



Operating Manual

SINGLE Smart Controller SSC
SINGLE Smart Controller plus SSC+



created for your perfection

Table of Contents

1	Notes about this manual.....	4
2	User interface and operation	5
2.1	Navigation bar.....	6
2.2	Control Panel.....	7
2.3	Overview of the operating concept.....	12
2.3.1	Service and Information menu.....	15
2.3.2	Functions menu	17
2.3.3	Alarm list.....	19
3	Operation of the temperature control system	20
3.1	Switching on / off, pump overrun.....	20
3.2	Switching on/off via external contact / restart lockout	21
3.3	Filling the system.....	22
3.4	System closure (only pressurised water devices)	22
3.5	Flow measurement	23
4	Temperature control	24
4.1	Control Sensor.....	24
4.2	Setpoint for the temperature control.....	25
4.3	Temperature control	26
4.3.1	PID control behaviour	26
4.3.2	Control behaviour of two-position controller	26
5	Expert Parameters.....	27
5.1	Basic settings.....	28
5.2	Device Control	29
5.3	Temperature control and self-optimisation	31
5.4	Alarms and limits	35
5.5	Communication.....	37
5.6	Pump control (only with optional frequency converter)	38
5.7	ECOTEMP.....	40
5.8	Program.....	41
5.9	Tool.....	43
5.10	Timer.....	43
5.11	Offset values.....	44
6	Temperature control device with SFC water distributor	45
6.1	Enable SFC water distributor operation	45

Translation of the original SSC Operating Manual / Version 2.1



created for your perfection

6.2	Switch SFC system on/off	46
6.3	Shutting Down Individual Circuits of the SFC Water Distributor	46
6.4	SFC water distributor Process Data view	47
6.4.1	Alarms and limits	50
6.4.2	Flow control	51
7	Software update	58
8	Pin assignment	59
9	Parameter lists.....	60
9.1	Functions	60
9.2	Basic settings.....	61
9.3	Device Control	62
9.4	Temperature control	63
9.5	Alarms.....	64
9.6	Communication.....	66
9.7	Pump control.....	67
9.8	Flow control SFC	68
9.9	Offset	69
9.10	ECOTEMP	70
10	List of alarms	71



created for your perfection

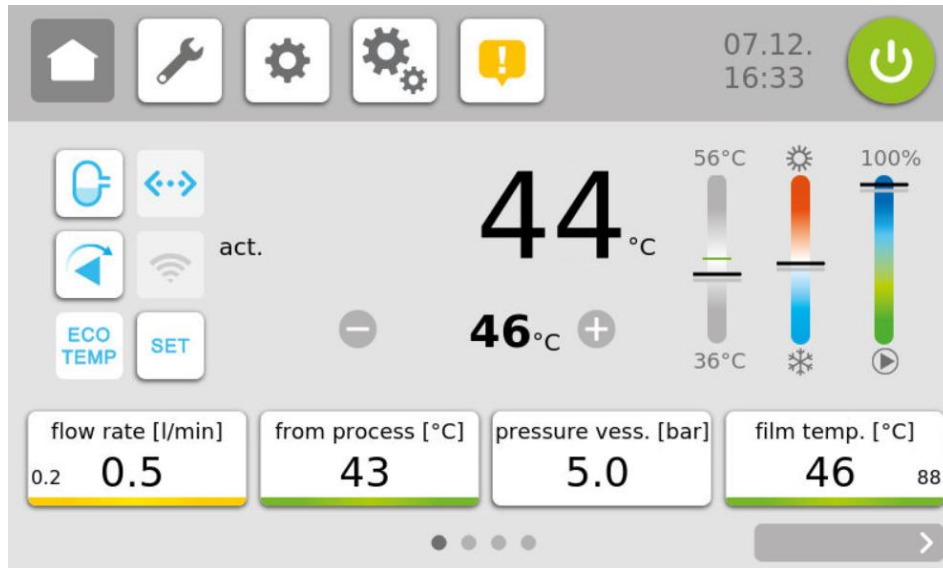
1 Notes about this manual

- This operating manual describes the functionality and operation of the Smart Controller and the Smart Controller plus.
- Compared to the Smart Controller, the Smart Controller plus has additional inputs and outputs. The Smart Controller plus software provides parameters for these additional inputs. The corresponding functions are indicated in the description.
- This manual covers the full range of functions of the controller. Some of these functions are optionally available in the temperature control devices. The actual range of functions is defined via the SINGLE customer order and the technical specification.
- The range of functions is defined via parameters in the factory settings that can only be accessed by SINGLE. These affect the operation of the controller as well as the display on the screen. Some buttons and parameters for non-enabled functions are hidden; this can result in differences between the images shown in this manual and the display on your system.
- Subsequent activation of functions is usually not possible as the appropriate components for the functionality must be installed in the temperature control device.
- If you have any questions, please contact SINGLE Customer Service. All confirmed functions in the customer order and in the technical specification are included and enabled in the temperature control device.

2 User interface and operation

The Smart Controller is also started when the temperature control device is switched on via the main switch. The starting process takes a few seconds; a start screen is displayed during this time.

After completion of the start-up process, the controller displays the *Process Data view*.



The Smart Controller is equipped with a touch display. Operation takes place exclusively via the touch display.








The touch display is divided into the navigation bar at the top (grey background) and the control panel.

2.1 Navigation bar

The navigation bar is displayed in all menus and in all operating states. It displays important content and is used for quick navigation.

The navigation bar provides the following functions:



Symbol	Meaning
	Home button Jumps from the individual menus back to the <i>Process Data view</i> (see 2 User interface and operation). The current actual temperature (control temperature) is always displayed.
	Calls up the <i>Service and Information</i> menu (see 2.3.1 Service and Information menu).
	Calls up the <i>Functions</i> menu (see 0 Functions menu).
	Calls up the <i>Expert Parameters</i> menu (see 5 Expert Parameters).
	A padlock is only displayed when the lock is activated. If the padlock is closed, operation of the device is only possible to a limited extent (function is explained after this table).
	Displays the alarm list (see 0 Alarm list). If the field flashes red, an alarm is currently active; the colour yellow signals a warning. If the field is grey, there is no currently active alarm.
	Switches the temperature control device on and off. Green means that the device is switched on; red means off, i.e. pump, heating and cooling, among other things, are switched off. If the field flashes green, the system is in cooling-down mode for tool changing or tool draining.

Operation Lock

It is possible to lock the device to prevent unwanted operation. To do so, enter a lock code under *Expert Parameters / Basic Settings* (see 0).

Activating the lock:

If the operation lock is not "ON" (see chapter 0), an open padlock icon is displayed in the navigation bar.

Tap this icon to activate the lock. Confirm the prompt in the additional dialogue.

The lock becomes active, and a closed padlock is displayed.

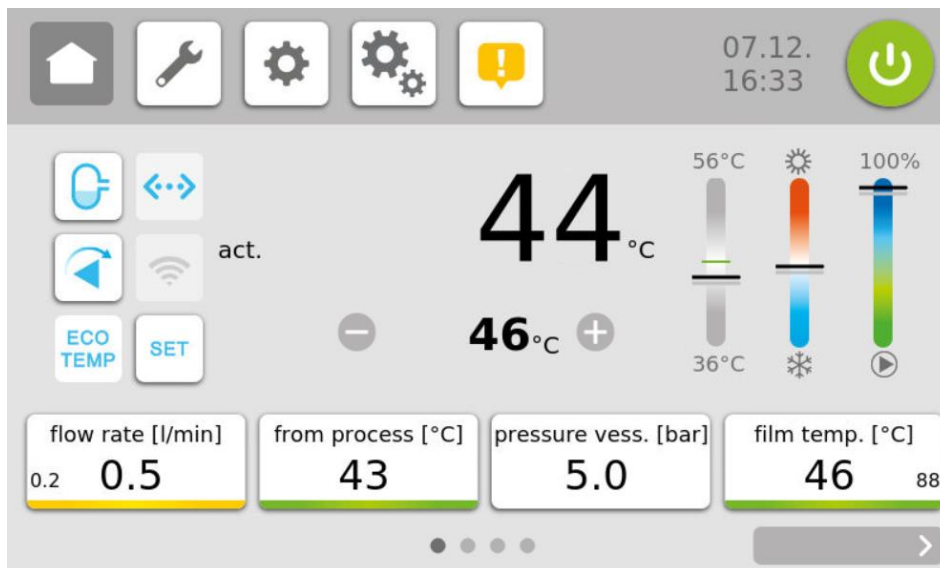
Deactivating the lock:

Tap the padlock in the navigation bar. Enter the release code.

If the code has been entered correctly, the lock is deactivated.

2.2 Control Panel









The control panel shows the actual and setpoint temperatures centrally.



The actual temperature is the temperature that is included for the control. In the delivery condition, this is the temperature that is recorded via the control sensor (last measuring point before the medium leaves the device). The "Source control" parameter under *Expert Parameters / Device Control* can be set so that an external sensor or the return sensor is used for the control.

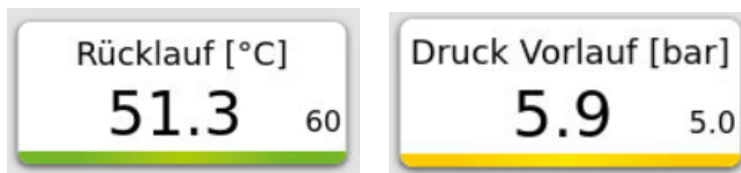
The view for the setpoint adjustment is displayed by tapping on the central area in the control panel. The permitted value range is displayed below the input window. Changes must be confirmed using "Save".

Pictograms on the left and right of the temperature display indicate the state of the system.

Symbol	Meaning
 	The system closure is open or closed (only for pressurised water devices). If the button is enabled, this means it can also be used to configure the system closure temperature.
 	The pump is running in the indicated direction of rotation (arrow pointing right: normal operation; arrow pointing left: inverse operation. e.g. for leak stop function). For temperature control devices with speed control, the button is enabled and can be used to set the parameters for speed control.
	Interface symbol: Grey: The interface is not enabled or no protocol has been selected in the communication parameters. Blue (flashing): The interface is active and the device is transmitting or receiving data via the interface. Blue (steady): The protocol is selected, interface operation is deactivated. Red (flashing): Interface operation is activated but communication cannot be established.
	Blue: Communication is taking place via the network. Red: There is no communication via the network.
	Grey: ECOTEMP not enabled Green: ECOTEMP in standby mode Blue: ECOTEMP active
	The temperature setpoint can be entered here.

The four buttons at the bottom show important process variables. The values can be underlined in colour.

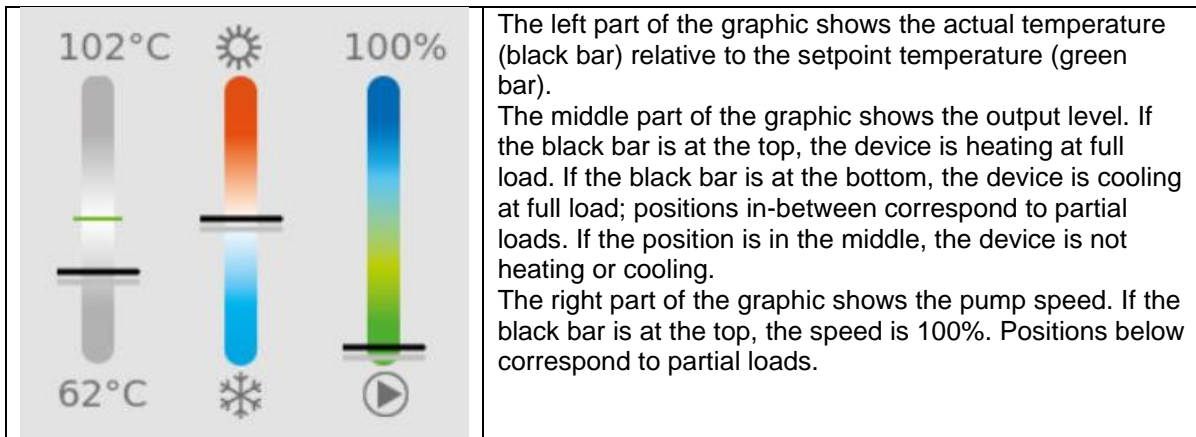
- Green means that the value is in the desired range or that no value has been entered.
- Yellow means that a process value is not in the desired range.
- Red means alarm, i.e. the safe operation of the device is at risk.




Depending on the equipment of the device, the buttons alternate between displaying two values, e.g. *tank pressure* and *flow pressure*. Tap the value on the button to adjust the limit values.

Each button has a value shown in large characters in the centre. This is the current process value. If there are warnings or alarms set for the respective process variable, these are shown on the left (lower limit) or right (upper limit) on the respective button.

There is a graphic on the right side of the control panel that displays temperature, output level and pump speed.



Tap the arrow button  at the bottom right of the control panel to go to expert mode.

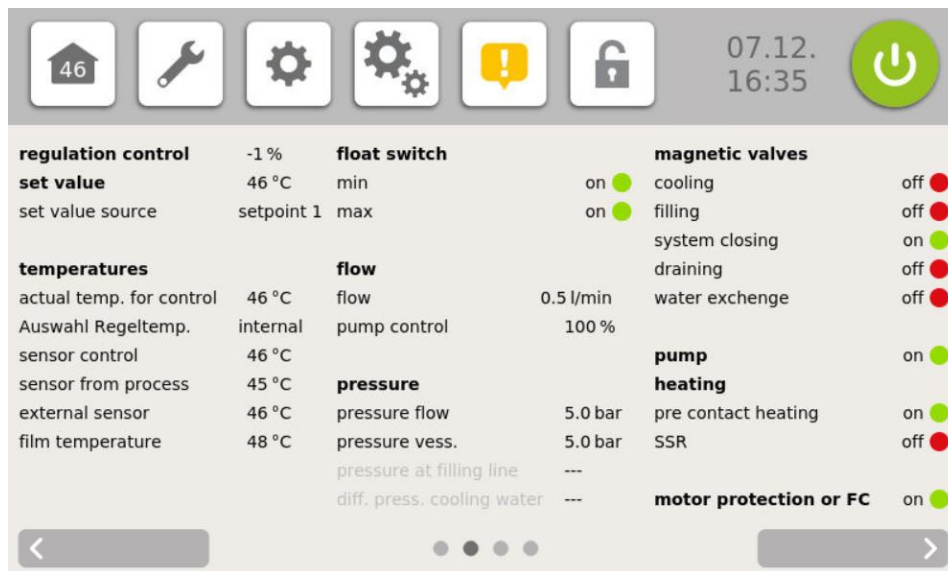
Expert Mode

Additional information is displayed in the expert mode. The expert mode has been designed for special applications or the service case.


Among other things, the expert mode displays the following data:

- Signals from all connected sensors
- State of the float switch
- Output level "heating" and "cooling"
- Flow rate and pressure (if the device has the corresponding equipment)
- Outputs of all valves
- Outputs "Pump" and "Pre contact heating"
- State of the motor circuit breaker

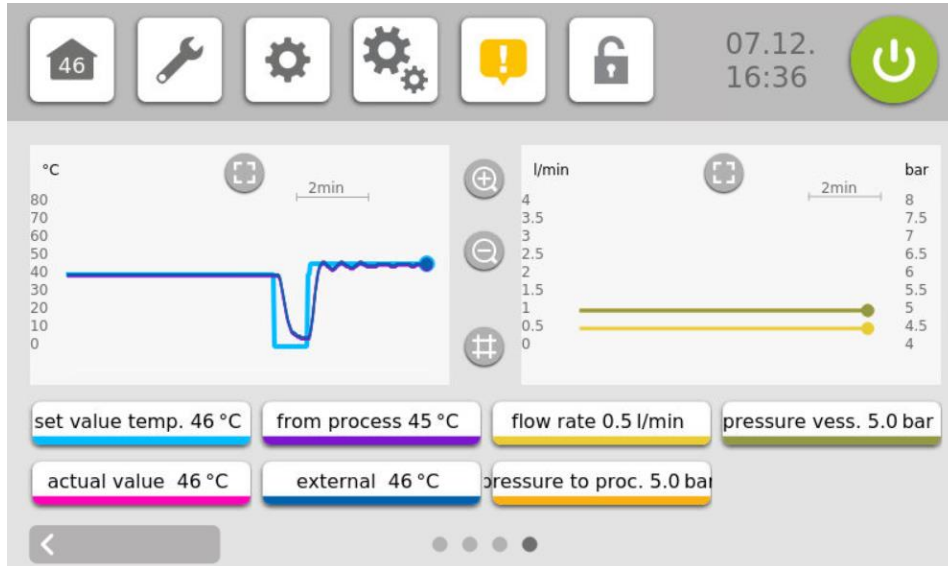
The following screenshot shows an example.



Parts of the display are connected to optional sensors (e.g. pressure sensor) or actuators (e.g. system closing valve). If these optional components are not installed, the associated values are not displayed.





Tap the arrow button  at the bottom right to go to the graph mode.

Graph Mode



Temperatures are shown on the left, with flow rate and pressure on the right. Individual values can be shown or hidden by tapping the corresponding button.

