ELOTECH
INDUSTRIEELEKTRONIK

Wilmod
heating & systems

RT7000
Hot runner control

Temperature controller with power outputs
for 8 and 16 control zones

Installation and operation manual

Important!
Read carefully before use!
Keep for later reference!

Table of contents

1 Introduction

1.1 Safety

General information

This manual contains instructions that you must observe for your own safety and in order to avoid damage to property. These instructions are supported by symbols and are used in this manual as shown.
Read this manual before you put the device into operation. Keep the manual in a place that is accessible to all users at all times.
If there are any difficulties during commissioning, we kindly ask you not to carry out any manipulations that may endanger your warranty claim.

Warning symbols

WARNING!

This symbol, in conjunction with the term "Warning," indicates that personal injury may occur if the appropriate precautions are not taken.

CAUTION!

This symbol, in conjunction with the term "Caution," indicates that damage to property or loss of data may occur if the appropriate precautions are not taken.

WARNING!

This symbol indicates that electrostatic discharge (ESD) can destroy components if the appropriate precautions are not taken.

Informative symbols

NOTE!

This symbol indicates important information about the product or its handling or additional uses.

REFERENCE!

This symbol indicates more information in other sections, chapters or other manuals.

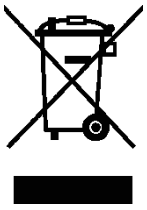
1.2 Intended use

The device is intended for use only in industrial environments, as specified in the technical data (see chapter 17). According to the EMC Directive 2014/30/EU, use in residential areas is not permitted. Any other use or use beyond that is regarded as inappropriate. The device is built in accordance with the applicable guidelines and standards as well as the applicable safety regulations. However, improper use may result in personal injury or damage to property. In order to avoid danger, the device may only be used:

- for the intended purpose,
- in perfect working order,
- by qualified persons,
- in compliance with the technical documentation supplied.

Even if the device is used appropriately or according to its intended purpose, it may pose application-related hazards, e.g. due to missing safety devices of the surrounding workplace or the surrounding plant or incorrect settings.

1.3 Disposal



DISPOSAL!

The device or replaced parts should not be put in the waste bin after the end of use, as it consists of materials that can be reused by specialised recycling plants.
Please, have the device and the packaging material properly disposed of in an **environmentally friendly manner**.
In doing so, the country-specific laws and regulations for waste treatment and disposal must be observed.

1.4 Further information

NOTE!

In the PDF version of this manual, clicking on an image or an internal document reference will take you directly to further information.

Symbols used
Symbols are used recurrently in this manual to represent specific processes. The meaning of these symbols is as follows:

Symbol:	Importance:
(*)	This symbol indicates the factory default value of a parameter. If the device is reset, the parameter reassumes this value. Example:
	Setting range: **OFF**, **0.1… 10.0**(*)**… 400.0 K**
	In this example, the setting range is between 0.1 and 400 K, the default value is 10 K (the parameter can also be set to OFF)
MRE	The abbreviation **MRE** stands for **M**easuring **R**ange **E**nd. The RT7000 is capable of using different types of thermocouples (TC), for which reason the parameterization of a temperature value depends on the applied sensor type.
	MRE for TC Type J (Fe-CuNi) & Type K (NiCr-Ni): **800 °C** **MRE** for TC Type L (Fe-CuNi): **1200 °C**
	This symbol indicates that you should tap the button shown with your finger.
	This symbol indicates that you should tap the button shown with your finger and hold it for >1 second.

2 Device identification

2.1 Short description of the RT7000

The RT7000 device defines the most comprehensive interface option of the RT family. From eight to 32 zones, this product family can cover a wide range of control processes. Thanks to the outstanding and unique **ELOTECH control algorithm,** particularly fast control is achieved with minimum overshoot, which ensures the protection of particularly sensitive system areas.

The RT7000 features a high-contrast **7-inch colour LCD** with capacitive **touch operation**. Clearly illustrated control surfaces ensure intuitive operation. In addition, the **internet-capable** system can be remotely controlled via a **VNC viewer app**. This app allows the monitoring and control of the system to be controlled from a distance. For the display, the user can choose between different view variants, such as the zone overview, process list or graph and PID representation.

The protection of the system is one of the most important objectives in the use of this control device. For example, the RT7000 protects the system by automatically interrupting the heating process in case of temperature anomalies and detects, among other things, the failure of a sensor. In order **to protect man and machine,** the system is then switched off.
Just as important as the physical protection of the system is the protection of internal data and settings. **User management** guarantees safe use of the RT7000. The usability of the device can be restricted according to the application via different rights levels. This ensures that parameterisation can only be performed by authorised persons. In addition, each login is recorded with a time stamp in a separate file. This data can be exported to a USB storage device by the administrator. Furthermore, all parameters relevant to control can be stored via USB or a complete set of parameters can be imported in the form of a tool recipe.

The RT7000 incorporates state-of-the-art technology and extensive functions in order to be able to work optimally in any application. With the help of the **soft start,** system areas are gently brought up to operating temperature or, for example, heat exchangers are dried in a manner appropriate for the machine. **Self-optimisation**, which determines the optimal parameters for the corresponding system after a short time, helps when searching for the ideal control parameters.

In addition to numerous other zone-related functions, the RT7000 also offers **cross-system** application support. Among other things, **global** - i.e. affecting all zones - temperature reductions can be carried out. This function can be useful, for example, for saving energy during production breaks without having to turn off the device. If production is to be resumed, the system can be brought back up to operating temperature in a short time. Zones that take a long time to heat up or which are intended to maintain their set temperature for other reasons can be individually excluded from the global reduction.

2.2 Type plate

The type plate is adhered to the back of the device and contains important information. This includes:

2.2.1 Type key

RT7000	-	0	-	ZZ	-	I	-	0000	-	P

Supply voltage	
1	400V AC 32A (8/16/24 Zonen)
2	400V AC 63A (32 Zonen)

Fieldbus	
0	Ohne
3	RS232 + RS485 + TTY
8	Profinet
A	OPC-UA

Number of control zones	
08	8 Zonen
16	16 Zonen
24	24 Zonen
32	32 Zonen

3 Assembly

3.1 Notes on commissioning

The device described here may only be used as intended! The user of this product must prove that he has instructed his specialist staff in the electrical operation.

In accordance with EN 50274:2002, there are no operating elements inside the housing that can or must be operated during operation.

The device is intended for free-standing use in indoor areas (protection class: IP20) and is to be installed such that it is protected from impermissible moisture, external heat exposure and heavy contamination. The permitted ambient temperature range of 5 to 40 °C must be observed. Endangerment to the cables due to sharp edges in normal local use must be avoided.

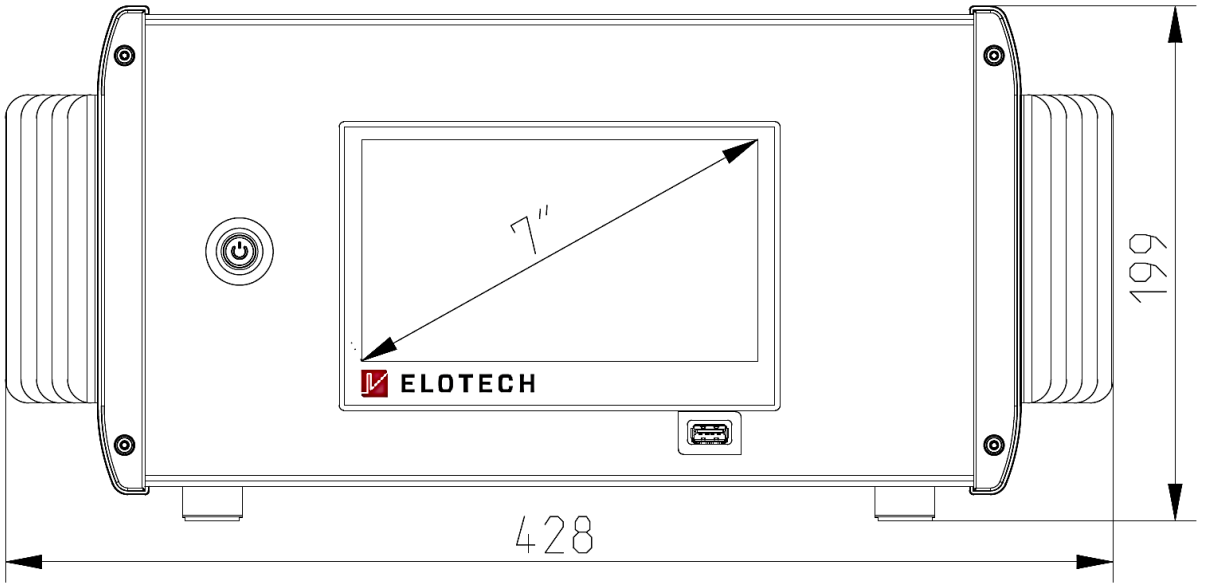
The electrical connections must be made by a specialist in accordance with the local regulations. Only measuring transducers that correspond to the set measuring range may be connected. When connecting thermocouples, the balancing line must be laid up to the device terminal. Measuring transducer cables and signal cables (e.g. interfaces or signal lines) must be installed separated from the mains power cables. Shielded measuring transducer cables must be used for CE compliance.

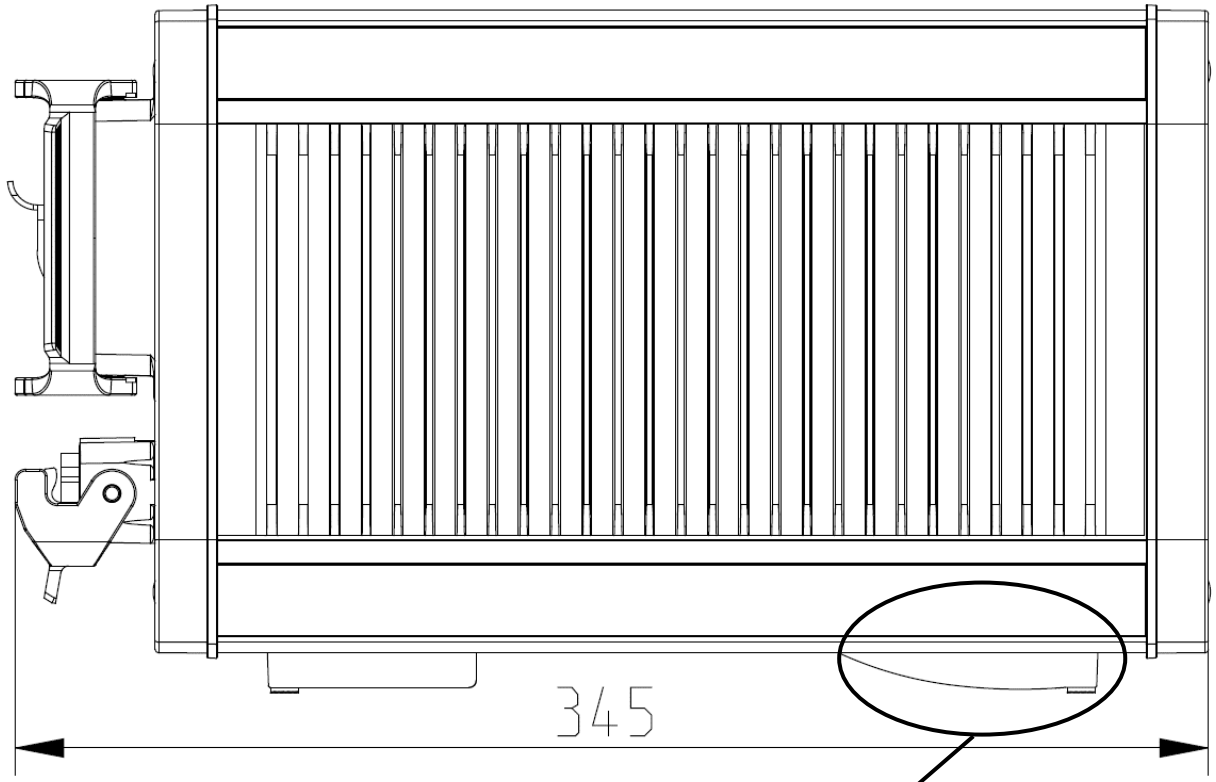
Spatial separation between the device and inductive consumers is recommended. This system controller is FI-capable. The user must ensure that the insulation values of the heating system are > 1 MΩ. The resulting differential current (max. 230 µA) allows the problem-free use of an RCCB for the entire system. The operation of the device requires a power supply on the system side protected by an RCCB and a suitable circuit breaker.
The device does not provide any safety shutdown for other connected devices or systems.
The protective conductor system of the device serves only for the internal potential compensation of the device. The heaters connected to the heating plugs of the device, which have a metal housing, must be provided by the system user with a working protective conductor concept. The metal bodies of the connected heaters must be connected within the machines to the protective conductor system of the machine.

The lateral heat sinks must not be covered. Natural convection must not be impeded. The heat sink temperature is monitored and the output power of the device is limited if necessary.

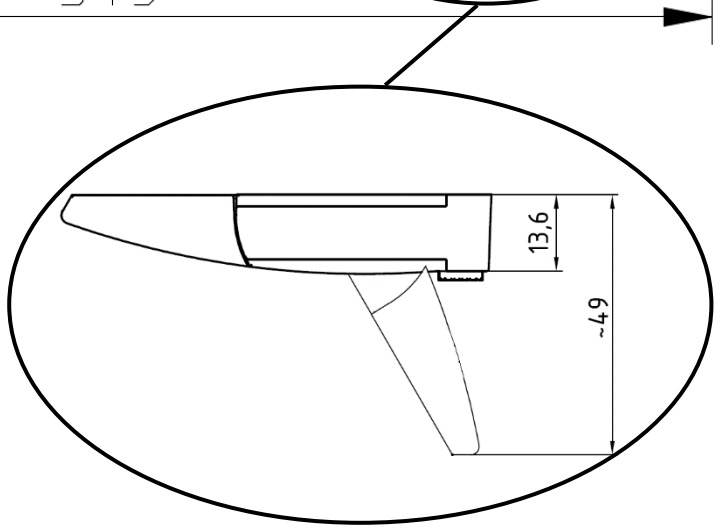
The device-related settings must be made first during commissioning.

3.2 Installation space of the 8 to 16 zone device





The two front-mounted feet can be used to change the height of the device and the viewing angle of the display.



3.3 Replacement of fuses

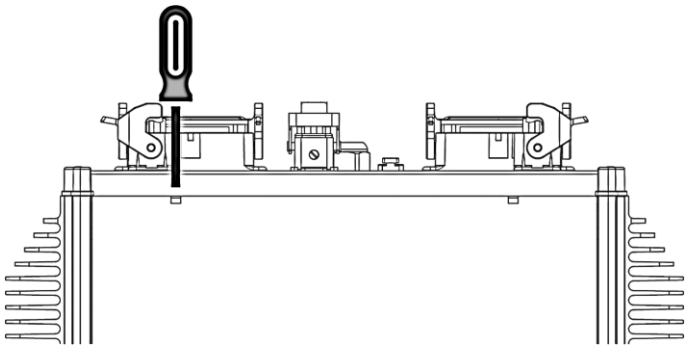
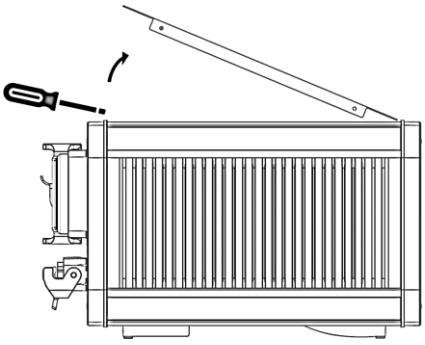
In the event of errors in the heaters or the wiring, a short-circuit may occur, causing an internal fuse to blow. To ensure a compact design and short cable paths, the fuses are located on the internal circuit boards of the output stages. The fuses can be replaced after opening the housing cover.

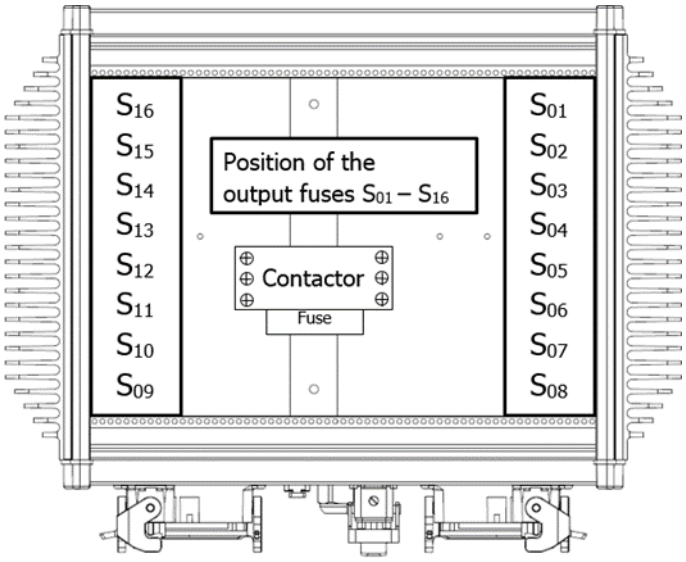
WARNING!

Opening the housing is only necessary if a fuse must be replaced. According to EN 50274:2002 (VDE 0660-514) there are no operating elements inside the housing that allow replacement during operation. **This replacement may only be carried out by qualified personnel.**

The housing cover has a monitoring contact that switches the output stages off if the cover is opened. Nevertheless, there are still live parts inside the housing! **The power supply must be disconnected before opening the cover (unplug the mains plug)!**

Instructions for replacing fuses

Step	Description	Illustration
1.	Power-off the device by switching off and unplugging the mains plug.	
2.	Open the cover plate of the housing by sliding a flat screwdriver into one of the grooves.	
3.	Carefully lever up the cover plate and remove it.	

Step	Description	Illustration
4.	The fuses are now accessible and can be replaced. Use only fuses of the following type: **6.3 x 32 mm,** **250 V, 16 A,** **Blowing behaviour: FF** Spare part item number: **FB1600**	
5.	After replacing the fuses, the cover plate must be fitted to the housing again.	

WARNING!

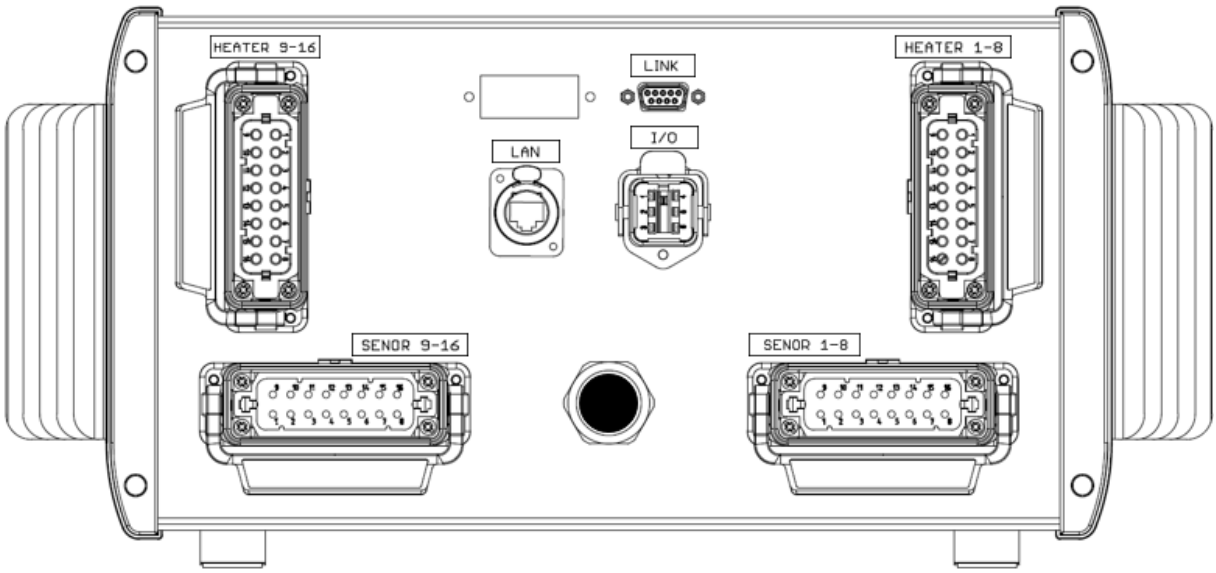
Care must be taken to ensure that the earth cable is connected to the blade terminal on the cover plate. The device may only be put back into operation after complete reassembly.

