R4000

Temperature Controller with
1, 2, 4, 6, 8, 12* or 16* zones Heating/Cooling

* With the extension module R4010 up to 16 zones can be connected.

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 (↗15). 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:

- f 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
www.elotech.de	Font for texts as shown on the controller display.
MRS / MRE	**M**easuring **R**ange **S**tart / **M**easuring **R**ange **E**nd
(*)	This symbol indicates the factory default value of a parameter. If the device is reset, the parameter reassumes this value.
↗	This symbol indicates a cross-reference to a chapter in the manual.

2 Assembly instructions

Make sure the device is used for the intended purpose only.

R4000 controllers are designed for installation in control panels. Protect the device against impermissible humidity and contamination. The permitted ambient temperature range may not be exceeded. Electrical connections must be made according to valid regulations and by properly qualified personnel.

If using thermocouple sensors, compensation lines have to be connected directly to the controller terminals. Sensors may be connected only in compliance with the programmed range. Sensor cables and signal lines (e.g. logic or linear voltage outputs) must be laid separately from control lines and mains voltage supply cables (power cables).

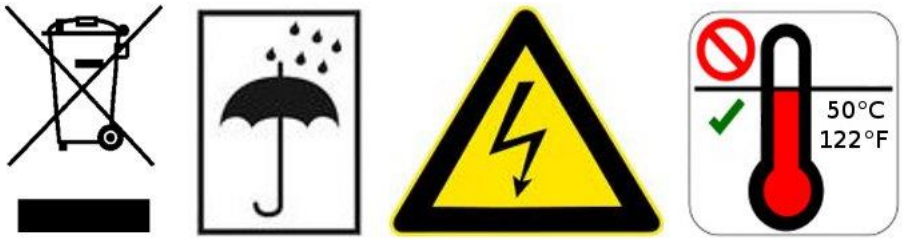
In order to maintain CE-Compliance screened detectors - and signal lines have to be used. It is not permitted to connect the grounds of the sensor-inputs and logic-outputs with each other.

Separate installation of controller and inductive loads is recommended. Interference from contactor coils must be suppressed by connecting adapted RC-combinations parallel to the coils. Control circuits (e.g. for contactors) should not be connected to the mains power supply terminals of the controller.

The configuration parameters are generally to be selected first (↗13 System)**.**

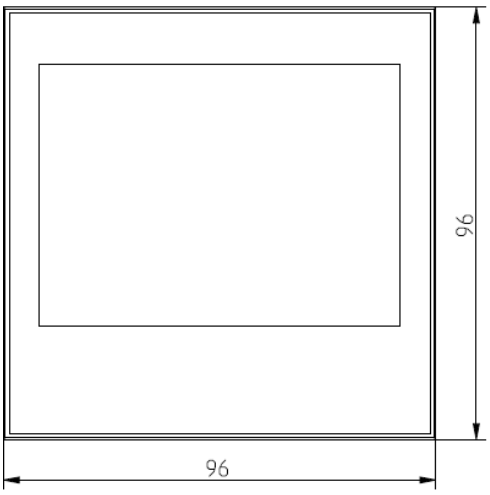
The contents of this document are checked for the conformity with the hardware and software described. Nevertheless, we are unable to preclude the possibility of deviations so that we are unable to assume warranty for full compliance. However, the information given in the publication is reviewed regularly. Necessary amendments are incorporated in the following editions.

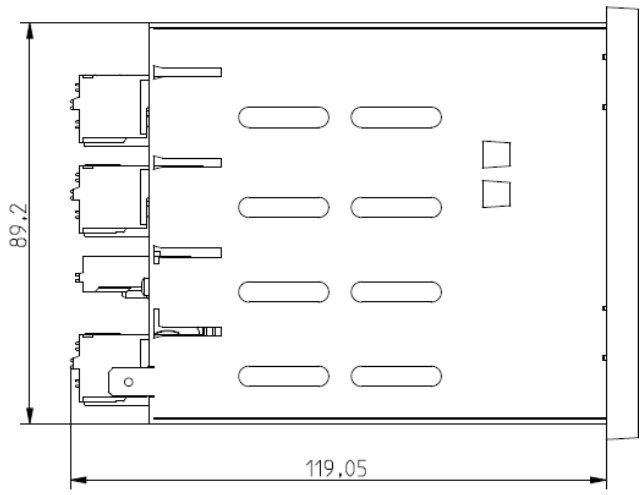
We would be pleased to receive any improvement proposals which you may have. The information contained herein is subject to change without notice.

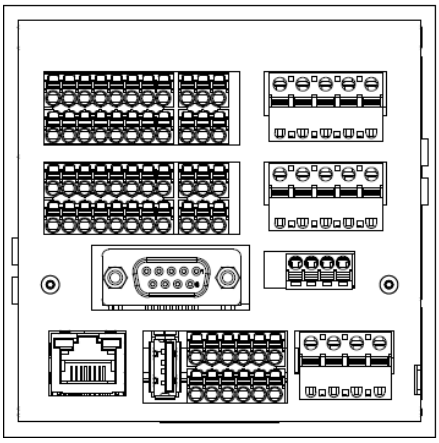


Electronic scrap and components are subject to special treatment and must be disposed of by authorised companies.

2.1 Dimensions







3 Type key

R40X0	-	X	-	Z	-	Y	-	000	-	DD	-	P

Mains Connection	
5	24 V/DC

Fieldbus	
00	No
03	RS 232-C + RS 485 + 0-20 mA TTY *
08	Profinet *
09	Profibus-DP *
90	E-Bus for extension module R4010

Heizstromüberwachung	
0	No
5	Yes (only possible with logic outputs)

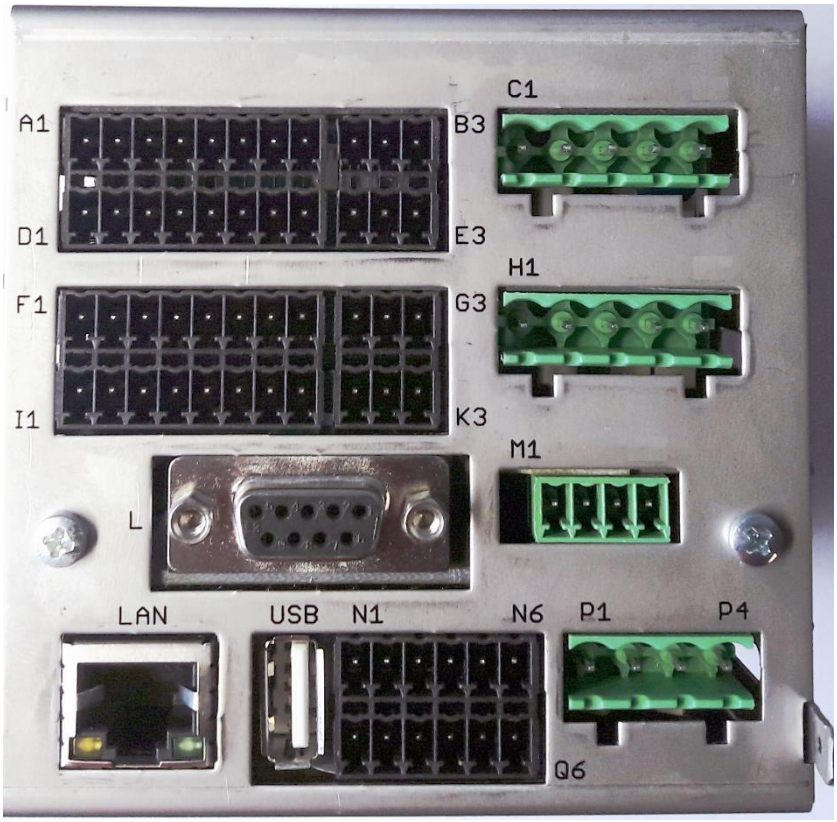
Number of control zones	
1	1 zone
2	2 zones
4	4 zones
6	6 zones
8	8 zones
12 to 16 zones **	

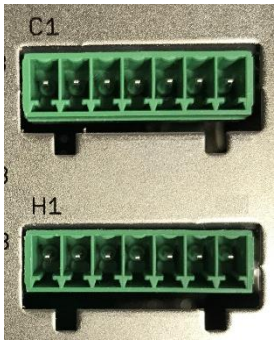
Version	
0	Outputs: 1x Logic + 1x Relais
1	Outputs: 1x Logic + 1x 0-10 V or 0/4-20 mA
Here: Outputs per zone	

* : Including E-Bus

: If more than eight zones are required, an 8-zone controller must be supplemented with an extension module **R4010. An E-bus interface is required for communication with the R4010.

4 Connection diagrams



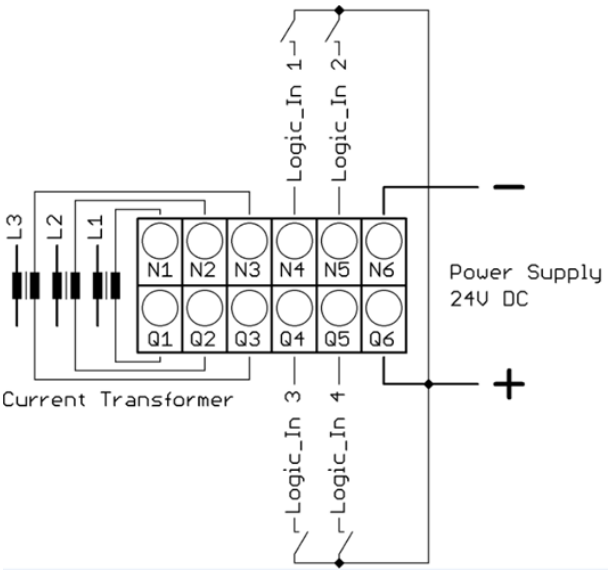


Option: continuous

Ground connection

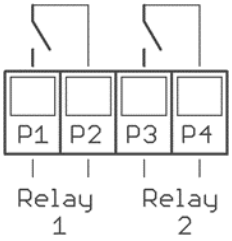
Flat plug 6,3 mm must be connected to an earth rail via a thick cable (>= 4 mm^2) in the shortest possible way (< 20 cm)!