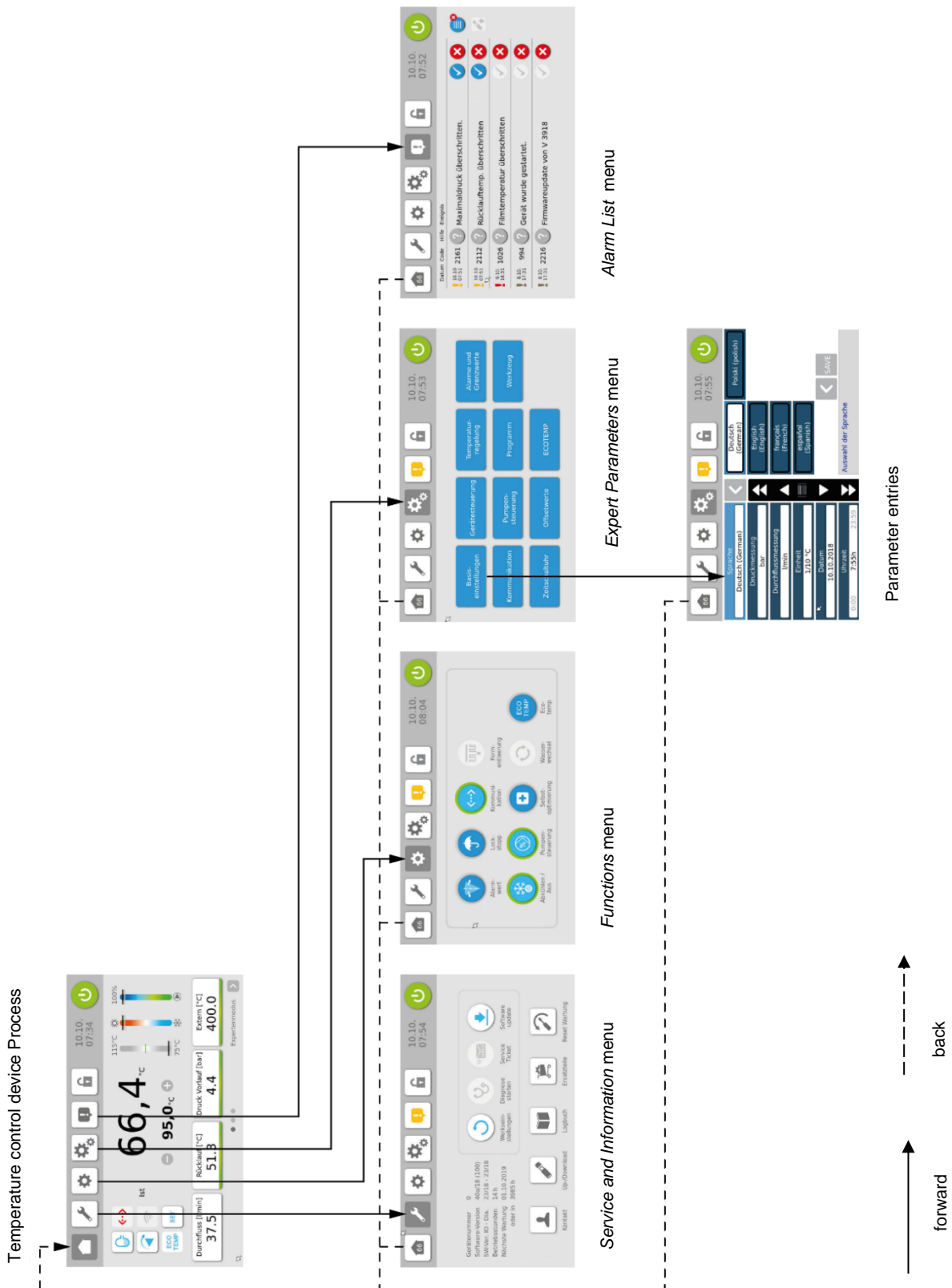
Other controls:

	Zoom in
	Zoom out
	Full screen
	Show/hide grid

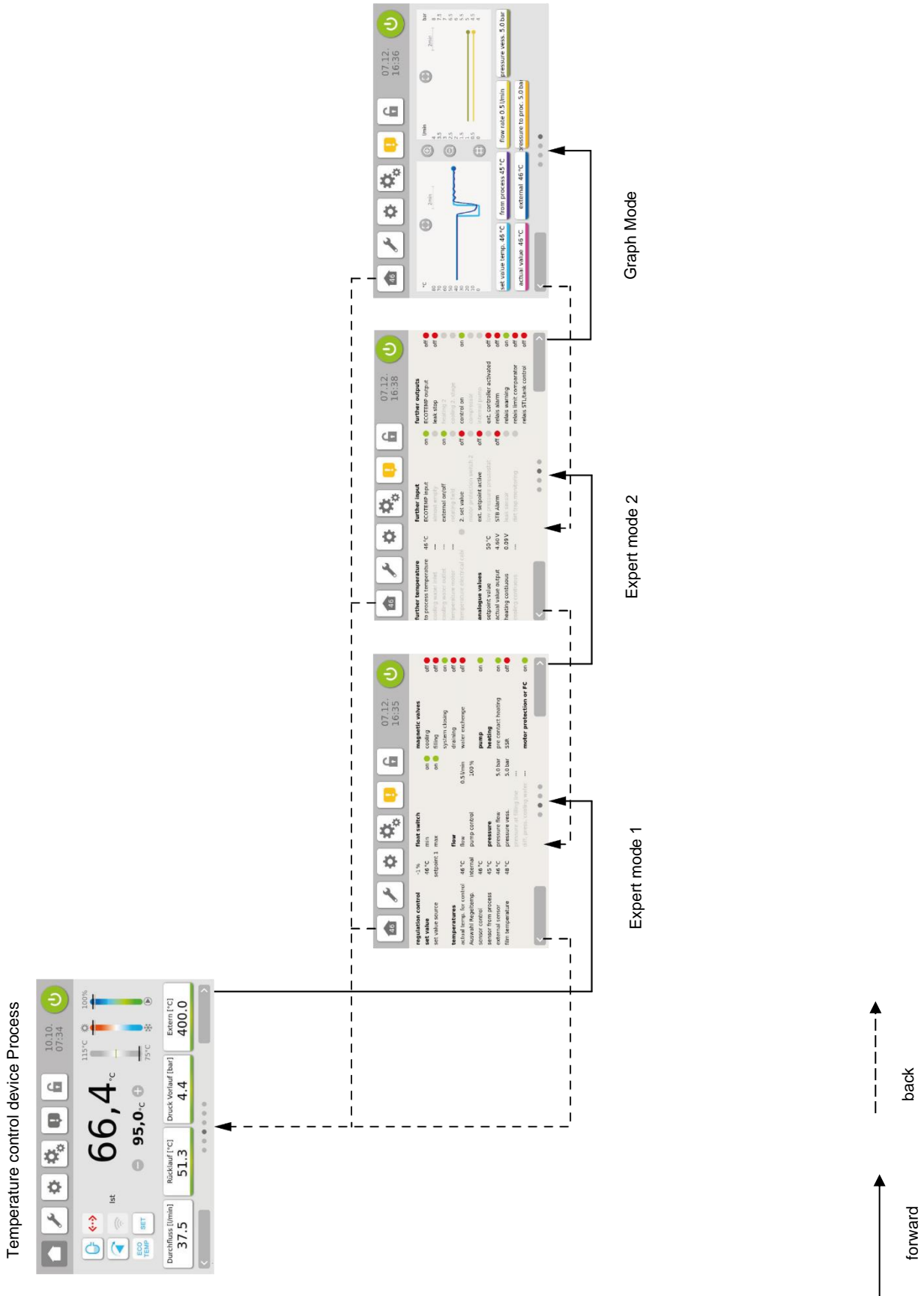
If you switch from one of the *Process Data View*, *Expert Mode* or *Graph Mode* views to another view and back again, you will be returned to the original view when you tap the Home button.

2.3 Overview of the operating concept

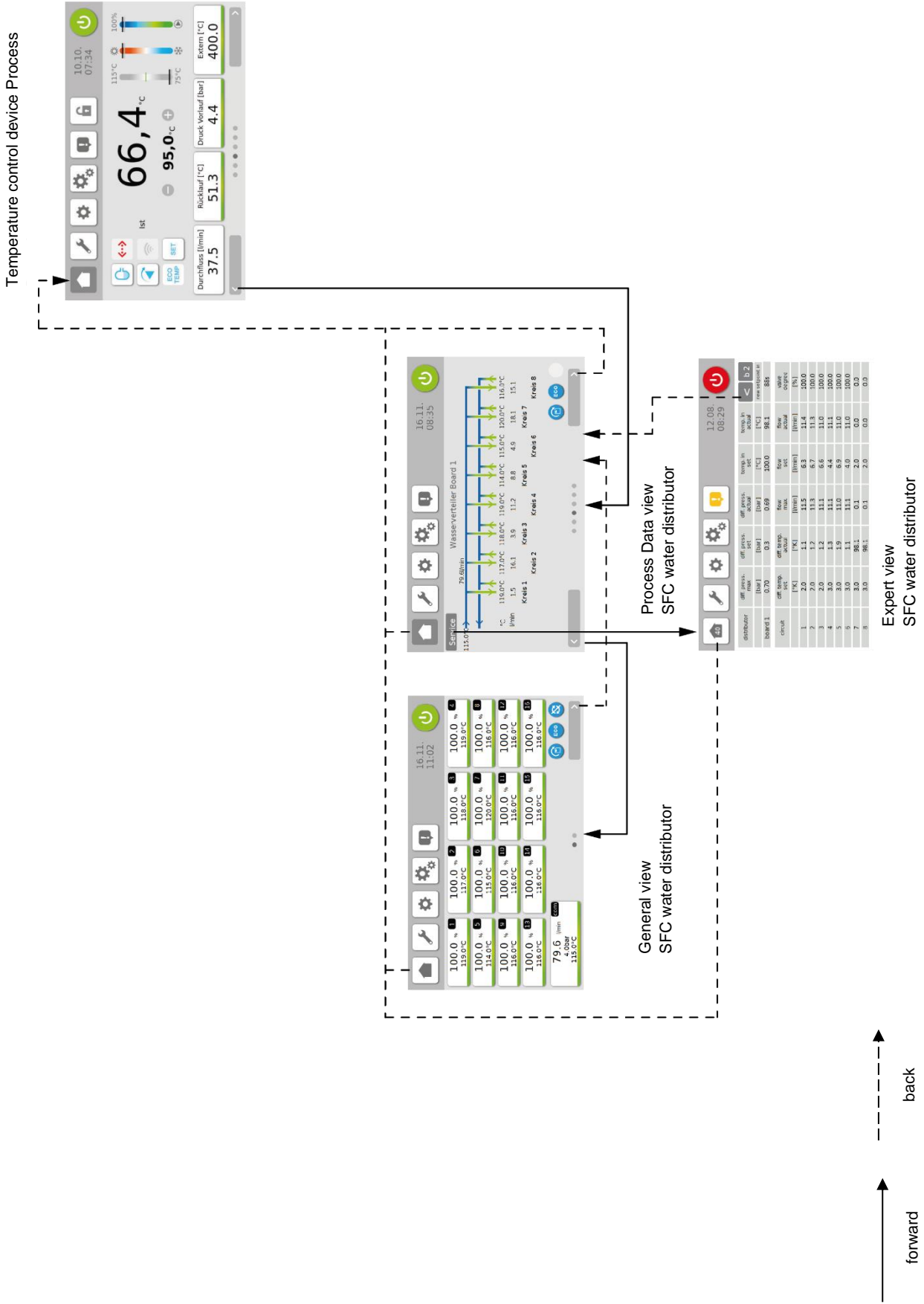
Menu Structure



Expert Mode and Graph Mode



SFC water distributor option – Process Data view, General view and Expert view

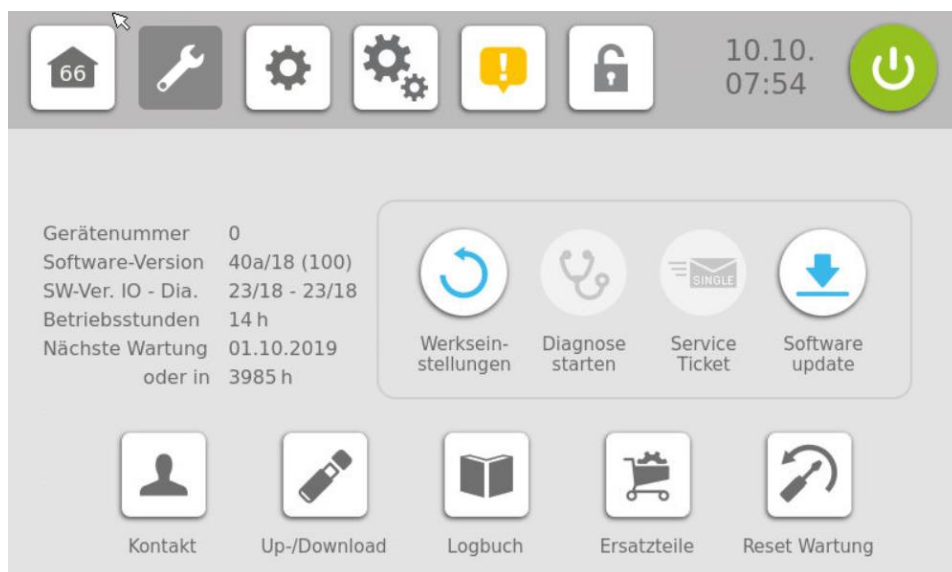


2.3.1 Service and Information menu




The following information is displayed on the screen when switching to the *Service and Information* menu:







- Device number
- Operating hours
- Software version
- Information about servicing

The device number information is important in the event of a service call as SINGLE stores the device data under the device number.



The following buttons are available:

	<p>Reset to factory settings</p> <p>The device is reset to the delivery condition using the <i>Reset</i> button. There is an additional prompt that must be confirmed by the User before the reset is performed.</p> <p>NOTE: Parameters set by the customer are lost with the reset.</p>
	<p>Start diagnostic run</p> <p>If the icon is greyed out, the diagnostic run is not enabled.</p>
	<p>Send service request to SINGLE</p> <p>If the icon is greyed out, this function is not supported or there is no active network connection.</p>




	<p>Perform update</p> <p>In order to use this function, a USB stick must be plugged in that contains the program data in a subdirectory named <i>Software</i>.</p>
	<p>Contact</p> <p>The telephone number and e-mail address of the service partner are stored here.</p>
	<p>USB Function</p> <p>The prerequisite for using the USB function is that a commercially available USB stick formatted as FAT16 or FAT32 is plugged into the back of the Smart Controller.</p> <p>Note: Due to the technical diversity, it cannot be guaranteed that every USB stick works.</p> <p>The following functions can be performed using the <i>USB Function</i> button:</p> <p>Export of parameters, parameter changes, process data, device documentation, spare parts list, messages (alarms etc.), programs and tools from the Smart Controller to the USB stick, import of parameters.</p>
	<p>Log book</p> <p>Can be used to store text entries. Maintenance operations and updates are stored automatically.</p>
	<p>Spare parts</p> <p>The spare parts list of the temperature control device is listed here.</p> <p>NOTE:</p> <p>The spare parts for the SFC water distributors connected to the temperature control device are not listed here. A list for the spare parts of the SFC water distributors can be found in the operating manual of the SFC water distributors.</p>
	<p>Maintenance</p> <p>The temperature control device must be serviced after a defined number of operating hours. An operating hours counter counts down for this purpose. As soon as the counter has reached zero, an alert is triggered to indicate that servicing is due. Alternatively, a calendar period of time expires.</p> <p>In addition to the device servicing, the temperature control device tracks the usage of other components. A message is generated when the typical service life is reached. After the component has been replaced, the counter can be reset.</p>







2.3.2 Functions menu

The most important and most frequently used device functions can be configured in the *Functions* menu. There are further settings for many functions that can be defined in the *Expert Parameters* submenu (see 5 Expert Parameters).

Some functions can be activated or deactivated. An activated function is indicated by a green frame around the button.

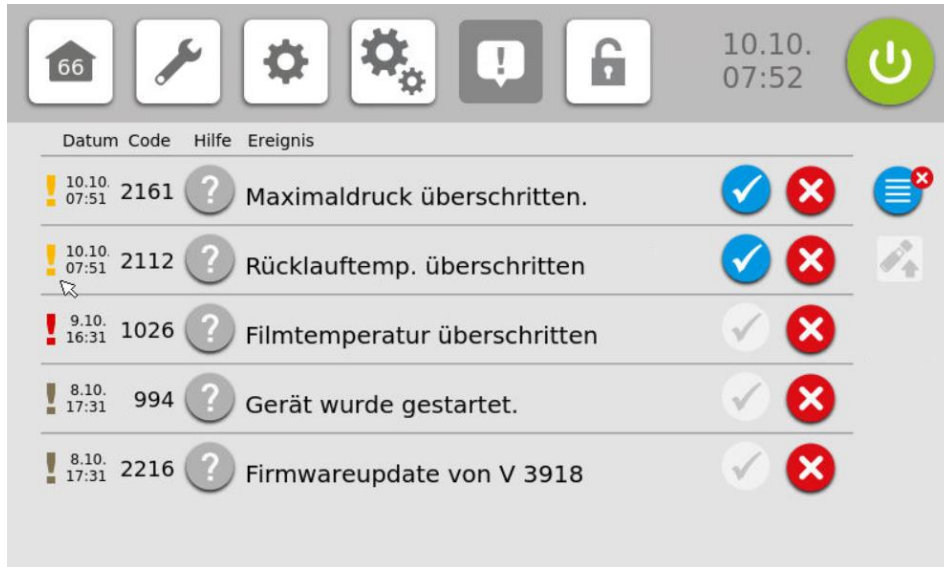
The following buttons are available:

	<p>Temperature warning</p> <p>The limit value for triggering a temperature alarm can be set or the function can be activated or deactivated using the <i>Temperature Alarm</i> button. Additional parameters can be configured using <i>Expert Parameters / Alarms</i> (see 5.4).</p>
	<p>Leak stop mode (optional)</p> <p>If this function is activated, it causes the reversal of the pump rotation direction. This causes the pump to run in suction mode to stop water escaping from a leak.</p> <p>This function is only available for open systems or below the system closing temperature. If the leak stop mode is activated, the pump delivers less medium; this can adversely affect the temperature balance of the tools. Flow sensors also only measure in one direction. Therefore the flow rate display is suppressed and there are no alarms in relation to the flow rate.</p>
	<p>Interface mode (optional)</p> <p>The prerequisite for the <i>interface mode</i> is an appropriate master system (e.g. injection moulding machine) with appropriate cabling between the master system and the temperature control system.</p> <p>If this function is activated, the device receives commands via a digital interface (e.g. setpoints, switching on of the device) and returns process values and alarms.</p>

	<p>Tool draining (optional)</p> <p>Prerequisite for any <i>tool draining</i> is the completed cooling down of the system, otherwise the device is still pressurised.</p> <p>If this function is activated, the temperature control system and the connected consumer are drained immediately after switching off the device. Additional parameters can be configured using <i>Expert Parameters / Device Control</i> (see 5.2).</p>
	<p>Pump Overrun</p> <p>If this function is activated, the temperature control system and the connected consumer are cooled down immediately after switching off the device (only for temperature control systems with heat exchanger). Additional parameters can be configured using <i>Expert Parameters / Device Control</i> (see 5.2).</p> <p>Further information about pump overrun can be found in chapter 3.1 Switching on / off, pump overrun.</p>
	<p>Pump control (optional equipment required)</p> <p>If this function is activated, the pump runs either at full power or with reduced speed. There are further options for the reduced speed which can be set using <i>Expert Parameters / Pump Control</i> (see 5.6 Pump control (only with optional frequency converter)).</p>
	<p>Self-optimisation</p> <p>Self-optimisation is used to determine suitable parameters for the P, I and D components of the PID temperature controller. The objective is to reach the setpoint temperature as quickly as possible with minimum overshooting.</p> <p>The self-optimisation is described in more detail in chapter 5.3.</p>
	<p>Water change</p> <p>From time to time, the temperature control system can pump water into the cooling water outlet and take in fresh water, for example in order to dispense additional water conditioning agents. Additional parameters can be configured using <i>Expert Parameters / Device Control</i> (see 5.2).</p>
	<p>ECOTEMP</p> <p>For cyclical processes, it may be useful to interrupt the cooling/heating of the consumer. This is done by the ECOTEMP function. Additional parameters can be configured using <i>Expert Parameters / ECOTEMP</i> (see 5.7 ECOTEMP).</p>

2.3.3 Alarm list

Alarms are displayed in this screen.