WARNING!

Inside the housing there are parts that can be destroyed by electrostatic discharge. Attention must be paid to the corresponding warning signs!

4 Electrical connections

The figure below shows the rear side of the RT7000 device. The 16-zone version is shown here. The plugs have been defined according to the illustration:



NOTE!

In the 8-zone version of the RT7000 device, the two connectors (**Heater 9-16** & **Sensor 9-16**) on the left of the rear side are omitted.

4.1 Assignment of phases

Each heating element is connected between phase and neutral. The zones are assigned to the phases as follows:

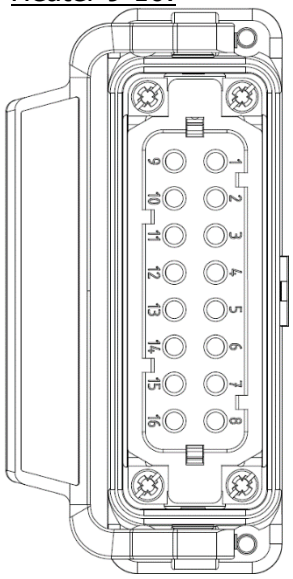
Phase	8-zone device	16-zone device
L1	Zone 1+2	Zone 1+2+3+4+5+6
L2	Zone 3+4+5+6	Zone 7+8+9+10
L3	Zone 7+8	Zone 11+12+13+14+15+16

WARNING!

The total permitted current of an 8-zone unit must not be exceeded (see 17 Technical data).
Each zone is protected internally by a 16 A fuse.

4.2 Connection diagram: Heater outputs and sensor inputs

Heater 9-16:

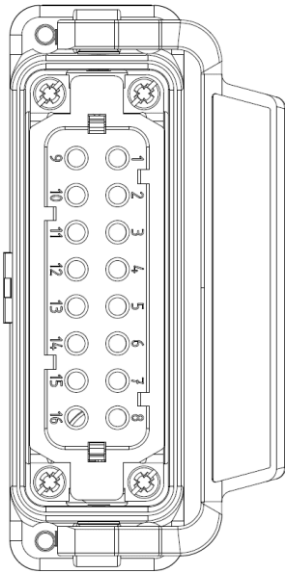


Zone 09 <1(L) 9(N)>
Zone 10 <2(L) 10(N)>
Zone 11 <3(L) 11(N)>
Zone 12 <4(L) 12(N)>
Zone 13 <5(L) 13(N)>
Zone 14 <6(L) 14(N)>
Zone 15 <7(L) 15(N)>
Zone 16 <8(L) 16(N)>

Socket strip (left)

Heater 1-8:

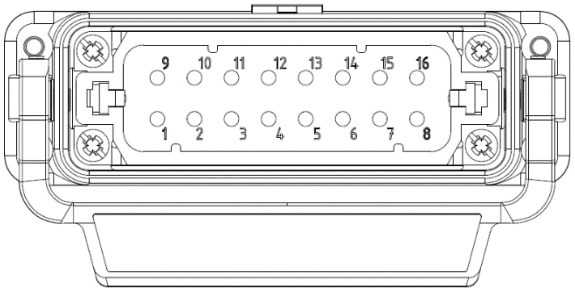
Zone 1 <1(L) 9(N)>
Zone 2 <2(L) 10(N)>
Zone 3 <3(L) 11(N)>
Zone 4 <4(L) 12(N)>
Zone 5 <5(L) 13(N)>
Zone 6 <6(L) 14(N)>
Zone 7 <7(L) 15(N)>
Zone 8 <8(L) 16(N)>



socket strip (right)

Sensor 9-16:

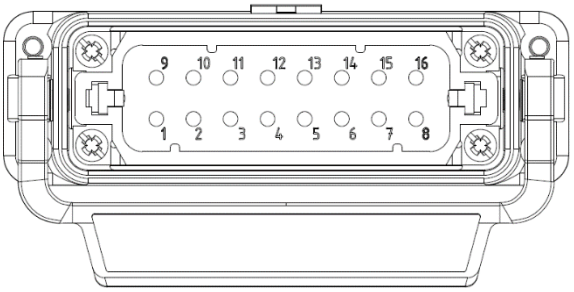
Zone 09 <1(+) 9(-)>
Zone 10 <2(+) 10(-)>
Zone 11 <3(+) 11(-)>
Zone 12 <4(+) 12(-)>
Zone 13 <5(+) 13(-)>
Zone 14 <6(+) 14(-)>
Zone 15 <7(+) 15(-)>
Zone 16 <8(+) 16(-)>



Pin strip (left)

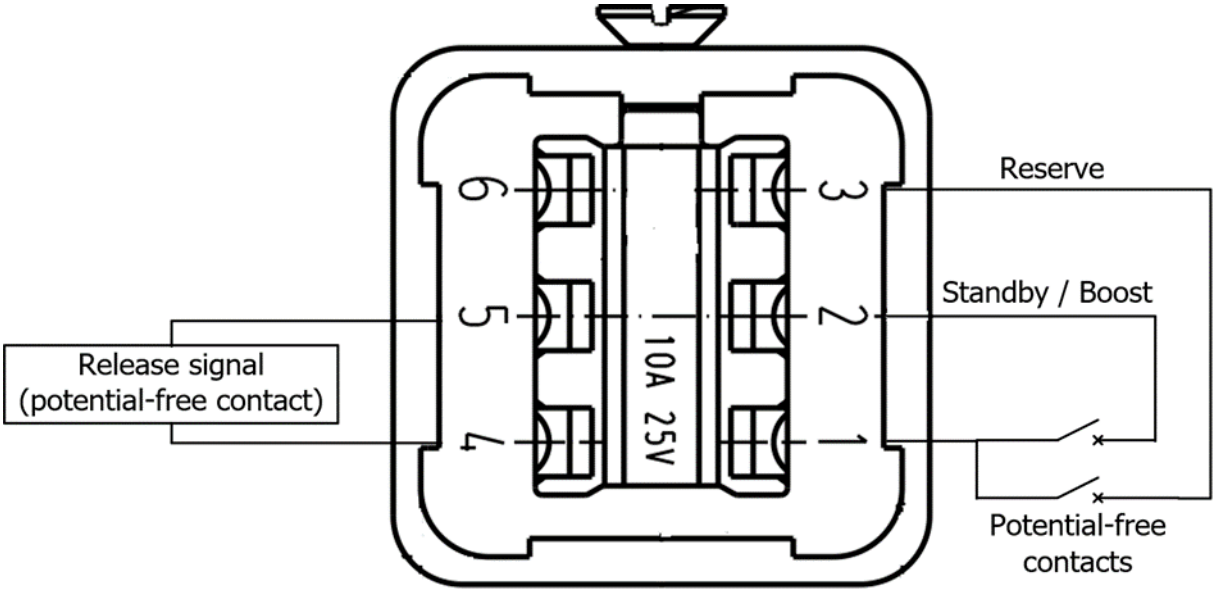
Sensor 1-8:

Zone 1 <1(+) 9(-)>
Zone 2 <2(+) 10(-)>
Zone 3 <3(+) 11(-)>
Zone 4 <4(+) 12(-)>
Zone 5 <5(+) 13(-)>
Zone 6 <6(+) 14(-)>
Zone 7 <7(+) 15(-)>
Zone 8 <8(+) 16(-)>



Pin strip (right)

4.3 Connection diagram: Control inputs and outputs



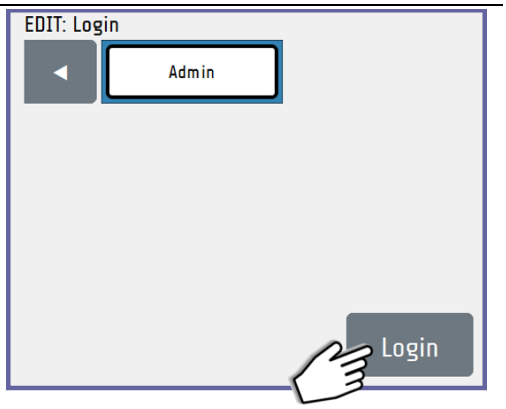
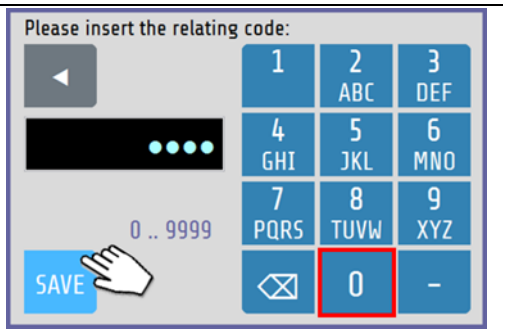
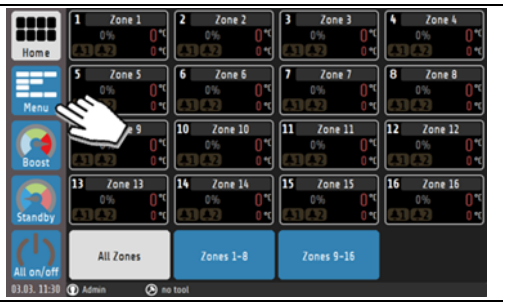
4.4 Connection diagram: Fieldbus interfaces

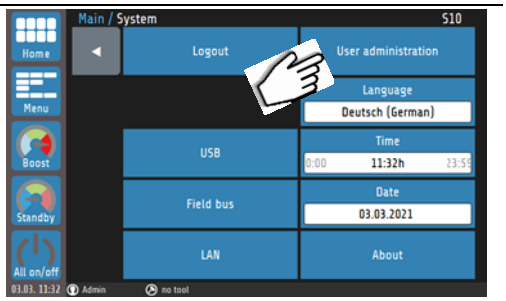
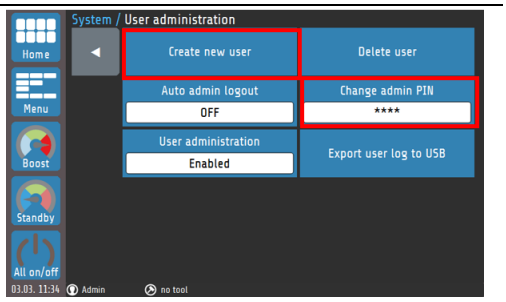
5 Getting Started (quick start)

In the delivery state, all parameters are factory-preset. Therefore, only a few steps have to be taken for initial commissioning.

5.1 Changing the Admin PIN & creating users

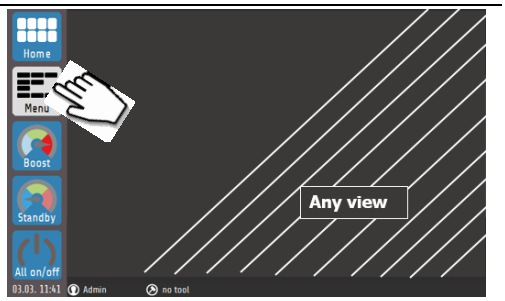
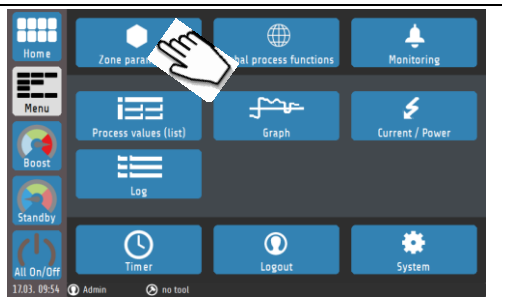
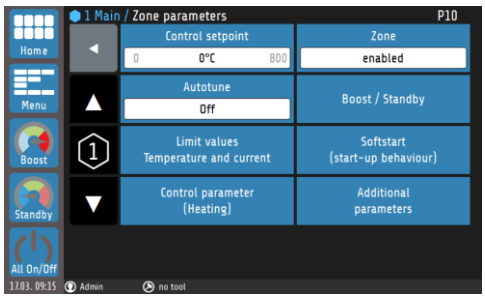
Before you can commence with the parameterisation of the individual zones, it is necessary for data protection that the Admin password be changed. The menu navigation from the first start of the device to the change of the Admin PIN is listed below. Only a few steps are required to access the **user management,** where you can create new users and change the Admin password.

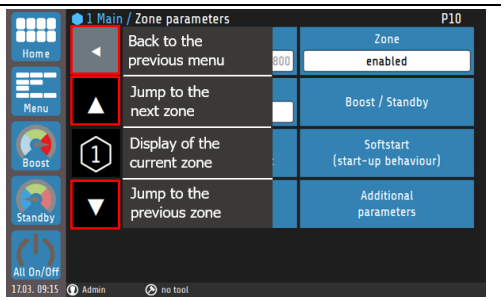
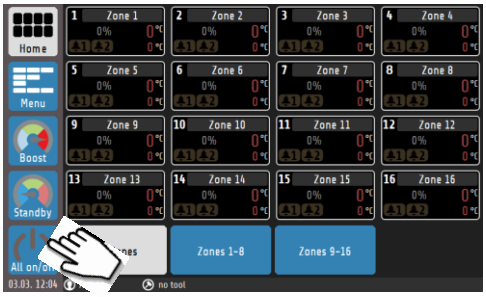
Step	Description	Illustration
1.	Connecting and switching on the device.	See Chapter 3 Assembly.
2.	After the device has powered up, the login window opens. Now tap **Login.**	
3.	An input box opens in which you have to enter the default Admin PIN. The PIN code is: **0 0 0 0** Confirm the entry via **SAVE**. This is followed by a notification from the system that you have been successfully logged in. Confirm this via **OK**.	
4.	After logging in, you can access the Home screen (Home) (see chapter 6.4). At the first time of use, all zones are switched off at startup. Via the Navigation bar (see chapter 6.1) on the left, you can access the Main menu (see chapter 6.5).	
5.	In the menu overview, tap the System button (see chapter 14).	

Step	Description	Illustration
6.	Now select the User management in the system settings (see chapter 14.1).	
7.	In **User Management,** you can create new users and change the Admin PIN or disable the User Management.	

5.2 Starting the control

Now the required parameters can be adapted to the application, if the default values are not already set appropriately. You can proceed as follows:

Step	Description	Illustration
1.	Tapping on the **Menu** button opens the menu overview.	
2.	Tapping the Zone parameters button opens the parameterisation menu for the individual zones. Here, among other things, the control parameters (PID, ...) can be set individually.	
3.	All parameters that apply individually to the respective zone can be adjusted here. For further information, see chapter 7 Zone parameters.	

Step	Description	Illustration
4.	Tapping the black arrow keys takes you to the next or previous zone. The arrow at the top left will take you back to the previous menu.	
5.	If all zones to be controlled have been assigned the appropriate parameters, the control can be started. To do this, tap **All on/off** at the bottom left of the navigation **bar** and confirm the input (all zones will be switched on unless they are **off** in the zone parameters). Immediately after switching on the zones, the colour of both the button and the **status bar** at the bottom of the screen change.	

NOTE!

The colour of the status bar changes depending on the current control status. Please refer to the further information in chapter 6.2 Status bar.

REFERENCE!

Parameters can also be assigned to multiple zones at the same time. The **Mulitsave** tool is used to parameterise many zones quickly and reliably.
For more information, see chapter 5.4 Multisave.

REFERENCE!

A complete parameter set can also be loaded as a tool recipe or backed up to a USB storage medium.
For more information, see chapter 9.2 Tool menu.
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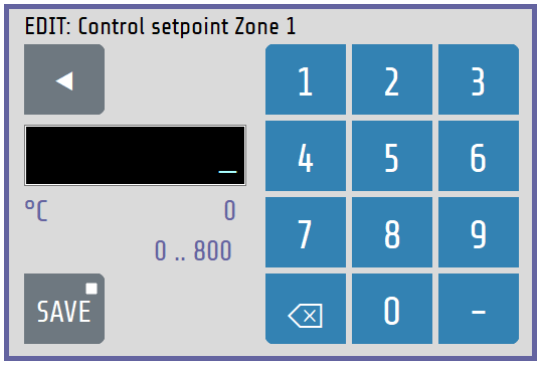
5.3 Setting the control setpoint

By tapping the **Control setpoint** box in the **zone parameters** menus (see chapter 7 Zone parameters) an input box is opened in which the desired setpoint can be entered.



The parameter name of the zone (here: **Control Setpoint Zone 1**) is displayed in the header.

The numeric keyboard can be used to set the value of the parameter.

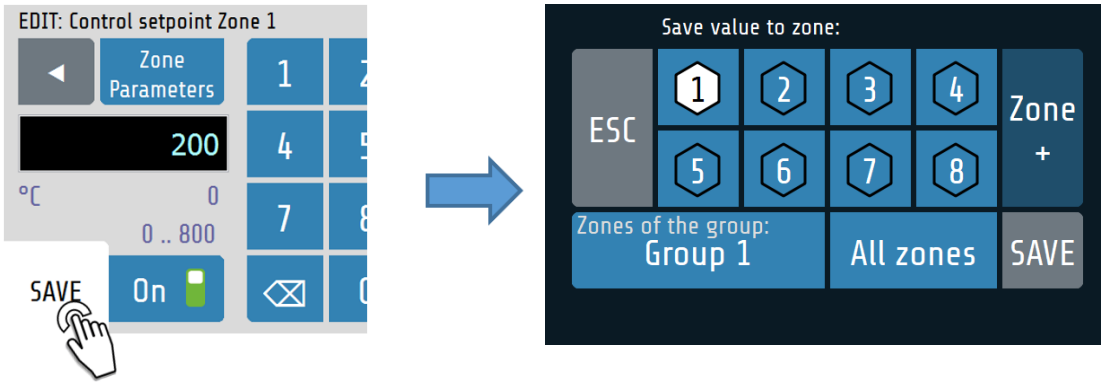
To accept the parameter value, it must be saved with the **SAVE** button.

Explanations for the individual boxes:

°C 150	Display of the currently set control setpoint.
0 .. 800	Setting range of the current parameter (**0... MRE**).
⌫	Deletes the last digit entered.
SAVE	Saves the value entered. Holding the Save button (>1 sec) opens the selection window to transfer the changed parameter value to multiple zones (see chapter 5.4 Multisave).
◀	Closes the window without saving. If a value has already been entered, a pop-up message appears requesting confirmation.