4.1 Connection Diagramm: Power supply, logic inputs and heater current

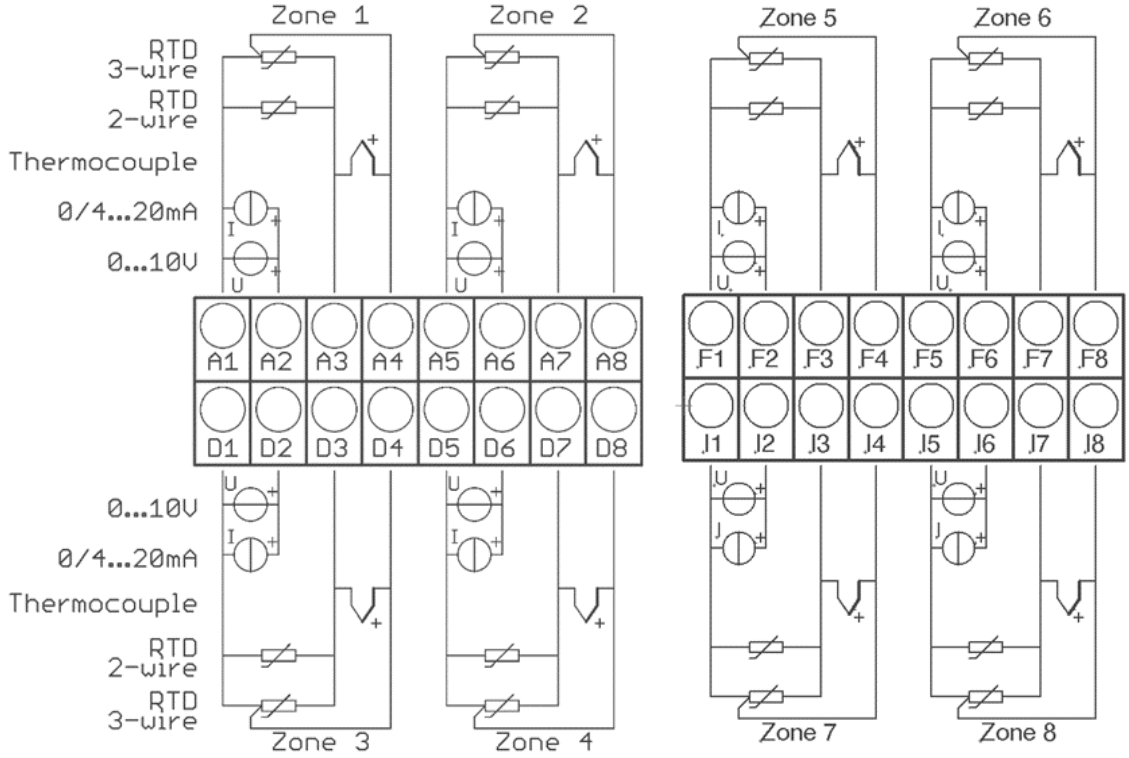


Function of logic inputs		
In_1:	0 =	Setpoint 1 active for all zones.
	1 =	Setpoint 2 active for all zones
In_2:	0 =	Parameter **Authorisation** is adjustable.
	1 =	Parameter **Authorisation** is not adjustable.
In_3:	No function	
In_4:	No function	

4.2 Connection diagram: Monitoring relay



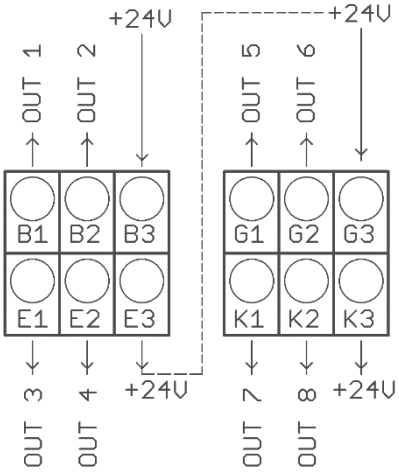
4.3 Connection diagram: Sensors



It is not permitted to connect the grounds of the sensor-inputs and logic-outputs with each other!

RTD/Ni120: The parameter **Sensor Settings/Sensor** has to be set accordingly to the connection diagram (2-wire/3-wire) (↗13.5).

4.4 Anschlussbild: Logikausgänge

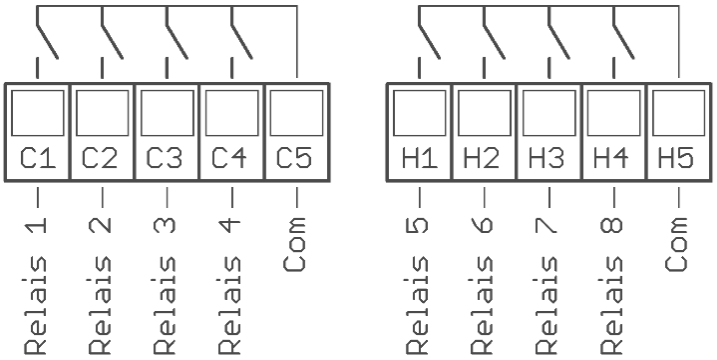


The power supply for the logic outputs has to be wired externally:
+24 V have to be applied to the terminals B3 and G3.

B3 is connected internally to E3 and G3 is connected to K3.
So the terminals E3 and K3 can be used to loop the +24 V.

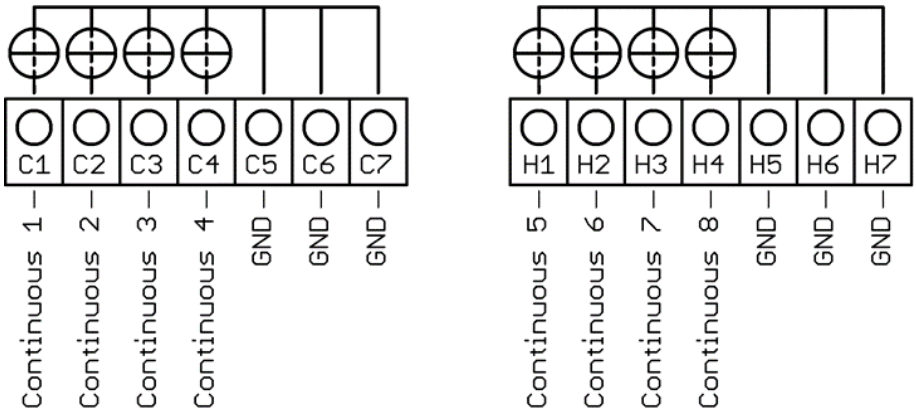
The 24 V are switched to the outputs out x and thus control the SSRs. Reference potential is the ground of the supply voltage.

4.5 Connection diagram: Relay outputs



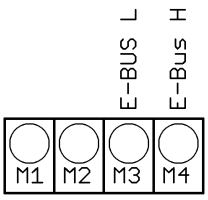
4.6 Connection diagram: Continuous outputs (option)

NOTE!
If continuous outputs are existed, the relay outputs are not available.



The GND connection terminals C5 - C7 and H5 - H7 are bridged. The output automatically switches to current or voltage, depending on the connected load.

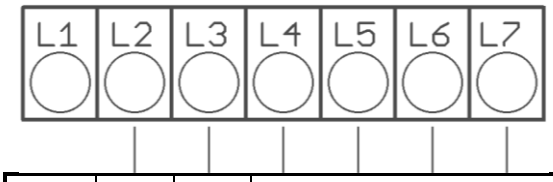
4.7 Connection diagram: E-Bus for extension module



The extension module R4010, for extension to 12 or 16 zones, is connected to the R4000 via the E-bus.
The lines „E-Bus L" and E-Bus H" must be connected to the corresponding terminals of the R4010.
The connection must be designed as a shielded cable. The shield has to be connected the earth (housing) at the R4010 side.

4.8 Connection diagram: Fieldbus interfaces

Type 03 / 07: Serial interface / CAN

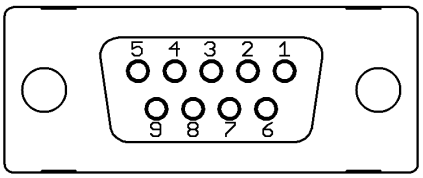


							Bus	Type	Remark
	A	B					RS485	03	Parameter HW-config = RS232 / RS485
			RxD	TxD	GND		RS232	03	Parameter HW-config = RS232 / RS485
					–	+	TTY	03	Parameter HW-config = TTY (current loop)
	H	L					CAN	07	Not available

The serial fieldbus module (Type: 03) contains the three interfaces RS232, RS485 und TTY. By choosing the connection and setting the parameter **HW-config** the desired bus is selected.

Type 08: Profinet Direct Ethernet connection with RJ45 plug connection

Type 09: Profibus



Pin 3	Data RxD / TxD - P
Pin 5	GND
Pin 6	+5 V
Pin 8	Data RxD / TxD - N

CAUTION!

The 5V-Supply is designed for the supply of the termination resistors. Further loads are not allowed.

4.9 LAN und USB

USB (please use FAT formatted USB flash drives):

- Save process data, configuration data and alarm data on an USB-Stick.
- Write back configuration data from USB-Stick to the controller.
- Make a firmware update.

LAN:

- Connection to configuration tool **EloVision 3**.
- Read and write parameters by MODBUS-TCP protocol.

5 Displays and operation

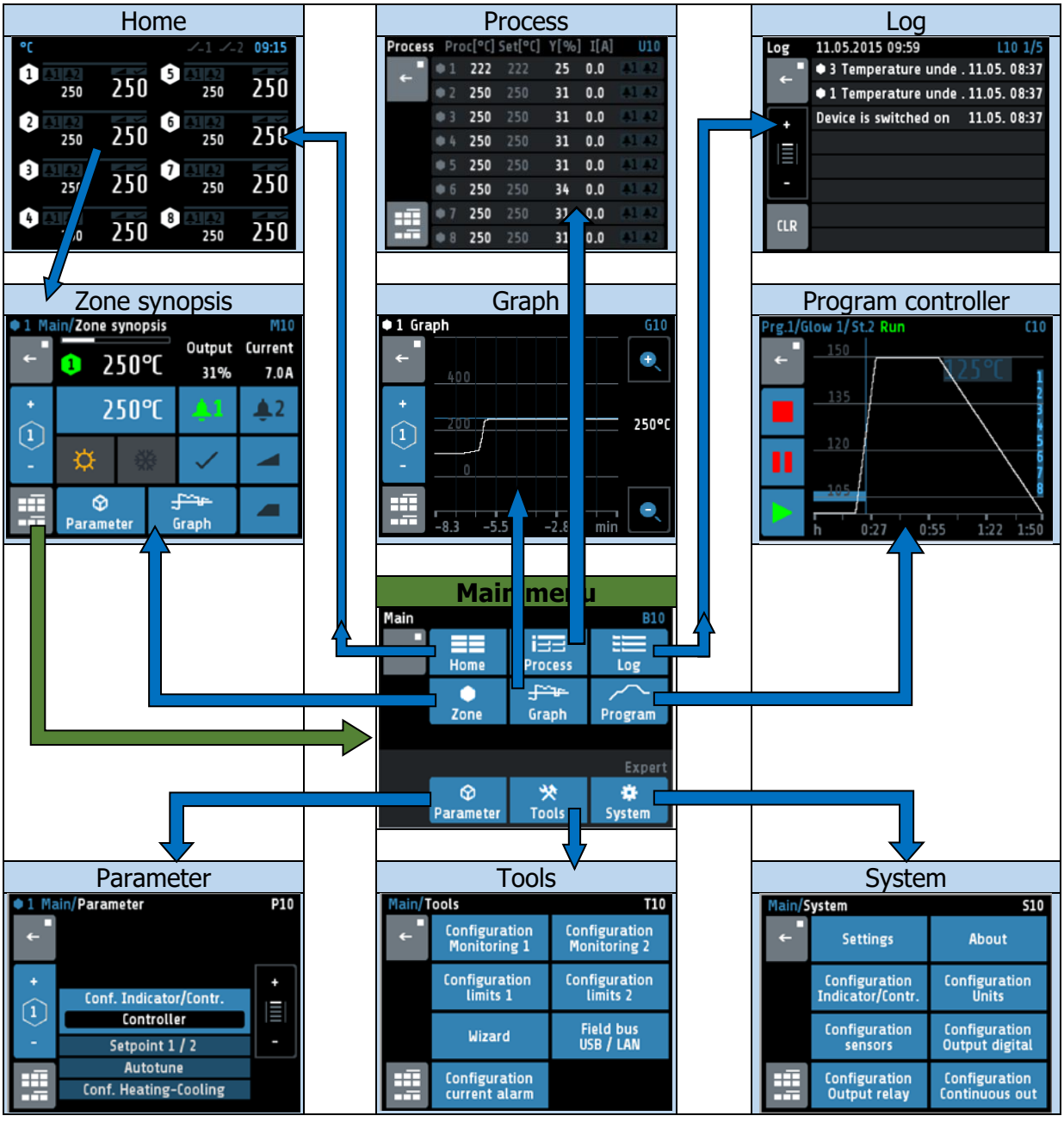
The device is equipped with a backlight colour LC-display.

After switching on the controller and completion of the initialization, the actual process values and setpoints of all connected zones are displayed.

