PE	4x protective earth (common protective earth for power connection terminal block)
③	*Signals* terminal block:	
	$1 - 4$	4x sensor input (Pt1000 temperature sensor)
	5	1x communication connection for cascading
	R_s	1x signal output (potential-free relay contact for safety extra-low voltage)
	PWM R1	2x control output (for controlling high-efficiency pumps)
	PWM R2	Connection: PWM = brown, ⊥ = blue
	⊥	7x ground connection (common ground for sensor inputs and control outputs)
④	Multi-pin connector, only for internal use, 2x input for PAW FlowSonic (white)	
⑤	Cable openings on the rear side of the casing	
⑥	Upper strain relief clamps (2 identical plastic links, each with 2 strain relief clamps, supplied in the scope of delivery)	
⑦	Lower strain relief clamps	
⑧	Cable openings at the bottom of the casing	
⑨	TTL-/eBUS-interface	

3.3.2   Preparing the cable openings

The cables can be fed through openings in the rear wall of the casing or at the bottom of the casing. The openings are pre-punched and must be prepared as required before installation.

Prepare the cable openings in the rear wall of the casing as follows:
1. Break out the cable openings ⑤ (Fig. 3) using a suitable tool.
2. Deburr the edges.

Prepare the cable openings at the bottom of the casing as follows:
1. Cut the *required* cable openings ⑧ (Fig. 3) at the left and right using a suitable knife and break them out.
2. Deburr the edges.

3.3.3   Connecting the cables

√   All cables are voltage-free.
√   The cable openings have been prepared.

▶   Observe the following points when connecting the cables:
•   Connect the cable conductors to the correct terminals as described in the following *Terminal pin assignments* section.
•   Mains input and outputs: First connect PE, then N and L.
•   Strain reliefs:
  – First clamp the *lower* strain relief clamps and then the *upper* strain relief clamps.
  – When using the upper strain relief clamps, use the plastic links as described below.
  – If the opening in the strain relief clamp is too large, e.g. in the case of thin cables, turn over the strain relief clamping bar (with the bend facing down).
  – Only use the strain relief clamps for cables entering the bottom of the casing. Use external strain relief clamps when feeding cables through the rear of the casing.

3.3.4   Inserting / removing plastic links

Insert the plastic links as follows:
1. Insert the right plastic link with the latching protrusion first ① (Fig. 4).
2. Press the other side of the plastic link down ②, until the spring clamp latches into place.
3. Insert the left plastic link the other way around (latching protrusion to the left, spring clamp to the right).
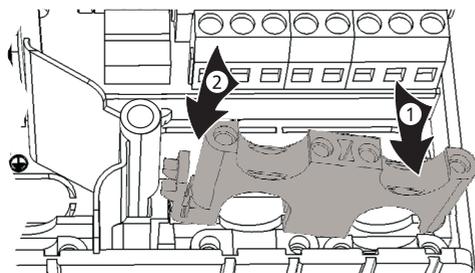
Fig 4:   Inserting the right plastic link

Remove the plastic links as follows:

1. Insert a screwdriver under the right plastic link between the casing and the spring clamp ①, ② (Fig. 5).
2. Carefully push the screwdriver to the left ③. Lever the spring clamp ① to the right until the plastic link ④ is free.
3. Pull out the plastic link upwards by hand ⑤.
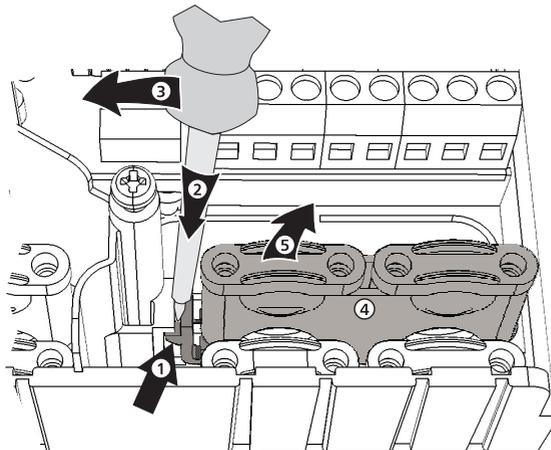4. Remove the left plastic link accordingly.

Fig 5:   Removing the right plastic link

3.4 Terminal pin assignments

The following tables and wiring diagrams show the assignment of the external components (pumps, sensors) to the controller terminal pins for the corresponding variants of the domestic hot water modules.

3.4.2 WHI freshaqua 22

Inputs

Terminal	Individual operation mode / Cascade operation mode
1, ⊥	Flow temperature, primary (TVL)
2, ⊥	---
3, ⊥	Optional: sensor for tank temperature (TSP)
4, ⊥	Cold water temperature, secondary (TKW)
E.1, T	Domestic hot water temperature, secondary
E.1, V'	Flow rate, secondary

Outputs

Terminal	Individual operation mode	Cascade operation mode
R1, N	---	Sequence valve
R2, N	Return valve (optional)	Return valve (optional, at the master controller)
R3, N	---	---
$L_{const.}$, N	Primary pump, Secondary pump (circulation)	Primary pump, Secondary pump (circulation, at the master controller)
PWM R1, ⊥	Primary pump	Primary pump
PWM R2, ⊥	Secondary pump (circulation)	Secondary pump (circulation, at the master controller)
Rs, Rs	Alarm	Alarm

The active valve R1 is not displayed on the controller display.

3.4.4 WHI freshaqua 44 / WHI freshaqua 55 / WHI freshaqua 100

Inputs

Terminal	Individual operation mode / Cascade operation mode
1, ⊥	Flow temperature, primary (TVL)
2, ⊥	Domestic hot water temperature, secondary (TWW)
3, ⊥	Optional: sensor for tank temperature (TSP)
4, ⊥	Cold water temperature, secondary (TKW)
E.1, T	(Domestic hot water temperature, secondary)
E.1, V'	Flow rate, secondary
E.2, T	(Domestic hot water temperature, secondary)
E.2, V'	Flow rate, secondary (only WHI freshaqua 100)

Outputs

Terminal	Individual operation mode	Cascade operation mode
R1, N	---	Sequence valve
R2, N	Return valve (optional)	Return valve (optional, at the master controller)
R3, N	Bypass (depending on station)	Bypass (depending on station)
$L_{const.}$, N	Primary pump, Secondary pump (circulation)*	Primary pump, Secondary pump (circulation, at the master controller)*
PWM R1, ⊥	Primary pump	Primary pump
PWM R2, ⊥	Secondary pump (circulation)	Secondary pump (circulation, at the master controller)
Rs, Rs	Alarm	Alarm

⚠️ **Caution**
* When using a circulation pump, especially with the WHI freshaqua 100, the power consumption of the pumps connected to the controller must absolutely be observed and it has to be checked whether they are compatible with the controller. In some cases the circulation pump the circulation pump directly has to be supplied by the mains connection. The speed is controlled via the PWM signal.
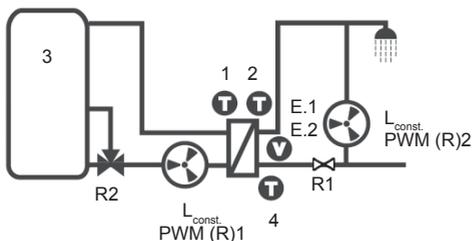
The active valve R1 is not displayed on the controller display.

The active valve R3 is displayed as a flashing heat exchanger on the display of the controller.

4   Commissioning the device for the first time

Danger
Risk of death by electrocution! Be sure to perform all the measures listed in the *Installation* section before starting the first commissioning.
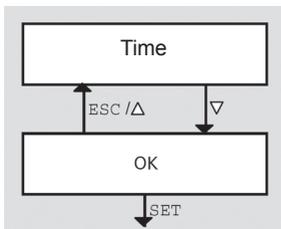
Note
- When power is removed for a longer period of time (> 15 min after a long period of power supply), the time and the date must be reset (following steps 1 – 5).
- Saved functions that are **not** connected with a time setting remain even after a longer power outage (> 15 minutes).

The controller is preset at the manufacturer.
You must only set the time and the date (Fig. left).