An alarm indicates a device malfunction, such as insufficient fill levels or a tripped motor circuit breaker. If an alarm has occurred, this is indicated by a yellow or red exclamation mark in the navigation bar.



A **yellow** exclamation mark means "warning"; this indicates a minor fault; the device continues running.



A **red** exclamation mark indicates an alarm. Depending on the severity of the fault, the entire device or only the heater is switched off. In refrigeration equipment, the compressor may shut down.

In addition, a red bar with a short description of the alarm is displayed in the process data view.

The most recent alarm is shown at the top in the alarm list. The following information is shown:

- Date and time when the alarm was created
- Error code
- Error text / short description

Tap  in order to acknowledge an alarm; the alarm remains on the screen but the field colour changes to grey. Tapping  deletes the alarm from the view, but it remains stored in the background. Alarms whose causes have not yet been resolved are regenerated and displayed again.

Tap  above the scroll bar to clear the entire alarm list. If a USB stick is plugged in, tap  to write the alarms to this stick.

3 Operation of the temperature control system

3.1 Switching on / off, pump overrun

When the supply voltage is applied and the temperature control system is switched on via the main switch, the Smart Controller is also started. The starting process takes a few seconds.

Restarting after interruption of the supply voltage

In the case of interruption of the supply voltage or switching off using the main switch, the controller goes to the "ready for operation" state after switching on again or restore of the supply voltage. In environments with frequent supply voltage interruptions, it can be desirable that the temperature control system should start automatically immediately after the supply voltage is restored.

Set the *Restart Lockout* parameter to "off" for this (under *Expert Parameters / Device Control*, see 5.2). The system starts automatically after the supply voltage is switched on.

Filling

Set the *Filling* parameter to "Automatic" (under *Expert Parameters / Device Control*, see 5.2) so that the temperature control system starts filling automatically after being switched on, if it is empty. This is only possible if the device is connected to a suitable supply, either by using the cooling water connection for filling, or by using a separate filling connection (see device configuration). Temperature control systems that use oil as heat transfer medium are usually filled manually.

After reaching a sufficient fill level, the pump starts and the system regulates to the specified setpoint temperature.

Switching on/off via signal contact

The system can optionally be switched on and off using a signal contact, The device must have previously been switched on manually for this. This contact can be used by the customer (see 8 Pin assignment). The system can be switched on manually or using a switch-on command in interface operation.

Alarm list

If the system cannot be switched on, check whether there is any fault in the alarm list (e.g. power supply fault, motor circuit breaker tripped, etc.). Note that it can take up to 10 seconds before an alarm is displayed.

Switching off and pump overrun

Depending on the setting (under *Functions / Pump Overrun* (see 2.3.2 Functions menu) the device does not switch off immediately but passes through cooling down (pump overrun) and/or draining.

If no (optional) heat exchanger is installed in the temperature control system, the cooling down of the pump overrun function only takes place through heat loss. As the pump brings additional energy into the circuit, the temperature can level out at values above the shutdown temperature. Then the system no longer switches off automatically.

Draining

After the system has cooled down, it shuts down or drains the consumer if *Tool draining* (see 2.3.2 Functions menu) has been selected. This is only possible if the device is equipped with a built-in tool draining device. Draining without first cooling down is not possible to protect the device and the cooling water pipes. If the *Pump overrun* parameter is set to "off", the device cools down to the preset value of 60 °C before draining.

3.2 Switching on/off via external contact / restart lockout

The temperature control system can also be switched on or off remotely. There are two options available for this:

Switching on/off via external contact

The controller has an input on the connection board that switches the device on/off via an external floating contact. The factory setting for this contact is "High" (24 V DC). To operate the device, the "On/Off" input must be set to logical "1", and the device must be switched on manually. The device shuts down if the "On/Off" input is set to logical "0" (0 V). Setting the input back to "1" switches on the device again. Switching the device on and off remotely will work until it is switched off manually. It is always possible to switch off the device manually on the touch display.

Switching on/off via interface

Prerequisite: The operation via an interface must be enabled.

Various interfaces allow the switching. Further information about interface operation can be found under *Expert Parameters / Communication* (see 5.5).

The *Pump overrun* (On/Off) and *Shutdown temperature* (On) parameters have effects on both options. If the device is switched off remotely and the *Pump overrun* parameter is enabled, it cools down until the shutdown temperature is reached.

3.3 Filling the system

The filling is monitored and controlled with a magnetic float switch. The switching contacts of the float switch are usually designed as normally open contacts for rising level.

Water systems: during automatic filling, the filling valve remains open in the temperature control system until the contact signals "full". This does not happen until the device is switched on.

Oil systems: oil systems are usually intended for manual filling. They may only be filled until reaching the minimum contact. If the level reaches "full", the system triggers an "overflow" alarm and the heating switches off.

An alarm is always triggered if the level falls below "empty". The pump is switched off for self-protection. Depending on the operating state, the switching off may involve a brief delay.

No alarm is generated if the system is switched on when it is empty. The temperature control system must be filled or fills automatically if the *Filling* parameter is set to "Automatic". An alarm is not generated until the system has been filled sufficiently once and then the level has dropped below the "empty" contact.

If the system has been filling without interruption for longer than the specified *Fill monitoring* parameter, it must be assumed that there is a major leak. The system stops the filling and triggers an alarm.

The system is equipped with a so-called Aquatimer to monitor smaller leaks. Thereby, the system counts the filling processes during operation. An alarm is also triggered if the number of filling processes is exceeded. The Aquatimer is disabled for the duration of the *Aquatimer start time* for the initial filling process. The Aquatimer start time and the number of filling processes are set in the *Expert Parameters* under *Device Control* (see 5.2).

3.4 System closure (only pressurised water devices)

To ensure that water-based temperature control systems can be operated at temperatures above 90 °C, the system must be pressurised. This is achieved by installing a valve in the system that closes the water circuit to the atmosphere. In this way, it is possible that pressure can build up that prevents any evaporation of the water.

This closing takes place at the so-called system closing temperature that is set using the System Closing Temperature parameter under Expert Parameters / Alarms and Limits (see 5.4 Alarms and Limits).

This valve stays closed when the controller starts up. The valve also remains closed in the switched-off state; also directly after and for a short time after any draining process for ventilation.

The system closure temperature is also an important parameter for the leak stop function as this is not available in the pressurised area for physical reasons

3.5 Flow measurement

If the temperature control system is equipped with a flow rate sensor, the controller shows the water flow rate. Values that are below approx. 10% of the maximum flow rate cannot be displayed for physical reasons. The temperature control system should not be operated in the range below this as a minimum flow rate is needed for useful energy transfer and temperature control.

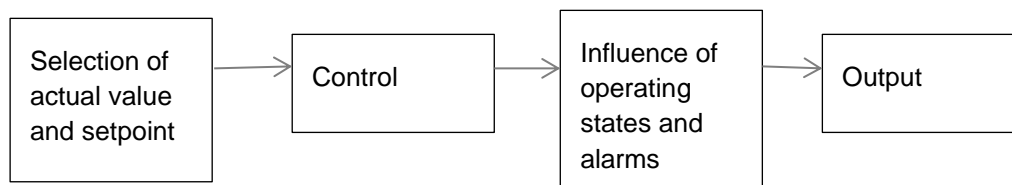
The minimum flow rate can be adjusted using parameters (see 5.4). An alarm is triggered if the value drops below this threshold.

As the flow rate measurement only functions in one direction for physical reasons, any display as well as the alarm signalling are suppressed if the device is being operated in leak stop mode in the opposite direction.

4 Temperature control

The regulation and control unit can have different operating states. The system only regulates the temperature to a desired setpoint value during normal operation; in other operating states such as draining, the control outputs are set to "zero". The actual control behaviour can be influenced in many different ways using a range of control parameters. These parameters are described in the *Expert Parameters* chapter in the section on control parameters (see 5.3).

The description of the control behaviour is divided into the following segments:



In a first step, there is a choice between various different inputs, such as temperature sensors. A number of setpoints also exists – fixed, variable (ramps) or externally defined (analogue or via interface) setpoints.

The controller uses the input signals and parameters to determine a control variable.

The influence of operating states and alarms corrects the control variable if necessary, e.g. the "heating" output level is set to "zero" if there is a film temperature alarm.

The output specifies the control of the various outputs for the actuation of control elements such as valves.

4.1 Control Sensor

By default, the control sensor provides the temperature value used for control.

If the *External Sensor* parameter (under *Expert Parameters / Device control*, see 5.2) is set to "external", the temperature signal of the external sensor is included for the control. If no sensor signal is present (e.g. sensor not connected or defective), the control reverts to the control sensor and outputs an alarm.

Alternatively, the temperature control system can also control based on the temperature value from the return sensor or on an actual temperature transmitted via the Profibus.

4.2 Setpoint for the temperature control

By default, the *Setpoint* parameter is included for the control. Setpoints can only be entered within the limits specified by the *Lower/Upper setpoint limit* parameters (see 5.4).

However, other settings can override the setpoint. The following prioritisation applies:

Priority 1 (interface mode):

If the interface mode is activated, the transmitted setpoint is included for the control. This overrides all other specified setpoints.

The following applies if the interface mode is not activated:

Priority 2 analogue external setpoint specification (only for Smart Controller plus):

If the *Setpoint selection* parameter is set to "external setpoint"*, the input signal from the external setpoint input is used for the control.

Priority 3:

If the *Setpoint selection* parameter is set to "Setpoint 2" or the *input 2nd Setpoint active* is set to "1", the "Second setpoint" is used for the control.

Priority 4 program:

If a program is active, the setpoint is generated dynamically by the program.

Otherwise, the value of the *Setpoint* parameter is adopted for the control. If the transmitted setpoint is outside the *Lower/Upper Setpoint Limit* parameters, the lower or upper setpoint limit is used for the control and an alarm is output.

4.3 Temperature control

The temperature controller is either a PID controller or, in combination with a refrigeration unit, a two-position controller. The parameters for the adjustment can be found under *Expert Parameters* for the temperature control.

Cascade control is implemented to prevent strong overshooting for temperature control using an external sensor that has long dead times due to unfavourable placement. The dead time is the time that elapses after a control variable has changed (e.g. a cooling valve opens) and until this change has an effect on the sensor.

If the temperature deviates by more than the value set in the *Cascade Control dT* parameter, the heating or cooling is limited. This gives the controlled system time to allow the temperature change to arrive before the output level increases. The entire system thus tends less to overshoot.

4.3.1 PID control behaviour

The controller uses standard control engineering variables.

All control parameters can be set separately for heating and cooling.

One control signal is generated for heating and one for cooling; simultaneous heating and cooling is not possible. The heating is always realised as PID controller, the cooling either as PID controller or as two-position controller, mainly for devices with active compressor cooling.

4.3.2 Control behaviour of two-position controller

This is a classic two-position controller with hysteresis. The hysteresis can be adjusted above and below the setpoint separately. The two-position controller only affects the cooling output. The heating output stays in the PID characteristics.

5 Expert Parameters

The expert parameters are grouped into the following subjects:



If one of the menus is selected, a list of the individual parameters opens.



The individual parameters are listed on the left of the list, and the current setting is centred in the white field below. If there are lower and/or upper limits, these are displayed in the white field in grey characters on the left and right respectively. Select a field to change the parameter. The right side of the screen then shows a numeric field or a selection, depending on the type of parameter. After making any changes, tap “Save”; otherwise, the new setting is not applied. If an invalid value has been entered, e.g. the value is too high, this value will not be applied.

After selecting a parameter, a brief description of the parameter is displayed at the bottom right.

5.1 Basic settings

Use the button to make basic settings.

The following settings can be made:

Language

Select the desired language.

Pressure unit (only for optional pressure sensor)

Select between bar and psi for the pressure unit.

If no pressure sensor has been installed at the factory, this selection/button is not available. In this case, the corresponding displays are suppressed and no alarms are created.

Unit for the flow rate (only for optional flow rate sensor)

Select between l/min, m³/h and gal/min for the flow rate unit.

If no flow rate sensor has been installed at the factory, this selection/button is not available. In this case, the corresponding displays are suppressed and no alarms are created.

Units of measure

Select between degrees Celsius (°C) and degrees Fahrenheit (°F) for the unit of the temperature.

For °C, it can be selected for the temperature display whether the value should be displayed as an integer or with a decimal place.

Operation Lock

Enter a four-digit code under Lockout Code. You can also select whether all inputs are locked or whether the setpoint can still be adjusted. Switching on and off is always possible for safety reasons.

If the *Lockout* parameter is not set to "OFF", the navigation bar at the top displays an open padlock icon (see 2.1 Navigation bar).

The lockout must be activated so that it becomes effective.

Activating the lockout:

Tap the displayed symbol (open padlock) to activate the lockout. Confirm the prompt in the additional dialogue.

The lockout becomes active and a closed padlock is displayed.

Deactivating the lockout:

Tap the closed padlock in the navigation bar. Enter the release code. If the code has been entered correctly, the lock is deactivated.

Note: if the code has been lost when the lockout is activated, contact SINGLE Service to obtain a release code. The 6-digit device number is needed for this.

5.2 Device Control

You can use the *Device Control* button to make settings to control the device logic.

The following settings can be made:

Drain time

This parameter defines the duration of the draining if *Tool draining* has been selected (see 2.3.2 Functions menu)

Functions menu

Manual / Automatic filling

This parameter defines whether the device is filled manually or automatically (see 3.1 Switching on / off, pump overrun).

The hydraulics must be prepared accordingly in each case for manual or automatic filling. For details, refer to the technical specifications or the order confirmation.

Changeover control

If the device is prepared accordingly, the control can also be carried out by an external control. This then directly controls the cooling and heating in the temperature control system without the intervention of the Smart Controller. Device monitoring is maintained.

Indirect/direct cooling

If the relevant option is installed in the hydraulic system, cooling can be switched over to direct cooling. This increases the cooling capacity for lower temperatures.

Indirect cooling of temperature control devices means that cooling water is passed through a heat exchanger. The cooling water circuit supply contains a solenoid valve that is controlled by the temperature controller.

In the case of direct cooling, the cooling water is fed directly into the heating circuit. The "cool" control output acts directly on the "fill" output and thus controls the filling valve. The Aquatimer must be deactivated for direct cooling.

As this changeover to direct cooling can also be used for pressurised temperature control devices (temperatures of up to 200 °C), the following boundary condition must be met: The system closing valve must have opened for direct cooling so that the hot water can flow through the system closing valve into the cooling water outlet, i.e. the direct cooling only works up to the system closing temperature.

Shutdown temperature for pump overrun

This parameter defines the temperature up to which cooling takes place during pump overrun. Regardless of this parameter, cooling down to the system closure temperature is always carried out so that the system is always depressurised.

Setpoint changeover

This parameter defines which setpoint should be included. By default, the setpoint is controlled to the adjusted setpoint; it is possible to control to an alternative value (setpoint 2).

An analogue setpoint (0 - 10 V, 4 mA - 20 mA) can also be specified in the Smart Controller plus version.

Actual temperature selection

This parameter defines which actual temperature will be used for the control. The selection includes: control sensor, external or return sensor, or a signal via the Profibus interface.

Type external sensor

This parameter tells the controller what type of sensor is connected. The selection includes: PT 100, thermocouple element type J, L, K, 0 – 10 V or 4 mA – 20 mA.

Actual value output (only Smart Controller plus)

This parameter defines which actual temperature value is applied to the analogue output. The selection includes: control sensor, external or return sensor, or a signal via the Profibus interface.

Aquatimer start time and cycles

This parameter is used for leak monitoring (see 3.3 Filling the system). The Aquatimer starts counting the filling cycles within one hour after expiry of the "start time". If the count exceeds the value set under *Cycles*, the system triggers an alarm.

Fill Monitoring

This parameter defines the duration of the filling. If the time specified here is exceeded, the system is shut down as a major leak is assumed or the supply is not guaranteed. The system triggers an alarm.

Attention: No alarm is generated for devices with activated direct cooling.

Restart lockout

This parameter defines whether the device should start automatically after operating voltage is applied (the restart lockout must be set to "off" for this).

Recorder function sample time

This parameter defines the time resolution in graph mode.

Water change configuration (only for water devices)

The purpose of the water change is to pump water out of the system, for example in order to re-supply conditioned water immediately afterwards. If the device includes the *Water change* option, this can be done manually after switching on, or as a time-controlled process.

The pumping-off time is controlled by the water change time; for a time-controlled configuration, the *Water change interval* parameter defines the frequency for pumping off the water. The device is configured for automatic filling. If using the water change function for pressurised water devices, it must be ensured that the device can be filled, either by an adequate cooling water pressure or by a booster pump integrated into the temperature control system.

Pulse Length Cooling Valve & Interval Cooling Valve

For devices with the option "Heat Exchanger with Cooling Water Valve," a cyclic flow through the heat exchanger on the cooling water side can be activated.

This function reduces the heating of the cooling water in the heat exchanger during the heating operation.

The value of the parameter "Pulse Length" indicates the opening duration of the cooling water valve. The value of the parameter "Interval" indicates the duration of the switching cycle of the cooling water valve.

To deactivate the function, set the value of the parameter "Interval" to "OFF."

5.3 Temperature control and self-optimisation

The *Temperature control* button can be used to configure parameters that influence the temperature control behaviour.

The following settings can be made.

Setpoint

This parameter is the normally used setpoint. It can be adjusted directly in the process data view.

Setpoint 2

An alternative setpoint can be defined with this parameter. The *Setpoint Changeover* parameter (see 5.2) can be used to switch to this second value; alternatively, the setpoint terminal contact (see Smart Controller plus connection diagram) can be used to switch between the normal and the second setpoint.