The device is operated by menus. The different parameters are displayed mainly in plain text and can be displayed in various languages.

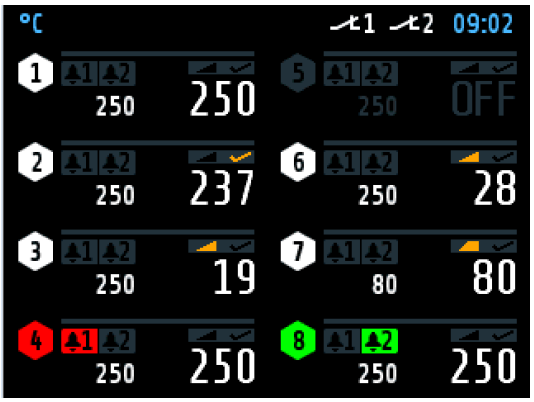
There are several windows for different functions and settings.

5.1 Basic displays and operation



5.2 Home

Display of setpoints and actual process values of all connected zones.

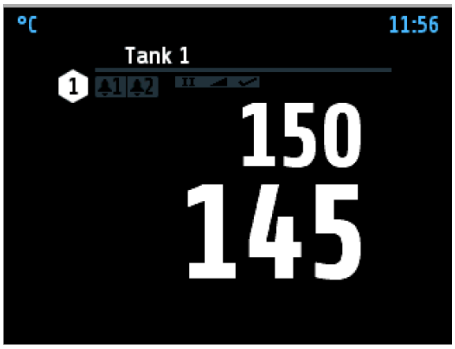


The header displays on the left the current unit, here **°C**.
The top right shows the time.

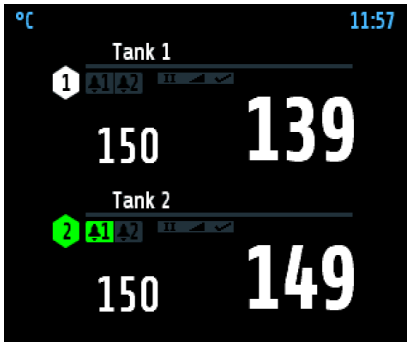
The hexagon displays the zone number.
If the zone is turned off, the actual process value displays **OFF**, here seen in zone 5, and the hexagon shows the numberof the zone is grey.

For every zone the actual process value is written in large and the setpoint in small numbers.

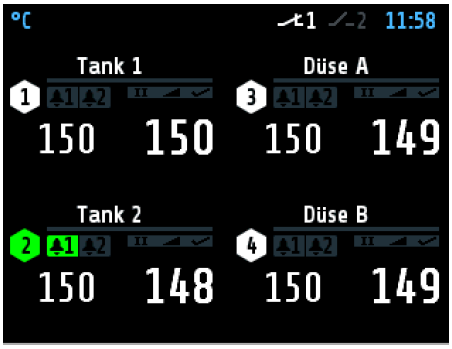
With the 1-6 zone controllers, the zone designation is displayed above the line (here: **Tank 1**).



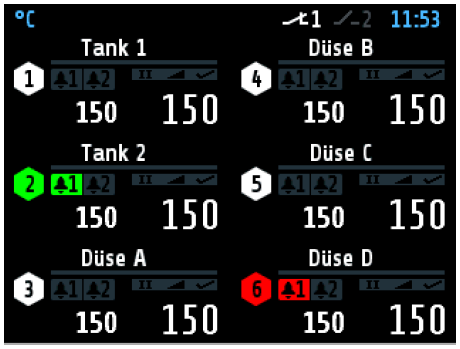
1 zone controller



2 zone controller

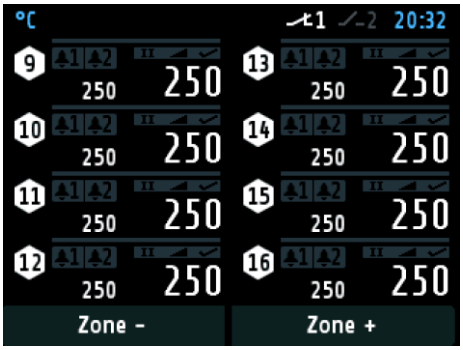


4 zone controller



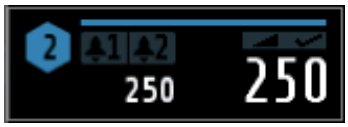
6 zone controller

12 to 16 zone controllers (in conjunction with 12/16-zone expansion module):



The structure is like the picture of the 8 zone controller. Below the zones are 2 buttons (+ / -) for switching the zones 1 ... 8 to 9 ... 16.

Further explanations of the displayed images:

	Red zone tile und bell 1 are displayed: Monitoring 1 of zone 4 is active.
	No setpoint is displayed, i.e. zone 4 is only configured as an indicator. Furthermore, there is a Monitoring 1 violation (red bell).
	Monitoring 2 of zone 8 is active.
	Ramp is active.
	Softstart is active.
	Auto tune is active.
	Even heat up active. The zone with this sign is still chained to another zone.
	Energy optimized heat up active.
	Energy optimized heat up: learning phase ("teach in") is active.
 	**SP2** in the header indicates that setpoint 2 is activated. If setpoint 2 is set in a zone, this zone is set to this setpoint 2 when logic input In_1 is closed. Zones with setpoint 2 set to **OFF** are not switched over.
	Contact of Monitoring relay 1 is closed. Contact of Monitoring relay 2 is open.
	Tapping the area of the zone, here zone 2, leads to the next menu. A grey frame and blue zone symbols show up while pressing the key. Briefly pressing the key leads to the zone overview. Holding down the key (>1 s) leads to the main.

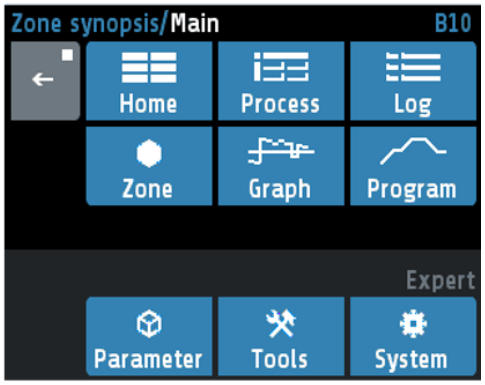
REFERENCE!

For more information on zone parameters and heat up functions see chapter ↗11.

For more information on monitoring see chapter ↗12.1.

5.3 Main menu

The main menu contains a summary of the other function menus.



This menu is accessed by long pressing (>1 s) the field of a zone in the ↗Home.

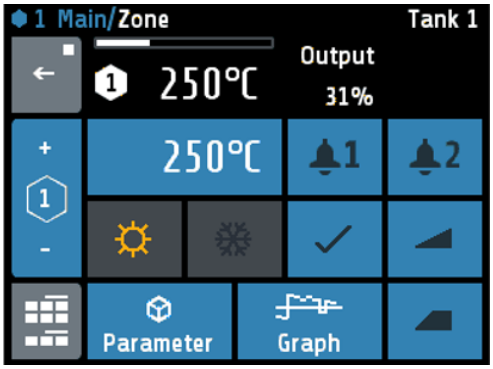
Likewise, you come into this window by pressing the following icon. In different windows this symbol appears in the lower left corner:

Explanations of the individual fields:

	Go to Home (↗5.2)
	Display for all zones: Actual process value, setpoint, output ratio, alarms, ramp, autotune, softstart
	Go to Zone (↗5.4)
	Display and entry for selected zone: Actual process value, setpoint, output ratio, current, monitoring state, ramp, autotune, softstart
	Go to Process (↗7)
	Display for all zones: Actual process value, setpoint, output ratio, current, monitoring state
	Go to Graph (↗8)
	Display for selected zone: Graphical display of the actual value process-temperature over time
	Go to Log (Logbook) (↗9)
	Display for all zones: Alarm and status messages
	Go to Programme (programme controller graph) (↗10)
	Graphical representation of the temperature profile with start / stop button and possibility of configuring the programs.
	Go to Parameter (↗11)
	Display and entry for all zones: All zone parameters
	Go to Tools (↗12)
	Configuration of the monitoring, alarms and interfaces (USB, Fieldbus, LAN), starting the **Wizard** (set-up assistance).
	Go to System (↗13)
	Configuration inputs, outputs, Indicator/Controller and unit. Setting language, date, sample time and restart lock-out.
	Touch < 1 sec = back to the previous menu Touch > 1 sec = go to ↗Home

5.4 Zone synopsis

The picture shows the most important process data of a zone. This menu is accessed by briefly pressing the field of a zone in the ↗Home



The header shows the current zone on the left and the zone designation (here: **Tank 1**) on the right.

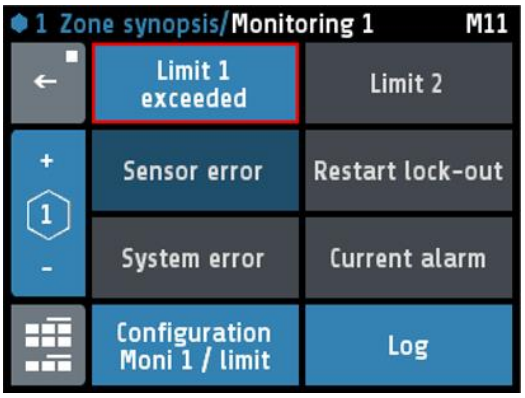
Below that, from left to right, are:
Actual value, output ratio and heating current.

Negative output ratios mean cooling mode.

Explanation of the individual fields:

	Shown is the current setpoint. When editing the setpoint the blue area has to be pressed.
	Setpoint 2 is active. To set the setpoint value 2, press this blue field and confirm the following warning message with Yes.
	Display of monitoring 1. Grey = signal not active / Coloured = signal active Pressing the area leads to the window ↗Monitoring . The same applies to Monitoring 2.
	Output ratio shown as bar. White bar: positive output ratio (heating). Blue bar: negative output ratio (cooling).
	Self-optimising: grey = not active, orange = active Pressing the area leads to the menu ↗Self-optimising.
	Ramp: grey = not active, orange = active Pressing the area leads to the menu ↗Ramps:
	Softstart: grey = not active, orange = active Pressing the area leads to the menu ↗Softstart .
	Heating: grey = Heater switched off / orange = Heater switched on
	Cooling: grey = Cooler switched off / blue = Cooler switched on
	+ : switchover to the next zone Display of the current zone number – : switchover to the previous zone
	Go to **Main menu**
	Go to **Parameter**
	Go to **Graph**

5.5 Monitoring display



The current zone is displayed in the header.

The **Configuration Moni 1 / limits** key takes you to the configuration for monitoring and alarms (↗12.1).

The Log key takes you to the logbook to get more information about alarms that have occurred (↗9).

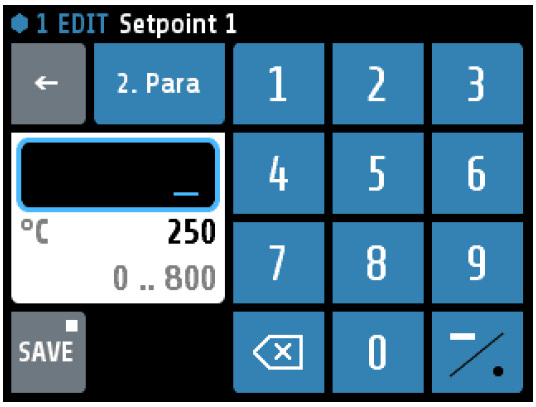
Explanation of the individual fields:

Limit 1 exceeded	The light blue background and the coloured frame shows that the event "Limit 1 exceeded" has triggered the monitoring. In case the event needs an acknowledgement, it must be done by pressing the button. Other monitoring events show **Limit reached** and **Limit undershot**.
Sensor error	The dark blue background shows that the event "Sensor error" is programmed for triggering the monitoring. The event is not active.
Systemfehler	The dark grey background shows that the event "System error" is not programmed for triggering the monitoring. In case of a system error the monitoring will not be active.
+ 2 -	+ : switchover to the next zone Display of the current zone number – : switchover to the previous zone
	Go to **Main menu.**
←	Back to previous menu.