For the operation observe the section *Operation*.

Values can be subsequently changed during the guided configuration process. The following applies:
- ∇/ESC/$\triangle$ navigate *block-wise* forwards and backwards (Fig. left: ∇ = forwards; ESC/ ∇ = back).
- Navigation (with ∇/ESC/$\triangle$) is always possible after completing a block.
- Subsequent modification of a block is started with SET.

Commission the controller for the first time as follows:

Setting the time

1. Apply power to the controller.
   - The time 12:00 is displayed.
   - 12 flashes (Fig. left)
2. Press $\nabla\triangle$ to set the hours.
3. Press SET. The minutes flash.
4. Press $\nabla\triangle$ to set the minutes.
5. Press SET.
6. Repeat the steps 4 and 5 in order to set the year, the month and the day.

Note
The daylight saving times switching has to be carried out manually.

5   Construction

5.1   Casing
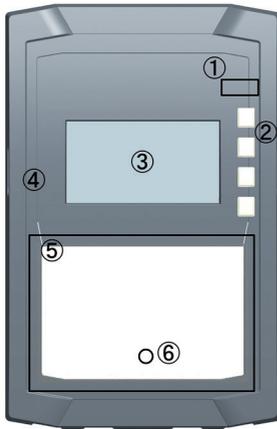
No.	Element	see section
①	Operation mode button ⌇⎓⎓⌇ (under front panel)	6.1, 7
②	Operating buttons △, SET, ESC, ▽	6.1
③	Display	5.2
④	Front panel	3.1
⑤	Terminal cover	3.3.1 [1]
⑥	Terminal cover fastening screw	–

[1] Section 3.3.1 describes the terminals under the terminal cover.

Fig 6:   Front view of the controller

5.2   Display

5.2.1   Overview
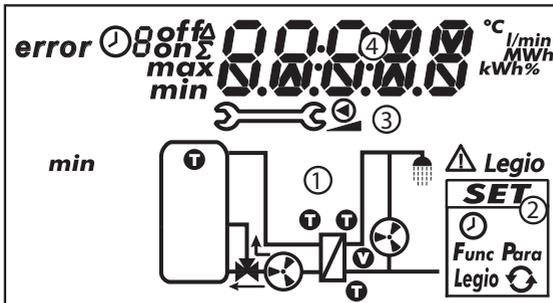
Fig 7:   Overview of the display areas (all elements visible)

①	System graphics
②	Settings menu
③	Pictograms for functions
④	Operational and setting values

The display areas are described below.

5.2.2   System graphical symbols

The following table describes the symbols used in the system graphics (① in fig. 7).

Symbol	Description		Symbol	Description
——	Pipes		(pump on)	Pump, switched on
/|	External heat exchanger		(pump off)	Pump, switched off
(tap)	Domestic water tap		T	Temperature sensor
(tank)	Storage tank		V	Flow rate sensor
(valve)	3-way valve with flow direction			

5.2.3   Settings menu

The settings menu (② in fig 7) contains the following entries:

Time

Functions   **SET** ⏰ **Func Para**   Nominal temperature of the domestic hot water

Thermal disinfection   **Legio** ↻   Reset to factory defaults

5.2.4   Pictograms for functions

The following table describes the pictograms used for functions (③ in fig. 7).

Symbol	Description
(wrench)	Manual operation
(pump)	Pump is speed controlled [1]
⚠	Alarm output [1]
Legio	Thermal disinfection [1]

[1]   Symbol is visible while the function/parameter is being edited in the settings menu.

5.2.5 Operational and setting values

The display of the operational and setting values (④ in fig. 7) consists of the following elements:

①	Symbol is displayed when an error occurs.
②	Symbol for time control of functions. This symbol is displayed when: • a time restriction/control has been set, • the status of time restriction/control is displayed, • the time restriction blocks a temperature control (symbol flashes).
③	Number of the time window that is currently being set/displayed or within which the current time lies. The time control of a function consists of 1 to 3 configurable time windows. Example: Time window 1: 06:00 – 08:00 Time window 2: 11:00 – 12:30 Time window 3: 17:00 – 19:00
④	Additional information: on, off: switching state/condition *on, off* max, min: *maximum* value, *minimum* value Σ: Summed operational value since first commissioning, cannot be reset Δ: Summed operational value since last reset to 0
⑤	Display of: • Measurements • Settings • Error codes • Additional information, e.g. software version
⑥	Physical unit of the value displayed in ⑤: °C, K, l/min, %, h, kWh, MWh

6 Operation

This section contains general information on operating the controller.

6.1 Operating buttons

The device is operated using the buttons △, ▽, SET, ESC and ⌇══╗ as follows:

△	• Scrolls up through the menu • Increases the setting value by 1 step
▽	• Scrolls down through the menu • Decreases the setting value by 1 step
SET	• Selects a setting to be changed (setting value flashes) • Confirms a setting value or jumps one level down in the menu structure • Calls up the settings menu (not in manual mode)
ESC	• Discards an entered setting • Jumps up by one operating level
⌇══╗	Sets the operating mode

(i) **Note**
We recommend that you write down all settings that you have changed.

6.2 Display when operating

• A flashing component in the system graphic means: The displayed operational or setting value applies to the flashing component.
  Exception: ⌇══╗ always flashes in manual mode.
• Displays that are automatically alternately displayed are shown overlapping in the figures. Example: Figure in the section *Operation mode Off*.
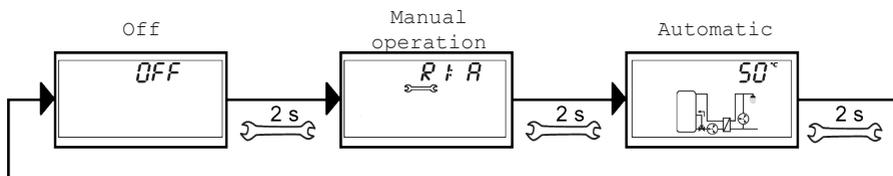
7 Modes of operation

7.1 Changing the mode of operation

⚠ **Caution**
Danger of pump damage if run dry. Only switch the system to manual or automatic mode when the system is filled.

1. Remove the front panel.
2. Press the button ⌇══╗ for 2 seconds to change the mode of operation.
3. Repeat step 2 if necessary.
4. Mount the front panel.

7.2   Off mode

Functioning

•   All outputs are switched off (outputs/control outputs without power, relays open).

⚠ **Caution**
The pump cables are under tension, because they are constantly supplied with 230 V.

•   OFF and the software version are displayed alternately.
    Example in the fig. below: software version bk 1.2
•   Backlighting is red.
•   Variant display can be selected (see fig. below).

Operation

▶   Press SET in order to select the display of the preset variant of the domestic hot water module.
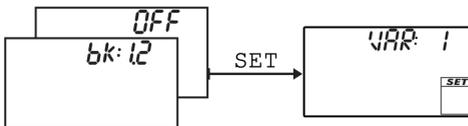
▶   Press △ and ▽ at the same time and hold them for 2 seconds to display the variant selection. For further information about the variants see chapter *8.8 Set hydraulic variant*.

ⓘ **Note**
The variant must exclusively be changed by professional personnel. If the variant is changed by somebody else, the correct function of the controller can not be guaranteed.

7.3   Manual mode

Functioning

- Backlighting is red, spanner symbol ⚲ flashes .
- The controller outputs (pumps, valves) can be manually switched.
  Possible switching states:
  `0`: off
  `1`: on
  `0% ... 100%`: control of the HE pump via PWM (only `H1`, `H2`)
  `A`: Automatic operation as per the settings in the settings menu
- Current temperatures and operating hours can be displayed (status display).
- The display of the domestic hot water temperature shows an unequalized value.
- When changing to `manual mode` all outputs are switched to `A`, `R1` is displayed.
- Typical application: Functional test (maintenance), fault-finding.

Operation

You switch the outputs on and off as follows:
1. If necessary, press △▽ to select a different output.
2. Press `SET`. The switching state flashes.
3. Press △▽ to change the switching state.
4. Press `SET` to adopt the change.