Heating/cooling output level limiting

These parameters are used to set the output level and limit effective output to a value between 0 and 100%. This results in corresponding slower heating or cooling. Specifying such a limit can be useful if the consumer cannot tolerate too rapid heating or cooling.

Control parameters XP, TV and TN

The parameters XP, TV and TN influence the actual control behaviour. Parameters can be configured individually as there can be different outputs for cooling and heating in a temperature control system.

The XP component is the amplification factor. This parameter should be increased if the system tends to overcontrol or overshoot. The parameter can be reduced if the system heats up too slowly at output levels below 100%.

TN is the integral component. It is required to ensure that the system achieves the setpoint value which cannot be achieved with the XP component alone. The parameter can be increased if the system tends to overshoot. If a control deviation remains for a relatively long time, although the output level of 100% has not yet been reached, the parameter can be reduced.

TV is the differential component. It is necessary if there are faults and the actual temperature therefore moves away from the setpoint temperature. In this case, the TV component counteracts the change in corresponding proportion. If the temperature drifts away too much, but the output level has not yet reached 100%, the TV component can be increased.

Do not heat dead range

This parameter defines a dead zone around the setpoint. Operating the system at very low output levels can result in alternating cooling and heating. To avoid this, a range can be defined in which no cooling or heating takes place.

Heating/cooling switching cycle time

The percentage-based output level is converted into a binary on/off behaviour for heating and cooling valves. An output level of 70% means that an actuator is 70% on and 30% off. The "on/off" cycle is always the same length which is specified with the "Switching cycle time" parameter. To protect the components, the time period should be as long as possible, however without the switching behaviour affecting the temperature.

Setpoint ramp rising/falling

If the consumer is sensitive to rapid temperature changes, parameter *Setpoint ramp rising/falling* can be used to reduce the rise/fall speed. The value is entered in K/min.

Cascade control dT (only in connection with an optional external temperature sensor connection)

The cascade control is needed in connection with external sensors to prevent any oscillations of the temperature. Positioning a sensor too far away from the temperature control medium can cause time delays between the response of the device responds and the measurement of this change by the sensor (dead time). Then there is a risk that the controller regulates too much and the entire system goes into temperature oscillation.

To avoid this, the controller switches off the heating when the control temperature exceeds a value greater than the setpoint plus dT of the cascade control.

Example: Setpoint temperature 150 °C, dT 10 K.

The system switches off the heating when 160 °C is reached at the control sensor even if the external sensor indicates lower values.

The system functions analogously in the cooling area, i.e. the cooling is switched off if the control temperature undercuts a value smaller than setpoint minus dT of the cascade control.

This gives the external sensor time to receive the changes. The system then no longer overregulates, but continues to heat/cool analogously to the change at the external sensor.

Switching hysteresis for cooling on/off

For devices with compressor cooling, the cooling is switched on when the temperature reaches the "Hysteresis on" temperature, and switched off when the temperature reaches the "Hysteresis off" temperature. The values must be entered as difference from the setpoint.

Example: Setpoint 25 °C; switch on at 26 °C and switch off at 23 °C.

The parameters must be set as follows:

- Hysteresis cooling on: 1 K
- Hysteresis cooling off: 2 K

For cooling devices with two compressors, the on and off points for the second compressor can be set separately under *Cooling 2*.

Limit/tolerance for film temperature

In order to protect the oil from excessive heating at the heater, especially in heat transfer systems with oil as the medium, the output level can be constantly limited before an unacceptably high temperature is reached. If the film temperature reaches the level defined in parameter *Limitation film temperature*, the output level is reduced to zero.

However, there is a smooth transition to reach this value: The reduction rate is defined by the *Tolerance film temperature* value.

Example: If the *Tolerance film temperature* is 270 °C and the *tolerance* is 10 K, no limitation is applied up to 260 °C; at 265 °C the limitation of the heating output level is 50%; starting at 270 °C, no output level is permitted.

Automatic self-optimisation

The self-optimisation determines suitable parameters for the P, I and D components of the PID temperature controller. The objective is to reach the setpoint temperature as quickly as possible with minimum overshooting. The self-optimisation is started in the Functions menu (see chapter 2.3.2).

If self-optimisation is started, a program routine runs. This cools down the system to a temperature approx. 13 °C below the setpoint. If the device is still 13 °C or more away from the setpoint when the self-optimisation is activated, no initial cooling takes place. The controller then steers the device towards the setpoint temperature; after exceeding a maximum value close to the setpoint, the device cools down for a certain time. This means that the temperature is not at the setpoint during the self-optimisation; production rejects can occur in this time.

As device and controlled system (consumer) are temperature-dependent systems and the optimum control settings are thus also temperature-dependent, it makes sense to perform the optimisation at the same setpoint temperature that will also be used later in the process. External circumstances must not be changed during self-optimisation and disruptions must be kept to a minimum.

As the device can cool down by approx. 13 °C below the setpoint during the self-optimisation, the setpoint must be at least approx. 20 K higher than the minimum achievable temperature. The minimum achievable temperature is the cooling water temperature for temperature control systems and the minimum temperature of the refrigeration system for refrigeration installations. It must be noted that cooling down to temperatures close to zero can cause frost damage if there is not enough antifreeze added to the circulating water.

If the device does not reach the desired temperatures during self-optimisation, the system aborts the optimisation and continues with the old parameters. The self-optimisation aborts as soon as any alarm occurs or if the limit value of the internal control temperature is exceeded during active cascade control is active and the heating is switched off as a result (see chapter "5.3 Cascade Control dT"). Therefore, deactivation of the cascade control is required before the start of the self-optimisation.

After the activation, a dialogue window opens with the text "Self-optimisation". Tap "Start" to confirm or "Cancel" to abort the process.

Selecting "Start" starts the self-optimisation process. While this is running, another window with status information and the option to cancel the process at any time is displayed. No further operation is possible during the running time.

If "Cancel" is selected, the Smart Controller returns to the Process Data view.

Self-optimisation results in conservative values without overshoots. If faster temperature control should be achieved, the Xp value can be gradually reduced until the required result is obtained.

Manual self-optimisation

The Xp controller parameters for heating and cooling must be set to zero by manual input for this purpose. This causes the system to start oscillating, i.e. the temperature is not stable at the setpoint, but fluctuates around it. This means that the temperature is not at the setpoint during the self-optimisation; production rejects can occur in this time.

The time duration of a full oscillation is measured for the determination, this is called Ts in the following. Furthermore, the differential temperature dX is measured between the lowest and the highest temperature value of the oscillation amplitude.

The parameters are then calculated for:

$$Xp, \text{ heating} = dX / 220 * 100\%$$

$$Xp, \text{ cooling} = dX / 110 * 100\%$$

$$Tv = 1/10 * Ts \quad (\text{heating and cooling})$$

$$Tn = 1/2 * Ts \quad (\text{heating and cooling})$$

These parameters must in turn be entered manually. If the system still tends to overshoot or fluctuate too much, increase the Xp values gradually by approx. 25%.

5.4 Alarms and limits

The *Alarms and limits* button can be used to set alarms.

Most alarms are not activated immediately after the error condition occurs, but with a 10 second delay. This is used to prevent false alarms that could possibly result in shutdown of the system.

Temperature alarm configuration

This function relates to the temperature alarm. Temperature alarms can be triggered in various ways: The associated temperature parameter is set under "Device Configuration" (see 0

Functions menu).

The following values can be defined:

- **Signal value**
The value entered here is added to the setpoint. An alarm is triggered if the actual temperature reaches this total value.
- **Limit value**
The value entered here is an absolute value. An alarm is triggered if this value is exceeded.
- **Comparator**
The value entered here defines an operating range around the setpoint, both downward and upward. An alarm is triggered if this range is exceeded in either direction.
- **Comparator with standby**
This mode is similar to the comparator mode. However, the triggering of an alarm is initially disabled. The deactivation is not revoked until the actual temperature has reached the operating range of the comparator once. This means that alarms are not output until afterwards if the actual temperature is outside the operating range.

If the setpoint is adjusted, the warning is deactivated again until the temperature in the new operating range has reached the value of the comparator again. The associated signal values, limit values or comparator values are located in the *Temperature warning value* parameter.

Upper/lower setpoint limit

This parameter is used to define an upper and a lower setpoint limit.

Setpoints can only be entered in the range between the lower and upper setpoint limits. If setpoints outside these limits are entered or are specified by an external source (analogue setpoint specification or interfaces), the input is limited to the minimum or maximum entered here.

Warning "Flow"

In addition to the actual control sensor in the flow, a second flow sensor, also referred to as flow monitor, is installed in many cases. A warning can be activated for the temperature value measured by this sensor.

Alarm "Film temperature"

A film temperature sensor that monitors the heating temperature separately is installed in the device. When the alarm is activated and the alarm value is exceeded, the heating is switched off in addition to the alarm signalling.

Warning "Return temperature"

If a return sensor is installed in the device, a warning can be generated for the temperature value measured by this sensor if it exceeds the value configured here.

Warning "dT"

A warning is triggered if the difference between flow and return exceeds this value.

System closing temperature

Pressurised devices are open below this value to guarantee ventilation of the entire hydraulic circuit. If the system closing temperature is reached, the system seals against the atmosphere and can build up pressure. Above the system closing temperature, the entire system including hoses/piping and consumers connected to the device can be pressurised.

Alarm "Minimum flow rate"

The system triggers an alarm if the flow rate drops below this value. The system requires a minimum flow rate to lubricate the pump and to remove the heat produced by the heater. A minimum flow rate is also essential to ensure proper temperature control. The user should not change the specified alarm value.

Unlike the "flow rate below limit", the purpose of this setting is to protect the functionality of the device.

In the leak stop mode for some devices, the medium flows through the flow rate sensor in the reverse direction; basically no measurement takes place here. Accordingly, no alarms will be triggered.

Warning "Flow rate below limit"

An alarm is triggered if the value drops below this threshold. Unlike the minimum flow rate, the purpose of this parameter is to safeguard the flow rate that the process needs.

Warning "Flow rate over limit"

A warning is triggered if this value is exceeded.

Alarm "Pressure over limit"

An alarm is triggered if the measured pressure on the supply side is above the *High pressure* parameter.

Alarm "Pressure below limit"

An alarm is triggered if the measured pressure in the flow is below the *Pressure too low* parameter.

Device stops if alarm is triggered

If this function is activated, the device switches off whenever any alarm occurs.



created for your perfection

5.5 Communication

The *Communication* button can be used to configure communication details, e.g. which protocol is used. The settings must match those of the master system.

If the system is equipped with an interface and a protocol is selected, the Smart Controller transmits process data (temperatures, alarm states, etc.).

During running interface operation, the interface symbol flashes blue.

If your temperature control system does not have an interface, it can be retrofitted with various interfaces and protocols and activated by a fee-based enable. Contact SINGLE Service for this.

There are SINGLE-specific protocols in addition to finally specified interfaces. The protocol specification can be requested from SINGLE.

The Smart Controller is able to communicate with the SINGLE Smarthub via a local network. To allow communication with the Smarthub, it must be enabled once on the temperature control device. This is done using the parameter *Allow Smarthub Connection*. After activation, the device can connect for 30 minutes. If a DHCP server should assign the IP address, this setting must be activated under DHCP. The IP address is displayed in a field below. If the IP address should be assigned manually, this can also be done using this parameter. However, the IP address can only be entered manually if the DHCP parameter is set to "off".

5.6 Pump control (only with optional frequency converter)

This function is only available if an optional frequency converter is installed in the temperature control system. The pump controller controls the pump speed, e.g. to achieve energy-optimised operation.

Tap the *Pump control* button to go to the screen for setting the parameters.

A frequency converter that influences the pump speed is controlled via the "Pump control" analogue output. It is necessary to have a minimum flow rate for all the functions described here, e.g. to be able to regulate the temperature properly. Therefore the minimum flow rate is restricted to 30% of the maximum flow rate; a higher lower limit can be necessary in some cases for a functioning process.

Pump control selection

This parameter defines which procedure should be used to control the pump speed.

The following options are possible:

Speed set in %:

The pump runs with a fixed output level.

Flow rate set in l/min:

The pump is controlled so that it maintains a defined flow rate value.

Auto (difference dT):

The pump speed is controlled automatically according to the needs of the temperature control process so that the production process runs with lowest possible energy consumption of the pump motor.

Pressure set in bar:

The pump is controlled so that it maintains a defined pressure value (flow pressure).

Fixed output level:

This parameter is used to set a fixed speed relative to the maximum speed. 100% is full load. The minimum accepted speed is 30% in order to satisfy minimum requirements for temperature control. As the power input is approximately the square of the speed, the energy consumption of the pump at 30% speed is less than 10% of the rated motor power.

Required flow rate value (only in combination with flow rate measurement)

This parameter is used to configure a flow rate. The system maintains this value.

If a value is set that is above the maximum value that the device can produce, the pump will run at full load. To achieve correct temperature control results, the specified flow rate must not be below 30% of the maximum flow rate.

The control is performed using a PID controller. If the control behaviour does not achieve the required results for the application, it can be adjusted using the Xp flow rate, TV flow rate and TN flow rate parameters (see below).

Difference dT (only with optional return sensor)

This parameter sets the temperature difference between flow and return.

The pump speed is reduced slowly. In doing so, the temperature difference between flow and return is monitored. The speed reduction is stopped when the dT temperature difference set here is reached.

Thereby, the speed is only reduced if the difference between setpoint and actual temperature is less than 1 K. A minimum flow rate is also needed for the temperature control. Therefore, the system maintains a control variable of at least 30%.

Required pressure value (only in combination with pressure transmitter in the flow)

This parameter is used to configure a flow pressure. The system maintains this value.

If a value is set that is above the maximum value that the device can produce, the pump will run at full load.

The control is performed using a PID controller. If the control behaviour does not achieve the required results for the application, it can be adjusted using the XP flow rate, TV flow rate and TN flow rate parameters (see below).

XP flow rate, TV flow rate, TN flow rate

These parameters influence the control behaviour of the pump for the *Required flow rate value* and *Required pressure value* functionality (see above).

5.7 ECOTEMP

ECOTEMP is an optional function that interrupts the temperature control process – usually cooling in an injection moulding process – by redirecting the water flow to an internal bypass.

The *ECOTEMP* button can be used to switch the function on and off. If the function is active, the ECOTEMP symbol in the Process Data view flashes green or blue.

ECOTEMP can only be activated when the device is switched on and not in leak stop mode.

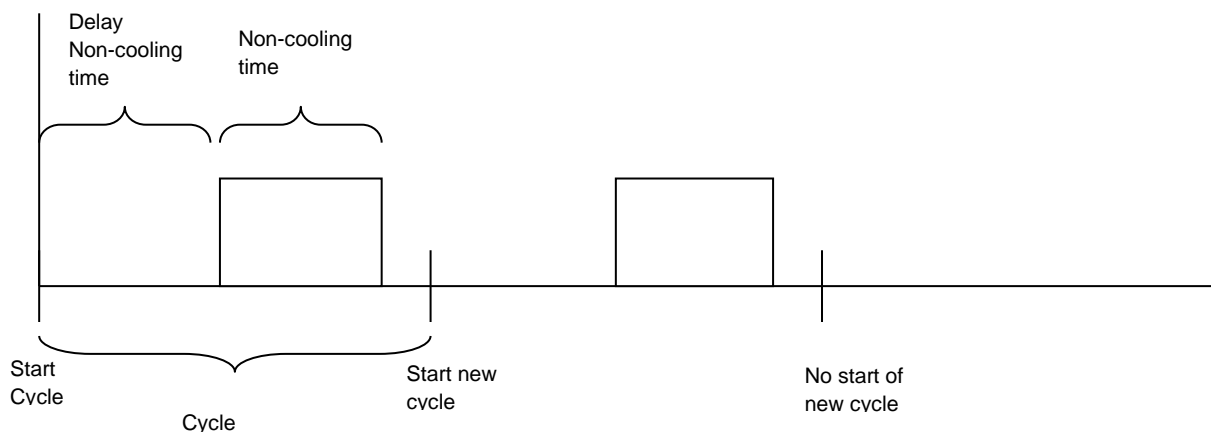
The ECOTEMP module generates an intermittent flow through the tool. It controls the cooling and non-cooling periods of the temperature control system. The specifically graduated temperature control of the injection moulding tool over the course of a cycle produces advantages for the process, the moulded part surface and strength as well as the cost-effectiveness.

In addition, a watchdog time is available that puts the temperature control system into standby mode after a specified time (parameter: timer standby mode). In standby mode, the temperature control device operates based on the second setpoint.

At the ECOTEMP input, the controller expects a 24 V signal. The response occurs with the status change from 0 V to 24 V. In the as-delivered state of the temperature control system, 24 V is applied to a contact of the ECOTEMP connection so that closing a floating contact between 24 V and the ECOTEMP input provides the required signal at the controller. For details, refer to the wiring diagram included with the device.

After any change from "Low" to "High" (from 0 V to 24 V) at the ECOTEMP input, the "Non-cooling delay time" starts. The temperature of the tool is controlled (cooled) here.

After this time has elapsed, the actual non-cooling time starts. During this time, the device is in bypass mode and the tool is not being cooled. If the system has an optional frequency converter, the temperature control system lowers the pump speed to the "Fixed setting" value (set on the Pump Control screen) for the duration of the non-cooling time.



If no new signal is received after the end of the standby time, the system regulates the temperature to a standby temperature, this is the second setpoint.

Output (ECOTEMP Out) and input signal (ECOTEMP In) are displayed in expert mode. The input and output signals can be monitored here.

5.8 Program

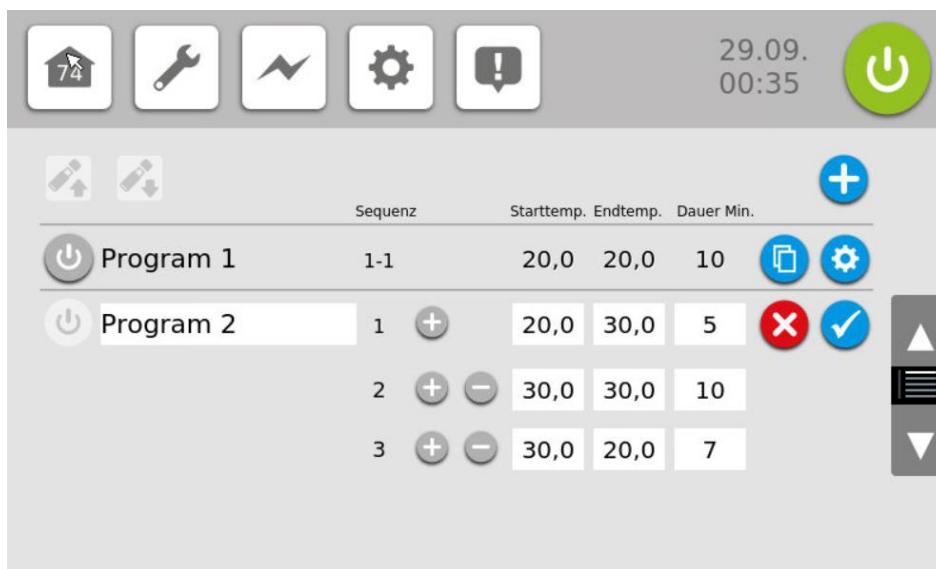
The *Program* button can be used to view a temperature curve, as opposed to a constant temperature in normal mode. The curve consists of straight lines. A curve can consist of up to 20 of these linear sections.