6 Adjusting windows

6.1 Entering number values

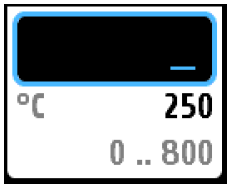
This window helps entering number values, here for the setpoint 1.



The header displays the current zone and the name of the parameter (here: "Setpoint 1").

By pressing the number keys the value of the parameters can be entered. In order to take over the parameter value, it must be saved by pressing the **SAVE** key.

Explanations to the individual fields:

	The value, entered by pressing the number keys, is now displayed within the blue frame. Underneath, on the left the unit is shown and the previous value is displayed on the right (250 °C). The allowed range is displayed at the bottom (0 ... 800 °C).
	If this Button is visible, two adjustable parameters are available. Such as: Setpoint: 1/2 or ramp: rising/falling Switch over by pressing this button. The name of the actual parameter is displayed in the header. After adjusting one parameter the window will not be closed and the second parameter can be adjusted.
	This key is visible when the parameter has a valid value **OFF**. **OFF** can be selected like a number key.
	Key to enter minus or comma. The minus sign can be pressed before entering a number. After the first number was entered the key automatically changes to comma.
	Delete last character.
	Back to previous menu.
	Saving of what has been entered and return to previous window. By pressing **SAVE** for >1 sec. a selection window appears, in which parameter values can be saved for other zones simultaneously (↗6.2).

6.2 Multisave

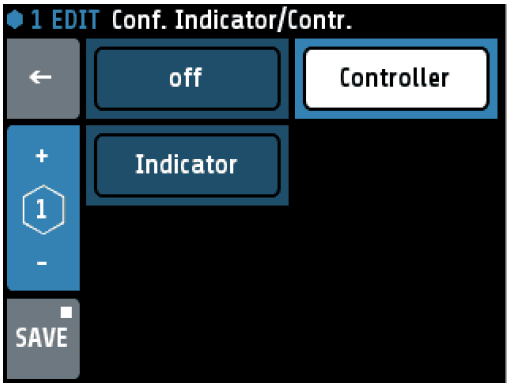
To save a value to several zones, the **SAVE** button can be held for 1 second when entering a parameter. The following window then opens:

The currently selected zone (here: zone 1) is marked and cannot be deactivated.

By tapping on other zone fields, zones can be added or removed. Black number on white symbol means that a zone has been added.

With the lower key "**1 ... 8**" all zones are marked.
With **ESC** the window is closed without saving.
With **SAVE**, the set parameter value for all marked zones is saved and the window is closed.

6.3 Selection with tiles



The header displays the zone number and the parameter name on the left (here: **Conf. Indicator/ Contr.**).

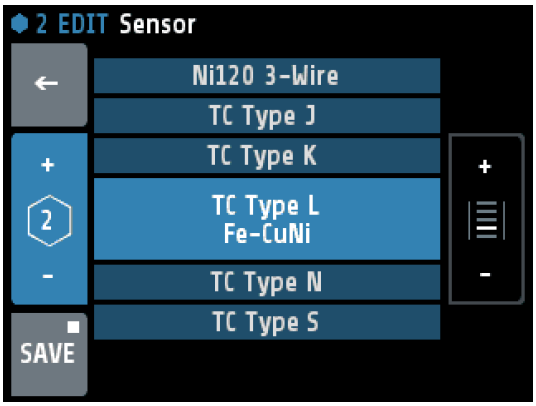
By pressing the tile key, the element can be selected.
Black text on a white background is used to display the selected element.

In order to save the parameter value, the **SAVE** key needs to be pressed.

Explanations to the individual fields:

	Selected element.
	Non-selected element.
	+ : switchover to the next zone Display of the current zone number – : switchover to the previous zone
	Saving of selection and return to previous window. When pressing **SAVE** for >1 s a selection window opens up, in which the parameter value can be saved onto other zones simultaneously (↗6.2).
	Back to previous menu.

6.4 Selection list view



The header displays the zone and the parameter name (here: Sensor).

The actual value is displayed in the middle with light blue background.
By pressing the +/- Buttons on the right (or pressing the upper or lower areas of the list) the list can slide up or down.

In order to save the parameter value, the **SAVE** key needs to be pressed.

	+ : switchover to the next zone Display of the current zone number – : switchover to the previous zone
	Saving of selection and return to previous window. When pressing **SAVE** for >1 s a selection window opens up, in which the parameter value can be saved onto other zones simultaneously (↗6.2).
	Back to previous menu.

6.5 Setting text

This window is used to enter text for description of program names.

The header displays the actual program number and the actual program name.

By pressing the number keys **0** to **9** the new text can be entered. To set the following letters "ABC1" you have to press the key more times.

After one second the character is taken over and the next character can be entered.

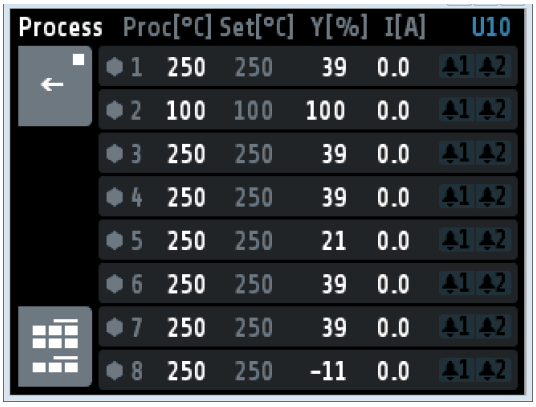
In order to take over the new text, it must be saved by pressing the **SAVE** key.

Explanations to the individual fields:

Glow 1	The new text is displayed in the blue/white frame.
⌫	Delete last character.
Clear all	Delete all characters.
2 ABC	Key for setting the text. Repeated pressing changes to the next character. Here: **A** → **B** → **C** → **2** → **Ä**
ABC	Switching case sensitive. Capital and small letters.
←	Back to previous menu.
SAVE	Saving of the new text and return to previous window.

7 Process

This window displays an overview of all zones.



In sechs Spalten stehen für alle Zonen:

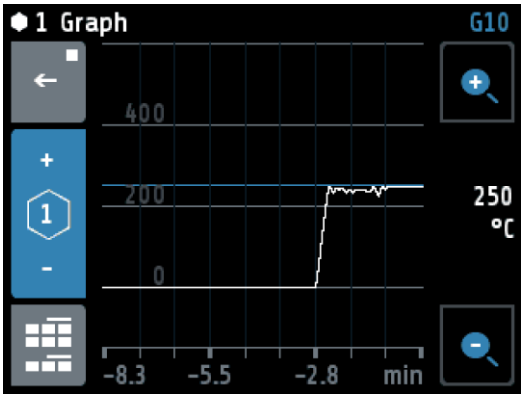
1. Zone number
2. Actual process value **Proc[°C]**
3. Setpoint **Set[°C]**
4. Output ratio **Y[%]**
5. Heater current **I[A]**
6. Monitoring 1 + 2 (bell symbol)

Explanations to the individual fields:

	Display of Monitoring 1 or 2. Grey = signal not active / Coloured = signal active
	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home
	Go to ↗Main menu

8 Graph

This window shows the temperature progression for one selected zone.
In the case of a technical incident the actual process value can still be examined afterwards.



On the right the actual process value is shown (here: 250 °C).

By pressing the loupe keys **+** and **–** the resolution of the temperature axis can be altered.
The time axis can be determined by the parameter **Graph sampling time** in the menu ↗System.

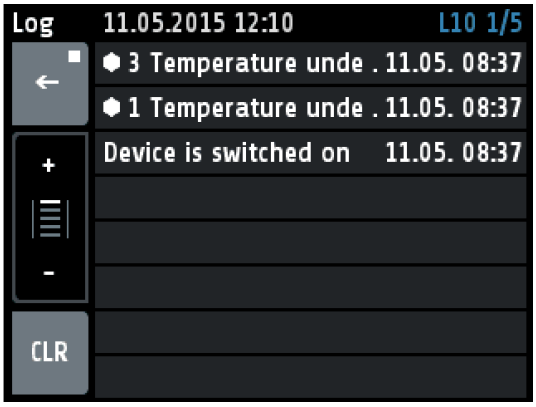
Turning off the device causes deletion of the values.

Explanations to the individual fields:

	+ : switchover to the next zone Display of the current zone number – : switchover to the previous zone
	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home
	Go to ↗Main menu

9 Log (Logbook)

This window displays alarm- and status messages for all zones.



The header displays the current date and time, the window number and page.

Pressing the log-texts displays the full text if it is abbreviated in the normal display.

The logbook can take up to 40 entries. The latest entry can be found on page 1/5. If 40 entries exist already, the oldest entry will be deleted.

The logbook is stored in a power failure safe manner.

Explanations to the individual fields:

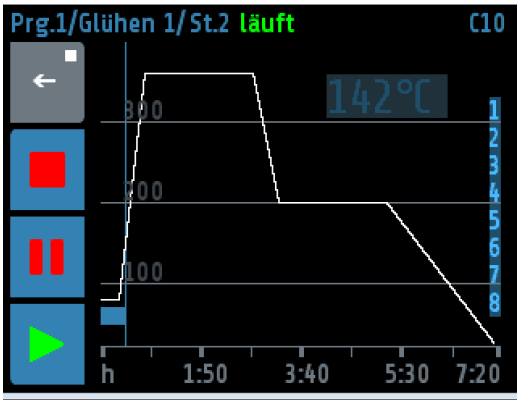
	Switching between the logbook pages: **+** previous page; **-** next page
	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home
	Deletion of the logbook entries.

NOTE!

You can also touch the top or bottom of the list to scroll up or down. Page switching only takes place if the key is pressed for <1 s, otherwise the display switches to the long text display.

10 Programme (programme controller graph)

This image shows the graphical representation of the selected control program.

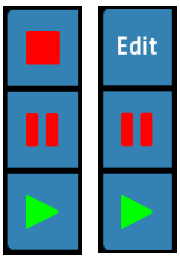


The header displays the ongoing program, step and the status.
Right above the graph is the indication of the current program setpoint.

On the right side the zones are displayed, whose setpoints are specified by the program.
At the bottom (x-axis) the time is shown in hours.

The elapsed time is displayed as a blue ribbon. Here on the left below the 105. The current time is indicated by the thin blue line at the right end of the tape.