See **2** in the figure below.

You display the current temperatures and operating hours as follows:
1. Press ESC. The temperature/operating hours are displayed and the associated component flashes (**3**, display is not illustrated).
2. Press ▽△ to select a different component.
3. Press SET to leave the temperature/operating hours display.

7.4 Automatic mode

Functioning

The `Automatic mode` is preset when the device is delivered.
`Automatic` is the normal operation mode and the system is automatically controlled.
The following actions are possible:

- Display status (status display):
  Display the status of external components (temperatures, switching states, run times) **4**
- Display stored min./max. values (temperature sensors) or sum/difference values (operating hours[1]) of the pumps and valves) **5**
  Sum values (symbol ∑): Operating hours since first commissioning. Sum values cannot be reset.
  Difference values (symbol Δ): Operating hours since the last reset to 0
- Reset the stored min./max./difference values **6**
- Call up the settings menu **7**

  [1] Summed switch-on times of the outputs

Operation

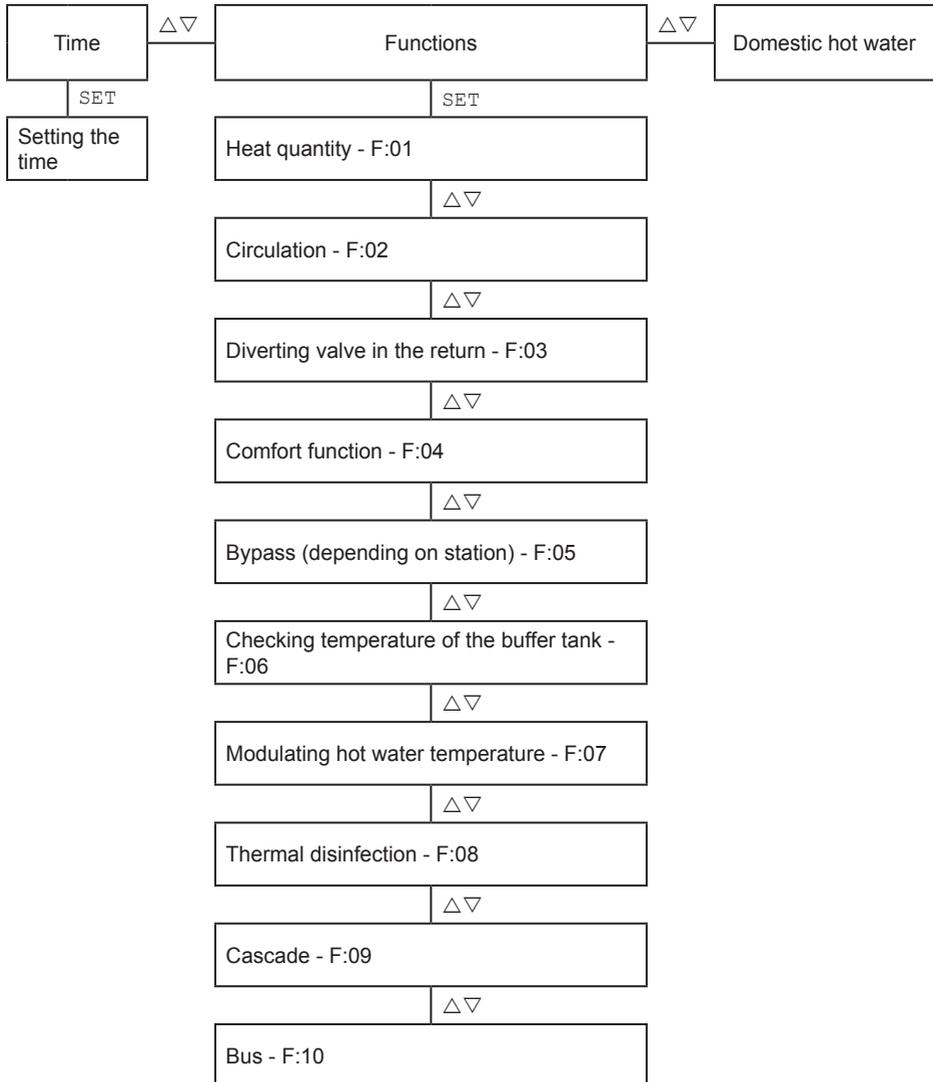√ The controller shows the status display.

You can display and reset the stored min./max./difference values as follows:
1. Press △▽ as required, in order to display other components (**4**, component flashes).
2. Press SET. The min./max./difference values are displayed alternately **5**.
3. If desired, press and hold the SET button for 2 seconds to reset the **currently** (!) displayed value **6**.
4. Press ESC. The status display is displayed.
5. Repeat steps 1 to 4 if necessary.

You can display the status of external components as follows:
▶ Press △▽ to display the status of other components (**4**).

You access the settings menu as follows:
▶ Press and hold SET for 2 seconds **7**. The settings menu appears.

8 Settings menu

8.1 Overview

The following graphic provides an overview of the structure of the settings menu.

```
┌──────────┐  △▽  ┌─────────────────────────────┐  △▽  ┌────────────────────┐
│   Time   │──────│          Functions          │──────│ Domestic hot water │
└──────────┘      └─────────────────────────────┘      └────────────────────┘
     │ SET                        │ SET
┌──────────────┐       ┌─────────────────────────────┐
│ Setting the  │       │ Heat quantity - F:01        │
│ time         │       └─────────────────────────────┘
└──────────────┘                  │ △▽
                       ┌─────────────────────────────┐
                       │ Circulation - F:02          │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Diverting valve in the return - F:03 │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Comfort function - F:04     │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Bypass (depending on station) - F:05 │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Checking temperature of the buffer tank - F:06 │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Modulating hot water temperature - F:07 │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Thermal disinfection - F:08 │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Cascade - F:09              │
                       └─────────────────────────────┘
                                  │ △▽
                       ┌─────────────────────────────┐
                       │ Bus - F:10                  │
                       └─────────────────────────────┘
```

nominal temperature	△▽	Thermal disinfection	△▽	Factory settings

SET 5 seconds

Reset to factory settings

8.2 Calling up the settings menu and selecting a menu entry

√   `Automatic` or `Off mode` is selected.

1. Press and hold `SET` for two seconds. The settings menu is displayed, menu entry ⏰ flashes.
2. Press △▽ to select a different menu entry.
3. Change the settings as described in the following sections.

8.3 Setting the time

√   ⏰ flashes.

1. Press `SET`. The hour flashes.
2. Press △▽ to set the hours.
3. Press `SET`. The minutes flash.
4. Press △▽ to set the minutes.
5. Press `SET`.
6. Repeat the steps 4 and 5 in order to set the year, the month and the day.

8.4 Setting the functions

√   **Func** flashes.

▶   Continue as described in the _Functions_ section.

8.5 Set nominal temperature of the domestic hot water

Functioning

The controller attempts to regulate the domestic hot water temperature to the value that has been set.
The domestic hot water temperature can be changed within the following limits.
Minimum: 20 °C
Maximum: 90 °C
Factory setting: 60 °C

Operation
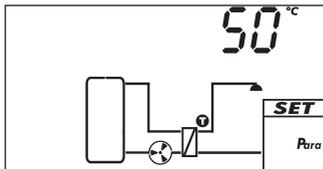
√   **Para** flashes.

1. Press `SET`. The nominal temperature of the domestic hot water is displayed, the corresponding component 🅣 in the system graphics is flashing (fig. left).
2. Press `SET`. The temperature value flashes.
3. Press △▽, to change the value.
4. Press `SET`, the change is set.

Advice for comfort optimisation:
For high buffer tank temperatures (f.ex solar thermal system) the domestic hot water temperature must be set as high as possible (max. 60 °C).

8.6   Switch on thermal disinfection

Functioning

If necessary, the domestic hot water module reaches higher domestic hot water temperatures in order to kill all dangerous germs. At the same time the circulation pump is actuated if the circulation function is activated. If no circulation function is active, the nominal temperature of the domestic hot water is increased in the defined time window to the disinfection temperature.