5.4 Multisave

To save a value to multiple zones, the **Save** button can be pressed and held for 1 second when entering a parameter. After the time has elapsed, the button grows in size. The button can now be released and the zone selection screen appears:



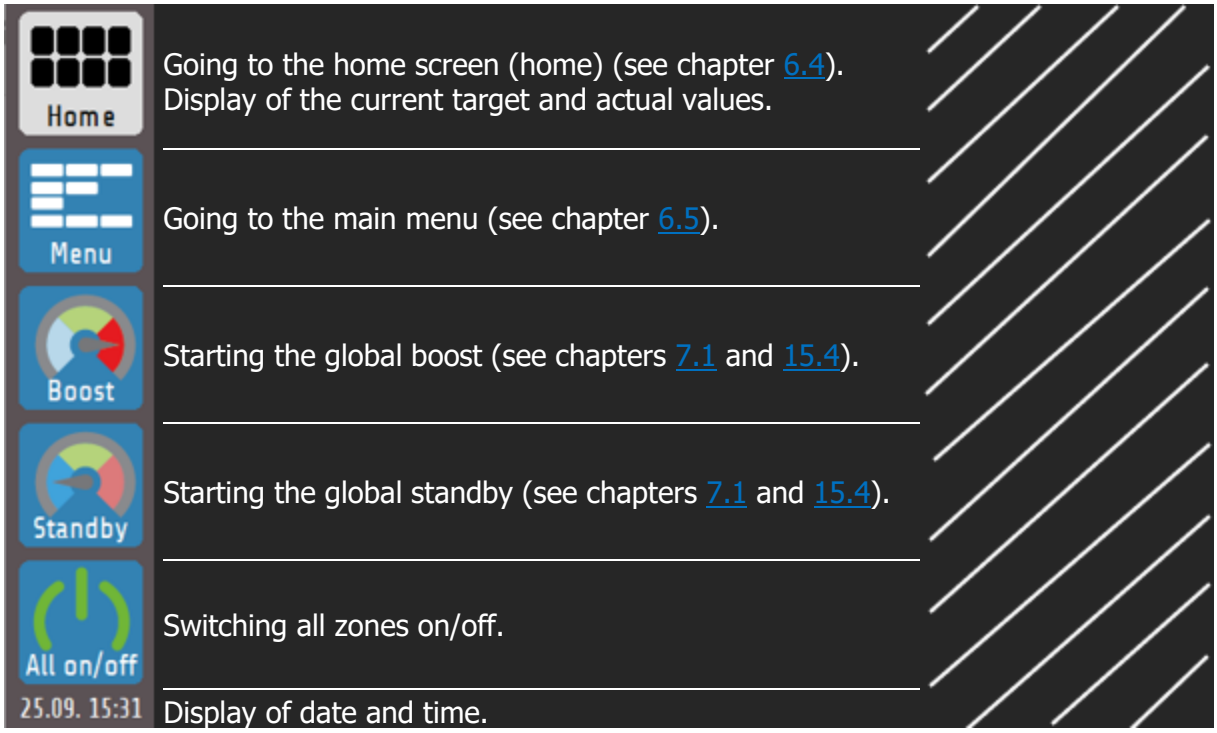
Explanations for the individual boxes:

	The currently selected zone is always marked in white and cannot be deselected. Zones can be added and removed by tapping another zone box. Zones with a black number on a white background accept the parameter value entered.
	You can switch between zones 1-8 or 9-16 respectively using the **Zone +** and **Zone -** buttons. The zones already selected remain activated.
	Selects all zones of the same group like the active zone. This button has no function if the current zone is not assigned to a group.
	The parameter value entered is assigned to all zones.
	Saves the parameter in the selected zones.
	Closes the window without saving.

6 Basic display and operation

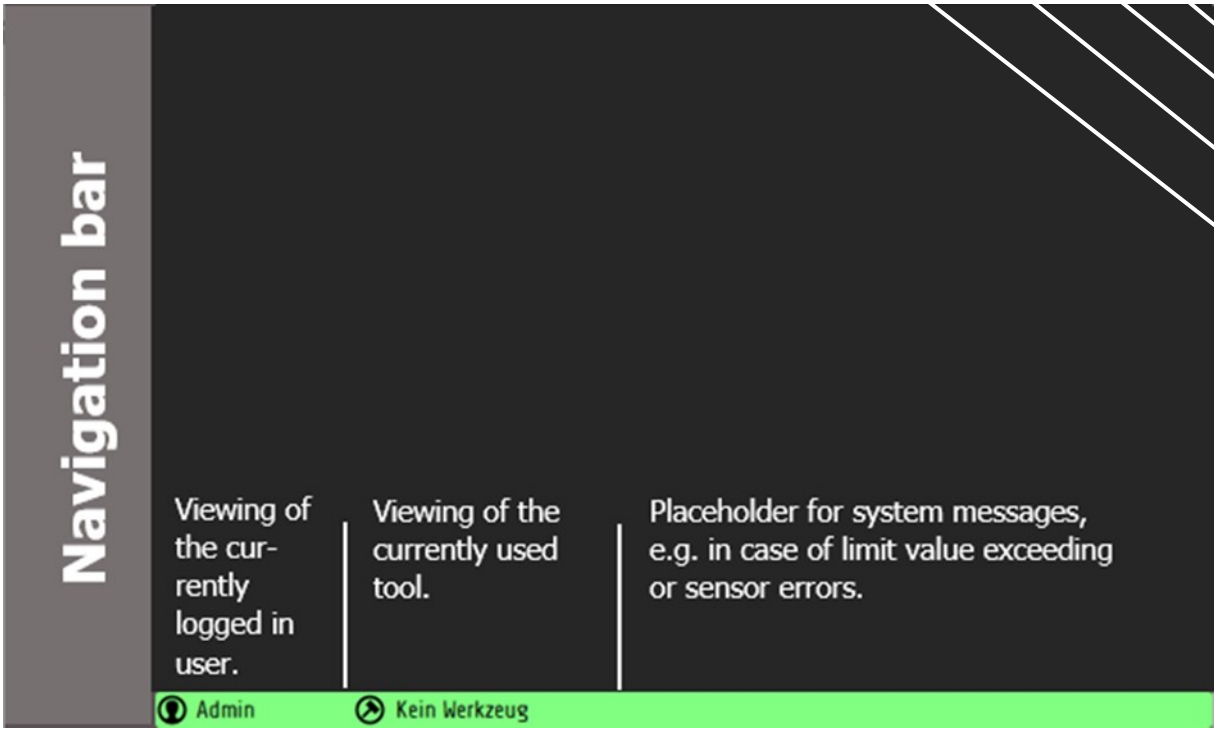
6.1 Navigation bar

The **navigation bar** at the left edge of the screen takes you from each screen to the **home screen** and the **main menu** with one click. Functions can be executed directly via other quick buttons. The navigation bar is always visible.



6.2 Status bar

The **status bar** provides a quick overview of the current state of the system. Among other things, the current user as well as information about the control in the form of a colour code are displayed here. The status bar is always located below the current menu at the height of the date display.



The colour of the status bar changes depending on the current actual values; the following applies:

Colour	Meaning	Illustration
Dark grey	All zones are switched off.	User Tool
Blue	At least one switched-on zone lies below the enable range.	User Tool
Green	All zones are within the range.	User Tool
Red	At least one zone lies above the enable range or there is a limit violation or other error.	User Tool

REFERENCE!

The **enable range** is ±5 K of the setpoint in the factory settings. You can adjust the range in the menus Monitoring and Global process functions (see chapters 8 and 9).

REFERENCE!

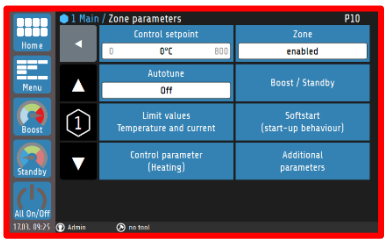
Adjustments to limit values and the signalling of other errors (including system errors) can be made using the Monitoring (see chapter 8).

6.3 Display of the basic menu

After switching on and initialising the device, the current measured values **(actual values**) and the **setpoints** of the control zones are displayed on a basic screen.

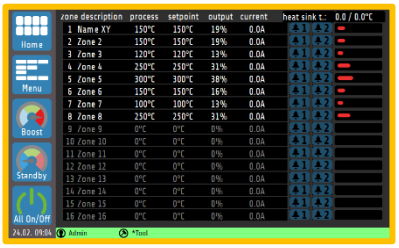
The operation of the various functions and setting the device is menu-guided. Starting from the **main menu,** the individual menu categories are shown below. The coloured frames around the menu images correspond to the frames placed in the main menu via the selection buttons:

Home (home screen)

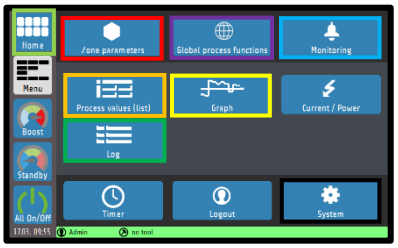


Zone parameters

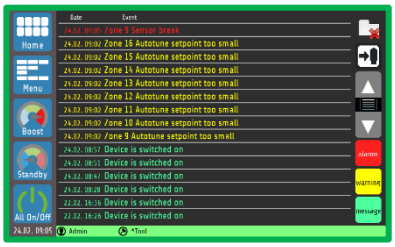
Graph



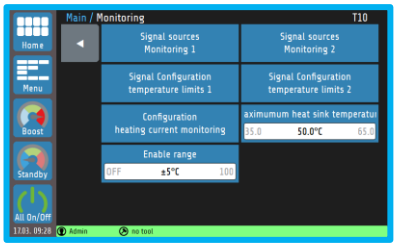
Process values (list)



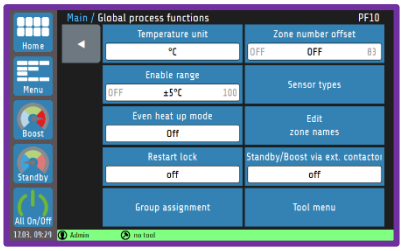
Main menu



Logbook



Monitoring (monitoring)



Global process functions

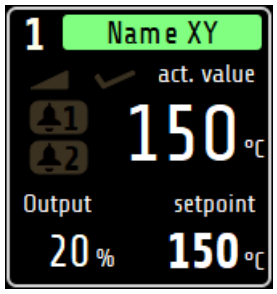
System

The individual parameters are largely displayed in plain text and can be set to different languages. The individual menus are explained in more detail below.

6.4 Home screen (Home)

The **home screen** shows the **zone tiles**, with the current value and state indicators belonging to the respective zone.

The home screen can be switched between the view of zones 1-8, 9-16 and a view of all available zones. The 8-zone view has the highest information content, while the **All Zones** screen only shows the target and actual values as well as the signal display. Explanation of the individual boxes:

	The **zone tile** contains: the zone number, the individually adjustable zone name, the actual value and setpoint, the output ratio of the control, two configurable signal displays as well as a function display for soft start, ramp and self-optimisation. The colour-coded box with the zone name also indicates the state of the zone. The convention is similar to the colour coding of the Status bar (see chapter 6.2).
	Ramp function active/inactive
	Soft start active/inactive
	Self-optimisation active/inactive
	Signal 1: Alarm (red)/ Release (green)/ Inactive (grey)
	Signal 2: Alarm (red)/ Release (green)/ Inactive (grey)

NOTE!

Tapping a zone tile takes you directly to the setpoint setting and to further parameterisations (see chapter 7 Zone parameters).
Holding a zone tile for >1 sec. shows the group affiliation of the zones. All zone tiles in a group have a white border (see chapter 9.1).

6.5 Main menu

The **main menu** serves as a central point for the individual function menus.

Explanation of the individual boxes:

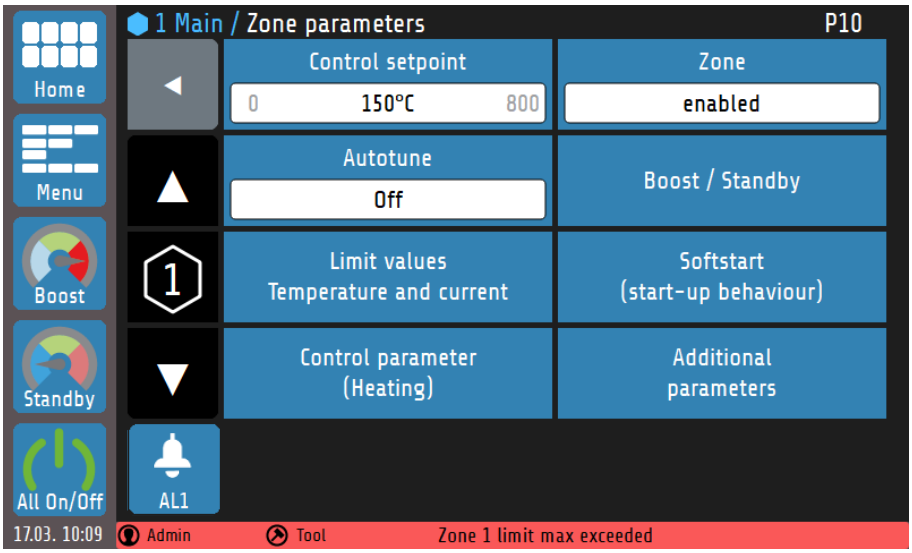
Zone parameters	Going to the **Zone Parameters** menu. Entry for one zone: **setpoint**, **control parameters**, **ramp**, **optimisation** and other control settings.
Global process functions	Going to the **Global Process Functions** menu Configuration of parameters that affect all temperature control zones: including access to **the group assignment** or the **tool menu**.
Monitoring	Going to the **Monitoring** menu Configuration of limit values for monitoring the process.
Process values (list)	Going to the **Process Values** display (list view). Overview display for all zones: **actual value**, **setpoint**, **output ratio,** current, **monitoring** status
Graph	Going to the **Graph** menu. Display for max. 8 zones (switchable): Graphic display of the actual temperature value over time.
Current / Power	Going to the **Current / Power** display Display of the maximum current, or maximum power and distribution to the phases as well as the current utilization of the device.
Log	Going to the **Log** menu Display of warning, alarm and status messages for the device
Timer	Going to the **Timer** menu Configuration of times for automated switching on/off of the control. If the automatic timer is active, the clock icon is displayed in green.
Login	**Login / Logout** Button for logging users in or out
System	Going to the **System** menu Configuration of interfaces and settings for language and time, user management.

NOTE!

In the PDF version of this guide, clicking on a box within the table will provide you with further information.

7 Zone parameters

The zone parameters can be accessed via the menu or the zone tiles on the home screen. The following illustration shows the most important process parameters of a zone:



Explanations for the individual boxes:

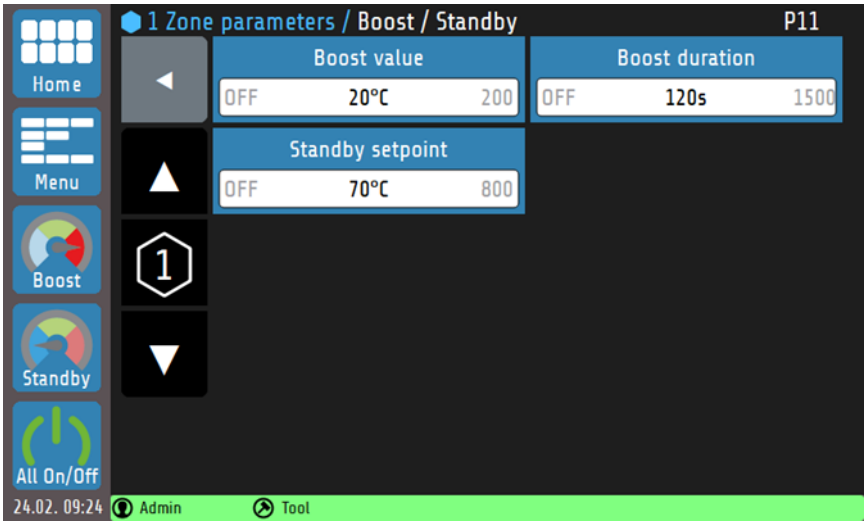
▲	Switch to the next zone.
1	Display of the current zone number.
▼	Switch to the previous zone.
Control setpoint 0 150°C 800	Control setpoint: The temperature value to which the selected zone is regulated. Tapping the box opens a numeric keyboard for changing the control setpoint.
	Setting range: **0**(*) **to MRE °C** The setting range can be set via the parameter **setpoint min. / max.** (see Chapter 7.5).
Autotune Off	Self-optimisation configuration (see chapter 15.3).
	Setting range: **off**(*), **start**, **automatic at each restart**
Zone enabled	Switch the zone on/off. If this parameter is set to **off,** the zone does not participate in the global **All On/Off** function.
	Setting range: **on**(*), **off**
Boost / Standby	Configuration of the boost and standby function (see chapter 7.1).
Limit values Temperature and current	Configuration of the limit values for temperature and current (see chapter 7.2).
Softstart (start-up behaviour)	Configuration of the soft start function (see chapter 7.3).
Control parameter (Heating)	Configuration of control parameters including P, I, D and output ratio limitation (see chapter 7.4).

Additional parameters	The menu provides additional parameters for controlling a zone (see chapter 7.5).
AL1	Acknowledge button for the limit value monitoring. This can be used to acknowledge the **self-locking** of the monitoring of limit values 1 and 2 (see Chapter 8.3) The button is invisible if: - no limit value violation has been detected and saved. - a saved limit value violation that is no longer present has been acknowledged.

(*): Factory setting

7.1 Boost / Standby

The following figure shows the zone-dependent settings menu for the **Boost** and **Standby** function:



The **Boost** and **Standby** function can be started or stopped from the **navigation bar**. The zones whose **boost** and/or **standby** parameters are set to **OFF** are not affected when enabling the global boost/standby. For more information on the **Standby** and **Boost** function, see Chapter 15.4.

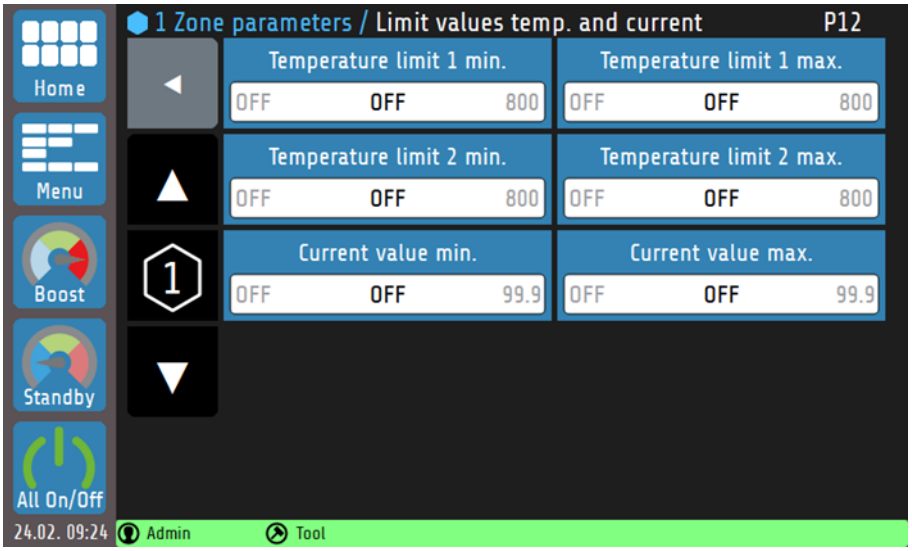
Explanations for the individual boxes:

Boost value OFF 20°C 200	Configuration of the (relative) **boost value**. The boost value is added to the setpoint and forms the boost temperature.
	Setting range: **OFF, 1 to 20(*) to 200 K**
Boost duration OFF 120s 1500	Configuration of **the boost duration** (holding time of the boost temperature).
	Setting range: **OFF, 1 to 120(*) to 1500 s**
Standby setpoint OFF 70°C 800	Configuration of **the standby setpoint**.
	Setting range: **OFF, 1 to 70(*) to MRE °C**

(*): Factory setting

7.2 Limit values temperature and current

The limit values are used for **monitoring** the process values. If a limit value is undershot or overshot, an alarm message is output by the controller. Before using limit values, the limit value configuration must be set (see chapter 8 Monitoring).