Each section (program step) has a temperature value at the start and at the end as well as a duration (entry in minutes).

After starting the program, the first program step is executed. The initial value is applied as setpoint for the temperature control. For the duration of the first program step, the temperature setpoint changes constantly so that after the time has elapsed, the final temperature value has been reached.

Example: The initial value is 50 °C, the final value is 65 °C, the duration is 3 minutes. The program starts at 50 °C and increases the temperature constantly. After one minute, the temperature reaches 55 °C, after two minutes 60 °C etc.


If the program contains multiple steps, these are executed in immediate succession. In principle, it is possible for the final value of one step to differ from the initial value of the following step. In this case, the temperature setpoint jumps. The controller tries to follow this specified curve. Due to the thermal inertia of the overall system, however, jumps are not possible. Depending on the overall system, a certain time is needed.




Tap the  button to create a new program. Enter a program name and tap the “Enter” button to confirm. The program is created. Initially, it consists of only one program step. Tap the  icon to edit the program. The start temperature, end temperature and duration can now be specified this step.

Tap the small  button in the program line to append further program steps.



If the start value does not match the final value of the preceding step, a jump occurs in the setpoint curve.

Tap  to delete program steps. A name can be changed by selecting the name field.


Tap  to finish editing a program. Programs can be modified subsequently. This is not possible while the program is running.


Tap on  to duplicate a program.

Up to 10 programs can be programmed, each with 10 individual steps.

Tap the icon before the program name to start the program. The icon turns green and a symbol with an arrow  is displayed. Tapping the icon again switches the program to repeat mode. This is indicated by a symbol with two arrows . Tapping the icon again stops the program immediately.

The prerequisite for starting the programs is that the device is switched on and that it is not in interface mode. As there are different setpoint sources, pay attention to the further parameter configuration (see also 4.2 Setpoint for the temperature control).

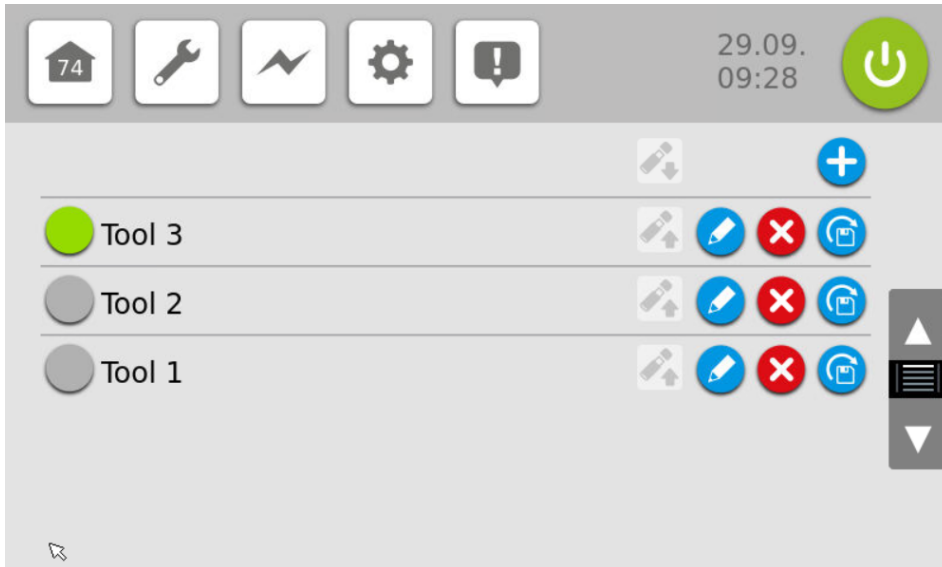
Tap  to copy all programs to a USB stick. The programs are stored as individual files using the program names.


Tap  to load programs from the USB stick onto the temperature control system. This copies all programs that are stored in the designated "Programm" (program) directory. Programs with identical names are not copied.

In order to delete a program, first tap  to select it and then tap  to delete it.

5.9 Tool



A temperature control system can be used for different end products. These different end products may require different parameter configurations of the temperature control device. Parameters can be saved using the *Tool* button and, if required, can be applied again to specific tools.





Tap  to create a new tool and store the current parameters for this tool. After tapping this icon, the system will first prompt for a tool name.

Up to 20 tools can be saved.

If a tool is switched on by tapping on the dot, the indicator changes colour to green. If any parameter is now changed, the current parameter configuration no longer matches the tool parameters. The changes are not saved automatically in the tool. For this reason, the colour of the dot changes back to grey.

Tap the floppy disc icon  to update a version. The tool data are overwritten with the current parameters. Alternatively, after changing the parameters, tap the  icon. A new tool data record is created.

It is also possible to download and upload tools by tapping the USB stick icon on the line, provided a suitable USB stick is plugged in. Tap  in order to copy tools from a USB stick to the device. This works provided that one or multiple data records are saved in the "werkzeug" ("tool") directory on the stick

Tap  to delete tools.

5.10 Timer

The controller includes a battery-backed clock. The *Timer* button can be used to switch the device on and off on any day of the week. The times for switching on and off must be specified for each day. Note when using the timer that the main switch of the device must not be switched off.

5.11 Offset values

As a result of ageing, the sensors may lose some of their accuracy. An offset value can be stored for each measured value that compensates for measuring errors due to ageing. The individual values are listed in the parameter lists in chapter 9.

The Smart Controller plus has an analogue setpoint input / actual value output. This function can be calibrated in this menu under "Analogue Standard Signal Setpoint/Actual", as well as "Temperature at 0 V/4 mA" and Temperature "at 10 V/20 mA".

- A selection can be made between 0 - 10 V or 4 mA - 20 mA.
- The temperature at which the analogue transmission range begins and ends can be defined.

If for example the temperature range between 50 °C and 150 °C is relevant, the parameter *Temperature at 0 V / 4 mA* is set to 50 °C; parameter *Temperature at 10V / 20mA* is set to 150 °C. If the setpoint is now specified as 5 V or 12 mA, the controller interprets this as setpoint temperature 100 °C.

6 Temperature control device with SFC water distributor

6.1 Enable SFC water distributor operation

NOTE:

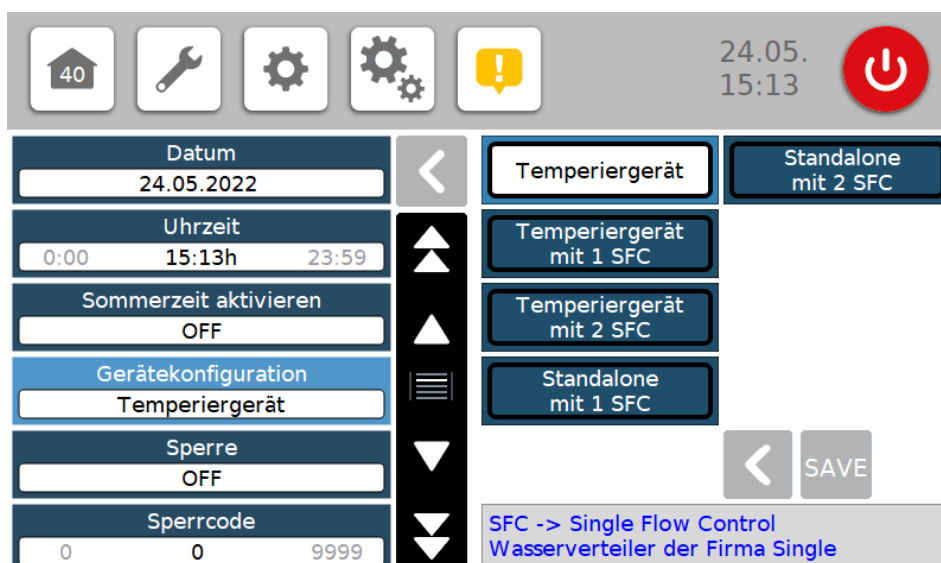
- Temperature control devices are always configured at the factory only as "temperature control device".
- The options "Temperature control device with 1 SFC water distributor" or "Temperature control device with 2 SFC water distributors" must be configured in the SSC controller by the customer in the relevant case.

Procedure:



Tap the Expert Parameters button in the navigation bar.

In the Expert Parameters menu, tap the Basic Settings button and scroll down to the Device Configuration menu.



In the Device Configuration menu, select either the option "Temperature control device with 1 SFC" or "Temperature control device with 2 SFC".

Tap the SAVE button.

6.2 Switch SFC system on/off

If "Temperature control device with 1 SFC" or "Temperature control device with 2 SFC" is selected in the device configuration, the SFC water distributor additional function starts automatically when the temperature control device is switched on. If the SFC water distributor is equipped with the option "with motor control valves in the return (SFC.VALVE.AUTO)", all valves are automatically fully opened when the device is switched off.

6.3 Shutting Down Individual Circuits of the SFC Water Distributor

If the SFC water distributor should not be operated with all individual circuits, the number of individual circuits can be reduced via the parameter "Number of Circuits."

The individual circuits with the highest numbers will always be shut down. It is not possible to freely choose which circuits to shut down.

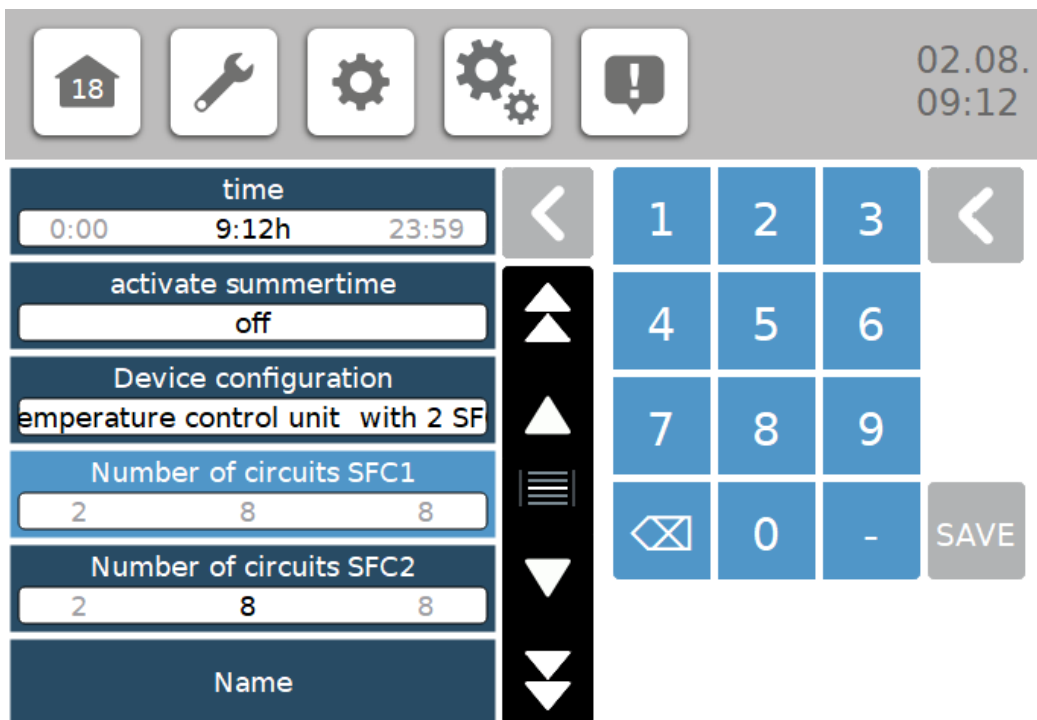
Example: If the parameter "Number of Circuits" is set to 4 on a 6-way distributor, circuits 5 and 6 will be shut down.

The supply and return connections of unused individual circuits must be tightly sealed with suitable threaded plugs.

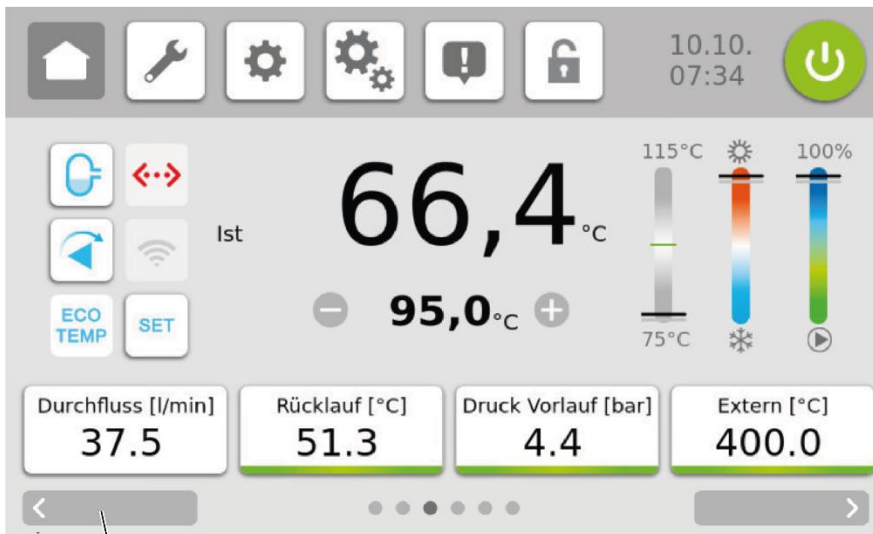
The ball valve must be set to the "open" position.

If the SFC water distributor is equipped with the option "with fine dosing valves in the return," the fine dosing valves must be set to the "open" position.

If the SFC water distributor is equipped with the option "with motorized control valves in the return," the motorized control valves of the shut-down circuits will automatically be set to the "open" position. The safety instructions in the SFC water distributor operating manual must be strictly followed.



6.4 SFC water distributor Process Data view

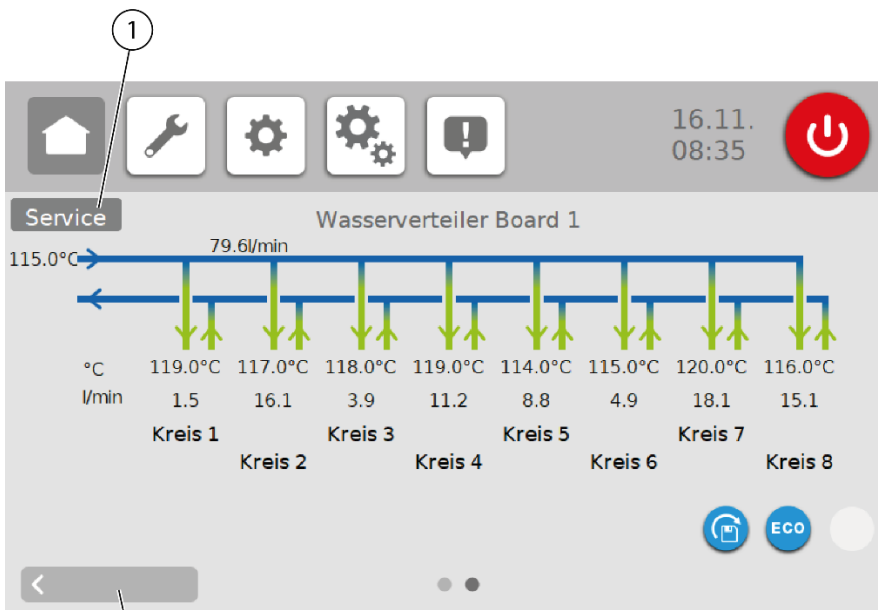


1

1	Toggle button	-	-
---	---------------	---	---

Tap the Toggle button to switch from the process data view of the temperature control device to the process data management of the SFC water distributor.

SFC water distributor Process Data view



2

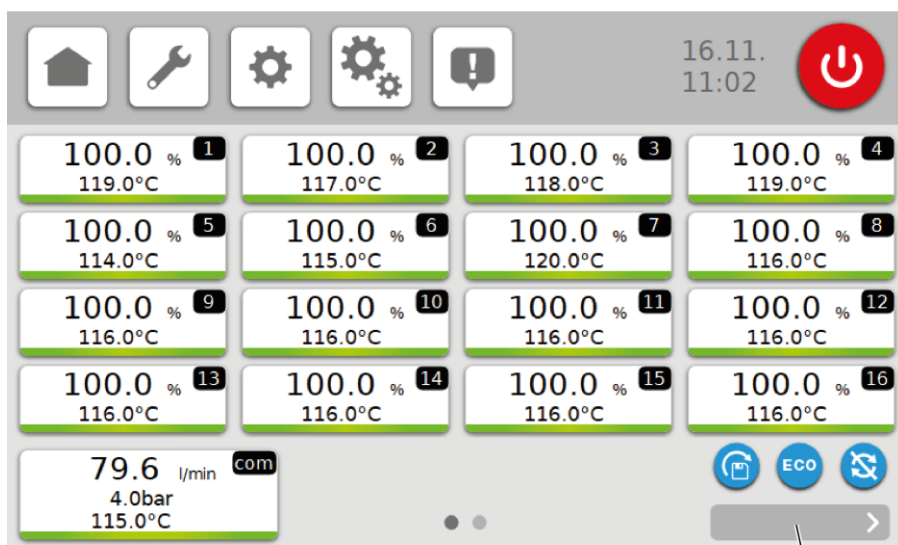
1	Service button	2	Toggle button
---	----------------	---	---------------

NOTE:

- In the touch display, the individual circuits on the SFC water distributor are only labelled "circuit" for space reasons

- If two SFC water distributors are connected to the temperature control device, the process data view switches cyclically at intervals of approx. 10 seconds between SFC water distributor 1 (base block, circuit 1 to max. 8) and SFC water distributor 2 (extension block), circuit 9 to max. 16).
 - If, for example, an SFC-6 with 6 individual circuits is operated as SFC water distributor 1 (base block) and an SFC-4 with 4 individual circuits is operated as SFC water distributor 2 (extension block), the touch display will show the SFC water distributor 1 (base block) with circuits 1 to 6 and water distributor 2 (extension block) with circuits 9 to 12.
 - The unused circuits are hidden.
- Tap the Toggle button to go to the general view (see below).
 - Tap the Service button to go to the expert view (see below).