The thermal disinfection can be started manually in the settings menu. After a manual start the thermal disinfection also has to be stopped manually. For safety reasons the thermal disinfection is automatically deactivated after one hour runtime when it was started manually.

Detailed adjustments for the thermal disinfection have to be made in the corresponding function (F:08), see section *9.2.8 Thermal disinfection*.

ⓘ **Note**
In cascade operation mode both modules are activated by the master controller during the disinfection.

Operation

√   The function thermal disinfection (F:08) was activated, see section *9.2.8 Thermal disinfection*. Otherwise „---" is displayed.
√   *Legio* flashes.

1. StArt is displayed.
2. Press SET. oFF is displayed.
3. Press SET. oFF flashes.
4. Press △▽. on and ⚠ *Legio* are flashing.
5. Press SET. The change is adopted. ⚠ *Legio* flashes. The controller stays in the menu for the protection against Legionella until the thermal disinfection is manually deactivated. At least after one hour the thermal disinfection is automatically deactivated.

8.7   Resetting to factory defaults

√   ↻ flashes, RESEt is displayed.

1. Press and hold SET for 5 seconds.
2. After a brief progress display the controller switches to the operation mode Automatic.

The following values are not reset:
• min./max. values
• operating hours
• time and date
• accumulated withdrawal quantity
• accumulated heat quantity
• hydraulic variant

8.8 Adjust hydraulic variant

The controller can represent all stations and is preset for the corresponding variant.
In case of servicing the variant must be reset, if necessary.

√ Operation mode `Off` is selected.

1. Press `SET`.
2. Press △ and ▽ at the same time for 2 seconds.
3. Press △ or ▽ in order to select the variant.
4. Press `SET`.

Variant	Station
2	WHI freshaqua 22
4	WHI freshaqua 44
6	WHI freshaqua 55 #1 and #2
8	WHI freshaqua 100 #1 and #2
10	WHI freshaqua 55
12	WHI freshaqua 100

9 Functions

9.1 General information on operating the functions

Displaying the functions
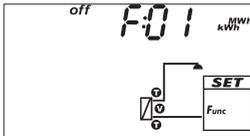
The following information is visible when the functions are displayed:
- Function number, e.g. `F:01` (Fig. left)
- Switching state:
  - `on`: Function is activated
  - `off`: Function is deactivated (Fig. left)

(i) **Note**
If the function is not displayed or neither `on` nor `off` are displayed, the function can not be used. Possible causes:
- The set system does not allow the use of this function.
- All outputs are used.

You display the functions as follows:

√ *Func* flashes.

1. Press `SET`. `F:01` flashes.
2. Press △▽ in order to display the next function.

Activating the function
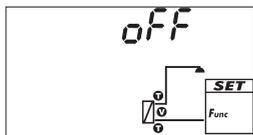
A function must be activated (activation = on) and all the associated characteristics must be correctly set before it can be used. If a function is activated and then exited before the characteristics are set then oFF flashes briefly (fig. left). After this, the function is displayed with a switching state of oFF (function is deactivated).

You activate a function as follows:
√   Function number flashes.

1. Press SET. The function is selected and flashes.
2. Press SET. oFF is displayed.
3. Press SET. oFF flashes.
4. Press △▽. on flashes.
5. Press SET. The function is activated.
6. Set the characteristics as described below.

Copy time window
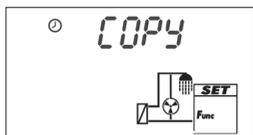
A set time window in the time control of some functions can be copied and transmitted to another day.

You copy a time window as follows:
√   The time window was set in the function.

1. Open the set menu of the time window.
2. Press △▽ until COPY displays.
3. Press SET. to: d.1 is displayed.
4. Press △▽ to choose the day.
5. Press SET. The time window was copied.

Setting the characteristics

The functions have different numbers of characteristics.
The characteristic values are always set via the same sequence of operating steps.
You set the values of characteristics as follows:
√   The function has been activated as described previously.
1. Press △▽ to select a characteristic.
2. Press SET. The value of the characteristic is displayed, the associated component flashes in the system graphics.
3. Press △▽, to change the value.
4. Press SET to adopt the change.
5. Repeat steps 1 to 4 for the other characteristics.
6. Press ESC when all characteristics of the function have been set.
   The function number flashes.

9.2 Function descriptions

The tables in this section describe the function characteristics as follows:
- The *rows* contain the characteristics in the same sequence as they appear on the display.
- The *columns* contain the following information, from left to right:

Column	Description
Display	Sample display when setting the characteristics.
Characteristic	Designation of the characteristics and their interdependence. Dependent characteristics can only be selected and set when the higher level characteristic has the value on. This is shown as follows: • Higher-level characteristic: **bold** text • Dependent characteristics: indented to the right below the higher level characteristic Example: In the table for the *circulation* function, the sensor input, switch-on temperature and switch-off temperature characteristics are only displayed when the temperature control is set to on.
Min., max., factory default setting	Lower (min.) and upper limit (max.) of a characteristic range and the factory setting. When a value range only contains a few values then these are individually listed. Example: on, oFF.

9.2.1 Heat quantity
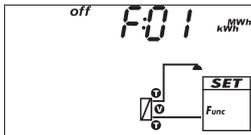
Calculates the acquired heat volume based on the following information:
- Domestic hot water temperature, secondary
- Cold water temperature, secondary
- Flow rate, secondary

No further settings are necessary.
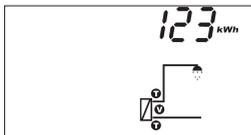The function can only be activated or deactivated.

Measured value display:
The measured values are displayed in the status menu. The current output and the daily heat quantity are displayed after the domestic hot water values.
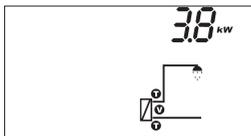
Current thermal output:
By pressing SET the respective max. value is displayed.

Daily heat quantity
By pressing SET the total heat quantity and the daily heat quantity are displayed alternately. The daily heat quantity is daily reset at 00:00.
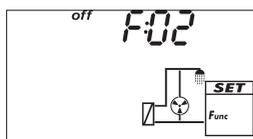
(i) **Note**
In the cascade operation mode every controller displays his own calculated heat quantity.

Characteristic	min.	max.	Factory setting
Activation	on,	oFF	on

9.2.2 Circulation

A proper function is only guaranteed when using a circulation pump with PWM signal.

Switches a circulation pump on and off on a temperature, time and/or tap controlled basis. These three types of control can be combined as required. In order to activate the circulation the speed setting of the pump has to be confirmed and one operation mode has to be activated.

Temperature control: If the temperature in the circulation return falls below the T_{on} value, then the circulation pump is switched on until the T_{off} temperature is reached. The control of temperature with activated time control is time restricted.

Time control: The circulation pump is switched on when the current time lies within one of 3 configurable time windows.
- permanently switched on, when the temperature control is deactivated (oFF)
- temperature controlled, when the temperature control is activated (on)

Tap control: Short tapping (< 5 s) switches the circulation pump for the switch-on duration on. After the switch-on duration has elapsed, the circulation pump is switched off for at least the time of the delay. The tap control works independently from the time control.

Connecting the operation modes:
When time and temperature control were selected, these functions are linked with AND. The flow control is always linked with OR and though has the highest priority, because it is the direct requirement of the user. When the desired temperature in the circulation circuit is reached, the flow requirement prematurely ends (for combination ‚tc' + ‚cc'+ ‚fc').

You can find instructions for the setting of the operating modes on the pages 30-31.