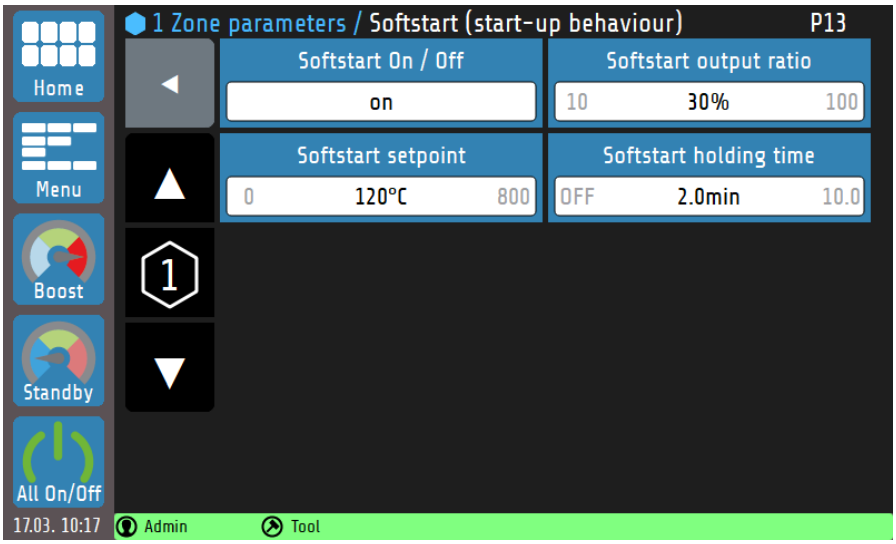
Parameter list: Limit values			
Parameter		**Selection/setting**	**Description**
Temperature limit value 1 min.	absolute	**OFF(*), 1 to MRE °C**	Absolute limit value that must not be undershot.
	relative	**OFF(*), -200 to 0 °C**	Relative limit value (relative to the setpoint) that must not be undershot.
Temperature limit value 1 max.	absolute	**OFF(*), 1 to MRE °C**	Absolute limit value that must not be overshot.
	relative	**OFF(*), 0 to 200 °C**	Relative limit value (relative to the setpoint) that must not be overshot.
T. limit value 2 min.	absolute	**OFF(*), 1 to MRE °C**	Like limit value 1 min.
	relative	**OFF(*), -200 to 0 °C**	
T. limit 2 max.	absolute	**OFF(*), 1 to MRE °C**	Like limit value 1 max.
	relative	**OFF(*), 0 to 200 °C**	
Min. current value		**OFF(*), 0.1 to 99.9 A**	Minimum current intensity
Max. current value		**OFF(*), 0.1 to 99.9 A**	Maximum current intensity
(*): Factory setting			

REFERENCE!

For more information on **limit value monitoring,** see chapter 8.3 Signal configuration of temperature limit values.

7.3 Soft start (start-up circuit)

For a detailed description of the **soft start** function, see chapter 15.1.



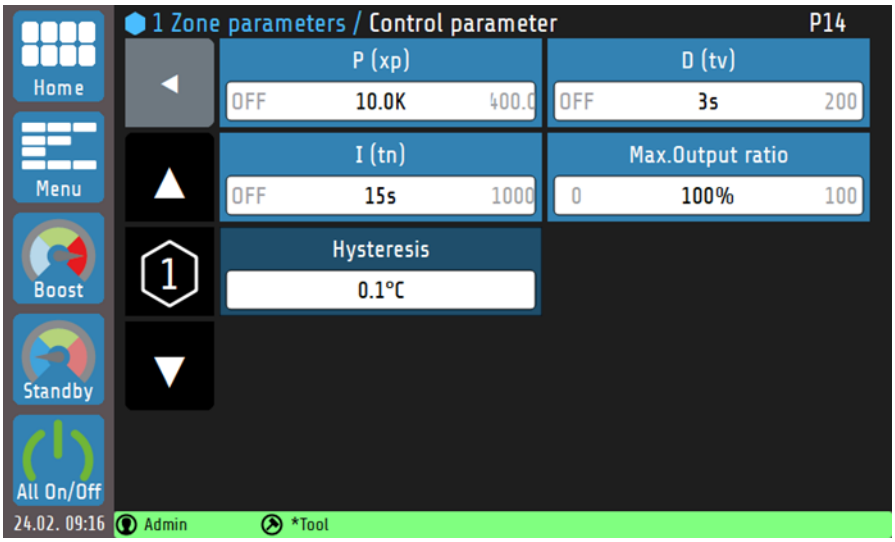
Explanations for the individual boxes:

Softstart On / Off on	The soft start function for a zone can be switched on and off here.
	Setting range: **on**(*), **off**
Softstart setpoint 0 120°C 800	Configuration of the **soft start setpoint**.
	Setting range: **0 to 120**(*) **to MRE °C**
Softstart output ratio 10 30% 100	Configuration of the **soft start output ratio**.
	Setting range: **10 to 30**(*) **to 100 %**
Softstart holding time OFF 2.0min 10.0	Configuration of **soft start time** (holding time). After the holding time has expired, the soft start is finished.
	Setting range: **OFF**, **0.1 to 2.0**(*) **to 10.0 min**

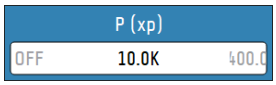
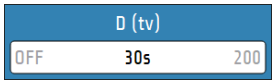
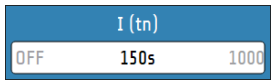
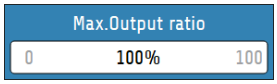
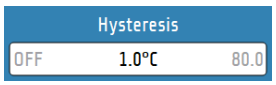
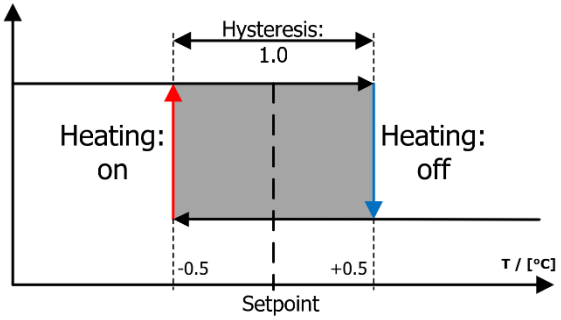
(*): Factory setting

7.4 Control parameters

The PID shares, the switching difference and the output ratio limitation can be set in the **Control parameters** menu.



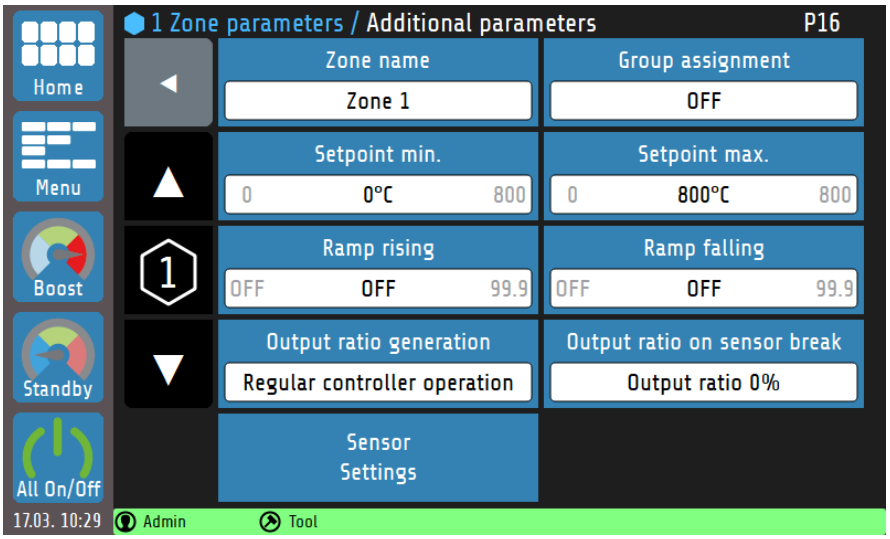
Explanations for the individual boxes:

	Configuration of the proportional element [K]. If the parameter **P (xp) is set to OFF**, the PID control is deactivated in its entirety and a two-point control by means of switching difference is set.
	Setting range: **OFF, 0.1 to 10.0**(*) **to 400.0 K**
	Configuration of the differential element / the rate time [s].
	Setting range: **OFF, 1 to 30**(*) **to 200 s**
	Configuration of the integral element / of the reset time [s].
	Setting range: **OFF, 1 to 150**(*) **to 1000 s**
	Output ratio limitation is only needed in the event of heavy over-dimensioned power supply to the controlled system. The output ratio is not usually limited (≙ **100%**). The output ratio limitation does not work during the self-optimisation phase.
	Setting range: **0 to 100**(*) **%**
	Only adjustable if **P(xp) = OFF**: Activation of two-point control mode. This reacts when the actual value exceeds the setpoint on both sides by the mean value of the switching difference. 
	Setting range: **OFF, 0.1**(*) **to 80.0 °C**

(*): Factory setting

7.5 Zone parameters - Additional parameters

In the **additional parameters** menu, there are additional setting options for controlling the selected zone:



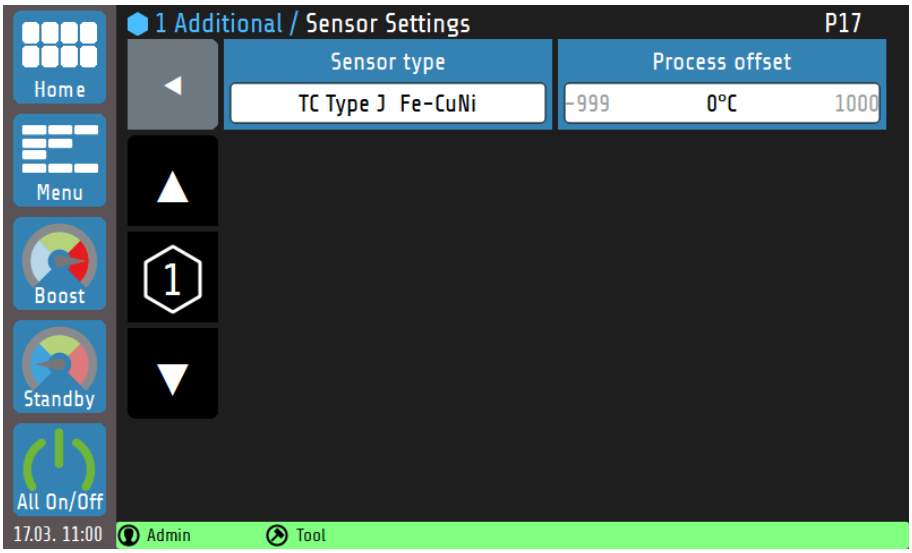
Explanations for the individual boxes:

Zone name Zone 1	Entry of any desired name for the zone. An on-screen keyboard opens to enter the name. The entry is confirmed with Enter.
Group assignment Group 1	Selection box for the Group assignment (see chapter 9.1).
Output ratio generation Regular controller operation	Selection box for the Output ratio generation (for more information see Chapter 15.5).
	Setting range: **Regular controller operation**(*), **from manual input, Adoption from zone**
Output ratio on sensor break Output ratio 0%	
	Setting range: **Output ration 0%**(*), **Hold last ration**
Ramp rising OFF 25.0K/min 99.9	Configuration of the desired heating rate.
	Setting range: **OFF**(*), **0.1 to 99.9 K/min**
Ramp falling OFF 25.0K/min 99.9	Entry of the desired cooling rate.
	Setting range: **OFF**(*), **0.1 to 99.9 K/min**
Setpoint min. 0 0°C 800	Selection box for limiting the minimum setpoint entry.
	Setting range: **0**(*) **to MRE °C**
Setpoint max. 0 800°C 800	Selection box for limiting the maximum setpoint entry.
	Setting range: **0 to MRE**(*) **°C**
Sensor Settings	Each zone can be assigned its own sensor type and an offset value (see chapter 7.5.1 Sensor settings).

(*): Factory setting

7.5.1 Sensor settings

Each zone can be assigned its own sensor type and an offset value. A selection of various thermocouples (TC) is possible.



Explanations for the individual boxes:

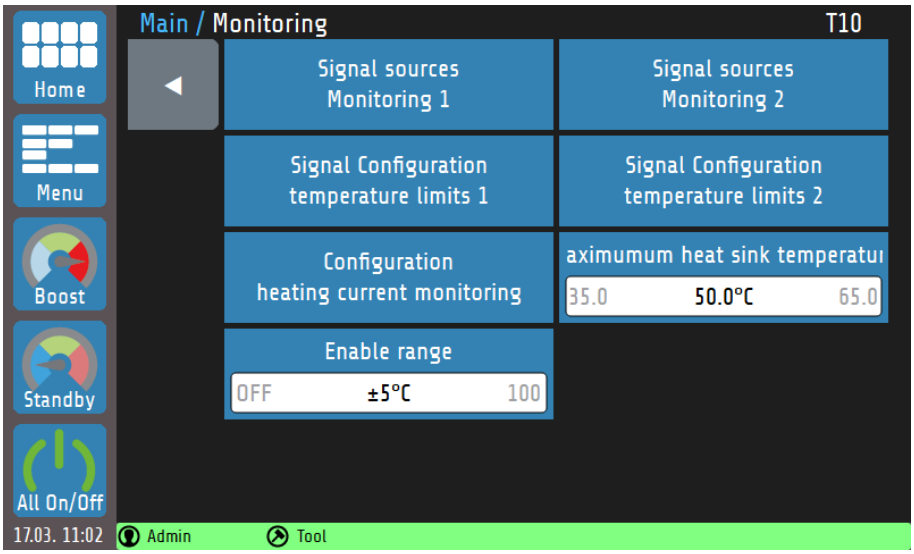
Sensor type TC Type J Fe-CuNi	Selection of the sensor type (For measuring ranges, see 17 Technical data). Setting range: **TC Fe-CuNi** (Type J(*), Type L), **TC Ni-CrNi** (Type K)
Process offset -999 0°C 1000	This parameter is used to correct the input signal. Setting range: **-999 to 0(*) to 1000 °C**

(*): Factory setting

8 Monitoring

The **Monitoring** main menu summarises the setting options for monitoring the control system:

- Definition of the variables or events to be monitored (current intensity, temperature, device restart, etc.).
- Definition of the deviations of the actual values from limit values (relative or absolute in relation to the setpoint).
- Definition of the type of signalling of limit value violations or the reaching of desired actual value ranges (choice of output relay, signalling colour, signal delay, logical linking of several events, signal inversion, etc.).
- Definition of numerical values (zone-individual Limit values can also be set in the menu Zone parameters see chapter 7.2).

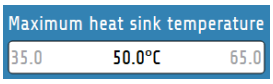


NOTE!

The output relays for monitoring signals 1 and 2 are not available in the standard equipment level but can be retrofitted. Regardless of this, the output relay linked with the **release window** is available in the standard equipment level. This parameter defines the cross-zone condition for starting production operation.

8.1 Maximum heat sink temperature

If the current heat sink temperature approaches the limit value, the output ratio of all affected zones is limited first. The output ratio limitation starts 5 K before the set limit value and is displayed with a yellow warning message in the **status bar**. As the heat sink temperature continues to rise, the output ratios are limited more severely. The maximum output ratio limitation of 50% is reached when the heat sink temperature has reached the limit value. In addition, a red alarm message appears. If the heat sink temperature reaches a value that is 5 K above the limit value, the main contactor of the device is switched off.



If the maximum heat sink temperature is exceeded, the monitoring signal is triggered.

Setting range: **35.0 to 50.0(*) to 65.0 °C**

(*): Factory setting

NOTE!

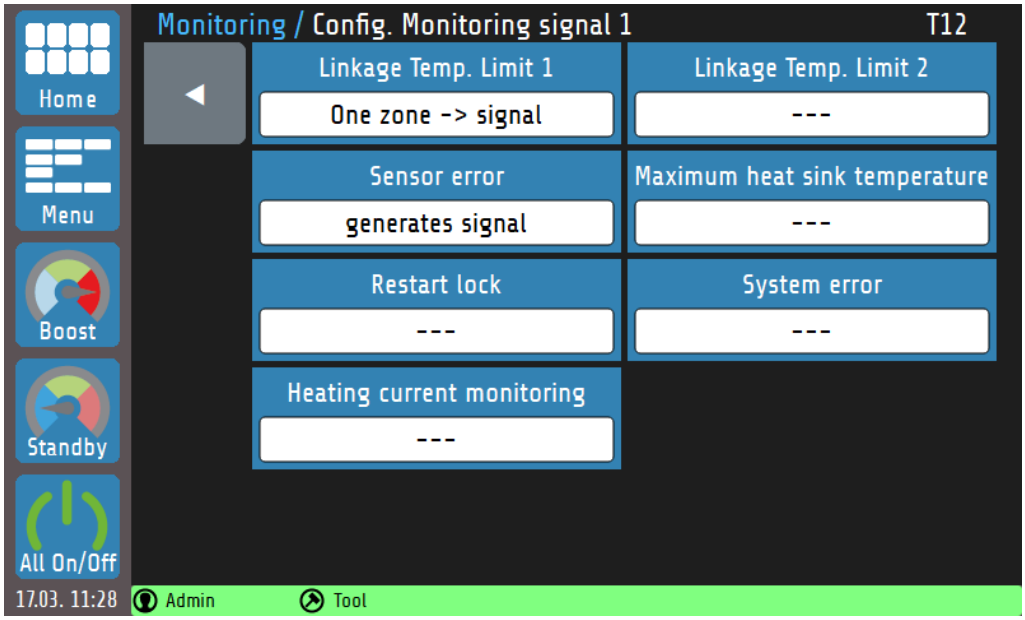
- The output ratio limitation is calculated from the limit value and the current heat sink temperature.
- The warning messages have a switch-on delay of 10 s.

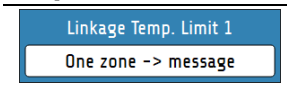
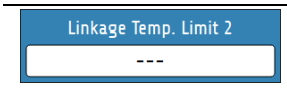
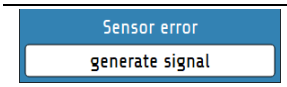
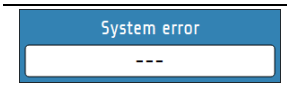
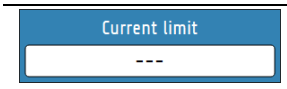
8.2 Selection of signal sources - Monitoring 1

The controller has two independent monitoring channels. The possible parameters and settings of the messages for Monitoring 1 are listed below. These parameters also exist analogously for Monitoring channel 2. The parameter selection can be accessed via the tile **Selection of signal sources Monitoring 1** or **Selection of signal sources Monitoring 2** in the Monitoring menu. Monitoring can be used to signal various events of the system and output them to the relays. All selected signal sources are linked via a logical OR.

If the monitoring signal is active, this is displayed by bell symbols 

. The colour of the depiction can be set to green, orange or red in the Monitoring menu under **Signal configuration temp. limit 1/2**. Other events have preset colours. If multiple events occur at the same time, the priority is: red, orange, green.