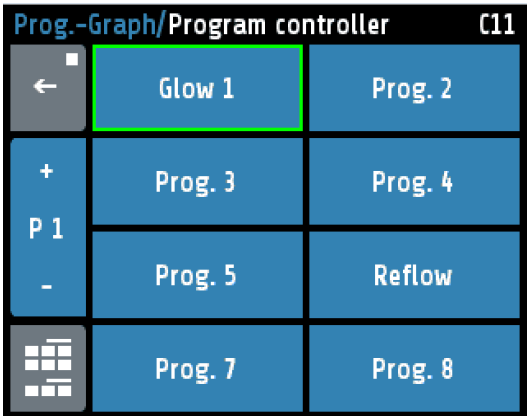
Explanations to the individual fields:

	These keys are used to control the program: Stop, Pause and Start. If the program is stopped, you will get to the menu for the program controller via the **Edit** button.
	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home

10.1 Programme controller selection / settings

This window gives an overview of the 8 control programs. One arrives on the **Edit** button in the ↗Programme (programme controller graph) into this menu. The procedure for setting a programme is described below:

1. Selcet the programme

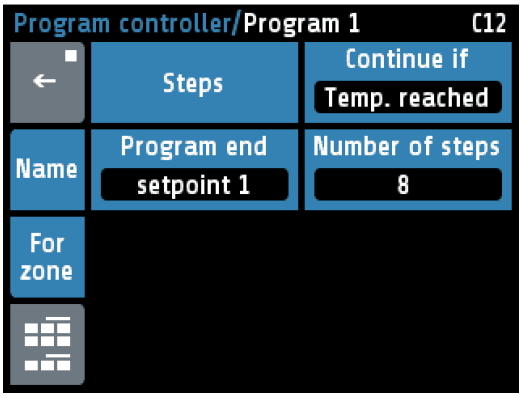


The green frame shows the selected program. Select another program by pressing **+** and **–** keys.

Press the respective program button branches to the setup menu of the program.

The name of the program can be changed in the following window.

2. Setting the programme properties



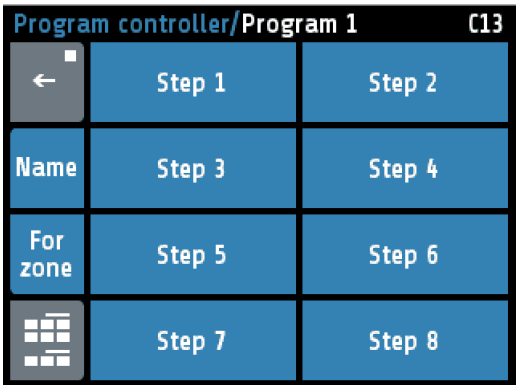
In this screen you can set the properties of the program. You can also use the **Steps** button to set the times and temperatures of the individual steps.

The **Name** button is used to set the program name.

Use the **For Zone** key to define the zones involved.

Parameter	Setting range	Description
Continue if	**Time expired**	All steps are executed according to the predefined time grid.
	Temp. reached	After the ramp time has elapsed, the current step temperature is controlled until all the relevant zones have reached this setpoint. **Note**: The setpoint must be reached up to ± 2 K.
Program end	**Setpoint 1**	After completion of the last step, the control setpoint is further regulated. Normally setpoint 1.
	Last Setpoint	After the last step has been completed, the temperature of the last step is further regulated.
	Repeat	After the last step has been completed, step 1 is started again.
Numberof Steps	**1 ... 8**	Count of steps.

3. Step selection

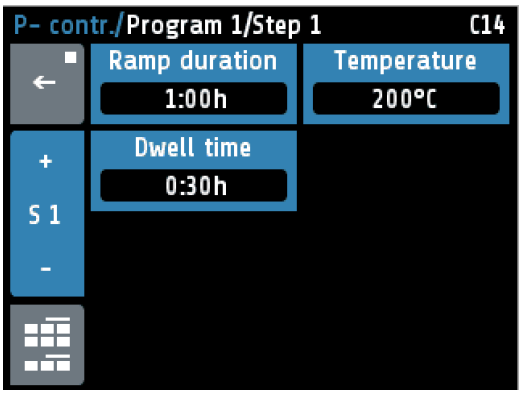


Here, the single step can be selected directly.

The **Name** key is used to set the program name.

With the key **For Zone**, the zones that will follow the program are defined.

4. Setting the program steps



In this figure, the ramp duration, the step temperature and the dwell time can be set for one step.

The key S1 + leads to the next step.

The key S1 - leads to the previous step.

Parameter	Setting range	Description
Ramp duration	**0:00 ... 99:59 h**	Time setting in which the setpoint is to go up from the previous step temperature to the temperature of the current step. In the first step, the actual value is set as the start setpoint. **Note**: If no ramp is desired, set this time to **0:00 h**.
Temperature	**-100 ... 1600 °C**	Temperature for this step.
Dwell time	**0:00 ... 99:59 h**	Time for the hold time of the current step temperature. The dwell time starts after the end of the ramp duration. When configuration is switched to "temp. reached", this time does not start until all the zones involved have the current step temperature. * Disabled zones are ignored. * For functional reasons, a "**Dwell time**" of at least one minute is used when the "**Continue if**" setting is set to "**Temperature reached**", even if the dwell time is set to "0:00 h".

5. Darstellung im Grundbild

Headline of the screen: "Actual Process Values"
Program controller active, Step2 is running.
Top picture: Program running.
Bottom picture: Program paused or stopped.

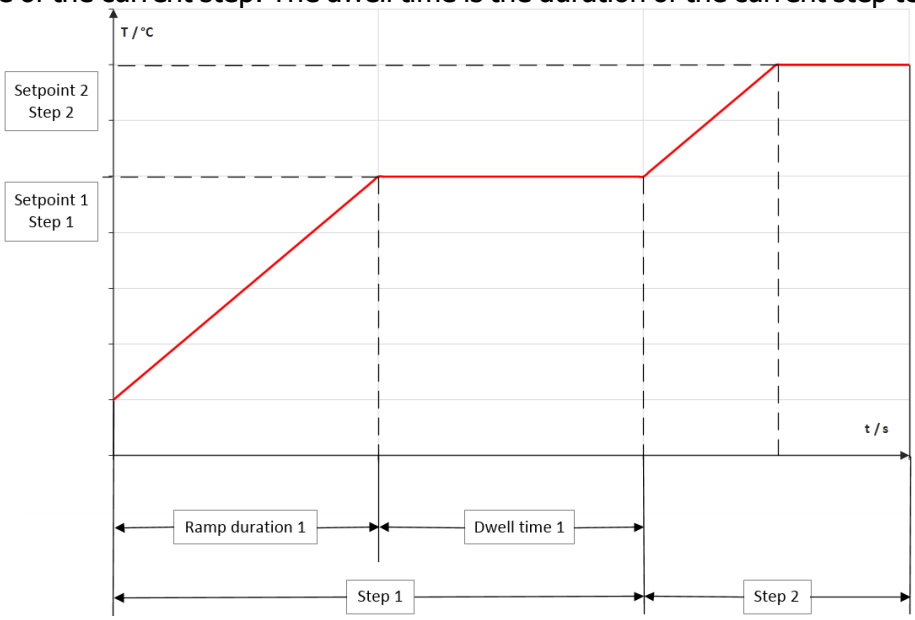
10.2 Sequence of programme control

The first step is to determine whether the program controller should run after a fixed time grid, or whether the respective step temperature must first be reached in order to reach the respective holding phase (see parameter **Continue if** ↗10.1).
You should also consider how the program controller should control the temperature after the end of the program. Three options are available: Setpoint 1, Last setpoint and Repeat (see parameter **Program End** ↗10.1).

The numberof steps [1 ... 8] must also be defined.

Now the time and temperature values for the desired steps must be entered in the **Setting the program steps** screen.

One step always involves ramp duration and dwell time. The ramp duration determines the time in which the setpoint is steadily increased from the previous temperature to the temperature of the current step. The dwell time is the duration of the current step temperature.



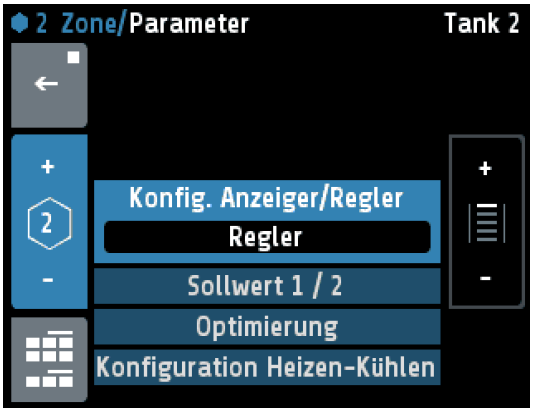
An exception is the ramp for the first step. Since the first step does not have a preliminary temperature, the ramp for all zones starts here with the current actual value of the first activated zone and ends at the temperature of step 1. The ramp duration can be switched off by setting it to zero.

The dwell time is the duration of the current step temperature. If the parameter **Switch on** is set to **Temp. reached**, the dwell time does not start until all zones have reached the step temperature.

After a network interruption with the program controller running, the program controller re-activates in the step at which the interruption took place.

11 Parameter

This menu is used as a display and input of all zone-parameters for all zones.



The header displays on the left the zone number and the menu name and on the right the zone name (here: **Tank 1**).

The selected parameter is displayed in the middle with light blue background.
By pressing the +/- Buttons on the right (or pressing the upper or lower areas of the list) the list can slide up or down.

Pressing the selected parameter will switch to a corresponding selection window.

	+ : switchover to the next zone Display of the current zone number – : switchover to the previous zone
	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home
	Go to ↗Main menu

11.1 Zone parameter list

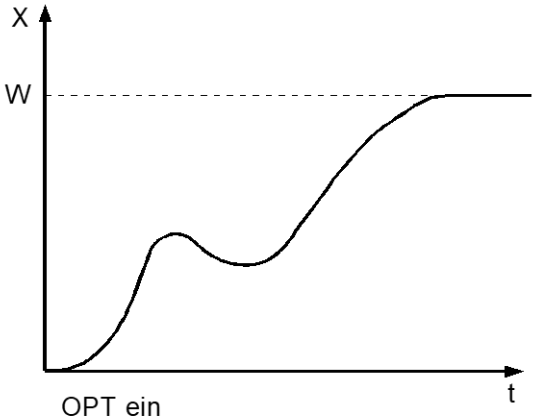
Parameter	Description	
Config. Indicator/Contr.	If you switch to Controller or Indicator, a wizard is started to set the correct sensor and unit configuration.	
	Setting range: **off, Controller(*), Indicator**	
Setpoint 1	Setting range: **MRS ... 0(*) ... MRE**	
Setpoint 2	As soon as the logic input In_1 is on level 1, setpoint 2 will become active on all zones in which the adjusted value is unlike **OFF**.	
	Setting range: **OFF(*), MRS ... MRE**	
Autotune	Switches the self-optimization on or off (↗11.1.1).	
	off(*), on, All zones, **automatic** (After a power restart auto-tuning starts automatically)	
Configuration Heating-Cooling	**Heating(*)**	Two-point controller: Heating
	Cooling	Two-point controller: Cooling
	non-lin. Cooling	Two-point controller: Cooling, with non-linear characteristic curve for evaporation cooling
	Heating-Cooling	Three-point controller: Heating-Off-Cooling"
	Heating-non-lin. cooling	Three-point controller: Heating-Off-Cooling, with non-linear characteristic curve for eva. cooling

(*): Factory setting

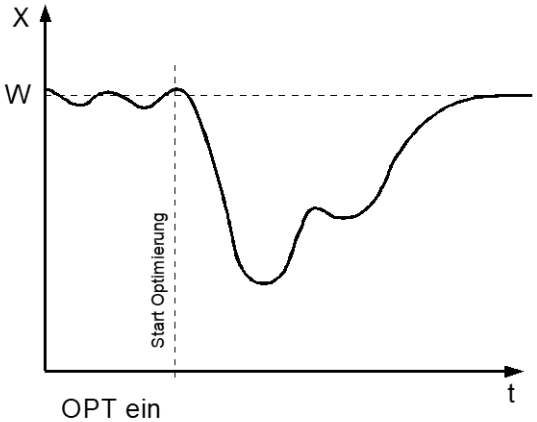
11.1.1 Self-optimising (Autotune)

The tuning algorithm determines the characteristic values within the controlled process and calculates the valid feedback parameters (P, D, I) and the cycle time of a PD/I- controller for a wide section of the range.