ⓘ **Note**
24h after the last start of the circulation pump a hygienic flushing of about 5 min flushes the system. This setting can not be changed. In the status display 24h is displayed.

| Characteristic	min.	max.	Factory setting
Activation	on, oFF		oFF
Speed control	0%	100%	40%
Temperature control (tc)	on, oFF		oFF
Switch-on temperature T_{on}	0 °C	T_{off} – 2 K	55 °C
Switch-off temperature T_{off}	T_{on} + 2 K	95 °C	60 °C
Time control (cc)	on, oFF		oFF
Day	day: 1 till day: 7		-
Time window 1 start/end 1on, 1off	00:00	23:59	6:00/8:00
Time window 2 start/end 2on, 2off	00:00	23:59	12:00/13:30
Time window 3 start/end 3on, 3off	00:00	23:59	18:00/20:00
Tapping control (fc)	on, oFF		oFF
Switch-on duration Ton	1 min	10 min	2 min
Wait time Toff	0 min	60 min	10 min

Speed control of the circulation pump
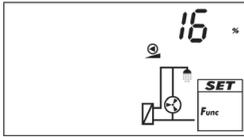
The speed of the circulation pump has to be set during the first commissioning. After the activation of F02 (on) press the key ▽. At regular intervals the speed (in %), the flow rate (in l/min) and the flow and return temperature (in °C) are displayed alternately. After pressing the SET key (speed value is displayed and flashes) the speed of the circulation pump has to be confirmed by the SET or set by the keys ▽ or △.

After the confirmation of the speed value you can control the setting by the help of the flow rate and the temperature. In order to guarantee a sufficient thermal disinfection, the temperature difference between inlet and outlet should be less than 5K (better 3-4K). If the difference is higher, the speed of the circulation pump can be increased and so more energy can be put into the system in order to reduce the temperature difference. When the speed is satisfactory, press the key ▽ for the activation of an operation mode.

Temperature control
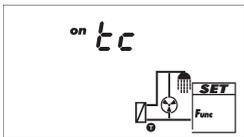
When a function is to be temperature controlled, the temperature control must be switched on (tc = temperature control).
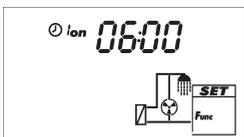In the figure the temperature control is switched on (on).

Time control

If a function is to be time controlled then the time control must be activated and the time windows must be set (cc = clock control). In the fig. on the left the time control is switched on (on).
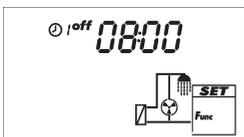
Starting time of a time window

When setting the start time of a time window, the following is displayed to the left of the start time (see fig. left):
- ⏱
- Number of time window 1 ... 3, whose start time is to be set (in this case: 1)
- on

End time of a time window

When setting the end time of a time window, the following is displayed to the left of the end time (see fig. left):
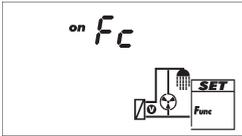- ⏱
- Number of time window 1 ... 3, whose end time is to be set (in this case: 1)
- off

ⓘ **Note**
The start time always lies before the end time! When an attempt is made to set a start time that is later than the end time, the end time is automatically adjusted.

Tapping control

If a function must be controlled by tapping, the tapping control must be switched on (Fc = flow control). In the figure the tapping control is switched on (on).

9.2.3 Diverting valve in the return
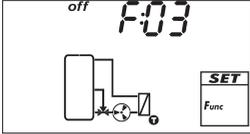
Closes the diverting valve in the return, which is predefined for the output R2. No further settings are necessary.
The function can only be activated or deactivated.

R2 on with TKW ≥ 28 °C
R2 off with TKW ≤ 23 °C

Measured value display:
The measured values are displayed in the status menu. The temperature of the cold water sensor and the operating hours of the diverting valve are displayed after the domestic hot water values.

Temperature of the cold water sensor:
By pressing SET the respective min/max values are displayed.

Operating hours of the diverting valve:
By pressing SET the delta value and the summed value of the operating hours are displayed alternately.

ⓘ **Note**
In cascade operation mode this function must only be activated at the master controller. This function is blocked for the slave controller. The slave controller transmits its cold water temperature to the master controller.
When both stations are active, the higher cold water temperature is used as switching value.

Characteristic	min.	max.	Factory setting
Activation	on,	oFF	oFF

9.2.4 Comfort function
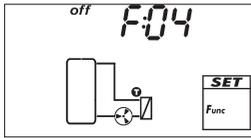
• not available for WHI freshaqua 22

Preheats the primary side of the heat exchanger in order to accelerate the starting behaviour of the module. The primary pump is actuated depending on the flow temperature. When the comfort temperature at the flow sensor is reached, the function is blocked for 5 minutes in order to avoid a switching of the pump.

> **Note**
> The protection against limescale is deactivated when the heat exchanger is always warm. Do not activate the comfort function when there is an increased risk of limescale.

The comfort function controls the operation of the primary pump when there is no withdrawal and circulation.
The comfort nominal temperature can not be adjusted, it is automatically calculated on the basis of the current set nominal temperature of the domestic hot water (THW NOM - 7 K).
In order to avoid a permanent operation of the primary pump because of a storage tank that is not hot enough, the controller carries out a security query. If within 100 s after the start of the comfort function the flow temperature has not reached the calculated comfort nominal temperature, the comfort function is blocked for one hour.
The function can only be activated or deactivated.

You will find instructions regarding the adjustment of the time control on page 33.

Measured value display:
The comfort function is displayed in the status menu. The slow rotation of the pump segments shows, that the pump is working.
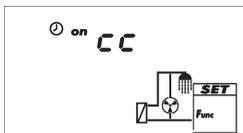
> **Note**
> In the cascade operation mode the function has to be activated in the master controller and in the slave controller. The comfort functions in the master and slave controller work independent from each other.
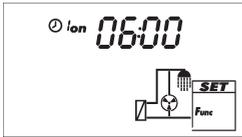
Characteristic	min.	max.	Factory setting
Activation	on, oFF		oFF
Speed control	0%	100%	35%
Time control	on, oFF		oFF
Time window 1 start/end	00:00	23:59	6:00/8:00
Time window 2 start/end	00:00	23:59	12:00/13:30
Time window 3 start/end	00:00	23:59	18:00/20:00

Time control

If a function is to be time controlled then the time control must be activated and the time windows must be set (cc = clock control). In the fig. on the left the time control is switched on (on).
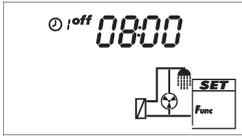
Starting time of a time window

When setting the start time of a time window, the following is displayed to the left of the start time (see fig. left):

- ⌚
- Number of time window 1 ... 3, whose start time is to be set (in this case: 1)
- on

End time of a time window

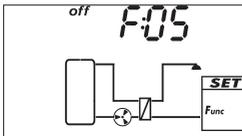When setting the end time of a time window, the following is displayed to the left of the end time (see fig. left):

- ⌚
- Number of time window 1 ... 3, whose end time is to be set (in this case: 1)
- off

> **ⓘ Note**
> The start time always lies before the end time! When an attempt is made to set a start time that is later than the end time, the end time is automatically adjusted.

9.2.5 Bypass

- only available for WHI freshaqua 55 #1 and #2 or WHI freshaqua 100 #1 and #2

Improves the control of the nominal temperature of the domestic hot water for small withdrawal quantities and high source temperatures. The primary flow rate and the flow temperature are lowered and the open bypass valve mixes cooled water from the return with the flow water.

Depending on the measured tap quantity and the temperature difference between the measured source temperature and the current adjusted DHW temperature the bypass is activated or deactivated.

Bypass activated, if:
Withdrawal quantity < switch-on treshold tap quantity AND
(source temperature - THW NOM) > switch-on temperature difference

Bypass not active, if:
Tap quantity > (switch-on threshold tap quantity + 3 l/min) OR
(source temperature - THW NOM) < (switch-on temperature difference - 5 K)

Measured value display:
The bypass function is displayed in the status menu. The flashing heat exchanger symbol shows the activated bypass valve.

> **ⓘ Note**
> In the cascade operation mode the function has to be activated in the master controller and in the slave controller. The bypass functions in the master and in the slave controller work independent from each other.

Characteristic	min.	max.	Factory setting
Activation	on, oFF		oFF
Switch-on threshold tap quantity	0 l/min	100 l/min	100 l/min
Switch-on temperature difference	10 K	50 K	40 K

9.2.6 Checking temperature of the buffer tank
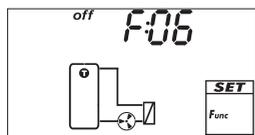
• only available as from software version `bk1.2`

Displays the temperature of the buffer tank on the controller display. Prevents an unwanted heat transfer from the secondary side of the DHW module to the primary side.