SFC water distributor general view



1

1	Toggle button	-	-
---	---------------	---	---

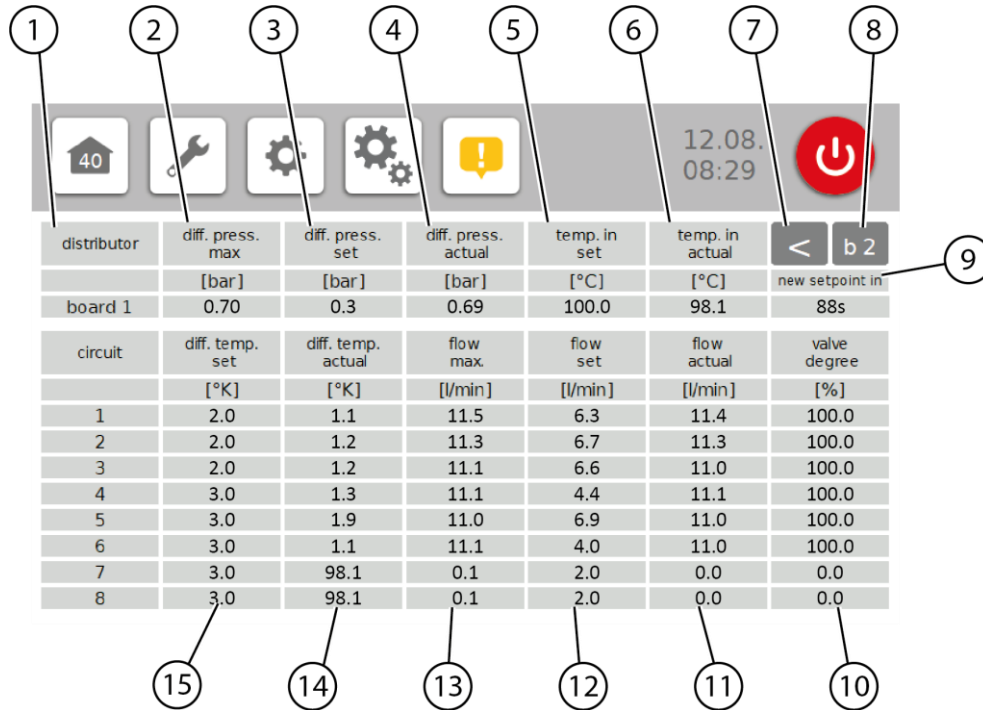
NOTE:

All (maximum 16) individual circuits are shown in the general view.

- Tap the Toggle button to return to the process data view.

Expert view

The control behaviour of the individual circuits can be viewed in detail in the expert view.



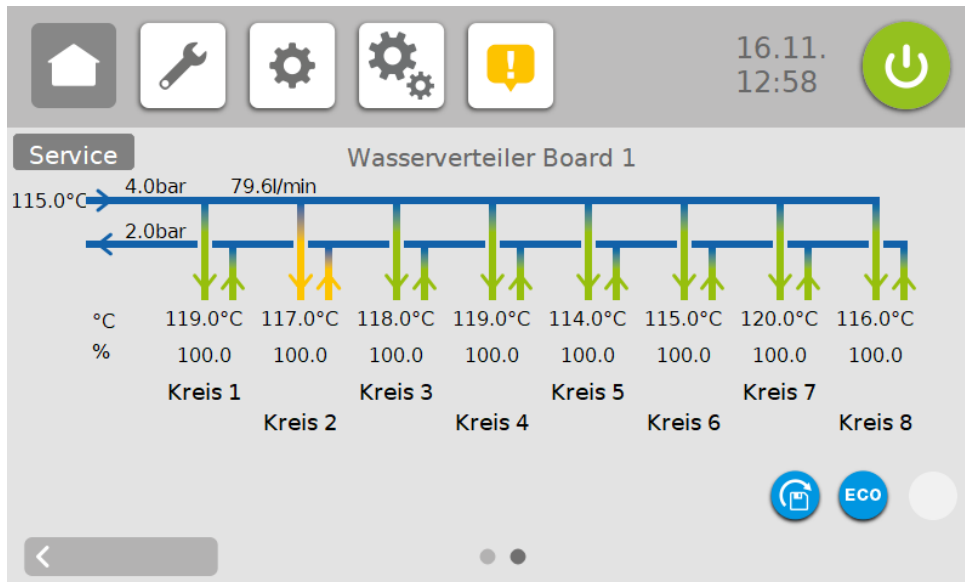
1	Board 1 = measured values for water distributor SFC 1 (base block) Board 2 = measured values for water distributor SFC 2 (extension block)
2	Max. differential pressure SFC (SFC flow pressure – SFC return pressure)
3	Cyclically determined setpoint differential pressure SFC. The pump regulates to this setpoint.
4	Actual differential pressure SFC. The pump regulates to this setpoint.
5	Setpoint flow temperature
6	Actual flow temperature
7	Toggle button
8	Button to toggle between SFC water distributor1 (base block) and SFC water distributor 2 (extension block)
9	Time until the "flow set values" are recalculated. See also "Parameter cycle recalculation dT control SFC".
10	Control valve output ratio
11	Actual flow rate in the circuit
12	Cyclically determined setpoint flow rate in the circuit
13	Max. flow rate in the circuit at 100% pump speed and all valves 100% opened.
14	Actual temperature difference in the circuit
15	Setpoint temperature difference in the circuit

- Tap the Toggle button to return to the process data view.

6.4.1 Alarms and limits

The *Alarms and limits* button can be used to set alarms. Most alarms are not activated immediately after the error condition occurs, but with a 10 second delay. This is used to prevent false alarms that could possibly result in shutdown of the system.

If a warning is pending, the corresponding circuit is marked in orange.

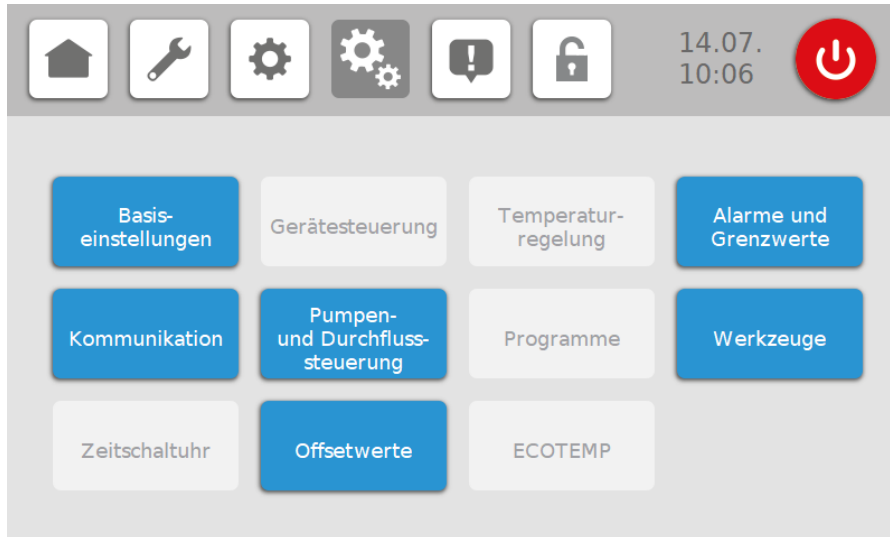


Function name	Description
Device stops if alarm is triggered	If this function is activated, the device switches off whenever any alarm occurs.
Temp. warning inlet min. SFC1/SFC2	A warning is triggered if this value is undercut.
Temp. warning inlet max. SFC1/SFC2	A warning is triggered if this value is exceeded.
Pressure warning inlet min. SFC1/SFC2	A warning is triggered if this value is undercut.
Pressure warning inlet max. SFC1/SFC2	A warning is triggered if this value is exceeded.
Temperature warning min. circuit 1 - 16	A warning is triggered if this value is undercut.
Temperature warning max. circuit 1 - 16	A warning is triggered if this value is exceeded.
Flow rate warning cycle circuit 1 - 16	A warning is triggered if this value is undercut.
Flow rate warning entire SFC1	A warning is triggered if this value is undercut.
Flow rate warning entire SFC2	A warning is triggered if this value is undercut.

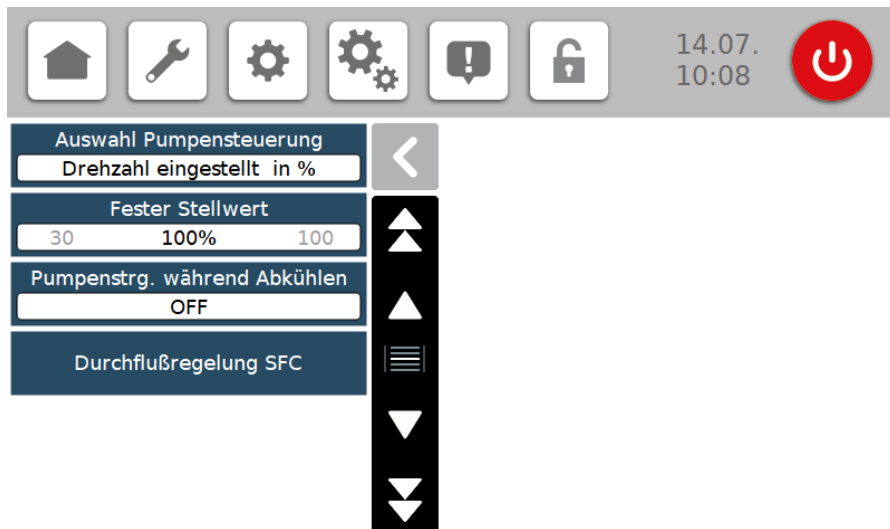
6.4.2 Flow control

NOTE:

The *Flow Control SFC* function is only available if the optional motorised control valves are installed in the SFC water distributor.



Tap the *Pump and Flow Control* button to go to the screen for setting the parameters.



NOTE:

The *Pump Control Selection*, *Fixed Control Variable* and *Pump Flow During Cooling* functions are not available on the SFC control box.

Tap the *Flow Control SFC* button to reach the screen for setting the parameters for the SFC water distributor.

NOTE:

A minimum value and a maximum value are defined for each parameter. The minimum value is on the left of the parameter, the maximum value is on the right of the parameter. An error message is output if an invalid value is entered.

Auswahl Ventilsteuerung

Fester Stellwert in %

Abweichung dT COM
OFF 3K 10

Fester Stellwert Kreis

Gewünschter Durchfluss Kreis

Regelung Aus bei Überschreitung
OFF 0K 10

XP Ventile
OFF OFF 999.9

NOTE:

It is necessary to have a minimum flow rate for all measured temperatures, e.g. to be able to measure the temperatures correctly. Therefore, the minimum flow rate must be set in *Alarms and limits*.

Function *Valve Control Selection*

Auswahl Ventilsteuerung

Fester Stellwert in %

Abweichung dT COM
OFF 3K 10

Fester Stellwert Kreis

Gewünschter Durchfluss Kreis

Regelung Aus bei Überschreitung
OFF 0K 10

XP Ventile
OFF OFF 999.9

Fester Stellwert in %

Gewünschter Durchflusswert

Auto = dT Regelung

SAVE

This parameter defines which procedure should be used to control the valves.

The following options are possible:

Fixed control variable in %:

The valves run on a fixed control variable. This can be defined individually for each circuit.

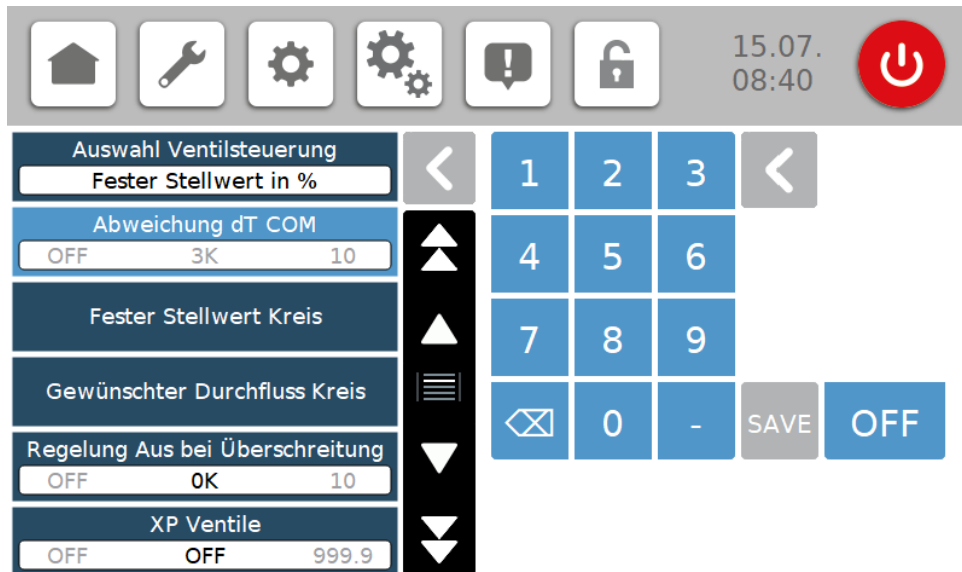
Desired flow rate value (in l/min):

The valves are regulated to a defined flow rate value. This can be defined individually for each circuit.

Auto = dT control (difference dT):

With the "Auto" setting, each circuit regulates the flow so that the permissible temperature difference between the inlet of the SFC water distributor and the return of the distribution circuit is maintained with the lowest possible flow rate.

Function *Difference dT COM*



A common permissible temperature difference for all circuits can be entered here.

Example:

The inlet has 100 °C. 105 °C is measured in the return.

Thus the delta is 5 K. It is set in the parameter " *Difference dT COM*" that the permissible difference may be 3 K.

Thus, by opening the valve, the flow is increased to reach the allowed difference.

The regulation is performed using a PID controller. If the control behaviour does not achieve the required results for the application, it can be adjusted using the Xp flow rate, TV flow rate and TN flow rate parameters (see below).

NOTE:

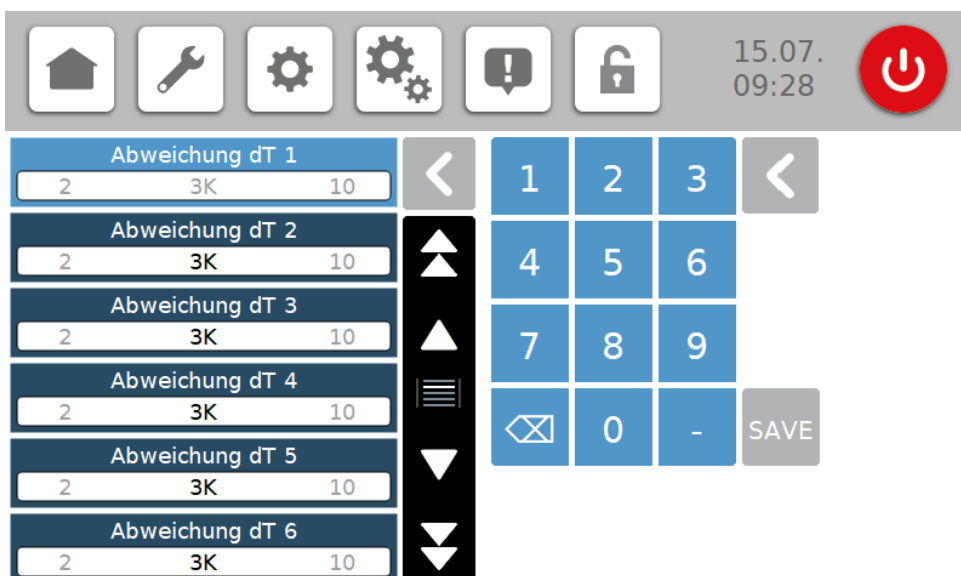
If a value of 2 to 10 K is entered in the *Difference dT COM function*, the *Difference dT* function is then deactivated and hidden.

If a value of 1 K is entered in the *Difference dT COM function* or the function is set to OFF, the *Difference dT* function is then activated and displayed.

Function *Difference dT COM* set to OFF



Function *Difference dT*



The setpoint temperature difference can be entered here individually for each circuit.

Example:

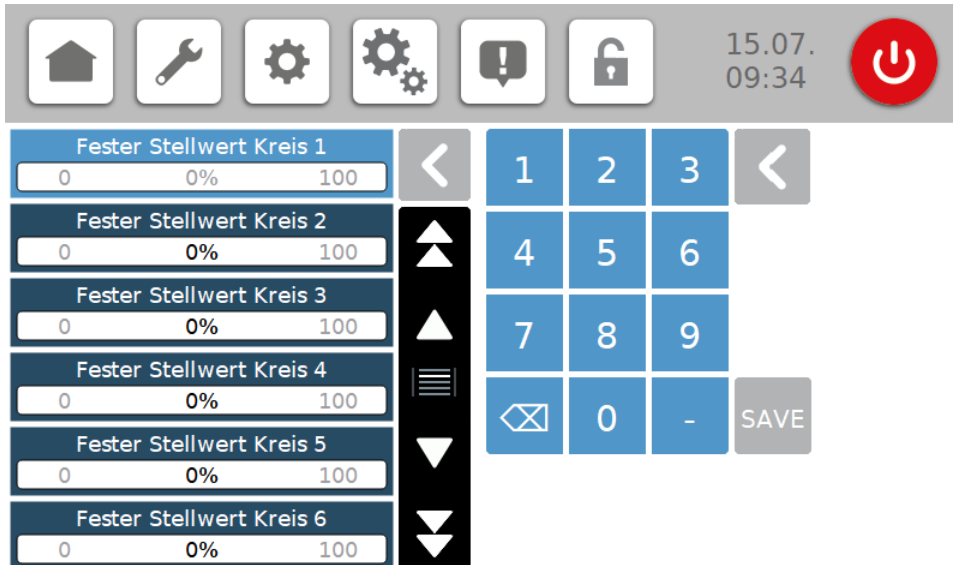
The distributor connection flow has 100 °C. 105 °C is measured in the return distributor connection of the circuit.

Thus the delta is 5 K. It is set in the parameter " Difference dT" that the setpoint temperature difference may be 3 K.

Thus, by opening the valve, the flow is increased in the circuit to reach the setpoint temperature difference.