The autotune mode works during start-up shortly before the setpoint is reached. If activated after the setpoint has already been reached, the temperature will first drop by approx. 7% of the measuring range.



OPT ein
Optimierung Aufheizender Strecke



OPT ein
Optimierung auf einen bereits „erreichten“ Sollwert

The tuning algorithm can be activated at any time by selecting the parameter **Autotune** = **on**. After having calculated the feedback parameters, the controller will lead the process value to the actual setpoint.

Selecting **Autotune** = **off** will stop the optimization.

If Autotune is active: Indication in the ↗Zone synopsis and ↗Home as an orange symbol:

If the Autotune duration is longer than 2 hours: optimization stops with an error message.

Conditions for starting the autotune algorithm:

- The setpoint must amount to at least 5 % of the measurement range.
- The sensor must not have a failure.
- The Softstart function must not be active (↗11.5)

Hints for adjusting the control parameters:

As standard the controller operates in PD/I control mode, i.e. controlling without deviation and with practically no overshoot during start-up.

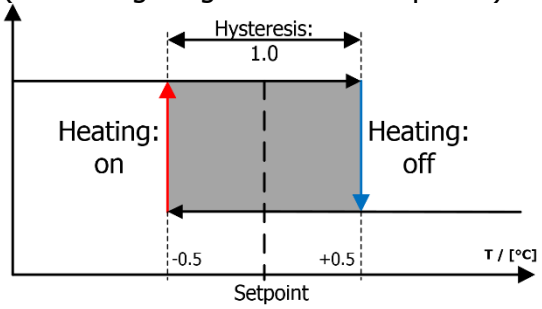
The control action can be altered in its structure by adjusting the following parameters:

a. no control action (on-off)	Setting P = off Continuing with the parameter **switching difference**
b. P-action	Setting D and I = off
c. PD-action	Setting I = off
d. PI-action	Setting D = off
e. PD/I	Modified PID-mode (set: P, D, I)

Depending on the configuration, certain parameters are not visible.

11.2 Heating parameters

Only visible in operating modes heating or heating-cooling

Parameter	Description
P (Xp)	Proportional range
	Setting range: **OFF; 0,1 ... 10(*) ... 400.0 K**
D (Tv)	Derivative time
	Setting range: **OFF; 1 ... 30(*) ... 200 s**
I (Tn)	Reset time
	Setting range: **OFF; 1 ... 150(*) ... 1000 s**
Cycle-Time	The switching frequency of the actuator can be determined through the cycle time. In this time interval the controller switches on and off once. **Recommended parameterisation**: • Voltage outputs for solid state relays (SSR): Cycle time: 0,5 ... 10 s • Rapid control processes: 0,8 s • Relay outputs: >10 s The cycle time should be adjusted to a time as long as possible in order to minimize wear of the relay contacts
	Setting range: **0,5 ... 10,0(*) ... 240 s**
Max. output ratio	The limitation becomes effective when the controllers calculated output ratio is greater than the maximum permissible (limited) ratio.
	Setting range: **0 ... 100(*) %**
Hysteresis	Only adjustable if **xp** = **off** (on-off action, without feedback)
	Setting range: **OFF; 0,1(*) ... 80.0 K** (Measuring range without decimal places)
	Setting range: **OFF; 0,01(*) ... 8.00 K** (measuring range with decimal places) 

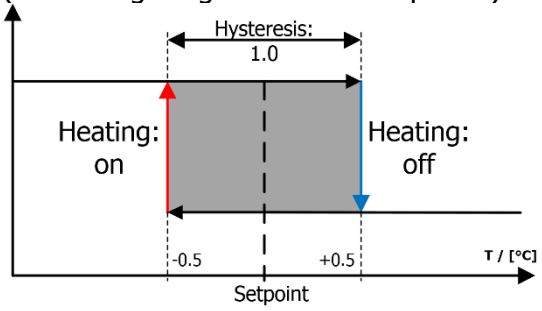
(*): Factory setting

CAUTION!

The **output ratio limitation** intervenes if the output ratio calculated by the controller is greater than the max. permissible output ratio.
It is only required if the energy supply to the controlled system is heavily oversized.
Normally, it should be out of operation (= 100 %).
Attention! The output limiter is not effective during the self-optimisation phase.

11.3 Cooling parameters

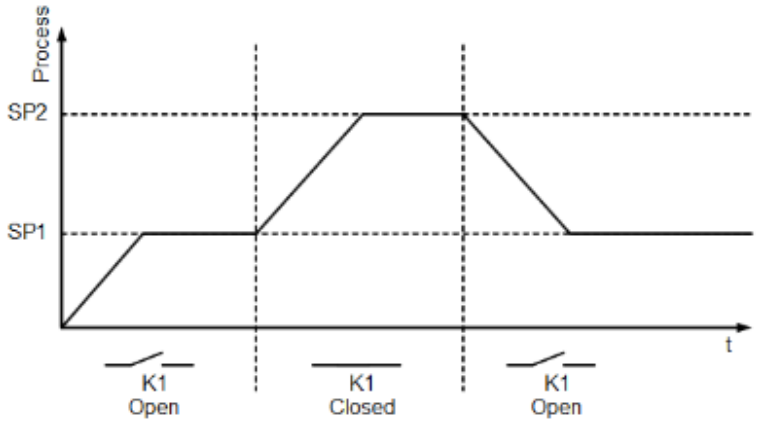
Only visible in operating modes Cooling or Heating-Cooling.

Parameter	Description
P (Xp)	Proportional range
	Setting range: **OFF; 0,1 ... 10(*) ... 400.0 K**
D (Tv)	Derivative time
	Setting range: **OFF; 1 ... 30(*) ... 200 s**
I (Tn)	Reset time
	Setting range: **OFF; 1 ... 150(*) ... 1000 s**
Cycle-Time	The switching frequency of the actuator can be determined through the cycle time. In this time interval the controller switches on and off once. **Recommended parameterisation**: • Voltage outputs for solid state relays (SSR): Cycle time: 0,5 ... 10 s • Rapid control processes: 0,8 s • Relay outputs: >10 s The cycle time should be adjusted to a time as long as possible in order to minimize wear of the relay contacts
	Setting range: **0,5 ... 10,0(*) ... 240 s**
Max. output ratio	The limitation becomes effective when the controllers calculated output ratio is greater than the maximum permissible (limited) ratio.
	Setting range: **0 ... 100(*) %**
Hysteresis	Only adjustable if **xp** = **off** (on-off action, without feedback)
	Setting range: **OFF; 0,1(*) ... 80.0 K** (Measuring range without decimal places)
	Setting range: **OFF; 0,01(*) ... 8.00 K** (Measuring range with decimal places) 

(*): Factory setting

11.4 Ramps: Ramp rising / Ramp falling

A programmed ramp is always activated when the setpoint is changed or when the mains supply is switched on. The ramp starts at the actual process value and ends at the preselected setpoint. The ramp can be activated for both setpoint 1 and setpoint 2.



By programming the second setpoint a setpoint profile can be obtained, accordingly (see example with external contact In_1 (K1) below).

Parameter	Setting range		
Ramp rising	**OFF(*); 0,1 ... 99,9**	**K/min**	(Measuring range without decimal places)
	OFF; 0,01 ... 9,99	**K/min**	(Measuring range with decimal places)
Rampe falling	**OFF(*); 0,1 ... 99,9**	**K/min**	(Measuring range without decimal places)
	OFF; 0,01 ... 9,99	**K/min**	(Measuring range with decimal places)

(*): Factory setting

11.5 Softstart

CAUTION!

For using the softstart function, make sure that the instrument is programmed to voltage (logic) outputs. This function is not allowed for relay outputs. Otherwise, the relays will be damaged!

During the **Softstart** the controller's heating output response is limited to a preselected ratio, in order to achieve a slow drying of high-performance heat cartridges. This results in a slower, more regular heating period. Simultaneously the output clock frequency is quadrupled.

Once the process value reaches the softstart setpoint, it remains stable at this value for the preselected duration time. At the end of this period the process value rises to the valid setpoint. If the softstart is active, the controller's autotune function cannot operate.
If a setpoint ramp has been programmed, the softstart has priority, and the ramp will become active after the softstart has been completed.

The softstart only works:

- if the parameter P (xp) is programmed > 0,1%
- if the actual process value is lower than the softstart setpoint – 5% of the selected measuring range

It is possible to select this function for each zone individually.

Parameter	**Setting range**	
Softstart On/Off	**Off(*), On**	
Softstart output ratio	**10 ... 30(*) ... 100 %**	
Softstart setpoint	**MRS ... 100(*) ... MRE °C**	
Duration time	**Off; 0,1 ... 2,0(*) ... 10,0 min**	
Output mode	**Controller mode**	Controller mode
	Mode MANUAL	The controller now works only as an actuator. The control is out of operation. The output level can be changed manually. Actual value display: current actual value. Setpoint display: Manual output level is displayed in %.
	Mode AUTOM:	In the event of sensor break the last valid output ratio is maintained. Like the setpoint, the output ratio can be changed manually. Under the following circumstances, the output ratio will be 0%: • if the output ratio was at the time of sensor break 100% • if the controller is working along a setpoint-ramp • if the control deviation from the measuring range was at time of sensor break > 0,25% • if parameter is set P (xp) = 0 • if softstart was active at the time of sensor break. A few seconds after sensor break has been rectified, the controller returns to automatic operation and calculates the required output ratio.

(*): Factory setting

11.6 Limit values

Adjustment of the limit values. It is necessary to set the limit configuration first (↗12.2 ↗12.6).

Parameter	Setting range absolute	Setting range relative
Limit 1 min.	**OFF(*) ... MRE**	**-100 ... OFF(*)**
Limit 1 max.	**OFF(*) ... MRE**	**OFF(*) ... 100**
Limit 2 min.	**OFF(*) ... MRE**	**-100 ... OFF(*)**
Limit 2 max.	**OFF(*) ... MRE**	**OFF(*) ... 100**
Configuration Limit 1	Go to Configuration limit values 1+2 (↗12.2)	
Configuration Limit 2	Go to Configuration limit values 1+2 (↗12.2)	
Undercurrent val.	**OFF(*) ... 99,9**	
Overcurrent val.	**OFF(*) ... 99,9**	

(*): Factory setting

11.7 Sensor settings

All parameters for sensor configuration (↗13.5).

Parameter	Description
Process fofset	This parameter serves to correct the input signal: • the correction of a gradient between the measuring point and the sensor tip • line resistance balancing at 2-wire-RTD • Correction of the control deviation when using P or PD action. Make sure that the adjusted actual temperature value should not fall below or exceed the measuring range limits.
	Setting range: **-999... 0(*) ... 1000 °C**
Setpoint min.	Lowest adjustable setpoint value.
	Setting range: **MRS ... 0(*) ... Setpoint max. °C**
Setpoint max.	Highest adjustable setpoint value.
	Setting range: **Setpoint min. ... 400(*) ... MRE °C**
Linear value min. *Linear measurement range only*	Measuring range starting value of the linear scale.
	Setting range: **-900 ... 0(*) ...** (Linear value max. – 100) **°C**
Linear value max. *Linear measurement range only*	Measuring range final value of the linear scale
	Setting range: (Linear value min. +100) **... 100(*) ... 10.000 °C**
The minimal span of linear value min. and max. is 100, the maximal span is 2000.	
Decimal *Linear measurement range only*	Decimal places of the linear measuring range.
	Setting range: **0; 1(*); 2**
Einheit Zone	For **control** zones, you can choose between ° C and ° F. The temperature values of the selected zone are set to the specified unit with this parameter. Please check all temperature values after adjustment (Limit values, setpoints, setpoint limits, actual value offset and, if applicable, the linear limits).
	Setting range: **°C(*); °F**
	Numerous units can be set in **display** zones.
	Setting range: **OFF(*); °C; °F; %; A; V; Hz; rpm; U/min; bar; psi; Pa; l/min; m³; l; m/s; m²/s; kg; N; Nm; J; J/m³; s; min; h**

(*): Factory setting

11.8 Control outputs

Possible settings for the logic outputs and relay or continuous outputs. This is used to determine which signal is sent to the output.