The temperature sensor is connected to terminal 3, ⊥ and is optionally available. The temperature sensor has to be an immersion sensor that is placed at the buffer tank near the connection of the domestic hot water module.

No further settings are necessary.
The function can only be activated or deactivated.

Measured value display:
The temperature of the buffer tank is displayed in the status menu.
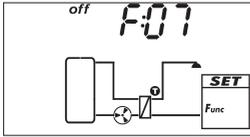
ⓘ **Note**
In cascade operation mode this function must only be activated at the master controller. This function is blocked for the slave controller. The slave controller transmits its cold water temperature to the master controller.

Characteristic	min.	max.	Factory setting
Activation	on, oFF		oFF

9.2.7 Modulating hot water temperature

Adjusts the nominal temperature of the domestic hot water to the temperature level of the buffer tank for preheating systems obtaining their energy from buffer tanks without back-up heating or for the improvement of the efficiency of systems with unstable temperatures (THW NOM = T_{VL} - 5 K). If the function circulation (F:02) is selected, the adjustment of the nominal temperature of the domestic hot water to the temperature level of the buffer tank is blocked.

This function works according to fix parameters. No further settings are necessary. If the function is active, a flashing temperature is displayed. The function can only be activated or deactivated.

ⓘ **Note**
In cascade operation mode this function is only recommended in exceptional cases, because high temperature fluctuations at the withdrawal point can occur when switching between the modules. However, if this function is selected it has to be activated in the master and in the slave controller. The functions work in both controllers independent from each other.

Characteristic	min.	max.	Factory setting
Activation	on, oFF		on

9.2.8 Thermal disinfection
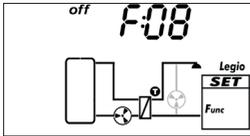
⚠ **Warning**
Danger of scalding due to hot water!
With the activated function there is the danger of scalding due to hot water!
- Inform user.
- Make sure to avoid scalding at the installation.

If necessary, the domestic hot water module reaches higher domestic hot water temperatures in order to kill all dangerous germs. At the same time the circulation pump is actuated if the circulation function is activated. If no circulation function is active, the nominal temperature of the domestic hot water is increased in the defined time window to the disinfection temperature.

For the thermal disinfection there is only one time window per day available.

Characteristic	min.	max.	Factory setting
Activation	on, oFF		oFF
Disinfection temperature	60 °C	80 °C	60 °C
Time control	on, oFF		on
Day	day: 1 till day: 7		-
Time window	00:00	23:59	01:00/02:00

9.2.9 Cascade

off **F:09**

SET

Func

Controls the cascade operation mode of two domestic hot water modules.
Condition: Both controllers are connected with each other via a communication bus.

The connection cable is connected to both controllers via the connections 5, ⊥. The bus cable must have a minimum cross section of 0,25 mm^2 and a maximum length of 3 m. 2-way-valves have to be integrated into the cold water line towards the module and the 2-way-valves have to be connected to R1 of the corresponding controller. Only use original accessories.
The cascade operation mode must be activated in both controllers.
One of them must be set as master (`MA`) and the other as slave (`SL`).

Characteristic	min.	max.	Factory setting
Activation	on, oFF		oFF
Master / slave	MA, SL		MA

The master controller transmits the following information to the slave:
- Command "activate"
- Command "deactivate"
- Nominal temperature of the domestic hot water
- Date and time

Switching points of the sequence valve for cascade operation mode:

The switching points depend on the hydraulics used.
The following settings are preset:
The regular change of the modules for an equal use
The activation of the second module when the first module has reached 80% of its maximum flow rate.
The deactivation of the second module when the flow rate falls below the lower limit of 60% (30% of the flow rate of each module).
Condition: Performance indicator 1 (as per SPF test procedure) with a flow temperature of the storage tank of 60° C, a domestic hot water temperature of 45 °C and a cold water temperature of 10 °C.

WHI freshaqua 22 / LK1: 30 l/(min*Modul)
Flow rate for the addition of the 2nd module: 24 l/min
Flow rate for the deactivation of the 2nd module: 18 l/min (total) = 9 l/min (per module)

WHI freshaqua 44 / LK1: 50 l/(min*Modul)
Flow rate for the addition of the 2nd module: 40 l/min
Flow rate for the deactivation of the 2nd module: 30 l/min (total) = 15 l/min (per module)

WHI freshaqua 55 / LK1: 67 l/(min*Modul)
Flow rate for the addition of the 2nd module: 54 l/min
Flow rate for the deactivation of the 2nd module: 40 l/min (total) = 20 l/min (per module)

WHI freshaqua 100 / LK1: 123 l/(min*Modul)
Flow rate for the addition of the 2nd module: 98 l/min
Flow rate for the deactivation of the 2nd module: 74 l/min (total) = 37 l/min (per module)

Circulation / diverting valve in the return for cascade operation mode:
The circulation pump with PWM control has to be mounted on site before the two modules in the shared circulation line. It can be controlled via the PWM signal of the master controller, if appropriate settings in the menu F:02 have been made. That is why this function is blocked for the slave controller. Only use original accessories.
The diverting valve has to be connected in the shared return of the stations. It is controlled by the master controller. That is why this function is blocked for the slave controller.

Thermal disinfection for cascade operation mode:
In cascade operation mode, the function "thermal disinfection" only has to be set for the maser controller. That is why this function is blocked for the slave controller. The master transmits the increased warm water nominal temperature via the cascade bus to the slave controller. During disinfection both modules are activated by the master controller and the circulation pump runs at 100% speed.

Alarm indication for cascade operation mode:
In cascade operation mode every module indicates a separate alarm via the relay Rs.

**Bus function for cascade operation mode:**
In cascade operation mode every module indicates a separate data string.

Heat quantity measurement for cascade operation mode:
In cascade operation mode every module counts a separate heat quantity.

All further functions, as e.g. the comfort function have to be activated or deactivated separately in order to guarantee a correct functionning.

9.2.10 Bus
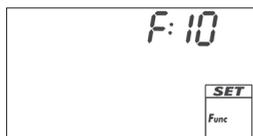
With the function "bus" a bus system can be selected. Different adapters can be connected to the controller via its TTL interface:
- Circuit board for the communication on different protocols
- Connecting cable for PC software in case of servicing

ⓘ Note
In the first 30 seconds after the activation of the controller there is no data exchange yet.

The following options are available:

Display	kind of communication
bus: -	no communication
bus: 1	eBUS
bus: 2	data string to the PAW Modbus Server (every 10 seconds)
bus: 3	in case of servicing communication with the service software

9.3   Alarm output

Controls the output R_s (normally closed, NC) for the following faults:
- Sensor fault due to short-circuit or interruption
- The electronic overload switch or fuse has triggered: `Er:2 ... Er:5` [1]
- Power outage: Because there is no voltage the relay opens

[1]   more information is provided in the *Fault messages* section.

⚠ **Caution:**
The signal output R_s may only be operated at extra-low voltage up to 24 V and limited power.

9.4   Emergency operation

- only available for WHI freshaqua 100

The secondary flow rate is measured and added up at two parallel working sensors (at E.1 and E.2). If an error occurs at E.1 (or E.2), the control doubles the measured value of E.2, V' (or E.1, V'). The error is displayed at the relevant sensor (backlighting is red).
The module keeps running.
If the error occurs simultaneously at both sensors E.1 and E.2, the control stops.

10   Deinstallation and disposal

⚠ **Danger**
Risk of death by electrocution!
- Disconnect the device from the power supply before opening the casing.
- All work on an open device must be performed by professional personnel.

1. Dismount the controller in the reverse sequence to installation; more information on this is provided in the section *Installation*.
2. Dispose the electrical and electronic components of the installation according to the European Waste Electronic and Electrical Equipment Directive. For further questions please contact the local authorities, responsible for the disposal.

11   Information messages

Display	Description
▢/ flashes	The bypass is active.
50 °C flashes	The modulating domestic hot water temperature is active.
24h flashes	The hygienic flushing is active, see section *Circulation*.