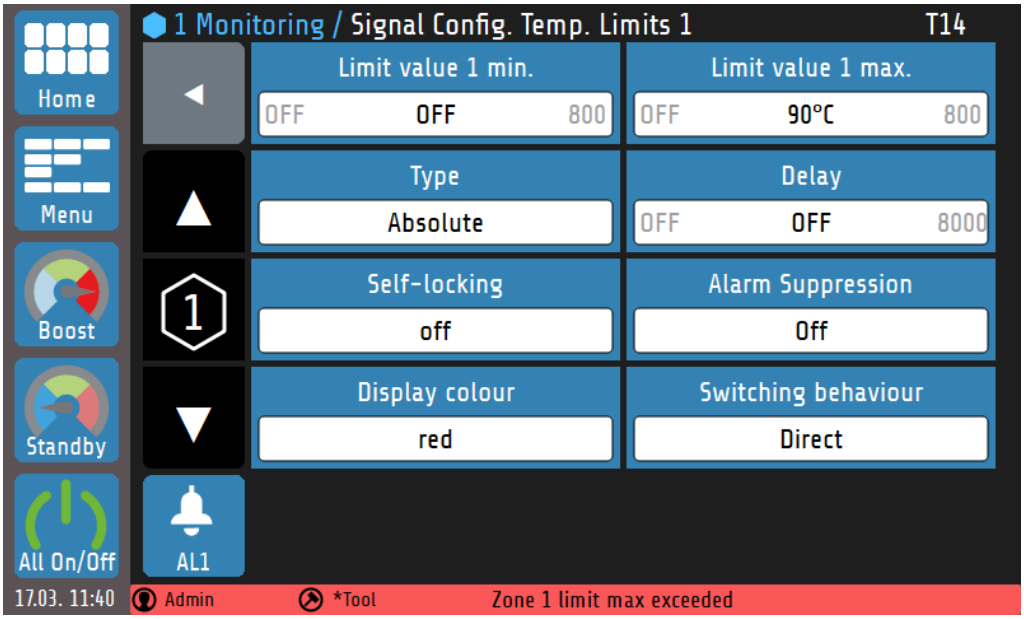
Depiction:	Selection:	Description:
	**---**(2)	No signal if the limit value 1 is undershot or overshot.
	One zone ->Signal(1)	The monitoring signal is displayed as soon as the limit value 1 is undershot or overshot in **one** zone.
	All zones =>Signal	The monitoring signal in only displayed when the limit value 1 is undershot or overshot for all switched-on zones.
	**---**(1)	No signal if the limit value 2 is undershot or overshot.
	One zone ->Signal(2)	The monitoring signal is displayed as soon as the limit value 2 is undershot or overshot in **one** zone.
	All zones =>Signal	The monitoring signal in only displayed when the limit value 2 is undershot or overshot for all switched-on zones.
	**---**(2)	No signal in case of sensor error.
	generates signal(1)	The monitoring signal is displayed when a sensor error has occurred (colour: red).
	**---**(1)(2)	No switch-on lock set.
	generates signal	The monitoring signal is displayed when a restart event has triggered (colour: orange).
	**---**(1)(2)	No signal in case of system errors.
	generates signal	The monitoring signal is displayed when there is a system error (colour: red).
	**---**(1)(2)	No signalling when the limit value is overshot.
	generates signal	Monitoring signal is displayed when the heat sink temperature has overshot its limit value.
	**---**(1)	No signal in case of overshooting or undershooting the current limit value.
	generates signal(2)	The monitoring signal is displayed in case of overshooting or undershooting the current limit value (colour: red).

(1): Factory setting for **signal sources monitoring 1**

(2): Factory setting for **signal sources monitoring 2**

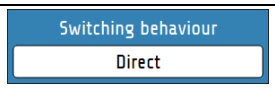
8.3 Signal configuration of temperature limit values

In the **Monitoring** menu, in the **Signal configuration temp limits 1** (or **2**) submenu, two independent limit value monitoring options can be parameterised for the monitoring channels. In the case of a programmed setpoint ramp, the relative limit values are tracked to the current ramp setpoints. In the case of sensor and cable faults, the limit value violations react as in the case of measuring range overflow.



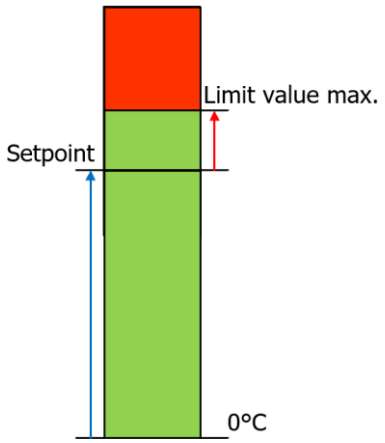
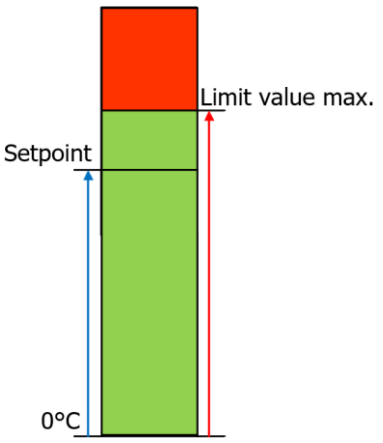
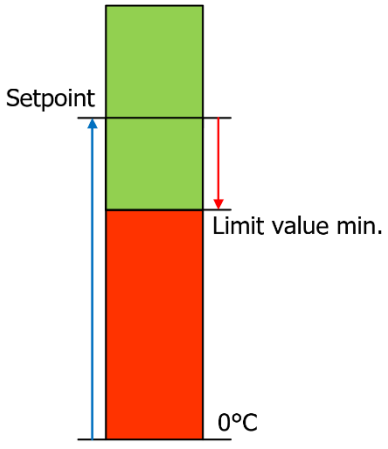
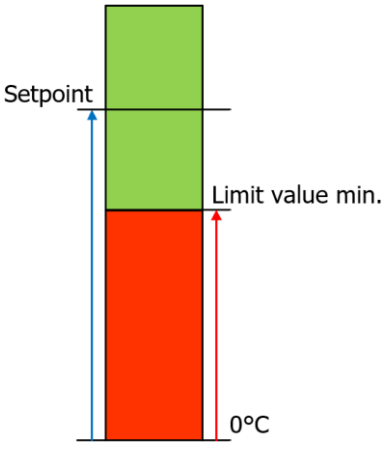
Explanation of the individual boxes:

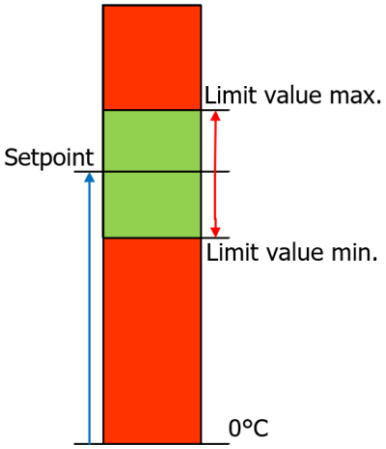
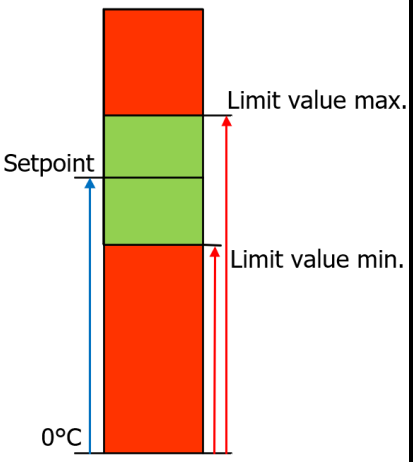
Limit value 1 min. OFF OFF 800	Lowest permitted actual value. The monitoring is displayed if this value is undershot.
	Setting range: **OFF**(*), **1 to MRE °C**
Limit value 1 max. OFF OFF 800	Highest permitted actual value. The monitoring is displayed if this value is overshot.
	Setting range: **OFF**(*), **1 to MRE °C**
Type Absolute	Definition of the limit value absolute or relative to the setpoint (see next page for further explanations).
	Setting range: **absolute**(*), **relative to setpoint**
Delay OFF OFF 8000	The monitoring sends a signal only after the set time and persistent violation of the limit values.
	Setting range: **OFF**(*), **1 to 8000 s**
Self-retaining off	When self-locking is active, a one-time/temporary triggering of the limit value monitoring is saved. The limit value violation is displayed until it is acknowledged by the operator.
	Setting range: **on**(*), **off**
AL1	A limit value violation stored by the self-locking can be acknowledged in any zone menu by pressing the button on the left. The button is invisible if: - a saved limit value violation that is no longer present has been acknowledged. - no limit value violation has been detected and saved.
Alarm Suppression Off	When alarm suppression is on, there will be no notifications for limit value violations during start-up.
	Setting range: **OFF**(*), **ON during start-up**

	In the event of a limit value violation, the status bar is set to the selected colour.
	Red(*), **green**, **orange**
	In the case of direct switching behaviour**,** the monitoring signal is only displayed when a switching condition (e.g. limit value violation) occurs. In the case of inverse switching behaviour, the monitoring signal is displayed as long as the switching condition does not occur (e.g. to signal a "good" area). Setting range: **Direct**(*), **Inverse**

(*): Factory setting for **configuration** of **limit values 1** and **limit values 2**

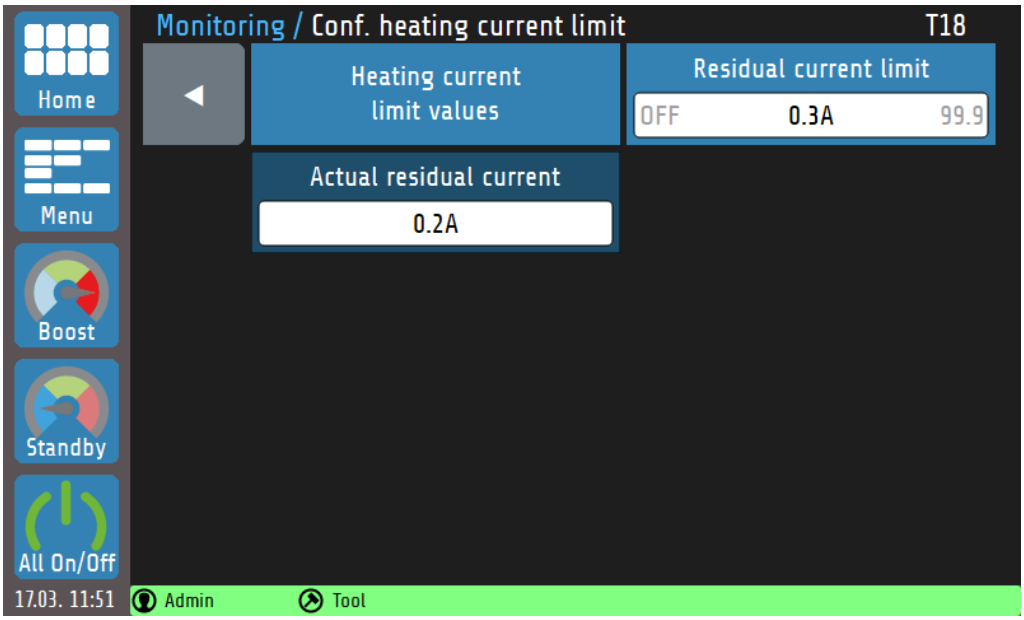
As shown in the previous table, limit values can be defined **both relative to the setpoint** and in **absolute** numerical values. The following table explains the differences between the two definitions. Note that monitoring is displayed if the actual value is outside of the white range:

Description	**Relative limit values**	**Absolute limit values**
Monitoring limit value overshoots. The signal is displayed if the actual value is greater than: **1. Relative limit values** • the sum of **max. limit value** and setpoint. **2. Absolute limit values** • the absolute **max. limit value**		
Monitoring of limit value undershoots. The signal is displayed if the actual value is less than: **1. Relative limit values** • the difference between setpoint and **min. limit value** **2. Absolute limit values** • the absolute **min. limit value**		

Description	Relative limit values	Absolute limit values
Monitoring of limit value violations on both sides (tolerance band). The signal is displayed if: **1. Relative limit values** • the actual value is greater than the sum of **max. limit value** and setpoint or smaller than the difference between setpoint and **min. limit value**. **2. Absolute limit values** • the actual value is greater than the **max.** absolute **limit value** or smaller than the **min.** absolute **limit value**		

8.4 Configuration heater current monitoring

To monitor the control system and as an additional protective measure, a heating current monitor can be configured. Note that mains voltage fluctuations do not trigger a false alarm of the heating current value to be monitored.



Explanations for the individual boxes:

Heating current limit values	Configuration of the absolute current limit values. This limit value can be set individually for each zone (see chapter 7.2).
Residual current limit OFF 0.3A 99.9	Monitoring for an impermissible continuous current. Measured residual currents above this value lead to an alarm.
	Setting range: **OFF, 0.1 to 0.3(*) to 99.9 A**
Actual residual current 0.2A	Display of the present residual current.

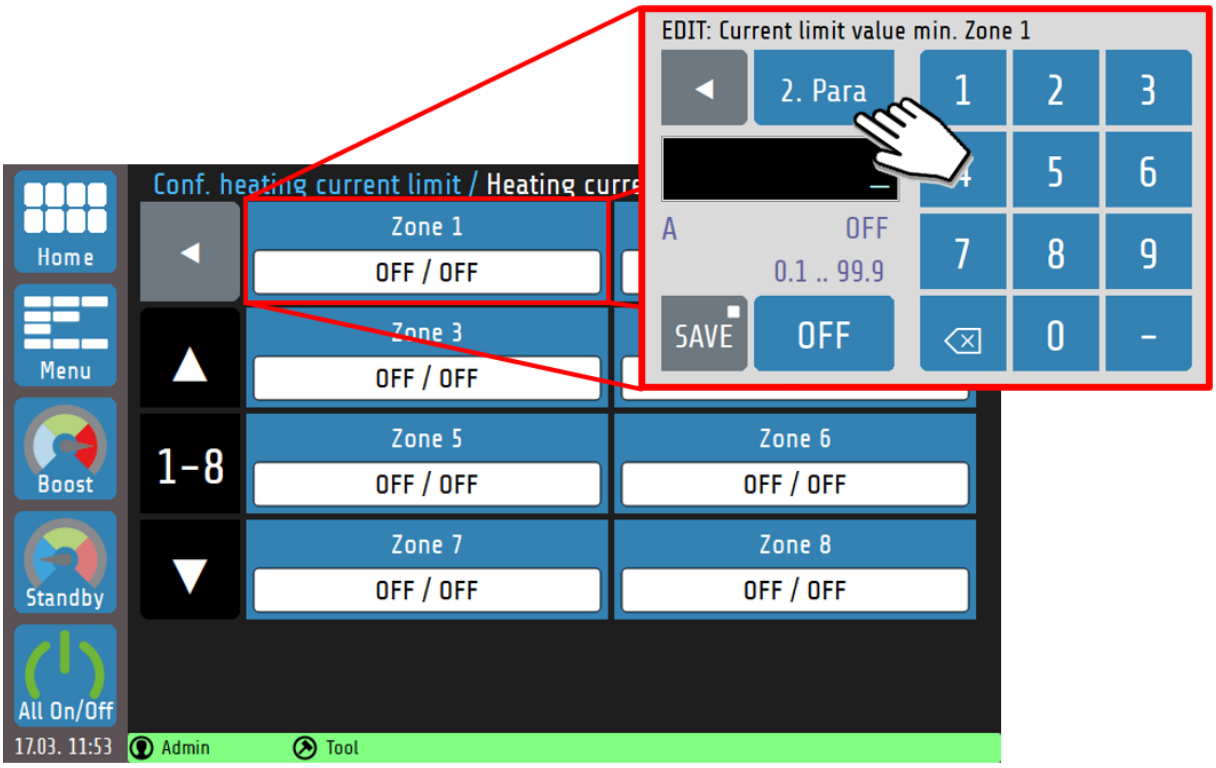
(*): Factory setting

NOTE!

If a continuous current is detected in a zone – e.g. due to a defective output stage – the current alarm signal is issued and the main contactor switches off all heaters.
The output stages have a certain leakage current due to their RC circuit. These currents add up and can result in a permanent residual current. Consequently, the limit value should be at least 0.3 A above the indicated **actual residual current**.

8.4.1 Heating current limit values

The heating current limit values can be defined individually for each zone or assigned to multiple zones using the **Multisave** tool.



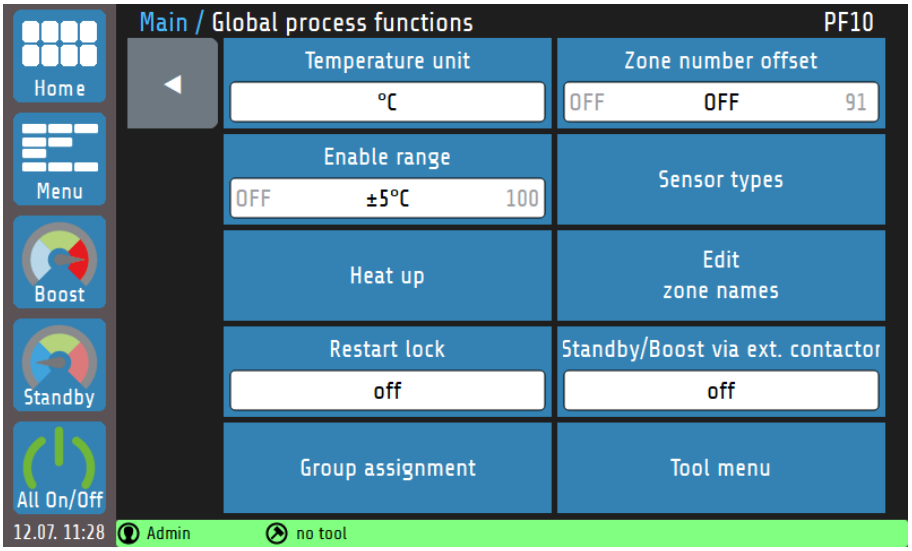
The **minimum current limit value** is set first during the limit value configuration. Application: Detection of the failure of a heater. For systems with several heaters per zone, a partial failure can be detected.

By tapping **2. Para**, the **maximum current limit value** can be set.

The heating current limit value are switched off for each zone in the factory. The setting range **0.1 to 99.9 A** applies to both the minimum and maximum limit values.

9 Global process functions

The **Global Process Functions** menu contains the settings that affect the entire device or all control zones respectively:



Explanations for the individual boxes:

Temperature unit °C	Configuration of the temperature unit.
	Setting range: **°C**(*), **°F**
Zone number offset OFF OFF 83	Configuration of the **zone number offset**; the displayed numbering of all zones is incremented by the offset value. This allows the zone numbers to be assigned sequentially in case of several independent devices.
	Setting range for 8-zone device: **OFF**(*), **1 to 91** Setting range for 16-zone device: **OFF**(*), **1 to 83**
Enable range OFF ±5°C 100	As soon as the actual values of all control zones are within the set release range (here: $_{Min/max}$ actual value = setpoint ± 5 °C), the release signal is output via a potential-free relay contact.
	Setting range (±): **OFF**, **1 to 5**(*) **to 100 °C**
Sensor types	Possibility to set the individual sensor types for all zones.
	Setting range: **TC Fe-CuNi** (Type J(*), Type L), **TC Ni-CrNi** (Type K)
Even heat up mode Off	Selection and configuration of the heating modes when starting the system (see chapter 15.6 for more information).
	Setting range: **Off**(*), **Even heat up mode**, **Energy optimised heat up**
Edit zone names	Here, an individual name can be assigned to each zone. The zone name can also be changed in the zone parameters (see chapter 7).
Standby/Boost via ext. contactor off	Temperature changes (**Standby**, **Boost**) can be controlled globally via an external, potential-free contact (see chapter 15.4.1).
	Setting range: **off**(*), **Standby**, **Boost**

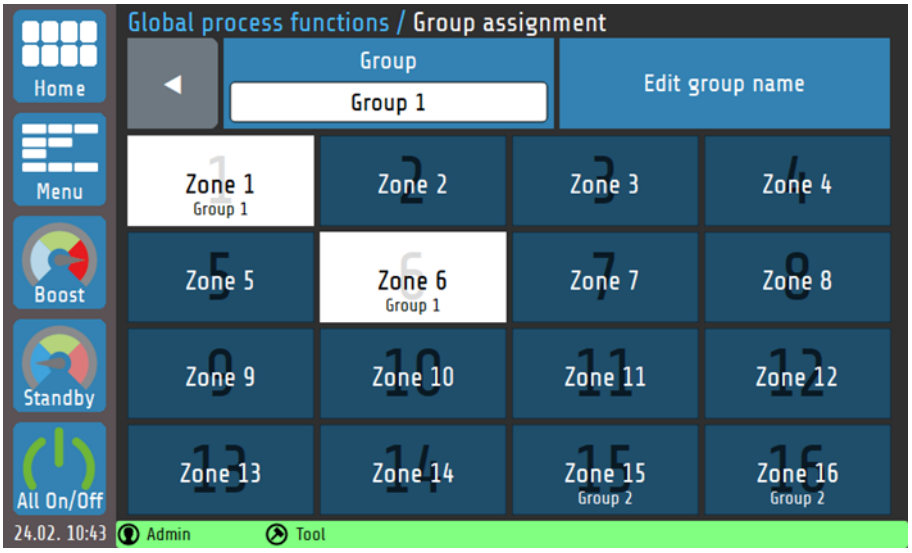
(*): Factory settings

Group assignment	Here you can group any zones together. For more information, see Chapter 9.1.
Restart lock-out off	If the restart lock is active, the zones will not be switched on again after the device is restarted. A query appears, asking whether the previously active zones should be reactivated immediately.
	Setting range: **on, off**(*)
Tool menu	Opens the **tool menu** (see chapter 9.2).