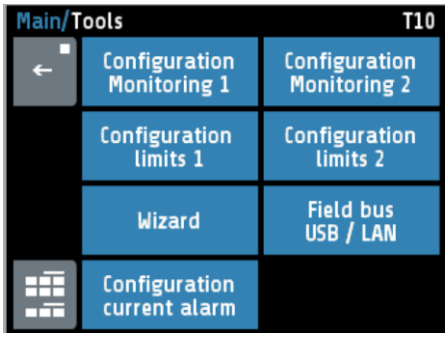
Parameter	Setting range	Description
Conf. digital out	**off**	No function
	Heating 1) (*)	Output of the heating signal at digital output x.
	Cooling 1)	Output of the cooling signal at digital output x.
	Limit 1	Output of limit violation 1 to digital output x.
	Limit 2	Output of limit violation 2 to digital output x.
When using the relay as the actuating output, the switching cycle time must be set as long as possible in order to minimize the contact wear of the relay.		
Conf. relay out	**off**	No function
	Heating 1) (*)	Output of the heating signal at relay x.
	Cooling 1)	Output of the cooling signal at relay x.
	Limit 1	Output of limit violation 1 to relay x.
	Limit 2	Output of limit violation 2 to relay x.
Continuous out configuration (Option)	**off**	No function
	Heating 1) **output ratio**	Output of the heating output ratio at continuous output x (0...20 mA or 0...10 V).
	Cooling 1) **Output ratio**	Output of the cooling output ratio at continuous output x (0…20 mA or 0...10 V)
	Current value	Output of the current value to the continuous output x (0…20 mA or 0...10 V)
	Heating output ratio live zero 1)	Output of the heating output ratio at continuous output x with offset zero. (4…20 mA or 2...10 V)
	Cooling output ratio live zero 1)	Output of the heating output ratio at continuous output x with offset zero. (4...20mA or 2...10 V)
	Current value live zero	Output of the current value to the continuous output x with offset zero. (4…20 mA or 2…10 V)
The minimal span of Continuous out min. and max. are 10.		
Cont. out min. *For continuous out "Current value" only*	Starting value of the linear output. Corresponds to 0/4 mA or 0/2 V.	
	Setting range: **MRS … 0(*)** (Cont. out max. – 10)	
Cont. out max. *For continuous out "Current value" only*	Final value of the linear output. Corresponds to 20mA or 10V.	
	Setting range: (Cont. out min + 10) **… 800(*) … MRE**	
1) The settings for heating and cooling are only visible if the controller is configured accordingly.		

(*): Factory setting

More Settings

Parameter	Description
Copy all parameters	Opens a window for selecting the zones into which the parameter values of the current zone shall be copied.
auf Zone …	Transfer all zone parameters to another zone.
Zone name	Opens the **Setting text** window to enter a name for the actual zone (↗6.5). This name is shown in the home screen for controllers with 6 zones and less.

12 Tools



Pressing the configuration key leads to windows in which the associated parameters can be selected or set.

Pressing the **wizard** key activates a guided setting help for the most important device parameters.

	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home
	Go to ↗Main menu

12.1 Configuration Monitoring 1+2

Settings for messages of monitoring 1. The same applies to monitoring (2). The controller has two independent monitoring relays. With the help of the monitoring several events of the controller can be routed (wired OR) to the relays.

If the monitoring is active, it is displayed by the bell symbols  . The colour of the symbols is programmable for the limit violations and fixed for all other events. In case of several events with different colours at the same time the priority of the colours is (priority high → low): red → orange → green.

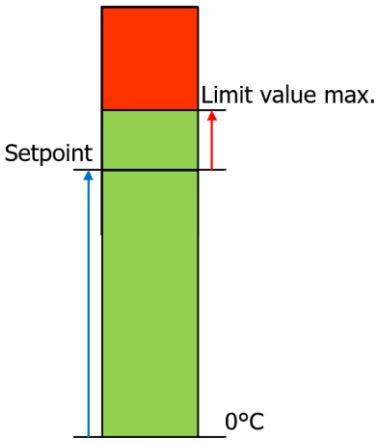
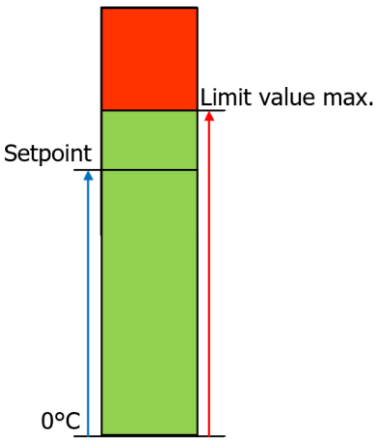
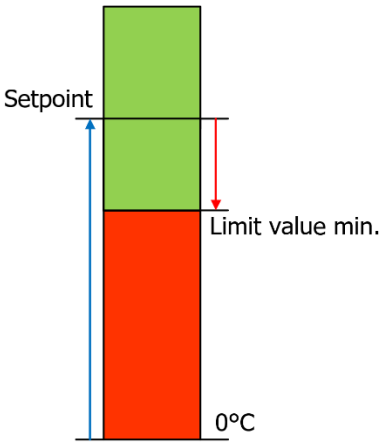
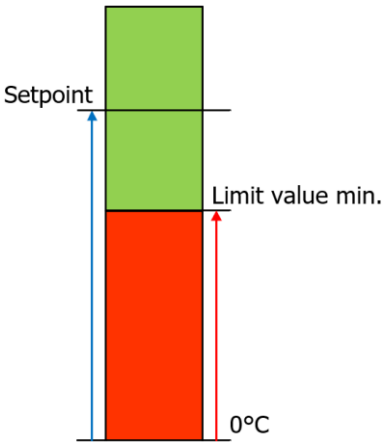
Parameter	Description	
Limit 1	**---**(2)	Not selected.
	One zone => Message(1)	Once Limit 1 is active in one zone, monitoring is set.
	All zones => Message	Monitoring is not set until Limit 1 is active in all zones.
Limit 2	**---**(1)	Not selected.
	One zone => Message(2)	Once Limit 2 is active in one zone, monitoring is set.
	All zones => Message	Monitoring is not set until Limit 2 is active in all zones.
Sensor error Colour: red	**---**(2)	Not selected.
	Active(1)	In the case of sensor break monitoring is set.
Restart lock-out Colour: orange	**---**(1) (2)	Not selected.
	generate Signal	Monitoring is set if a restarting-incident triggered.
System error Colour: red	**---**(1) (2)	Not selected.
	Active	Monitoring is set if system error occurred.
End of Program controller Colour: orange	**---**(1) (2)	Not selected.
	generate Signal	Monitoring is set when the program controller has finished.

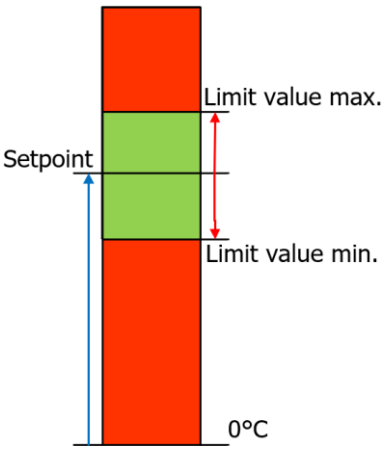
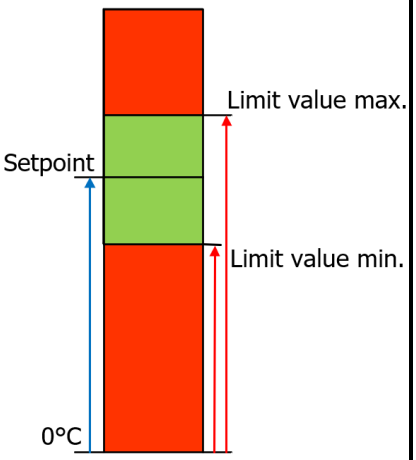
(1): Factory setting for **configuration Monitoring 1**

Parameter	Description	
(2): Factory setting for **configuration Monitoring 2**		
Moni 1(2) Relay	**Direct**[1] [2]	Relay switches on if monitoring is active.
	Indirect	Relay switches off if monitoring is active.
Current alarm Colour: red	**---**[1]	Not selected.
	Active[2]	Monitoring is set, if current alarm occurred.
(1): Factory setting für **Konfiguration Monitoring 1**		
(2): Factory setting für **Konfiguration Monitoring 2**		

12.2 Configuration limit values 1+2

The limit values can be output to the monitoring relays via the monitoring function (↗12.1). Irrespective of this, the limit value overruns can be output on the zone relays or logic outputs. With a programmed setpoint ramp, the relative limit values are tracked to the current ramp setpoints. In the case of sensor and line errors, the limit value violations react in the same way as range override.
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**		

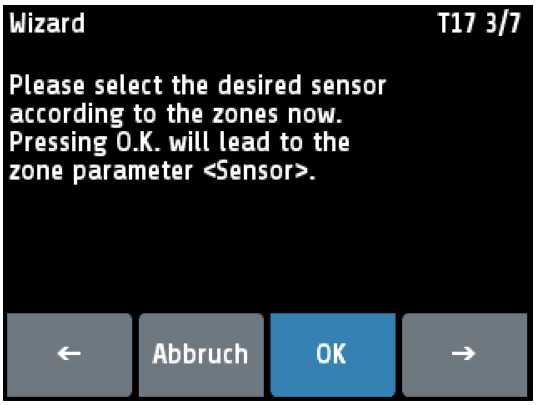
Description	Relative limit values	Absolute limit values
Monitoring of limit value violations on both sides (tolerance band). The signal is displayed if: **1. Relative limit values** • the actual value is greater than the sum of **max. limit value** and setpoint or smaller than the difference between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

Settings for the limit values:

Parameter	Setting Range	Description
Limit values	**Limit value 1 / 2 (min.)**	Relative to setpoint: **-200 ... 0; OFF(*)** (1 = OFF) Absolute: **MRS** (*) **... MRE**
	Limit value 1 / 2 (max.)	Relative to setpoint: **OFF(*); 0 ... 200** (-1 = OFF) Absolute: **MRS**(*)**... MRE**
Type limit	**Absolute(*)**	Absolute limits. Not dependent on setpoint.
	Based on setpoint	Limits relative to setpoint.
Delay	**OFF(*)**	🌡-Alarm delay switched off.
	1 ... 8000 s	🌡-Alarm is delayed by selected time.
Self-retaining	**off(*)**	No self-holding of the temperature alarm.
	on	An activation of the 🌡-alarm will be stored. The 🌡-alarm can be acknowledged in the window "Monitoring".
Start suppression	**OFF(*)** **Without start up**	Start-up 🌡-alarm suppression switched off.
	Start up Suppression active	Start-up 🌡-alarm suppression active: Temperature must be within the limits once. Only then the 🌡-alarm is activated when reaching the alarm value.
Display colour	**Red(*)**	The monitoring displays the 🌡-alarm in red colour.
	Green	Intended for enabling signals: Display colour is green.
	Orange	Display colour is orange.
Switching behaviour	**Direct**	The monitoring output is activated when the max. limit value has been exceeded or if the min. limit value has been undercut.
	Inverse	The signal is inverted and output to the monitoring. If the min. limit value has been exceeded or if the max. limit value has been undercut the output is set.