12 Information messages

⚠ **Warning**
Risk of death by electrocution!
• Immediately disconnect the device from the mains supply when it can no longer be operated safely, e.g. in the case of visible damage.
• Disconnect the device from the mains power before opening the case.
• All work on an open device must be performed by professional personnel.
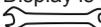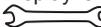
ⓘ **Note**
The controller is a quality product, conceived for years of continuous trouble-free operation. Observe the following points:
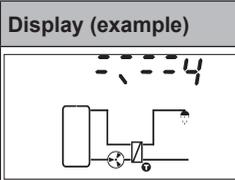• Faults are often caused by connected components and not by the controller.
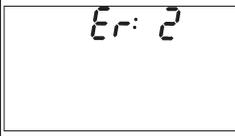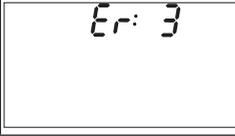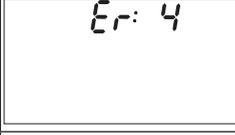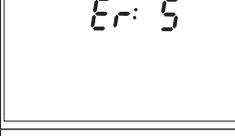• The following notes on fault identification indicate the most common causes of faults.
• Only return the controller when you are absolutely sure that none of the problems listed below is responsible for the fault.

12.1 General faults

Display	Possible cause	Solution
Controller not functioning at all		
Display empty/dark	Controller power supply is interrupted.	• Check the controller power cable. • Check the fuse for the power supply.
Controller constantly displays 12:00		
`12` flashes	Controller power supply was interrupted for longer than 15 minutes **Note:** The time has to be reset after an interruption that is even shorter than 15 minutes, except the controller has been supplied with power for a few hours.	Setting the time Saved functions that are **not** connected with a time setting remain even after a power outage. The functions circulation (when time window `cc` was activated) and thermal disinfection are inactive.
Primary pump does not work even though domestic hot water is tapped		
Pump symbol rotates	Power supply or control signal of the pump is interrupted	Check power cable and control cable of the pump
	Pump has seized up.	Get the pump working again, replace if necessary.
Pump symbol does not rotate	Maximum temperature of domestic hot water was exceeded for a short period	no fault
• Pump symbol does not rotate • Display is red • ⌒‾‾‾‾⌒ flashes	`Manual mode` is switched on, output `R1` is set to `0` (off)	Switch on operation mode `Automatic`
• Pump symbol does not rotate • Display flashes red	Short-circuit or interruption of the temperature sensor	• Request current values of the connected sensors at the controller. • Check sensors and cables.
Primary pump is running even though no domestic hot water is tapped		
Pump symbol rotates	• Comfort function active • Thermal disinfection active • Circulation active • Sensor detects withdrawal • Pump is working because of blocking protection	• Maybe no fault • Deactivate the relevant functions, if necessary. • Sensor fault E.1 (permanent display of a flow)
• Pump symbol rotates • Display is red • ⌒‾‾‾‾⌒ is displayed	`Manual mode` is switched on, output `H1` is set to > 10%	Switch on operation mode `Automatic`
Primary pump is running, domestic hot water is tapped, no heat transport in the heat exchanger.		
Pump symbol rotates	Air in the primary circuit	Check the primary circuit for air
	The isolating valve is closed.	Check the isolating valve
	Limescale or contamination in heat exchanger	Flush / clean heat exchanger according to the instructions of the manufacturer.

12.2   Fault messages

Faults are displayed as shown below, the backlighting is red. The figures in this section show example systems.

Display (example)	Description	Solution
`-----4`	An interruption was detected at the displayed sensor input (in this case: sensor input 4).	Check the cable and sensor connected to the sensor input.
`-----4`	A short-circuit was detected at the displayed sensor input (in this case: sensor input 4).	Check the cable and sensor connected to the sensor input.
`Er: 1`	The nominal temperature of the domestic hot water can not be reached. Possible causes: • Storage tank is not heated • Shut-off valve in the primary circuit is closed • Air in the pipes • Primary pump defective • Calcified heat exchanger	 • Heat storage tank • Check the isolating valve • Bleed air from the system • Check the pump • Decalcify heat exchanger
`Er: 2`	Short-circuit at output `R1`. Possible causes: • Valve defective • Wiring fault	 • Check valve • Check the wiring to `R1`.
`Er: 3`	Output `R1` was overloaded. Cause: The permissible values for `R1` specified on the type plate have been permanently exceeded, the output has been switched off.	Check the electrical data of the pump, replace pump if necessary. `R1` is automatically switched on again.
`Er: 4`	Short-circuit at output `R2`. Possible causes: • Valve defective • Wiring fault	 • Check valve • Check the wiring to `R2`.
`Er: 5`	Output `R2` was overloaded. Cause: The permissible values for `R2` specified on the type plate have been permanently exceeded, the output has been switched off.	Check the electrical data of the pump, replace pump if necessary. `R2` is automatically switched on again.
`Er: 6`	In the cascade operation mode there was no communication between master and slave controller for minimum 1 min. Possible causes: • Cascade operation mode activated by mistake • Master (`MA`) or Slave (`SL`) is activated in both controllers	 • Automatic troubleshooting at successful communication • Deactivate cascade operation mode • Check Master/Slave settings

12.3   Fault at sensor

A fault at the sensor exclusively affects the functionality, the sensor is used for.
The controller can not correctly operate the corresponding function and stops the control of this function. All other functions continue to operate properly.

Fault at sensor	Termi-nal	Effect on regulation
Flow temperature, primary (TVL)	1, ⊥	The controller assumes 75 °C as provisional value in order to continue operating the control.
Domestic hot water temperature, secondary (TWW)	2, ⊥	Controller uses temperature value of the sensor E.1, T for the control.
Temperature of buffer tank (TSP) or source temperature (TQ)	3, ⊥	The temperature has no influence on the control. In case of an error only the corresponding function will be stopped (here: the temperature of the buffer tank is no longer displayed).
Cold water temperature, secondary (TKW)	4, ⊥	The cold water temperature has no influence on the control. In case of an error only the corresponding function will be stopped (here: the heat quantity is no longer measured).
Domestic hot water temperature, secondary	E.1, T	WHI freshaqua 22: The control stops. WHI freshaqua 44 / 55 / 100: For the control the hot water temperature at the terminal 2, ⊥ is used. That is why a fault at E.1 has no influence on the control.
Flow rate, secondary	E.1, V'	The control stops. Exception WHI freshaqua 100: The secondary flow rate is measured at two parallel working sensors (at E.1 and E.2). If an error occurs at E.1 the control doubles the measured value of E.2, V'. If the error occurs simultaneously at both sensors E.1 and E.2, the control stops.
Flow rate, secondary	E.2, V'	Only for WHI freshaqua 100: see E.1, V'

12.4   Checking the Pt1000 temperature sensors

⚠ **Warning**
Risk of death by electrocution! Before opening the device, make sure that all cables leading to the device have been disconnected from the mains power and cannot be unintentionally reconnected to the mains power.

1. Remove the terminal cover.
2. Disconnect the temperature sensor.
3. Measure the resistance of the temperature sensor with an ohmmeter and compare with the following table. Small deviations are acceptable.
4. Mount the terminal cover.

Temperature – Resistance assignments

Temperature [°C]	-30	-20	-10	0	10	20	30	40	50	60	70
Resistance [Ω]	882	922	961	1000	1039	1078	1117	1155	1194	1232	1271

Temperature [°C]	80	90	100	110	120	130	140	150	160	170	180
Resistance [Ω]	1309	1347	1385	1423	1461	1498	1536	1573	1611	1648	1685

12.5 Checking the VFS 2-40 flow sensor

• only for WHI freshaqua 22

⚠️ **Warning**
Risk of death by electrocution! Before opening the device, make sure that all cables leading to the device have been disconnected from the mains power and cannot be unintentionally reconnected to the mains power.

1. Remove the terminal cover.
2. Connect voltmeter with the plug in the controller. Observe pin-assignment:
   Positive pole to white, negative pole to green (see fig.).
3. Measure tension of the flow sensor with voltmeter and compare to table hereafter.
   Small deviations are acceptable.
4. Mount the terminal cover.