(*): Factory settings

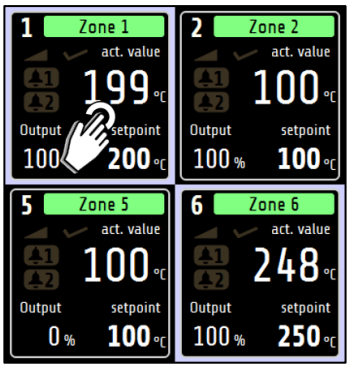
9.1 Group assignment

Groups of zones make it easier to parameterise and operate the device.



Explanation of the individual boxes:

Group Group 1	Selection of one of eight groups to which the selected zones are to be assigned.
Edit group name	Each group can be assigned an individual group name.
Zone 2	The selection area of an unselected zone is displayed in dark blue.
Zone 15 Group 2	The selection area of a zone that is already assigned to a group also contains the name of the group. If these zones are reselected, the affiliation changes to the current group.
Zone 1 Group 1	A selected zone has a white background and includes the group name.



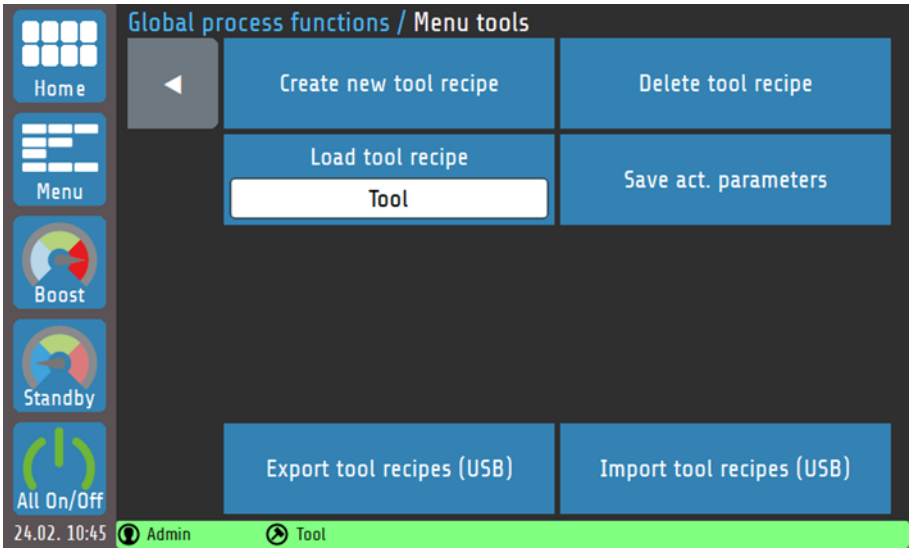
The group affiliation of a zone can also be displayed on the home screen. To do this, all you have to do is hold any zone tile for >1 sec. Subsequently, all zone tiles in a group are bordered white.

REFERENCE!

There are many advantages to **group assignment**. Among other things, for the Multisave tool (see chapter 5.4) or the **parallel circuit** (see chapter 15.5.1).

9.2 Tool menu

Tool recipes contain all control-relevant settings and can be created, loaded, saved and deleted as desired.



Explanation of the individual boxes:

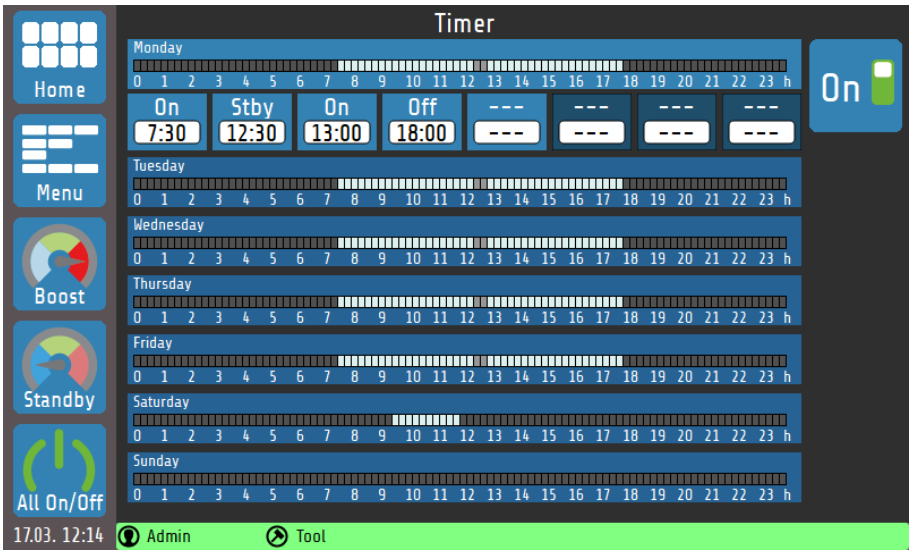
Create new tool recipe	Opens a keyboard with which the name of the new tool recipe can be entered.
Load tool recipe Tool	Opens a selection list with all recipes. The selected recipe is loaded and the parameters are assigned to the zones.
Save act. parameters	The current control-relevant settings can be saved in a previously created tool recipe.
Export tool recipes (USB)	All saved tool recipes are stored as a .tool file on the storage media. The name of the storage file contains the first six letters of the recipe and a timestamp. Example of a file name: **abcdefYYMMDDhhmm.tool**
Import tool recipes (USB)	Tool recipes can also be loaded from a storage medium onto the RT7000. Please note: The tool recipes of the same name will not be overwritten!

NOTE!

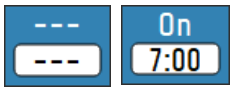
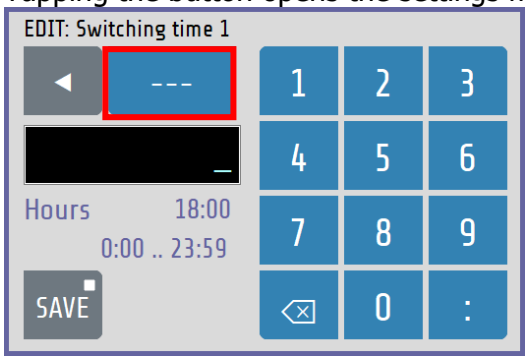
- A tool recipe can only be managed by a user with administrator or machine setter rights.
- A modified tool recipe (e.g. modified by changing a setpoint) is indicated by an asterisk ***** in the status bar.
- Up to 25 tool recipes can be stored on one device at the same time.
- Existing recipes are **not** overwritten during USB import.

10 Timer

The **timer** enables the automated activation and deactivation of the global functions **All on/off** and **Standby** (see 6.1 Navigation bar).

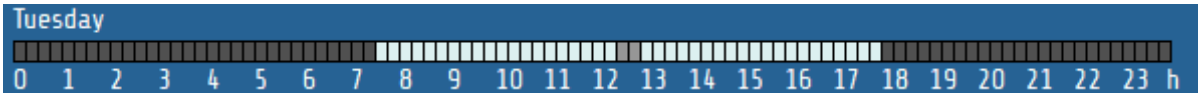


If the timeline of a day of the week is tapped, the buttons of the switching points for that day appear. Explanations for the individual boxes:

	Switching the automatic timer on/off
	This button represents a possible switching point. The top line (white on blue) shows the switching action, and the box below it (black on white) shows the time at which the action is performed. Tapping the button opens the settings menu:  Explanations for the settings menu:  By repeatedly tapping the button marked in red here, three possible switching actions are selected: **---** (no time function), **On** (switch on), **Stby** (standby) and **Off** (switch off).

The desired time for the switching point can be entered using the numeric keys. The two settings (switching action and switching time) are saved by tapping **Save**.
The time presets are automatically arranged in ascending order from left to right when saved.
If the time entered is identical to time already set, the old entry is deleted.
If a switching time is set to "---", this switching time is deactivated and moved to the right.

In the timeline, the times of the different operating states are shown in colour:

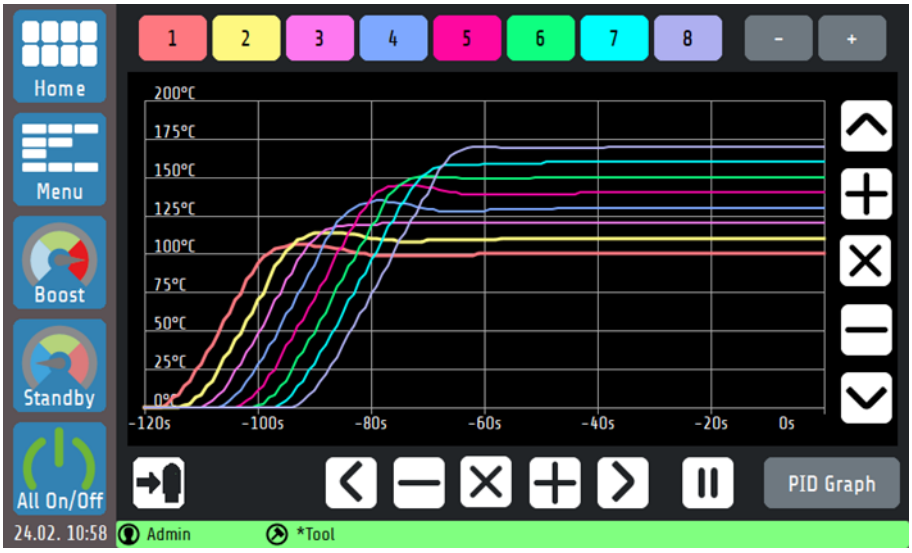


	Zones switched on
	Zones switched off
	Standby active

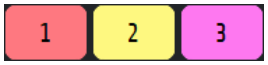
NOTE!
The selected setting can be saved to any days of the week at the same time by holding the **Save** button for >1 second
(see Chapter 5.4 Multisave).

11 Graph

A graphic display of the actual temperature values of up to eight zones is possible simultaneously by selecting the **Graph** function in the main menu:

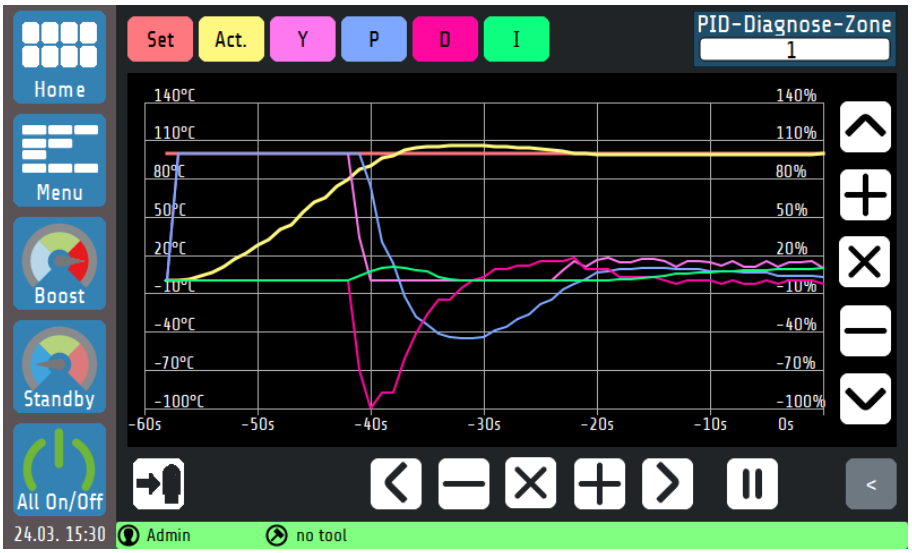


The curves of all zones can be saved immediately to a USB flash drive via the USB export button. Explanations for the individual boxes:

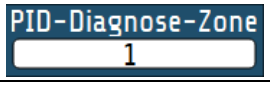
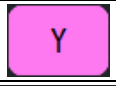
	Show/hide the temperature curve of a zone.
	Switching between zones 1-8, 9-16, etc.
	Saving all temperature values to USB flash drive in .csv format. This parameter is disabled if no USB storage device is present.
	Increasing or decreasing the vertical and horizontal resolution.
	Moving the view to the left, right, downwards or upwards.
	Resetting all zoom and moving actions to the default view.
	Freeze / Continue the view.
	Change to the PID graph display (see chapter 11.1)

11.1 PID graph

By selecting the **PID Graph** button in the **Graph** menu, you can optionally display the curve of the PID components of a zone for further examination. The sum of the PID components the current output ratio **Y** in percent.



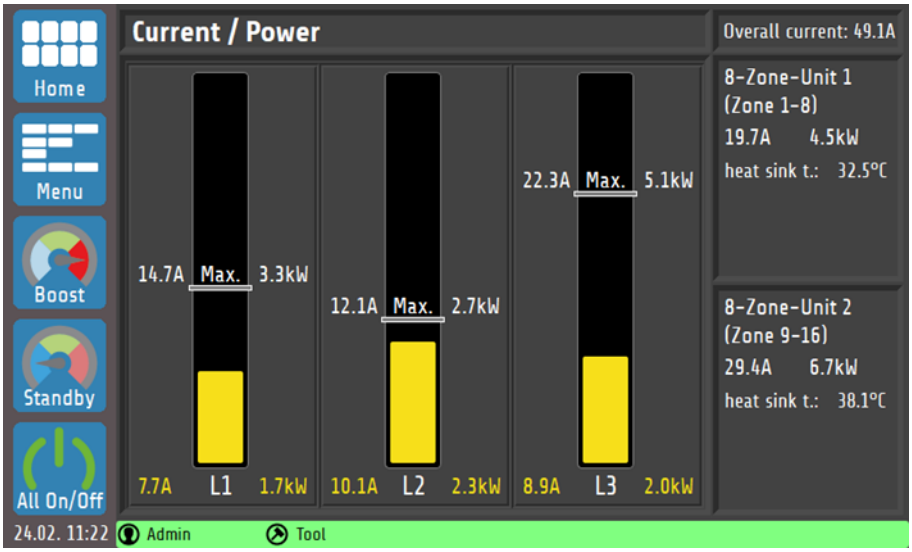
This view shows the temperature curve and the gradients of the P, I and D components for a selected zone. In this way, the influences of the three control parameters on the process can be explored and conclusions can be drawn about the output ratio generation. The control elements for scaling the graph behave as shown in chapter 10. Explanation of the individual boxes:

	Selection of a zone to be viewed.
	Pressing this shows or hides the curve of the setpoint or actual value.
	Pressing this shows or hides the curve of the output ratio.
	Pressing this shows or hides the curve of the P, D or I component.
	Back to Graph (see Chapter 11).

12 Current and power display

The RT7000 automatically measures the current consumption of each zone and calculates the maximum current consumption per phase from the sum of these currents. That would be the value if all zones were working at 100% output ratio. The current power data (shown in yellow) are calculated from the mean current values, which depend on the output ratios that are changeable over time.

A rated voltage of 230 V is assumed for the calculation. Mains voltage fluctuations are not taken into account.



REFERENCE!

The distribution of the zones to the phases can be found in the connection diagrams (see chapter 4.1 Assignment of phases).

13 Logbook

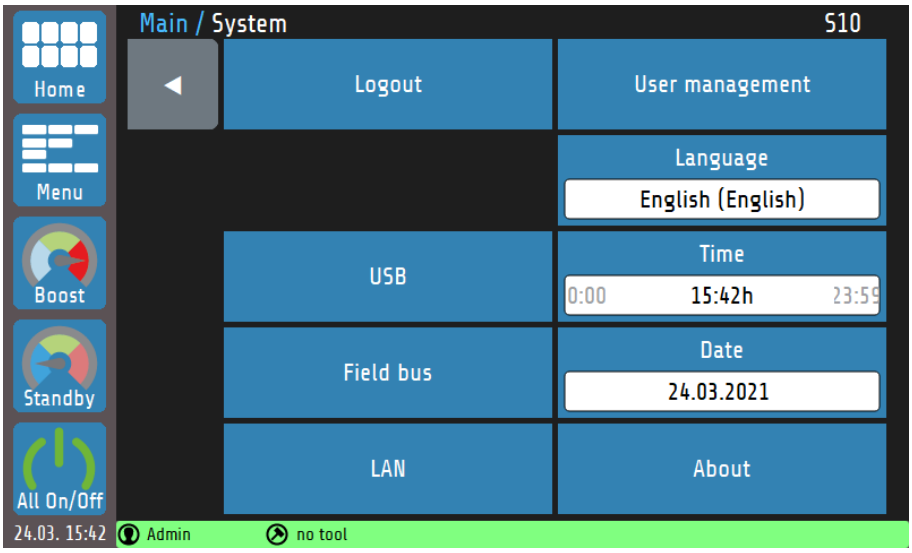
The **log**book displays and stores general events, alarms and warnings, along with the date and time they occur.

Explanations for the individual boxes:

	Scroll down/up page by page in the history.
	Filter for alarms/warnings/messages.
	Delete the logbook (administrator only).
	Export the logbook to a USB flash drive.

14 System

In the **System** menu there are other zone-independent settings:

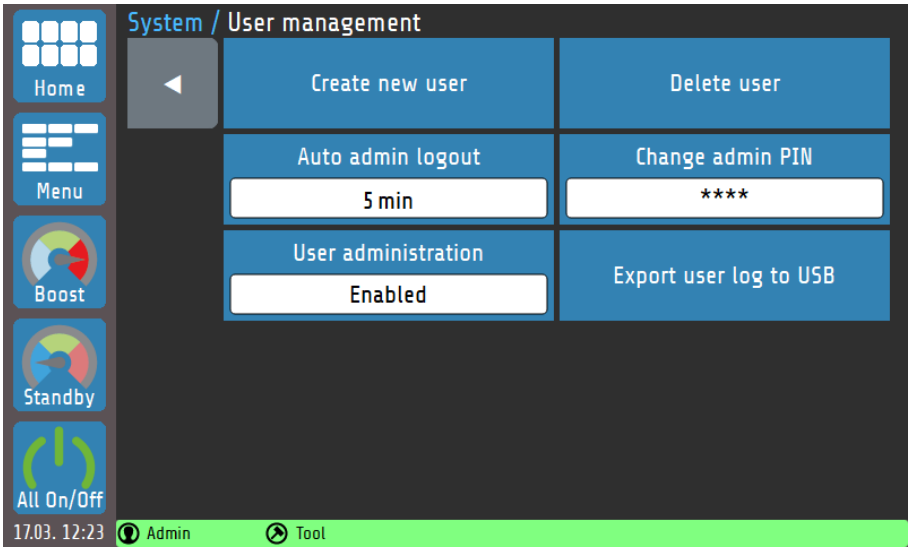


Explanations for the individual boxes:

Logout	User login or logout.
User administration	Configuration of the user settings (see chapter 14.1).
USB	USB settings for saving and loading data.
Field bus	Settings menu for fieldbus connections.
LAN	Network setting: IP address, gateway, DHCP, VNC viewer, etc.
About	Device information, firmware update, restore factory settings, imprint (see chapter 14.2).

14.1 User management

In the **user management**, new users can be created or deleted by the administrator ("**Admin**").



Explanations for the individual boxes:

Auto admin logout 5 min	Setting of after how many minutes the administrator is automatically logged out. Setting range: **OFF, 1 to 5**(*) **to 100 min**
User administration Enabled	If user management is enabled, rights can be restricted. Setting range: **Enabled**(*), **Disabled**
Export user log to USB	Saves the time curve of the device's usage access to a USB storage device.

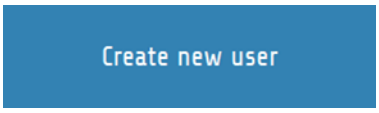
(*): Factory settings

NOTE!