The regulation is performed using a PID controller. If the control behaviour does not achieve the required results for the application, it can be adjusted using the Xp flow rate, TV flow rate and TN flow rate parameters (see below).

Function Fixed control variable circuit

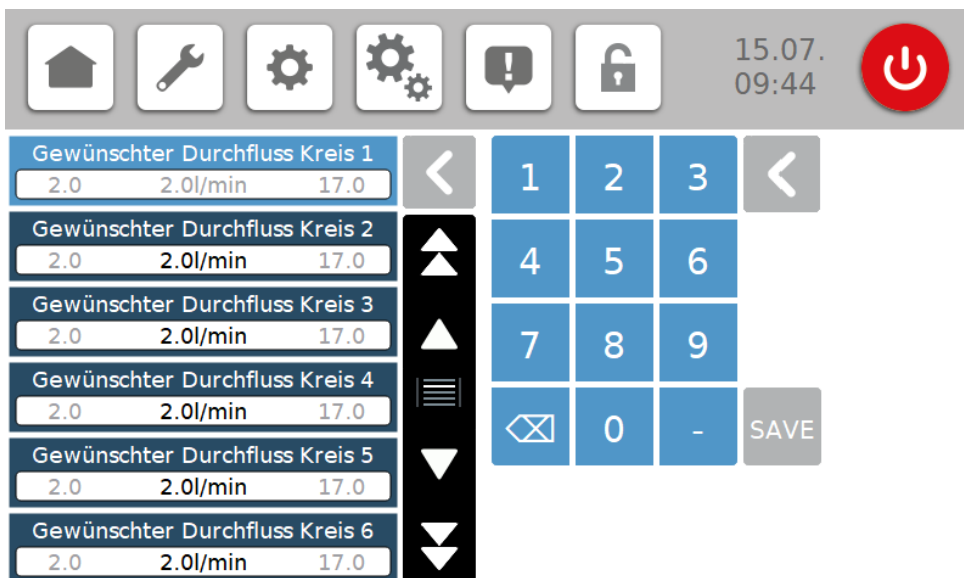


The control variable for the valve can be entered here individually for each circuit.

NOTE:

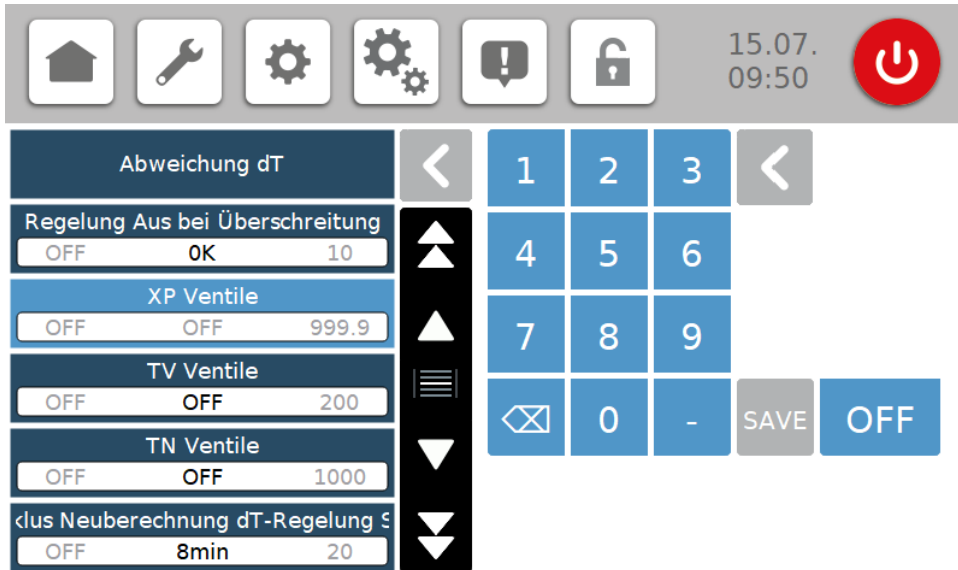
If 0%, the valve is completely closed; if 100%, it is completely open.

Function Desired flow rate circuit



The setpoint flow rate can be entered here individually for each circuit.

Control parameters XP valves, TV valves and TN valves



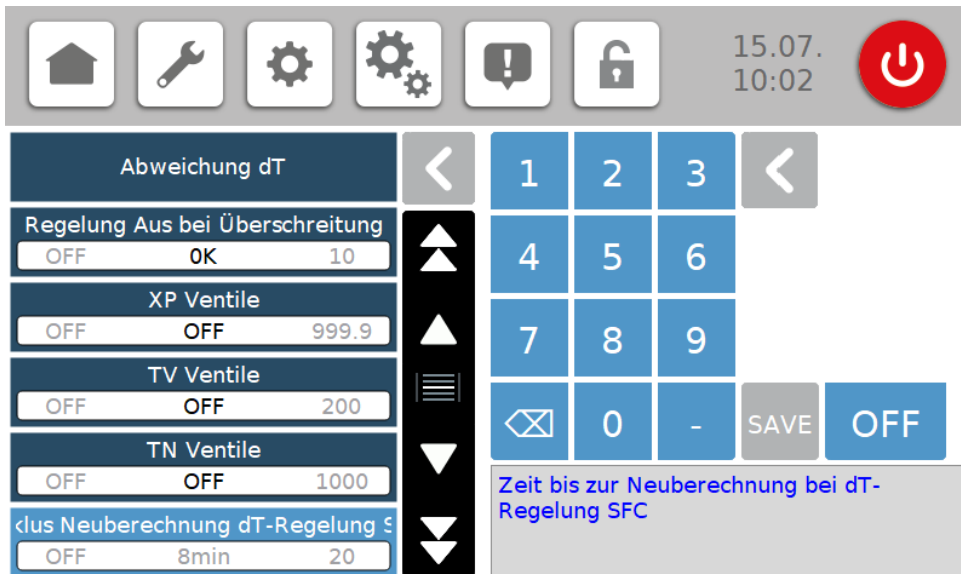
The parameters XP, TV and TN influence the actual control behaviour.

XP is the proportional component. This parameter should be increased if the system tends to overcontrol or overshoot. If the flow increases too slowly with output ratios below 100%, the parameter can be reduced.

TN is the integral component. It is required to ensure that the system achieves the setpoint value which cannot be achieved with the XP component alone. The parameter can be increased if the system tends to overshoot. If a control deviation remains for a relatively long time, although the output level of 100% has not yet been reached, the parameter can be reduced.

TV is the differential component. TV comes into play when interference causes the actual flow rate to move away from the setpoint flow rate. In this case, the TV component counteracts the change in corresponding proportion. The TV component can be increased if interference causes the flow rate to move away too much and the output level has not yet reached 100%.

Parameter Cycle Recalculation dT Control SFC



Parameter	Value	Unit
Abweichung dT	OFF	OK
Regelung Aus bei Überschreitung	OFF	10
XP Ventile	OFF	999.9
TV Ventile	OFF	200
TN Ventile	OFF	1000
klus Neuberechnung dT-Regelung SFC	OFF	8min 20

Zeit bis zur Neuberechnung bei dT-Regelung SFC

Cyclical values are calculated for the dT control. The parameter Cycle Recalculation dT Control SFC specifies after which time a recalculation takes place.

The parameter should be reduced if the dT actual value drifts away during the cycle time.

NOTE:

A cycle time from 1 to 20 minutes can be set.


If values smaller than 1 are entered, the parameter is set to OFF.

With OFF, the time until recalculation is set to 0 minutes. This means the recalculation is performed continuously.

7 Software update

It is possible to update the software via the USB port. In order to use this function, a USB stick must be plugged in that contains the program files in a subdirectory named *Software*.

Tap the *Maintenance* icon in the navigation bar and call up the *Service and Information* menu.

Tap  and start the software update.

The process takes several seconds. The supply voltage must remain switched on during the process, i.e. the device is connected and the main switch is in the "On" position.

If the update process could not be performed completely, the voltage must be switched off for 10 seconds using the main switch of the device. The controller then starts with the old program.

After the update has ended, the supply voltage must be switched off for 10 seconds before restarting.

9 Parameter lists

Remarks: The settings range refers to metric units. Some parameters will be hidden if the associated functionality of the device is not enabled.

9.1 Functions

Name	Value range	To	Function	Only SCC plus
Temp. warning			Value for temperature warning	
Leak stop	ON, OFF		Further parameter configuration under Device Control	
Communication	ON, OFF		Interface operation; further parameter configuration under Communication	
Tool draining	ON, OFF		Tool draining before switch-off; further parameter configuration under Device Control	
Cooling before Off	ON, OFF		Cooling down before switch-off; further parameter configuration under Device Control	
Pump speed	ON, OFF		Speed 100% or reduced; further parameter configuration under Pump Control	
Self-optimisation			Start self-optimisation	
Enable water change	ON, OFF		Activation of the water change function	
ECOTEMP	ON, OFF		Activation of the EOTEMP function	

9.2 Basic settings

Description	Value range From	To	Function	Only SCC plus
Language	Various		Selection of the language (language used on device display)	
Pressure unit	Off, bar, PSI		Units for the pressure measurement (unit of measure for pressure)	
Flow rate unit	Off, l/min; m ³ /h; gal/min		Unit of measure for flow rate	
Temperature unit	C; 0,1C; F		Units for the temperature measurement (temperature display)	
Date			Setting of the date	
Time			Setting of the time	
Daylight saving time	ON, OFF		Switch summertime on and off	
Device configuration	Temperature control unit; temperature control unit with 1 SFC; temperature control unit with 2 SFC; standalone with 1 SFC; standalone with 2 SFC		Selection of the device configuration	
Menu: Names				
Name of the SFC1	alphanumeric		Individual name of the SFC water distributor 1 (base block)	
Name of the SFC2	alphanumeric		Individual name of the SFC water distributor 2 (extension block)	
Circuit name 1 - 16	alphanumeric		Individual naming of the individual circuits	
Lockout	Off; only device On/Off adjustable; only On/Off + setpoint adjustable.		Type of the operation lock	
Lockout Code	****		Lockout code for locking and unlocking, specified by User	
Single service access			Only for Single service team	
Test interval safety valve	0 days	2000	After this time has elapsed, a warning message is triggered	

9.3 Device Control

Name	Value range from	To	Function	Only SCC plus
Drain time	Off, 10 sec	900 sec	Blow-out or extraction time for devices with tool draining, in seconds	
Filling	Manual / Automatic		Manual means the filling of the devices is performed manually. Automatic means the filling of the devices is performed automatically.	
External control	ON, OFF		If external control is set to ON, heating and cooling are controlled by an external controller	
Cooling	Indirect / direct		Cooling using heat exchanger, or direct Direct cooling is only possible for water devices	
Switch-off temperature	10 °C	100 °C	After switching off, the pump runs until this temperature has been reached	
Setpoint selection	Setpoint or setpoint 2 or ext. setpoint (option)		Setpoint switchover	X (ext. setpoint)
Actual temperature selection	Internal, external, return or via Profibus		Selection of which temperature should be used for control	
Type of external sensor			PT100, thermocouple element type J, K, L, 0-10 V, 0-20 mA or 4-20 mA	
Aquatimer start time	5 min	120 min	Time from start-up without monitoring of filling cycles	
Aquatimer cycles	Off ; 1	40	Setting value corresponds to max. permissible filling cycles after 1 hour of operation	
Filling time monitoring	Off ; 1	99	Setting in minutes; if the filling takes longer, the filling process is aborted and the device shuts down (only for automatic filling)	
Restart lockout	ON, OFF		Restart lock after network reset <ul style="list-style-type: none"> • off = restart lock not activated • on = restart lock activated 	
Recorder function sample time	1 min	24 hours	Scaling of recorder	
Control external sensor	Internal, external		Temperature control based on external sensor (only if enabled in factory parameters)	
Water change configuration	Off, manually, after switching on, time-controlled		Water change function	
Water change time	1 sec	30 sec	Duration of water change	
Water change interval	1 min	300 min		

9.4 Temperature control

Name	Value range	To	Function	Only SCC plus
Setpoint	USG	OSG	USG lower setpoint limit OSG upper setpoint limit	
Setpoint 2	USG	OSG	USG lower setpoint limit OSG upper setpoint limit	
Heating output level limitation	0	100	In %	
Cooling output level limitation	0	100	In %	
XP heating	OFF, 0,1	99.9	In %, proportional range of the controlled system	
TV heating	OFF, 1	200	In seconds, rate time of the controlled system	
TN heating	OFF, 1	1000	In seconds, reset time of the controlled system	
XP cooling	OFF, 0,1	99.9	In %, proportional range of the controlled system	
TV cooling	OFF, 1	200	In seconds, rate time of the controlled system	
TN cooling	OFF, 1	1000	In seconds, reset time of the controlled system	
Dead zone, no heating	OFF, 0,1	10		
Heating switching cycle time	1 s	240 s	For hybrid output starting at 10 sec	
Cooling switching cycle time	1 s	240 s		
Setpoint ramp, rising	OFF, 0,1	99.9	In K/min	
Setpoint ramp, falling	OFF, 0,1	99.9	In K/min	
Hysteresis cooling on	0.5 K	10 K	Only for cooling devices	
Hysteresis cooling off	0.5 K	10 K	Only for cooling devices	
Hysteresis cooling 2 on	0.5 K	10 K	Only for cooling devices with two power levels	
Hysteresis cooling 2 off	0.5 K	10 K	Only for cooling devices with two power levels	
Limitation of the internal flow temperature of the device	OFF; 1	100 K	Limitation of the flow temperature for external sensor	
Film temperature limitation	OFF; 100	400 °C	Reduction of output level when this value is reached	
Film temperature tolerance	1	20 K	Degree of output level reduction for limitation of film temperature	

9.5 Alarms

Name	Value range	To	Function	Only SCC plus
Temperature warning configuration	1	4	Configuration of the warning output <ul style="list-style-type: none"> ● = Signal contact ● = Limit contact ● = Limit comparator ● = Limit comparator with standby behaviour 	
Temperature warning value	OFF; 0.1	400		
Upper setpoint limit	Lower setpoint limit		Maximum setpoint limit corresponds to maximum temperature of the device	
Lower setpoint limit		Upper setpoint limit	In °C; the starting value of the setpoint settings range can be preselected here	
Warning "Flow"	OFF; 0	400	Temperature warning in the flow (not for cold)	
Film alarm	OFF; 0	400	Temperature alarm on heating	
Warning "Return temperature"	OFF; 0	400	Temperature in the return	
Warning dT	OFF; -100	100	Monitoring of temperature difference between flow and return	
System closing temperature	OFF; 35	95	In pressurised water devices, the hydraulic system is sealed off from the atmosphere. Water: Temperature preselection for system closure in °C Oil: extraction only possible below the configured value	
Alarm "Minimum flow rate"	OFF; 0	2000	Protects the device, minimum that ensures proper functioning of the device; only for normal pump function	
Warning Flow rate below limit	OFF; 0	2000	Safeguards the production process; only for normal pump function	
Warning Flow rate over limit	OFF; 0	2000		
Alarm Pressure over limit	OFF, 0,1	40.0		
Alarm Pressure below limit	OFF, 0,1	40.0		
Device stops if alarm is triggered	On; OFF		Safety shutdown	
Temp. warning inlet min. SFC1	OFF; 0	120/160 ° C(*)	A warning is triggered if the minimum temperature is undercut	
Temp. warning inlet max. SFC1	OFF; 0	120/160 ° C(*)	A warning is triggered if the maximum temperature is exceeded	
Temp. warning inlet min. SFC2	OFF; 0	120/160 ° C(*)	A warning is triggered if the minimum temperature is undercut	
Temp. warning inlet max. SFC1	OFF; 0	120/160 ° C(*)	A warning is triggered if the maximum temperature is exceeded	
Pressure warning inlet min. SFC1	OFF; 0	10 bar	A warning is triggered if the minimum pressure is undercut	
Pressure warning inlet max. SFC1	OFF; 0	10 bar	A warning is triggered if the maximum pressure is exceeded	
Pressure warning inlet min. SFC2	OFF; 0	10 bar	A warning is triggered if the minimum pressure is undercut	
Pressure warning inlet max. SFC2	OFF; 0	10 bar	A warning is triggered if the maximum pressure is exceeded	

Name	Value range	To	Function	Only SCC plus
Menu: Temperature warning min. circuit				
Temperature warning min. circuit 1 - 16	OFF; 0	120/160 ° C(*)	A warning is triggered if the minimum temperature of an individual circuit is undercut	
Menu: Temperature warning max. circuit				
Temperature warning max. circuit 1 - 16	OFF; 0	120/160 ° C(*)	A warning is triggered if the maximum temperature of an individual circuit is exceeded	
Menu: Flow rate warning circuit				
Flow rate warning circuit 1 - 16	OFF; 2	17 l/min	A warning is triggered if the minimum flow rate of an individual circuit is undercut	
Flow rate warning entire SFC1	OFF; 0	2000.0 l/min	A warning is triggered if the minimum flow rate is undercut	
Flow rate warning entire SFC2	OFF; 0	2000.0 l/min	A warning is triggered if the minimum flow rate is undercut	

9.6 Communication

Name	Value range	To	Function	Only SCC plus
Address	1	255	Input of the addressing of the device. If several devices run on the same interface, different addresses must be configured.	
Protocol	OFF		<ul style="list-style-type: none"> • Arburg • KraussMaffei • Dr. Boy • Engel • Profibus DP • Modbus • Single Standard • SPI • CAN Euromap 66 • OPC-UA Euromap 82 Selection according to which interfaces are enabled	
Baud rate	OFF, 0,3	19.2	Used to program the transmission speed – baud rate – of the interface. Possible settings are: OFF = no baud rate configured <ul style="list-style-type: none"> • 1.2 = 1.2 kBaud • 2.4 = 2.4 kBaud • 4.8 = 4.8 kBaud • 9.6 = 9.6 kBaud • 19.2=19.2 kBaud • 38.4=38.4 kBaud 	
Data format			Used to program the data format of the interface. The data format is composed of: Data bits, parity bit, stop bit. Possible settings are: 7E1, 7o1, 7E2, 7o2, 7n2, 8E1, 8o1, 8n1, 8n2	
Status	---	Data Exchange	Interface status	
Switching	RS232/485	20 mA TTY		
Smarthub	ON; OFF		Allow connection to Smarthub	
DHCP			Allow DHCP (automatic assignment of IP address by DHCP server)	
IP address			Network address of the device	
Subnet mask			Subnet mask of the device	
Default gateway			Default gateway in the connected network	
Viewer	ON; OFF		Activates the VNC server on the controller An explanation and an application example for the VNC function can be found in the separate manual "Smart Controller SSC VNC (EN)"	
Viewer Code	1111		Password of the VNC sever	

9.7 Pump control

Name	Value range	To	Function	Only SCC plus
Mode	Pump control mode: 1.) Fixed control variable Speed set in % 2.) Flow rate set in l/min (in combination with flow measurement) 3.) Auto dT: Process window, if dT is less than 50% of the setpoint and setpoint minus actual temperature >1 °C, the speed will be reduced by 1% per minute (only with return sensor) 4.) Flow pressure set in bar (only in combination with pressure transmitter in the flow)			
Fixed control variable	30	100	In %	
Desired flow rate value	0	100.0	In l/min	
Difference dT	0	10	Maximum permitted temperature difference between flow and return temperature	
Desired pressure value	0	25	In bar	
XP pump	OFF, 0,1	999.9	In %, proportional range of the controlled system for speed control	
TV pump	OFF, 1	200	In sec., rate time of the controlled system for speed control	
TN pump	OFF, 1	1000	In sec., reset time of the controlled system for speed control	

9.8 Flow control SFC

Name	Value range	To	Function	Only SCC plus
Selection valve control	Mode of the SFC valves: 1.) Fixed control variable set in % 2.) Flow rate set in l/min 3.) Auto dT: Control of the flow rate based on the flow-return temperature difference of the individual circuits			
Difference dT COM				
Fixed control variable circuits 1 - 16	0	100	In %	
Desired flow rate circuits 1 - 16	2	17.0	In l/min	
Difference dT circuits 1 - 16	2	10	Maximum permitted temperature difference between flow and return temperature of the circuit	
XP valves	OFF, 0,1	999.9	In %, proportional range of the controlled system for valve control	
TV valves	OFF, 1	200	In sec., rate time of the controlled system for valve control	
TN valves	OFF, 1	1000	In sec., reset time of the controlled system for valve control	
Cycle recalculation dT control SFC	OFF, 1	20	Cycle time in minutes for the recalculation for dT control (OFF -> continuous recalculation).	