Assignment tension - flow

Voltage [V]	0.5	0.658	0.816	0.974	1.132	1.290	1.447	1.605	1.763	1.921
Flow [l/min]	2	4	6	8	10	12	14	16	18	20

Voltage [V]	2.079	2.237	2.395	2.553	2.711	2.869	3.026	3.184	3.342	3.500
Flow [l/min]	22	24	26	28	30	32	34	36	38	40

Assignment voltage - temperature

Voltage [V]	0.5	0.8	1.1	1.4	1.7	2.0	2.3	2.6	2.9	3.2
Temperature [°C]	0	10	20	30	40	50	60	70	80	90

Signal configuration VFS 2-40

Pin	Designation	Technical description	Cable
1	Temperature signal	0.5-3.5 V measured to pin 3	yellow
2	Flow signal	0.5-3.5 V measured to pin 3	white
3	Ground	0 V	green
4	Power supply	5 V DC	brown

Pin-assignment flow signal   **Pin assignment temperature signal**
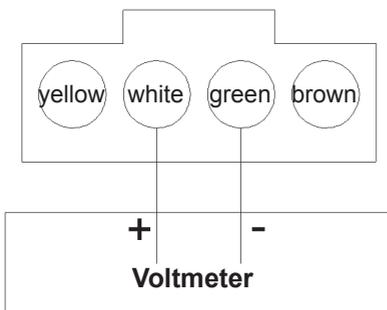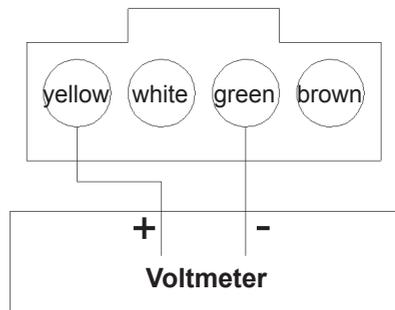
12.6   Checking the FlowSonic flow sensor

- only for WHI freshaqua 44, 55 and 100

⚠️ **Warning**
Risk of death by electrocution! Before opening the device, make sure that all cables leading to the device have been disconnected from the mains power and cannot be unintentionally reconnected to the mains power.

1. Remove the terminal cover.
2. Connect voltmeter with the plug in the controller. Observe pin-assignment:
   Positive pole to white, negative pole to green (see fig.).
3. Measure tension of the flow sensor with voltmeter and compare to table hereafter.
   Small deviations are acceptable.
4. Mount the terminal cover.

Assignment tension - flow

Voltage [V]	0.35	0.380	0.506	0.664	0.821	0.979	1.136	1.294	1.451	1.609	1.766
Flow [l/min]	0 Standby	1	5	10	15	20	25	30	35	40	45

Voltage [V]	1.924	2.081	2.239	2.396	2.554	2.711	2.869	3.026	3.184	3.341	3.499
Flow [l/min]	50	55	60	65	70	75	80	85	90	95	100

Signal configuration FlowSonic

Pin	Designation	Technical description	Cable
1	Temperature signal	not important for the control	yellow
2	Flow signal	0.38-4.5 V measured to pin 3	white
3	Ground	0 V	green
4	Power supply	5 V DC	brown

Pin assignment
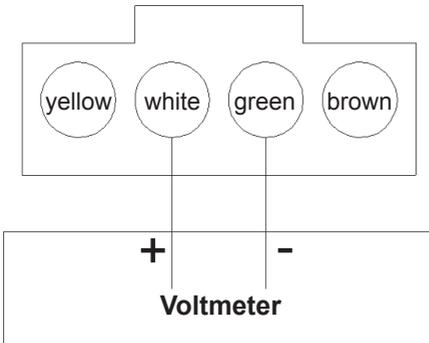
13   Technical data

Inputs/outputs		
Rated voltage (system voltage)		115 ... 230 V~, 50/60 Hz
Own consumption		≤ 0.8 W, two Pt1000 temperature sensors connected
Outputs R1, R2	Number	2
	Type	triac
	Switching current	1.1 (1.1) A each
	Voltage	115 ... 230 V~, 50/60 Hz
Output R3	Number	1
	Type	relay
	Switching current	2.0 (2.0) A
	Voltage	115 ... 230 V~, 50/60 Hz
L_{const}	Switching current	2.0 (2.0) A
	Voltage	115 ... 230 V~, 50/60 Hz
Total	Switching current	4.2 (4.2) A
	Voltage	115 ... 230 V~, 50/60 Hz
Signal inputs/outputs		
Signal inputs 1 ... 5	Number	5
	Type of signal inputs 1 ... 4	Pt1000 (temperature acquisition)
	Type of signal input 5	bus communication for cascading
Signal output R_s	Type	potential-free NO contact
	Max. contact load	1 (0) A, 24 V
Signal outputs PWM R1, PWM R2		
	Type	PWM, 250 Hz, 11 V; Characteristic: 0 % PWM = Pump off 100 % PWM = max. speed
	Max. load	10 mA
Hydraulic variants		
Number		4
Display		
Type		LCD display with backlighting
Application conditions		
Protection class		IP 22, DIN 40050 [without front panel: IP 20]
Protection class		I
Ambient temperature		0 ... +50 °C, when wall-mounted
Physical specifications		
Dimensions L x W x H		110 x 160 x 51 mm
Weight		350 g
Software class		A
Type of action		type 1.Y
Type of fastening for permanently connected cables		type X
Degree of pollution		2
Ball pressure test temperature		casing pan: 125 °C, other casing parts: 75 °C
Overvoltage category		class II (2500 V)

13.1   Cable specifications

Mains cable	
Mains cable type	H05 VV-... (NYM…)
External diameter of mantle	6.5 mm to 10 mm
Conductor cross-section	
Single strand (solid)	$\leq$ 2.5 mm^2
Fine strand (with core end sleeves)	$\leq$ 1.5 mm^2
Diameter of the internal strain relief	6.5 mm to 10 mm
Signal cable	
Sensor cable length	$\leq$ 100 m, including extension
Sensor extension cable Design	twisted-pair conductors for lengths > 10 m
Cross-section of each conductor	0.75 mm^2 for lengths < 50 m
	1.5 mm^2 for lengths > 50 m

Exclusion of liability

The manufacturer can neither monitor the compliance with this manual nor the conditions and methods during the installation, operation, usage and maintenance of the controller. Improper installation of the system may result in damage to property and, as a result, to bodily injury.

Therefore, the manufacturer assumes no responsibility and liability for loss, damage or costs which result from or are in any way related to incorrect installation, improper operation, incorrect execution of installation work and incorrect usage and maintenance. Similarly, we assume no responsibility for patent right or other right infringements of third parties caused by usage of this controller.

The manufacturer reserves the right to make changes to the product, technical data or installation and operating instructions without prior notice.

Legal guarantee

In accordance with German statutory regulations, there is a 2-year legal guarantee on this product for the customer. The seller will remove all manufacturing and material faults that occur in the product during the guarantee period and affect the correct functioning of the product. Natural wear and tear does not constitute a malfunction. No legal guarantee can be offered if the fault can be attributed to third parties, unprofessional installation or commissioning, incorrect or negligent handling, improper transport, excessive loading, use of improper equipment, faulty construction work, unsuitable construction location or improper operation or use. Legal guarantee claims shall only be accepted if notification of the fault is provided immediately after it is discovered. Guarantee claims are to be directed to the seller.

The seller must be informed before guarantee claims are processed. For processing a guarantee claim an exact fault description and the invoice / delivery note must be provided.

The seller can choose to fulfil the legal guarantee either by repair or replacement. If the product can neither be repaired nor replaced, or if this does not occur within a suitable period in spite of the specification of an extension period in writing by the customer, the reduction in value caused by the fault shall be replaced, or, if this is not sufficient taking the interests of the end customer into consideration, the contract is cancelled.

Any further claims against the seller based on this guarantee obligation, in particular claims for damages due to lost profit, loss-of-use or indirect damages are excluded, unless liability is obligatory by law.