User management can also be disabled by the administrator. In this case, there are no restrictions on the operation of the device and the login query when starting the device is omitted. All users have the rights of an administrator (see chapter 14.1.1).

14.1.1 Creating a new user

Only the administrator has permission to create new users in the User Management. Up to seven additional users can be created.



A new user is created as follows:

1. The process can be started by tapping the **Create New User** box. A keyboard opens. This can be used to enter the user's name.
2. The admin assigns the rights that are valid for the user. A distinction can be made here between the **machine setter** and **the operator**.
3. Issuing of a one to four-digit numeric password. Please note that the user password cannot be changed afterwards.

When the admin creates a new user, he can specify user rights. A distinction is made between the machine setter and the operator. The rights of the user types are listed below:

Administrator:	• Has all rights. • Is the only person who can create new users or delete existing ones. • Can disable user management. • Can reset the device to the factory settings.
Machine setter:	• Can set all parameters and edit tool recipes. • Does not have rights for user management.
Operator:	• Can set the setpoints of all zones. • Can switch the **Boost/Standby** function on and off.

14.1.2 Changing the Admin PIN

When the device is used for the first time, only the Admin user exists. He has the following factory-set login code:

Admin PIN: 0000

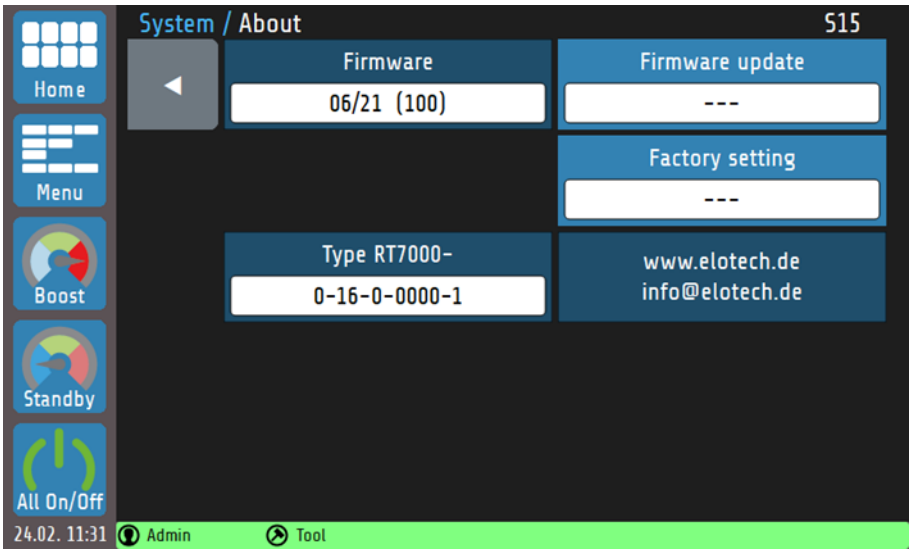
A new code can be assigned by tapping the **Change Admin PIN** box.

NOTE!

If the admin password should be lost, a **machine setter** can reset the device to the **factory settings**. The Admin PIN then corresponds once again to the factory setting **0000**.
Please note that all parameters will be deleted, so take appropriate precautions for data backup, e.g. in the form of **tool recipes** (see chapter 9.2).

14.2 About (Firmware Updates & Factory Settings)

Device-specific information can be read and modifications made by tapping **About** in the system settings.



Explanation of the individual boxes:

Firmware 39/20 (100)	Display of the currently installed firmware.
Firmware update ---	Opens a dialog box that can be used to install a firmware update via USB.
Factory setting ---	Resets all parameters to factory setting and deletes all users (except **Admin**).
Type RT7000- 0-16-0-0000-1	Display of the Type key (see chapter 2.2.1).
www.elotech.de info@elotech.de	Manufacturer's service contact details.

15 More detailed description of the function

The following chapters contain more detailed information about the individual functions and explain the content and effect of the functions.

15.1 Soft start (start-up circuit)

The soft starting of cold machines and systems extends the machine lifetime and saves energy at the same time.

In order for a zone to start via **soft start,** a limited output ratio (default 30%) and a **soft start setpoint** must first be defined. After reaching the soft start setpoint, the temperature is controlled for the duration of the **holding time**. After the holding time has elapsed, the zones are adjusted to the desired setpoint.

REFERENCE!

If a Temperature ramp is parameterised for a zone (see chapter 15.2), it becomes active only when the holding time of the **soft start** has elapsed.

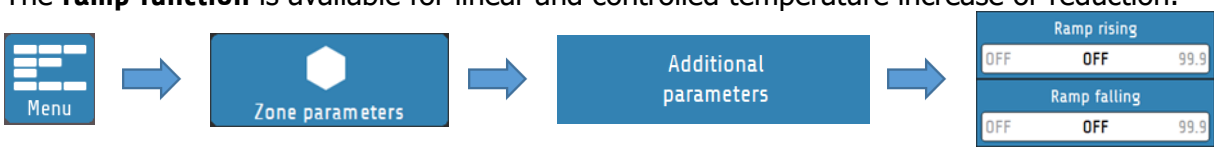
The start-up circuit is active if:

- the controller is switched on **and**
- the current actual value is less than the difference between *soft start setpoint and 5% of the measuring range*.

If the soft start is in operation, the Self-optimising (see chapter 15.3) cannot be called up during this time. In addition, the soft start always has priority over the ramp and, if necessary, other setpoint specifications.

15.2 Temperature ramp

The **ramp function** is available for linear and controlled temperature increase or reduction.

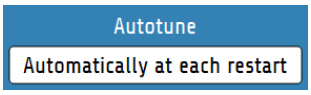
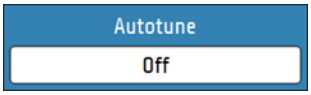


The temperature of a zone is increased or decreased in even steps via a setpoint ramp [$^{K}/_{min}$] in accordance with an adjustable heating rate [K]. The **ramp function** deactivates as soon as the set control setpoint is reached. The start-up circuit oversteers the ramp function. The ramp becomes active only after the start-up circuit has expired.

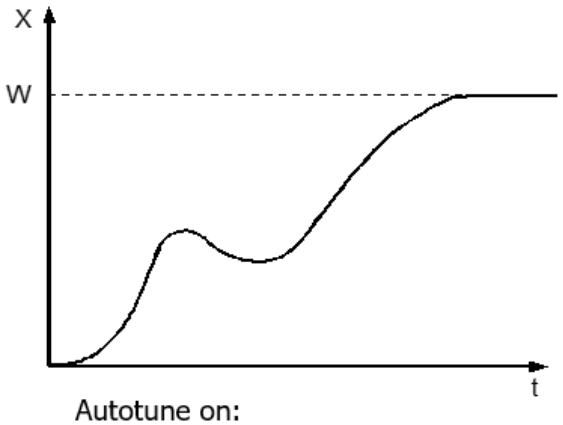
15.3 Self-optimising

The RT7000 is able to determine the optimal control parameters for each connected load independently.

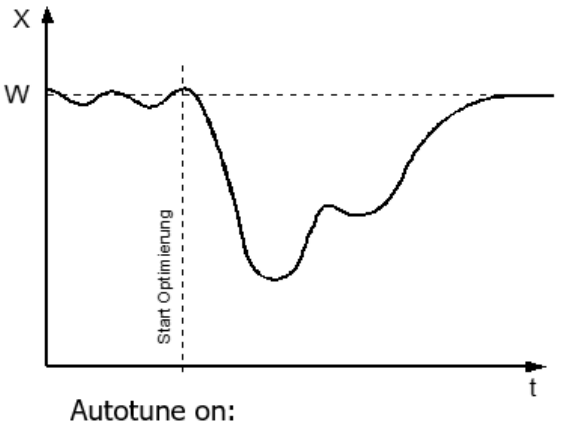
Optimisation can be triggered at any time by selecting **Autotune = Start**. After calculating the feedback parameters, the controller automatically guides the measured value to the desired setpoint. Self-optimisation can be set in the zone parameters as follows:

	Selection: **Start** Starts the optimisation immediately.
	Selection: **Automatically at each restart** An optimisation is performed after each device restart.
	Selection: **Off** Optimisation is stopped or no optimisation is carried out.

An error message is displayed if the optimisation takes longer than 20 minutes. The optimisation algorithm determines the characteristic data of the section in the closed control loop and calculates the feedback parameters (xp, Tv, Tn) of a PID controller, which are valid over a wide range.
Optimisation takes place at start-up just before the set setpoint. When optimising at a setpoint that has already been reached, a temperature reduction of approx. 3.5% of the measuring range is initially carried out.



Autotune on:
Optimisation to a heating system



Autotune on:
Optimisation to already achieved setpoint

NOTE!

For the execution of the self-optimisation, it should be noted that:

- the setpoint must be at least 5% of the measuring range,
- there must be no sensor error,
- the soft start must not be active.

15.4 Global temperature changes (Standby, Boost)

The global temperature changes are configured for both the **Boost** and **Standby** functions via the Zone parameters and can be done individually for each zone (see chapter 7.1).

Global temperature increase: "**Boost**"
The **Boost** function leads to a short-term temperature increase that goes beyond the control setpoint. To do this, a **boost value** must first be set. The "Boost Temperature " is composed of the sum of the **setpoint** and the **boost value**. If the **Boost value** parameter is set to **OFF,** the zone does not participate in the global temperature increase.
In addition, a **boost duration** can be set. The boost temperature is held for the time set as the **boost duration**. The time period for which the boost remains active begins only after reaching the boost temperature. The function is automatically deactivated on expiry of this time. It should be noted that the **Boost** function can switch off at different times for zones with the same **boost duration** depending on how long the heating up has taken. If the **boost duration** is set to **OFF,** the **Boost** function for this zone switches off immediately after reaching the boost temperature.

Global temperature reduction: "**Standby**"
Standby mode saves energy during breaks or a short production stop without having to shut down the complete system.
Global temperature reduction lowers the control setpoint for all zones to the **standby setpoint**. If the **standby setpoint** parameter is set to **OFF**, the zone does not participate in the global standby function. The button is located in the navigation bar and is always visible in each menu. The standby state must be switched off manually.

Global temperature changes are activated and deactivated using the Navigation bar (see chapter 6.1).

15.4.1 Standby / Boost via external control signal

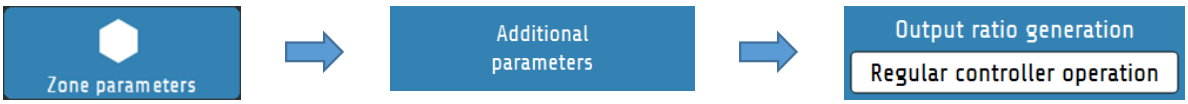
The global functions **Standby** and **Boost** can also be activated by an external control signal. Whether, and if so, which of the two functions should be operated can be set in the **Global Process Functions** menu. The respective function can then no longer be started via the touch display.
Whenever the external control signal is active (and configured to Boost or Standby), the two functions can no longer be operated via the touch display.

In addition, the external control signal is prioritised over an input via the touch display. Example: The external control signal is parameterised to standby and the boost has been activated via the touch display. When the external signal becomes active, the boost is immediately aborted and the standby is initiated.

When controlling the **Boost** function via the external signal, the **Boost duration** parameter loses its effectiveness. The boost remains active until the control signal switches off again.

15.5 Output ratio generation

The output ratio generation determines the operating mode of a zone. The device can generate the output ratio in four different ways. The switching of the operating mode is mainly relevant in the case of sensor errors. Several options are available at this point in order to continue operating a zone with a defective sensor in emergency mode.

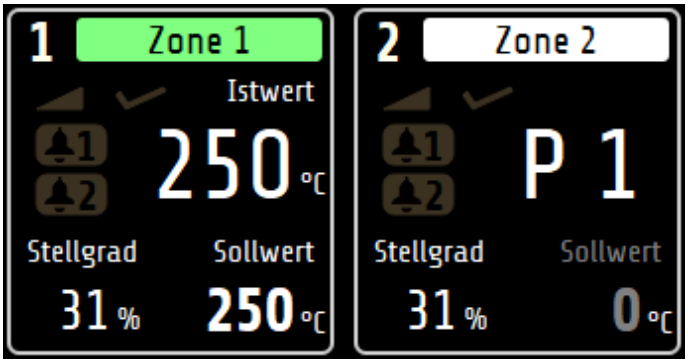


In addition to the output ratio generation from **the control mode,** in which the device determines the output ratio by means of control calculations and adjusts it dynamically, the operating mode can also be configured differently.

15.5.1 Parallel connection of zones (coupling, output ratio adoption)

One possible operating mode is the **output ratio adoption from another zone.** We also talk about the *coupling* or *parallel connection* of zones.
If a measuring sensor of a zone fails during operation, it is possible to couple the affected zone to another, similar zone.
After this mode of operation has been selected, a selection window opens in which the desired zone can be selected for coupling.

The parallel connection allows the work process to be continued with a correct function and terminated to subsequently carry out repair. The coupling of zones causes the defective zone to take over the **output ratio** of an intact zone.



A coupled zone is symbolised on the **home screen** by a white bar within the **zone tile**. Instead of the actual value, this zone contains a **P** (for **parallel connection**) and the number of the coupled zone (here: **Zone 1**)

REFERENCE!

When **coupling** zones - for security reasons - only zones that are in the same group can be selected (see Chapter 9.1).
If no Group assignment has been carried out, any zone can be selected for coupling.

The coupling of zones is an operating mode that can be used to avert acute damage to the system in the event of a fault or machine downtime during an ongoing process.

WARNING!

If the coupling/parallel connection of zones is used as an emergency function, the fault in the system that activated the function should be rectified immediately after the work process has been completed! Improper actions can result in personal injury or damage to property!

15.5.2 Automatic output ratio adoption

The **automatic output ratio adoption** offers the possibility of an automated change of operating mode in the event of a sensor failure.

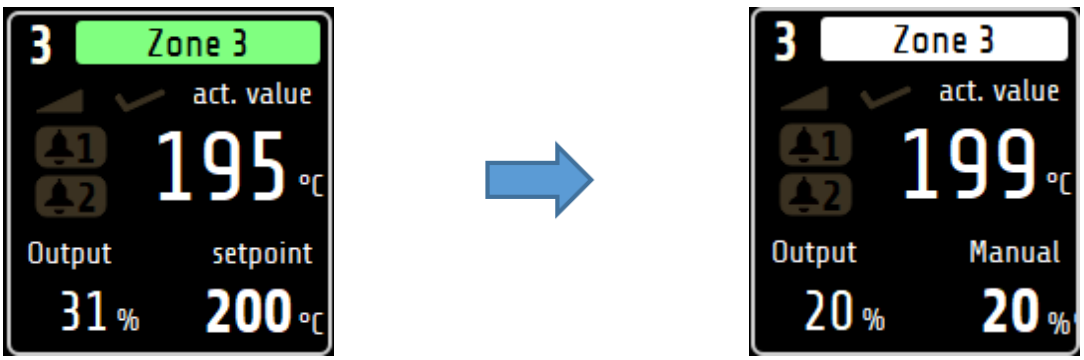
The zone normally operates in **control mode**. When the zone is stabilised, the device automatically switches to Manual operation (manual output ratio) in the event of a sensor error and continues with the last valid output ratio. The output ratio can subsequently be changed by the operator.

An output ratio of 0% is output if:

- the output ratio is 100% at the moment of the sensor breakage,
- the control deviation from the measuring range is >0.25% at the moment of the sensor breakage,
- the soft start circuit is active at the moment of the sensor breakage,
- the controller is currently following a setpoint ramp,
- the P-share (x_p) = 0.

15.5.3 Manual operation (manual output ratio)

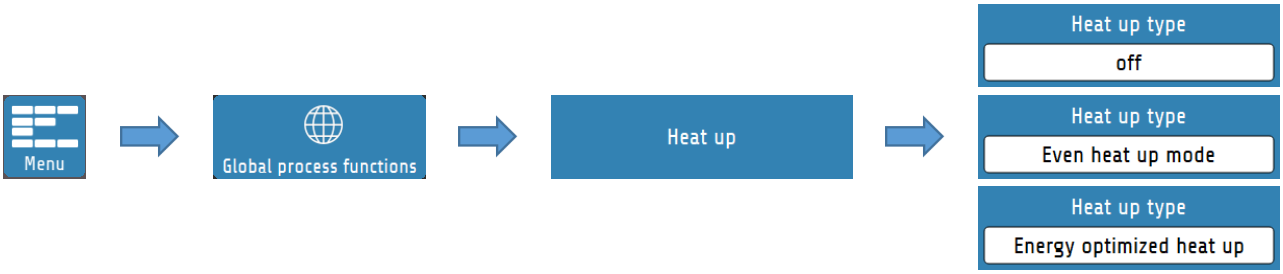
In the **manual operation,** the controller operates with an output ratio set by the operator (*manual output ratio*) – control is out of service. In **manual operation,** the zone tile on the **Home** screen changes as follows:



The zone now no longer follows colour coding but is permanently displayed in white. The set manual output ratio is displayed instead of the setpoint. The manual output ratio can be entered in the Home screen (Home) by tapping the zone tile.

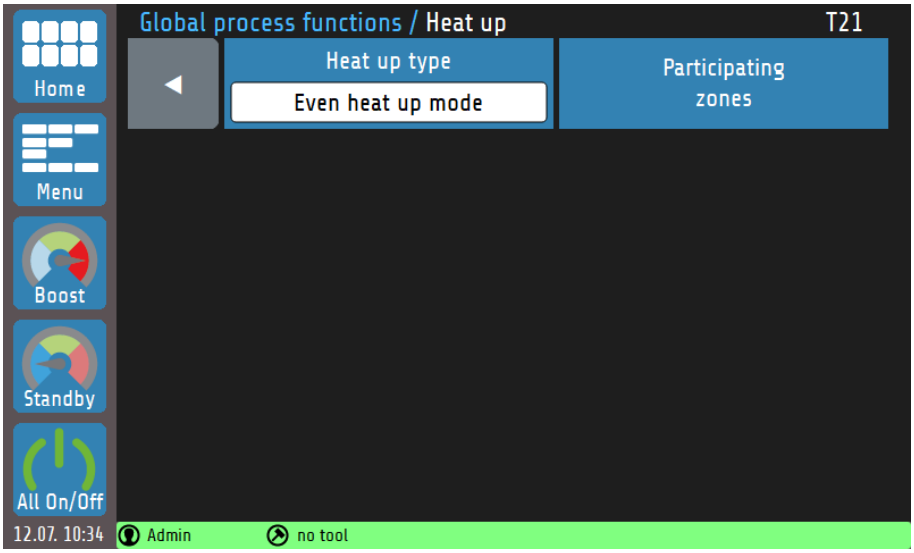
15.6 Heat up modes

The system can be heated up at the start of operation in different ways. The system can be heated evenly to the same temperature by compound heating by means of a control zone, or **energy optimised** with the objective of reducing the energy requirement by the time-delayed switching on of control zones.



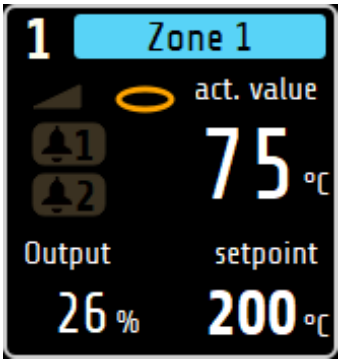
15.6.1 Even heat up mode

If the **even heat up mode** is switched on, the heating speed is set by the zone with the lowest actual value, the **compound control zone**.



The control zone is regulated to the specified setpoint during heating at full power, while the output ratios of the connected zones are dynamically oriented to the actual value of the compound control zone. Thus, all zones have approximately the same actual value during the heating phase.

The zones that are to participate in the compound heating are selected via the box **Participating Zones**.