9.9 Offset

Name	Value range	To	Function	Only SCC plus
Offset internal	Off, -199	199 °C	Offset for internal control sensor	
Offset return	Off, -199	199 °C	Offset for return sensor	
Offset external sensor	Off, -199	199 °C	Offset for external sensor	
Offset flow sensor	Off, -199	199 °C	Offset for flow sensor	
Offset film	Off, -199	199 °C	Offset for film temperature sensor	
Offset for cooling output level	0	100	%, output level	
Setpoint setting, actual value output	0-10 V; 4-20 mA		Configuration of analogue input and output	X
Temperature at 0 V / 4 mA	MR start	MR end	Configuration of analogue input and output	X
Temperature at 10 V / 20 mA	MR start	MR end	Configuration of analogue input and output	X
Flow rate measurement offset	-1.00	1.00	mA or V	
Threshold flow rate	0	500	mV; below this threshold, no flow rate is displayed	
Offset flow pressure	-1.00	1.00	mA or V	
Offset tank pressure	-1.00	1.00	mA or V	
Offset temp. sensor inlet SFC1	-20 K	20	Offset on temperature sensor	
Offset temp. sensor inlet SFC2	-20 K	20	Offset on temperature sensor	
Offset pressure sensor inlet SFC1	-10 bar	10	Offset on pressure sensor	
Offset pressure sensor outlet SFC1	-10 bar	10	Offset on pressure sensor	
Offset pressure sensor inlet SFC2	-10 bar	10	Offset on pressure sensor	
Offset pressure sensor outlet SFC2	-10 bar	10	Offset on pressure sensor	
Menu: Offset flow rate value circuit				
Offset flow rate value circuit 1 - 16	-99 l/min	99	Offset on pressure sensor in the individual circuits	
Menu: Offset temperature sensor circuit				
Offset temperature sensor circuit 1 - 16	-20 K	20	Offset on pressure sensor in the individual circuits	



created for your perfection

9.10 ECOTEMP

10 List of alarms

Code	Status	Text	Help text
H100	A	At least one phase of the power supply is missing.	Check the electrical connection and pre-fuses of the power supply.
H1001	A	Control sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found.
H1002	A	Control sensor interrupted or value below measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H101	A	Incorrect rotary field direction of the electrical supply	Turn two phases on the electrical connection
H1022	A	Film temperature sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found.
H1023	A	Film temperature sensor interrupted or value below measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H1026	A	Film temperature exceeded	Insufficient heat dissipation at the heater; check whether there is sufficient flow (clean dirt trap, check connection to tool, check tool for deposits or blockages). Check heating element for deposits. Alarm message is triggered when the maximum film temperature is exceeded. If the film temperature alarm (in Setup under Alarms and Limits) is disabled, the upper setpoint limit is checked as a substitute (Setup under Alarms and Limits)
H1027	A	Flow temperature exceeded	Check whether there is sufficient flow (clean dirt trap, check connection to tool, check tool for deposits or blockages). Increase the speed of the pump if a speed control is installed and in use. If necessary, reduce the warning value in the Setup under Alarms and Limits.
H1080	W	Electrical current at the flow sensor is less than 4 mA	Check the electrical connection of the sensor and the sensor itself
H1083	W	Electrical current at the expansion tank pressure sensor is less than 4 mA	Check sensor
H1084	W	Electrical current at the flow pressure sensor is less than 4 mA	Check sensor
H1100	H	Enable parameter defective.	
H1101	H	Device control parameter set is defective.	
H1102	H	The alarms/temperatures/offset parameter set is defective.	
H1103	H	The Ecotemp parameter set is defective.	
H1104	H	The limits parameter set is defective.	
H1105	H	The communication parameter set is defective.	
H1106	H	The pump control parameter set is defective.	
H1107	H	The water change parameter set is defective.	
H1108	H	The control parameter set is defective.	
H1109	H	The factory settings parameter set is defective.	
H1110	H	The operation parameter set is defective.	
H1111	H	Log cannot be written to or read.	
H1112	H	Messages cannot be written or read.	
H1113	H	Password lost or password cannot be written or read.	
H1114	H	Lost program list or programs cannot be written or read.	

Code	Status	Text	Help text
H1115	H	Lost tool list or tools cannot be written or read.	
H1116	H	Lost timer data or times cannot be written or read.	
H1117	H	Non-volatile memory cannot be written or read.	
H1150	H	Invalid flow sensor configuration.	Check the parameter settings
H2010	W	External device enable is not present	Device has a customer-side switch-on option via an external 24 V signal or a contact on pin 1 of the connector board. This switch-on signal is missing, therefore the device cannot be switched on. Provide signal and check electrical connection.
H2020	W	Value below the "almost empty" level.	Refill the system if the configuration is "manual filling"; ensure a sufficient water supply if the configuration is "automatic filling"
H2030	W	Value below lower flow rate.	Check the dirt trap, the hydraulic connection to the consumer (tool) and check the consumer for deposits and obstructions. Increase the speed of the pump if a speed control is installed and in use. If necessary, reduce the warning value in the Setup under Alarms and Limits.
H2031	W	Upper flow rate exceeded.	Adjust flow through dosing tap or check warning value (Setup / Alarms and Limits)
H2040	W	Maintenance interval has expired	Carry out servicing on the temperature control system and acknowledge the servicing in the Service menu
H2041	H	Safety valve inspection interval expired	Carry out a check of the safety valve (acknowledge the check in the Service menu, then Reset Maintenance)
H2050	W	Value below the lower setpoint limit.	The external setpoint setting from an interface or a program falls below or exceeds the permitted lower/upper setpoint limit. Check the external setpoint settings.
H2051	W	Setpoint temperature exceeds upper setpoint limit	The external setpoint setting from an interface or a program falls below or exceeds the permitted lower/upper setpoint limit. Check the external setpoint settings.
H2059	W	dT flow/return above limit	Flow/return temperature difference above warning value. Check whether there is sufficient flow (clean dirt trap, check connection to tool, check tool for deposits or blockages). Increase the speed of the pump if a speed control is installed and in use. If necessary, increase the warning value in the Setup under Alarms and Limits.
H2060	W	Flow sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found
H2061	W	Flow sensor interrupted or value below measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H2070	W	Return sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found
H2071	W	Return sensor interrupted or value below measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H2075	W	External sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found.
H2076	W	External sensor interrupted, not connected or value above measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H2078	W	Cooling water inlet sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found
H2079	W	Cooling water inlet sensor interrupted or value above measuring range	Check the sensor connection. Replace the sensor if no fault can be found
H2081	W	Cooling water outlet sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found
H2082	W	Cooling water outlet sensor interrupted or value above measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H2084	W	Motor temperature sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found

Code	Status	Text	Help text
H2085	W	Motor temperature sensor interrupted or value above measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H2086	W	Tank sensor short circuit or value below measuring range	Check the sensor connection. Replace the sensor if no fault can be found
H2087	W	Tank sensor interrupted or value above measuring range	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary
H2101	W	Temperature below minimum limit	If necessary, reduce the warning value in the Setup under Alarms and Limits. Eliminate causes of insufficient temperature control, e.g. controller parameters (if temperature fluctuates), insufficient heating capacity (device does not reach target temperature)
H2102	W	Temperature above maximum limit	If necessary, increase the warning value in the Setup under Alarms and Limits. Eliminate causes of insufficient temperature control, e.g. controller parameters (if temperature fluctuates), insufficient cooling capacity or cooling water too warm (device does not reach target temperature)
H2112	W	Return temperature limit has been exceeded.	Check the flow and, if required, the settings under Setup Alarms and Limits
H2130	H	Control sensor as substitute for external sensor	The external sensor has a fault or is not connected correctly. Therefore, the system now regulates using the control sensor.
H2130	H	Control sensor as substitute for return sensor	The return sensor has a fault or is not connected correctly. Therefore, the system now regulates using the control sensor.
H2132	H	Flow sensor as substitute for the control sensor	The control sensor has a fault. Therefore, the system now regulates in emergency mode using the probe/sensor in the flow.
H2133	A	No temperature signal. Device had to be switched off	No temperature signal for the control could be determined
H2134	W	No enable for heating	
H2135	W	Return sensor as substitute for the control sensor	Return sensor is used as substitute for the control sensor for the temperature control
H2140	H	USB stick could not be mounted	Try a different USB stick
H2141	H	Error during import or export	
H2160	W	Value below the minimum pressure.	Check causes of the pressure loss; check the sensor or settings (Setup / Alarms and Limits)
H2161	W	Maximum pressure has been exceeded.	Check causes for high pressure: External volume too large (only if overpressure occurs during heating), consumer or dirt trap (partially) clogged, defective sensor. If necessary, increase the warning value in the Setup under Alarms and Limits.
H2180	H	Corrupt measurement log file.	
H2185	H	Could not open spare parts list.	
H2200	W	Termination of self-optimisation	The self-optimisation was terminated because the temperature fluctuates too much. Avoid external interference, let the device run for a few minutes and start the self-optimisation again
H2210	H	EAROM error	Please contact Single customer service
H2211	H	Profibus error	
H2212	H	Calibration error IO board	Please contact Single customer service
H2213	A	Inadequate flow (watchdog)	Clean dirt trap, ensure sufficient flow in the consumer
H2301	W	Actual temperature transmitted by Profibus is outside the measuring range	Check the sensor
H4001	W	The temperature in the switch cabinet is too high	Clean the air filter in the switch box, ensure sufficiently low ambient temperatures. If necessary, check the function of the fan.
H4002	W	Leak detected at the leak sensor	Check the device for leaks
H4003	W	Motor temperature too high	Check installation situation and ambient temperature
H4004	W	Cooling water differential pressure too low	Check cooling water supply, cooling water connection and cooling water dirt trap
H4005	W	Dirt trap clogged	Clean dirt trap
H5001	H	Service ticket started	

Code	Status	Text	Help text
H5002	H	Article number of the requested part: spare part request	
H600	A	Motor circuit breaker / FC triggered	Check motor circuit breaker or frequency converter and unlock if required. If the error recurs, check the pump flows, replace pump if necessary
H601	W	Motor circuit breaker of the second pump has triggered	Check motor circuit breaker of the second pump and unlock. If the error recurs, check the pump flows, replace pump if necessary
H700	H	Specified language could not be loaded	
H710	A	Pressostat high pressure has triggered	Perform a reset on the high pressure monitor, then switch the device off and on again. In the case of repeated occurrence: Corrective actions according to the operating manual
H720	A	Frost protection monitor has triggered	For the restart: Eliminate the fault, then switch the device off and on again.
H721	A	Defective sensor in the internal cooling circuit	Check the sensor at the "Flow" controller input. This monitors the internal circuit
H722	W	Setpoint temperature in the internal cooling circuit not yet reached	Wait until temperature is reached or increase parameter Circulation pump switch-on temperature in the alarm parameters
H725	A	Pressostat low pressure has triggered	
H730	A	Safety temperature limiter has triggered	Reset of the safety temperature limiter by acknowledgement of the error message.
H800	A	Defective float switch	Float switch must be replaced
H810	A	Maximum filling time exceeded	Check the entire system including tool for leaks. Check whether the filling pressure is sufficient; for pressurised water devices without a filling pump, the supply pressure must be higher than the system pressure. Check the water supply or - and if present- the separate filling connection, check the float switch for free movement. check filling valve if necessary. If necessary, increase the permissible filling time in the Setup under Device Control
H811	A	System is overfilled	The maximum value of the float switch has been reached: The cause can be that too much oil has been filled in or the external volume is too large. In heat transfer systems, the oil may only be filled up to the minimum value of the float switch. The oil expands when the temperature increases. The heating has been switched off for safety reasons. Reduce the amount of oil in the tank; check whether the external volume is greater than the permitted value (indicated in the technical specification of the device documentation).
H812	A	System is empty	For water devices and configuration for manual filling: Fill or refill water For water devices and configuration for automatic filling: Connect the cooling water supply correctly and wait for filling, ensure sufficient filling pressure. If the device is not filled, check whether the filling pressure is sufficient; for pressurised water devices without a filling pump, the supply pressure must be higher than the system pressure. Check filling valve if necessary.
H820	A	Leakage in the system	Aquatimer reports too many device fillings. Find and repair the leak in the consumer (tool), tubing, piping and device.
H830	A	Minimum flow rate below specified limit.	Check the dirt trap, the hydraulic connection to the consumer (tool) and check the consumer for deposits and obstructions. Increase the speed of the pump if a speed control is installed and in use. If necessary, reduce the warning value in the Setup under Alarms and Limits.
H831	A	Defective flow rate sensor	If necessary, reduce the warning value in the Setup under Alarms and Limits.
H840	H	Defective tool data structure.	
H990	H	I/O board missing	Please contact Single customer service
H993	A	IO board reports connection error	The IO board has detected an interruption in the connection to the controller. If this warning occurs together with the alarm

Code	Status	Text	Help text
			"I/O board missing", check the connection cable for loose contact.
H994	A	Device has been started.	Smart Controller restart after switching off via main switch or mains power interruption.
H995	A	No communication to SFC	The connection to the SFC board is interrupted
H2214	A	SFC calibration error	
H5010	W	Temperature below minimum limit in the circuit	Setup under Alarms and Limits. Eliminate the cause of insufficient temperature control, e.g. controller parameters (if temperature fluctuates), insufficient heating capacity (device does not reach target temperature)
H5011	W	Temperature above maximum limit in the circuit	If necessary, increase the warning value in the Setup under Alarms and Limits. Eliminate the cause of insufficient temperature control, e.g. controller parameters (if temperature fluctuates), insufficient cooling capacity or cooling water too warm (device does not reach target temperature)
H5012	W	Temperature below minimum limit in the inlet of SFC	If necessary, reduce the warning value in the Setup under Alarms and Limits. Eliminate the cause of insufficient temperature control, e.g. controller parameters (if temperature fluctuates), insufficient heating capacity (supply device does not reach target temperature)
H5013	W	Temperature above maximum limit in the inlet of SFC	If necessary, increase the warning value in the Setup under Alarms and Limits. Eliminate the cause of insufficient temperature control, e.g. controller parameters (if temperature fluctuates), insufficient cooling capacity or cooling water too warm (device does not reach target temperature)
H5020	W	Signal flow sensor is less than 4 mA in circuit	Signal flow sensor is less than 4 mA in circuit
H5021	W	Value below lower flow rate in circuit	Check the dirt trap, the hydraulic connections to the consumer (tool) and check the consumer for deposits and obstructions. Increase the speed of the pump if a speed control is installed and switched on. If necessary, reduce the warning value in the Setup under Alarms and Limits.
H5022	W	Value below lower flow rate in SFC	Check the dirt trap, the hydraulic connections to the consumer (tool) and check the consumer for deposits and obstructions. Increase the speed of the pump if a speed control is installed and switched on. If necessary, reduce the warning value in the Setup under Alarms and Limits.
H5030	W	Pressure sensor inlet signal is less than 4 mA SFC	Check sensor
H5031	W	Pressure sensor outlet signal is less than 4 mA SFC	Check sensor
H5032	W	Pressure below minimum SFC	Check possible causes for pressure loss, check the sensor or settings (check in the Setup under Alarms and Limits).
H5033	W	Maximum pressure exceeded SFC	Check causes for high pressure: External volume too large (only if overpressure occurs during heating), consumer or dirt trap (partially) clogged, defective sensor. If necessary, increase the warning value in the Setup under Alarms and Limits.
H5041	W	Sensor short circuit or value below measuring range in circuit	Check the sensor connection. Replace the sensor if no fault can be found
H5042	W	Sensor interrupted or value above measuring range in circuit	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary.
H5043	W	Sensor short circuit or value below measuring range in inlet of SFC	Please check the sensor connection. If you cannot find any fault, replace the sensor.
H5044	W	Sensor short circuit or value above measuring range in inlet of SFC	Defect in the sensor or in the electrical connection of the sensor. Check the sensor, replace if necessary.
H5050	W	Control aborted due to sensor error	
H5060	W	Control not successful due to strong temperature fluctuations	The control is not successful due to strong temperature fluctuations



created for your perfection

Code	Status	Text	Help text
H5070	W	Minimum flow rate reached.	
H5071	W	Maximum flow rate reached.	Maximum flow rate of the circuit reached. This can cause destruction of the sensor.
H5072	W	Minimum temperature reached.	Maximum temperature or minimum temperature of the SFC reached. This can cause destruction of the SFC.
H5073	W	Maximum temperature reached.	Maximum temperature or minimum temperature of the SFC reached. This can cause destruction of the SFC.