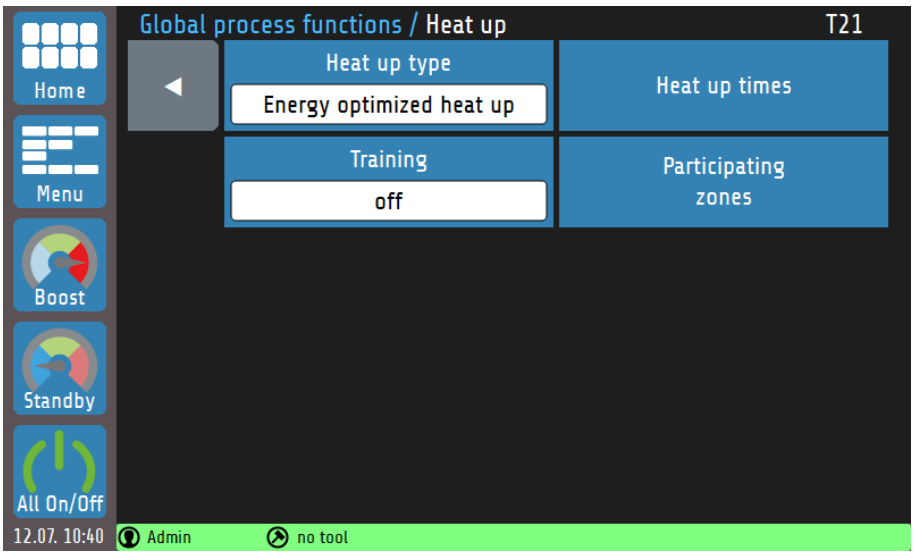
Zones that are currently participating in the even heat up mode are marked by a yellow ring on the home screen. Furthermore, a message that the **heat up mode** is active appears in the **status bar** during the active heat up.

NOTE!

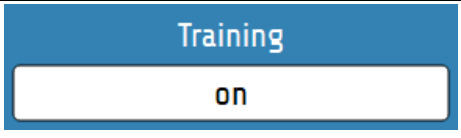
Faster heating zones can have a temperature difference of approx. +15 °C compared to the compound control zone.

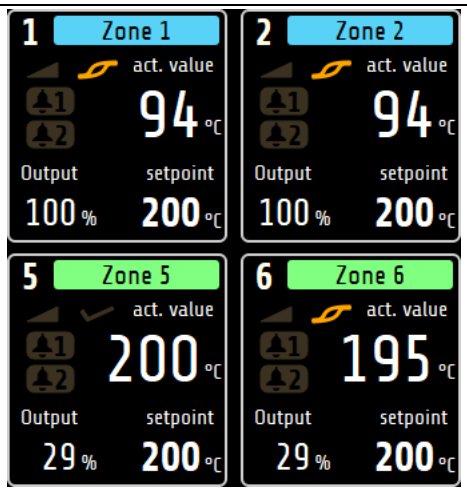
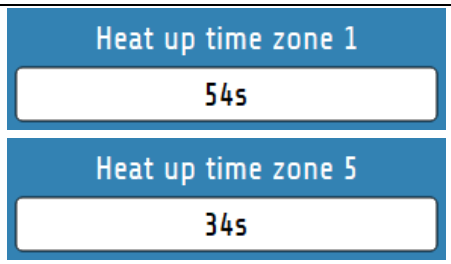
15.6.2 Energy optimised heat up

It is usual for parts of a control system to differ in their mass, thermal conductivity and thus heating speed. To reduce the energy consumption and energy costs, systems can be heated up in such a way that faster zones are only started when they will reach their setpoints at the same time as slower heating zones.



In **energy optimised heat up**, the time that a zone needs to reach its setpoint is first measured. The next time the system is started up, the zones are switched on with a time delay so that all zones reach their operating point at the same time. In order to start the system with energy-optimisation, proceed as follows:

Step:	Description:	Illustration / reference:
1.	In order to determine the heating times, the control zones should first be **optimised**. Optimisation is not necessary if regulation without optimisation produces satisfactory results, or if adequate regulation is achieved through the input of appropriate PID parameters.	See Chapter 15.3 Self-optimisation.
2.	Select the parameter **Training** and set it to **on**. The next time the system is started, the **RT7000** measures the heating times of each zone.	
3.	Now switch the **RT7000** off by the mains switch or the **All On/Off** button and only switch it on again when all zones have cooled down.	

Step:	Description:	Illustration / reference:
4.	The time measurement starts as soon as the control system has been started again. Make sure that the zones have cooled to ambient temperature so that the measurement is not influenced. Zones that are in **energy optimised heat up mode** are illustrated symbolically on the Home screen (Home). On completion of the "Teaching procedure", the parameter **Training** is automatically reset to **off**.	
5.	On completion of heating, the taught time values can be viewed under **Heat up times** and manually changed if necessary.	

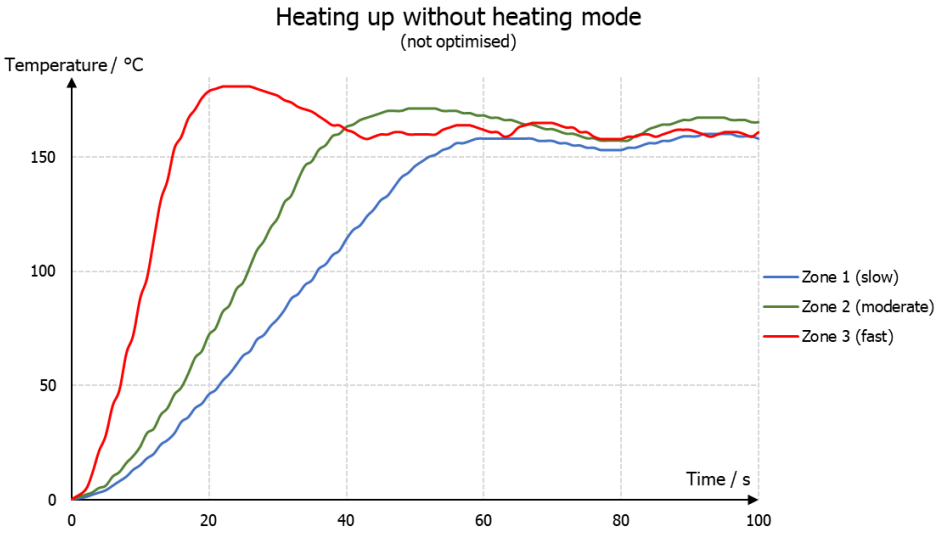
When the system is restarted in future, the zones are heated with a time delay. In the example from step 5, **Zone 1** requires 55 seconds to reach the setpoint, while **Zone 5** needs only 34 seconds. Accordingly, Zone 3 is switched on **21 seconds later**.

15.6.3 Comparison of the heating modes

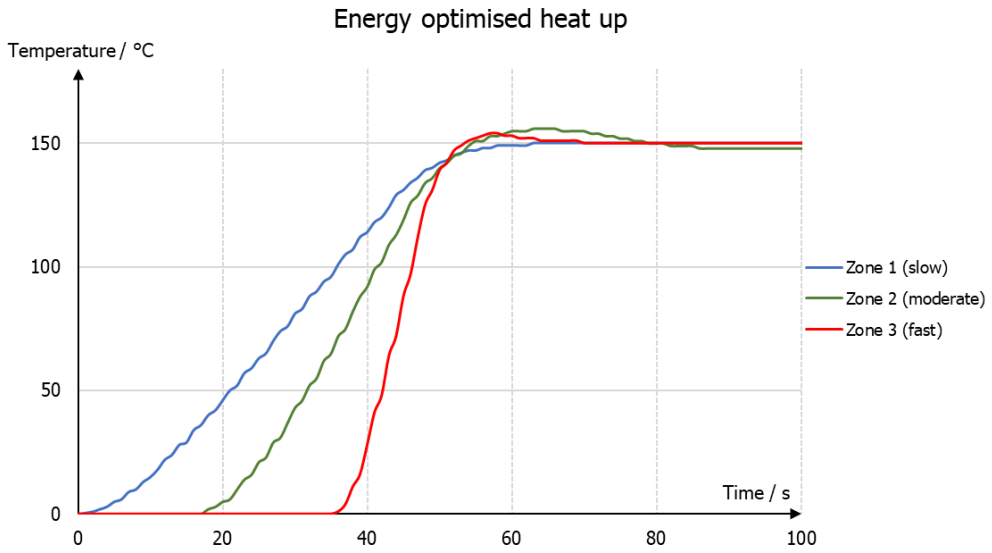
In this chapter the three heating modes **compound heating**, **energy-optimised heating** and **heating without heating mode** (parameter: **OFF**) will be compared graphically.

Three control zones are considered in the following examples. Zone 1 is the zone with the lowest heating rate and Zone 3 that with the highest. The setpoint for all zones is 150 °C.

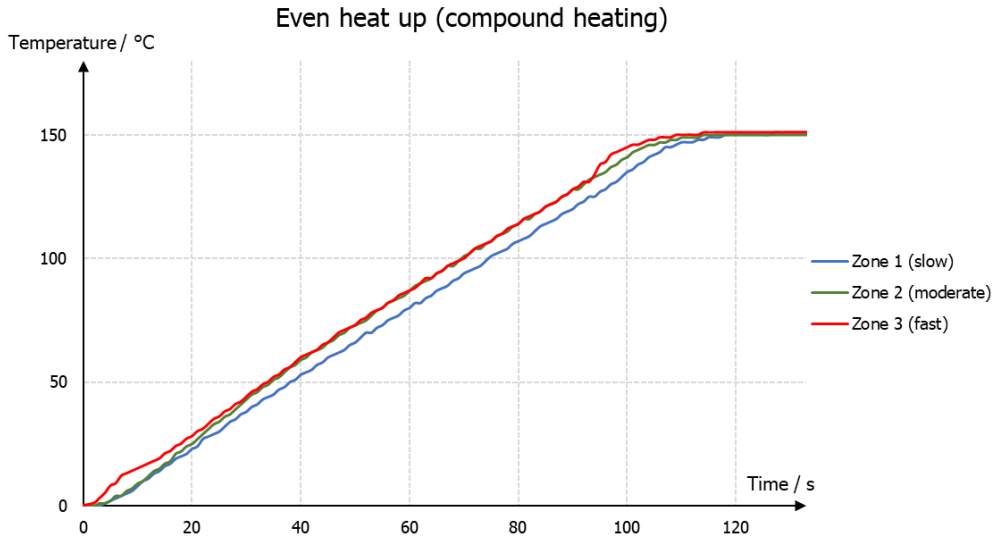
If the device is started **without heating mode**, all activated zones begin to heat at the same time. Faster zones (e.g. small components such as nozzles) reach their setpoints much earlier than slower zones. Note that the zones have not been optimised in the following illustration. The deviations of the actual values from the setpoint are minimised by a completed optimisation (see 15.3 Self-optimising).



If a production process requires all zones to reach their operating temperature (setpoint) before production can begin, **energy optimised heating** is recommended. The zones switch on in succession so that the operating temperature is reached at the same time. Energy costs are lowered, as faster zones are switched on later and the setpoint does not need to be maintained until further zones are ready for operation.



In compound heating, all participating zones are heated evenly, i.e. the actual values are always similar. The slowest zone is heated at 100% output ratio, while the faster zones are heated with less power. In this case, too, the setpoint of all zones is reached simultaneously. **Compound heating** is suitable for heating that is gentle on the machine, as thermally induced mechanical stresses occur due to the heating process. These stresses are reduced by even heating or even expansion.



15.7 Monitoring

Monitoring can be used to apply various monitoring functions to the individual zones.

The **monitoring** has two independent signal paths (channels), which are represented in the zone tiles of the home screen by the bell symbols  . If the monitoring signal of a channel is active, the colour of the bell symbol changes from grey to a selectable signal colour (red, orange or green). Certain events such as system errors have specified colours. If multiple events occur with different colours, the priority is: red, orange, green.

In the monitoring menu, you can specify which type of monitoring functions should be integrated into the signal chain of the respective channels.

The following configurations are possible:

- Monitoring temperature limit value overshoot/undershoot (relative/absolute),
- Monitoring temperature limit value within tolerance band (relative/absolute),
- Heater current monitoring.

Via the selectable colours, as well as the possibility to invert the logic of the signal, it is possible to signal both limit value violations and alarm states as well as releases.

15.8 Timer

The timer offers the possibility to start or stop the control mode of the device automatically, or to put the control zones into the **standby** state. Individual times can be set for each day of the week. It should be noted, however, that when the device is operated beyond the daily limits (12 midnight), the last switching point of the day is valid until the first switching point of the following day. If no switching point is defined on the following day, the last regular switching point is valid for several days until the next switching time occurs.

After restarting the device, the operating state (**On**/**Off**/**Standby**) present at the time of switch-off is restored, regardless of the currently valid switching value of the timer. The regular timer mode only starts again with the entry of the chronologically next switching point.

15.9 DHCP

The RT7000 is capable of communicating with a DHCP-Server. Thus, the IP-Parameters of the connected network will automatically be adopted by the device.
DHCP can also be disabled so that users can manually set IP-Parameters.

15.10 Viewer

With the Viewer function, the RT7000 can be remotely controlled with the help of a computer, smartphone or tablet. Transmission is via **VNC** (Virtual Network Computing). In order to connect to the RT7000, a four-digit code must be entered. This code can be viewed and changed in the LAN menu.

A **VNC viewer** is required on the respective terminal device.
The following links offer a selection of VNC viewer applications that have been tested with our products:

- Apple
  https://apps.apple.com/de/app/vnc-viewer-remote-desktop/id352019548
- Android:
  https://play.google.com/store/apps/details?id=com.realvnc.viewer.android&hl=de
- Windows:
  https://www.tightvnc.com/download.php

16 Error messages

Display	Meaning	Possible remedy
	Measuring range overflow, sensor error	Check the sensor and cable
	Measuring range underflow, sensor error.	Check the sensor and cable; check the actual value offset; thermocouple poles swapped?
REMOTE: Parameters locked	Operation is not possible because the controller is controlled via a fieldbus.	Profibus: The "Remote" parameter in the fieldbus menu is turned on.
DataFlash Init Error	Error in the display texts.	Contact the manufacturer.
ERR 0	Factory adjustment parameters incorrect.	Send the device to the factory for inspection.
ERR 8	Power fail-safe parameter memory reports errors.	Delete error message; check parameters. In case of repeated occurrence, send device to the factory for inspection.
ERR IO-Board	Error of the output stage assembly	Return the device to the factory for inspection.
Attention! Unplug the mains plug!	The cover plate of the device has been opened during operation.	Switch the device off immediately and unplug the mains plug (see chapter 3.3 Replacement of fuses).

17 Technical data

17.1 Inputs

Sensor inputs

Name	Standard	Measurement range	Measuring accuracy [a]	Ambient temperature influence
Number		Corresponds to the number of zones		
Type J (Fe-CuNi)	EN 60584-1: 2014-07	0 to 800 °C	< 0.25 %	< 0.01 %/K
Type L (Fe-CuNi)		0 to 1200 °C	< 0.25 %	< 0.01 %/K
Type K (NiCr-Ni)	EN 60584-1: 2014-07	0 to 800 °C	< 0.25 %	< 0.01 %/K
Reference point		internal		
Linearisation error		0.2 %		
Reference point accuracy		± 1 K		
Protective device		• Sensor breakage protection: Electronic detection with signalling • Reverse polarity protection		

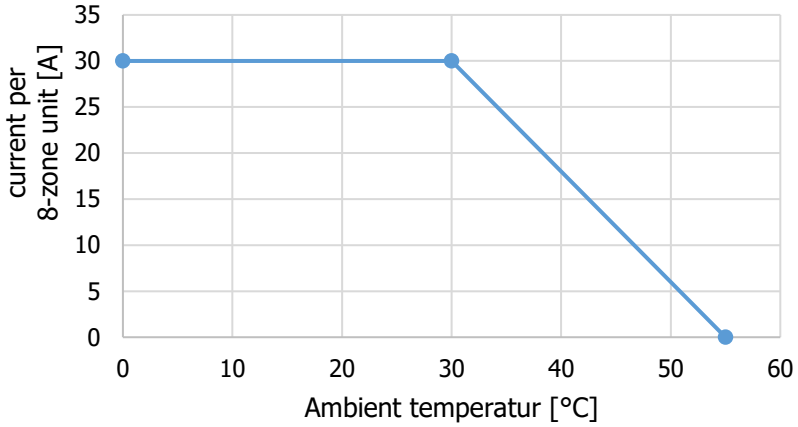
[a] The accuracy data refer to the maximum measuring range.

Input for potential-free contact

6-pin Han E socket on rear panel	No external voltage may be applied! Internal switching voltage max. 24 V Internal resistance > 5kOhm Switching level; logical 0 < 2 V; logical 1 = 9 to 24 V

17.2 Outputs

Power outputs

Number:	Corresponds to the number of zones
Power rating:	230 V AC single phase + N, max. 14 A resistive load per zone
Load capacity:	Each output stage group (zones 1-8 / 9-16) may be loaded with a maximum of 6.5 kW (30 A). An overload of the total power of an output stage group of 20% is allowed for 20 minutes during start-up. These data apply at an ambient temperature ≤ 30 °C. At higher ambient temperatures, the following derating (reduction of the permissible current) must be observed: 
Output signal:	pulse width modulation, switching in zero crossing
Fusing:	Use only fuses with the size and rating 6.3 x 32 mm – 250 V – 16 A – blowing behaviour FF! Spare part number: FB1600

Relay output F

6-pin Han E socket on rear panel	Load capacity: max. 48 V DC, max. 2 A, potential-free

17.3 Interfaces

Fieldbus

RS232	electrically isolated
RS485	
TTY	

Ethernet

Addressing range:	IP address can be set
Connection:	RJ45 on back

USB

Connection:	On front side for storage medium e.g. for firmware update, saving/loading parameter sets, etc.

17.4 Electrical data

Mains supply: (Mains cable permanently installed)	400 V AC 3~/N/PE 50/60 Hz	8-zone device: 6.5 kW load 16-zone device 13 kW load Each ampere load current generates approx. 1.5 W thermal power dissipation
Power rating:	Own consumption 10 W Approx. 1.5 W thermal power dissipation per ampere load current	
Mains plug:	CEE-16 (8-zone device), CEE-32 (16-zone device)	
Power outputs:	230 V + N (max. 14 A) The output stages are thermally monitored and, if necessary, adjusted down.	
Protective conductor current: (leakage current)	0.15 mA for the internal electronics. Additional leakage currents may occur due to the externally connected heaters.	
Electrical safety:	According to EN 61010-1:2010; overvoltage category II to 300 V mains voltage; contamination level 2	
CE marking:	The device complies with the Electromagnetic Compatibility Directive (2014/30/EU) and the Low Voltage Directive (2014/35/EU), which are the basis of the CE marking.	

17.5 Environmental influences

Ambient temperature range	
Operation:	5 to 40 °C
Transport, storage:	0 to 70 °C
Climatic environmental conditions	
Climate resistance:	≤ 75% rel. humidity without condensation
Storage:	Class 1K2
Transport:	Class 2K3
Operation:	Class 3K3
Mechanical environmental conditions	
Storage:	Class 1M2
Transport:	Class 2M2
Operation:	Class 3M2
Electromagnetic Compatibility (EMC)	
Interference emission:	Class A
Interference immunity:	Industrial environment

17.6 Display and operation

Operating unit:	7-inch (17.8 cm) colour LCD with capacitive touch panel
Resolution:	800 x 480 pixels

17.7 Housing

Housing type:	Steel and aluminium stand housing		
Protection class:	IP20		
Protection class:	1		
Weight:	8-zone device: 16-zone device:	Approx. 8.5 kg Approx. 10.0 kg	(incl. 2.5 m mains cable)
Dimensions [mm]:	428 x 345 x 199 (W x D x H) See Chapter 3.2 Installation space of the 8 to 16 zone device.		

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Imprint

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Subject to technical changes!