(*): Factory setting

12.3 Wizard



The wizard serves as a support for initial commissioning of the controller or in the occasion of a reconfiguration.

Please notice the wise order in which the parameters of the wizard have to be adjusted. The wizard can be cancelled at any time.
By pressing the arrow keys you will move on to the next step. Pressing the **OK** key will lead to the parameters.

New controllers automatically start with the wizard. After pressing "finish" in the last window of the wizard the wizard will not be shown anymore at startup.

12.4 Fieldbus / USB / LAN

Menu: Fieldbus It depends on the installed field bus module what parameters will be visible.

Protocol	**aus**	No protocol selected		
	Elotech	<SERIAL> ELOTECH-Standard-protocol		
	Modbus	<SERIAL> Modbus-RTU-protocol		
	Arburg 1	<SERIAL> Hot runner: One device address for all zones.		
	Arburg 2	<SERIAL> Hot runner: Every zone has its own address.		
	Arburg 3	<SERIAL> Protocol for temperature control systems		
	Profinet	<PROFINET> Profinet		
	Profibus DP	<PROFIBUS> Profibus DP		
Status Nur Indicator	**---**	<SERIAL> No data communication		
	Data Exchange	<SERIAL> Data communication is active <PROFIBUS/PROFINET> Data-Exchange-Mode		
	Wait Param	Controller waits for configuration / parametrisation <PROFIBUS/PROFINET>		
	No connection	No master connected / Master not active <PROFIBUS/PROFINET>		
Baudrate <SERIAL>	**1.2 kBaud**	1.200 Bit/s	**9.6 kBaud**	9.600 Bit/s (*)
	2.4 kBaud	2.400 Bit/s	**19.2 kBaud**	19.200 Bit/s
	4.8 kBaud	4.800 Bit/s	**38.4 kBaud**	38.400 Bit/s
Baudrate <PROFIBUS>	**Only Indicator**	45,5 kBaud – 12Mbaud (forced by the master) Not detected = no master connected		
Adress	**1 … 255**	**1**(*) … **255** (ELOTECH-Standard) **1**(*) … **247** (Modbus-RTU-Protocol) **1**(*) … **32** (Arburg-Protocol) **2**(*) … **125** (Profibus) At this address a master communicates with the controller. Each controller needs a unique address. → **Profinet**: Master assigns adress		
Format <SERIAL>	**7 E 1**	7 Data bits, 1 Stop bit, Parity Even (*)		
	7 O 1	7 Data bits, 1 Stop bit, Parity Odd		
	7 E 2	7 Data bits, 2 Stop bits, Parity Even		
	7 O 2	7 Data bits, 2 Stop bits, Parity Odd		
	7 N 2	7 Data bits, 2 Stop bits, Parity None		
	8 E 1	8 Data bits, 1 Stop bit, Parity Even		
	8 O 1	8 Data bits, 1 Stop bit, Parity Odd		
	8 N 1	8 Data bits, 1 Stop bit, Parity None		
	8 N 2	8 Data bits, 2 Stop bits, Parity None		
HW-config <SERIAL>	The serial fieldbus module has three integrated interfaces. Select here the desired interface.			
	RS232/RS485	Signals see connection diagram (↗4.8).		
	TTY	Signals see connection diagram (↗4.8).		
Remote <PROFIBUS> <PROFINET>	**On**	Profibus/Profinet can read and write. Local operation is locked.		
	Off(*)	Profibus/Profinet can read only. Local operation is permitted.		
Sensor selection <PROFIBUS>	**Internal**(*)	The actual value is generated via the internal sensor.		
	via profibus	The actual value is specified via the Profibus interface.		

(*): Factory setting

Menu: USB Save controller data on an USB-Stick. (USB-flash drive)
The data is stored as a text file in an adjustable CSV-format.
The USB-flash-drive must be formatted with FAT (FAT16/ FAT32).
The file name contains the last 5 digits "xxxxx" of the MAC-ID.

Save to USB	**All parameters**	Save all parameters for all zones. Generates the file -> LogParaxxxxx.txt and LogPara.bin
	Al. Logbook	Save the entries of the Alarm Logbook. Generates the file -> LogBookxxxxx.txt
	Graph	Save the measuring points of the graph for all zones. Generates the file -> LogGraphxxxxx.txt
	Act. program	Save the current program of the program controller. Generates the file -> ProgAkt.bin
	All programs	Save all programs of the program controller in one file. Generates the file -> ProgAll.bin
USB status	**- - -**	Display of the USB-status: no stick detected.
	Key detected	USB-stick detected: Files can be saved or loaded from the USB flash drive.
Load	**Load all Parameters**	Loading a previously saved parameter set. The file "LogPara.bin" must exist on the USB flash drive.
	Act. program	Load a program for the program controller. The program contained in the ProgAkt.bin file is loaded into the currently set program.
	All programs	Load all programs. The programs contained in the ProgAll.bin file are loaded into the program controller.
Separator	**none** (*)	Delimiter symbol between single data sets: Spaces
	comma	,
	semicolon	;
	colon	:
	tabulator	<TAB>
Sample-Interval	**OFF(*); 5 … 720s**	Cycle time for writing an output line with time stamp on the USB stick.
	If the parameter "Log interval" is set to a numerical value, so a file named "LogR4000_xxxxx_YYYY_MM_DD.txt" is generated on the USB stick. "xxxxx" the last 5 digits of the MAC-ID. YYYY, MM and DD mean the year, month, day. After a change of date, a new file is created. With the included names MAC-ID "xxxxx", the files can be assigned to different R4000 controllers. Each "Log interval" time a new row is added. The line includes a timestamp, setpoint, the actual value, the output ratio and the actual current value of Zone 1 to Zone 8.	

(*): Factory setting

Menu: LAN	Ethernet interface for connection to the configuration tool EloVision 3 or for a MODBUS-TCP communication.
IP-Adress (standard)	
IP-Adress 1	IP-Adress **192** . 168 . 100 . 100 (Part 1)
IP-Adress 2	IP-Adress 192 . **168** . 100 . 100 (Part 2)
IP-Adress 3	IP-Adress 192 . 168 . **100** . 100 (Part 3)
IP-Adress 4	IP-Adress 192 . 168 . 100 . **100** (Part 4)
Subnet mask (standard)	
Subnet mask 1	Subnet mask **255**. 255 . 255 . 0 (Part 1)
Subnet mask 2	Subnet mask 255 . **255**. 255 . 0 (Part 2)
Subnet mask 3	Subnet mask 255 . 255 . **255**. 0 (Part 3)
Subnet mask 4	Subnet mask 255 . 255 . 255 . **0** (Part 4)
Default gateway (Standard)	
Def.-gateway 1	Default gateway **192**. 168 . 100 . 1 (Part 1)
Def.-gateway 2	Default gateway 192 . **168**. 100 . 1 (Part 2)
Def.-gateway 3	Default gateway 192 . 168 . **100**. 1 (Part 3)
Def.-gateway 4	Default gateway 192 . 168 . 100 . **1** (Part 4)

MAC ID	**549A11:5xxxxx**	Display of a MAC-ID: 54:9A:11:5x:xx:xx

12.5 Heat up

Auswahl und Konfiguration der Aufheizart beim Start des Systems.

Parameter	**Setting range / Description**	
Heat up type	**off**(*)	Compound and energy opt. heating is switched off.
	Even heat up	Compound heating is switched on. The activated zones are heated up as a group (↗12.5.1).
	Energy opt. heat up	This function has the aim of reducing the energy required by time-shifted switching of the control zones (↗12.5.2).
Heat up times *<only with energy opt. heat up>*	**0**(*)... **30000 s**	Display of the zone-assigned times that were determined during the **training phase**. The values can also be entered manually.
Training *<only with energy opt. heat up>*	**off**(*)	Normal state. After switching on the function **Energy opt. heating** will be performed.
	on	The next time the system is switched on, the heat up times of the individual zones are determined. After heating up, the parameter is automatically set to **off**.
Participating zones	Selection of the zones that should take part in the respective type of heating. Factory setting: **All zones activated**	

(*): Factory setting

12.5.1 Even heat up

If the **even heatup 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**.
If the **Even heatup** mode is activated all zones are selected by default.
Zones that are currently participating in the even heat up mode are marked by a yellow ring on the home screen.

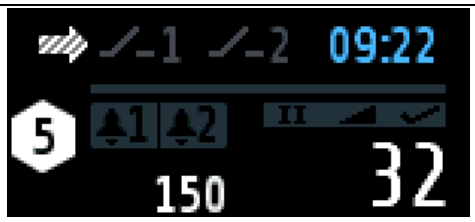
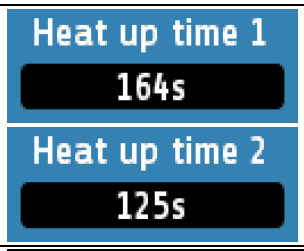
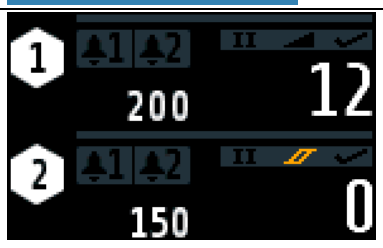
NOTE!

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

12.5.2 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.	↗11.1.1 Self-optimising (Autotune)
2.	Select the parameter **Training** and set it to **on**. The next time the system is started, the **R4000** measures the heating times of each zone	
3.	Now switch the **RT4000** off by the mains switch and only switch it on again when all zones have cooled down.	
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. The training status is illustrated symbolically on the ↗Home symbolised by a dashed arrow at the top right edge. 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.	
6.	The next time the R4000 is switched on the energy optimised heat up is active. Zone were the heat up mode is active are symbolised at the ↗Home.	

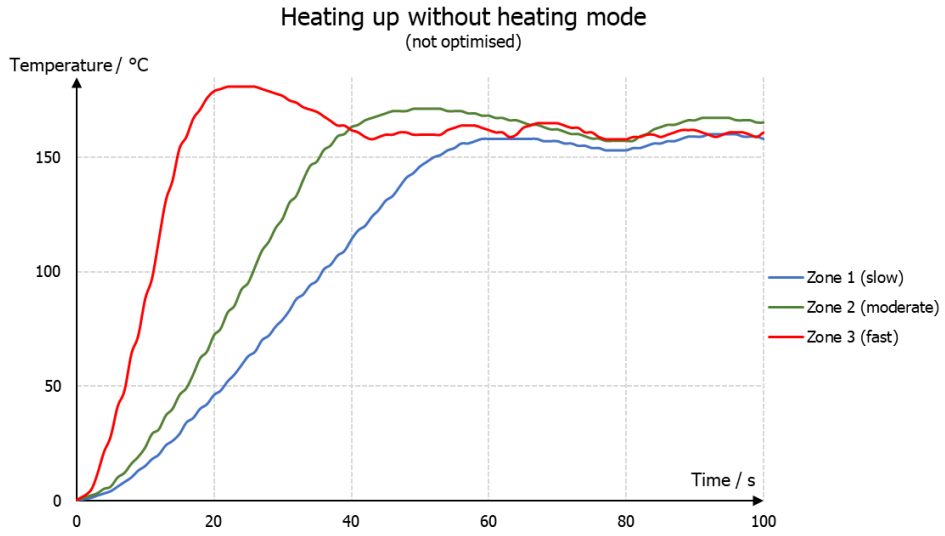
When the system is restarted in future, the zones are heated with a time delay. In the example from step five, Zone 1 requires 164 seconds to reach the setpoint, while Zone 2 needs only 125 seconds. Accordingly, Zone 2 is switched on **39 seconds later**.

12.5.3 Comparison of the heating modes

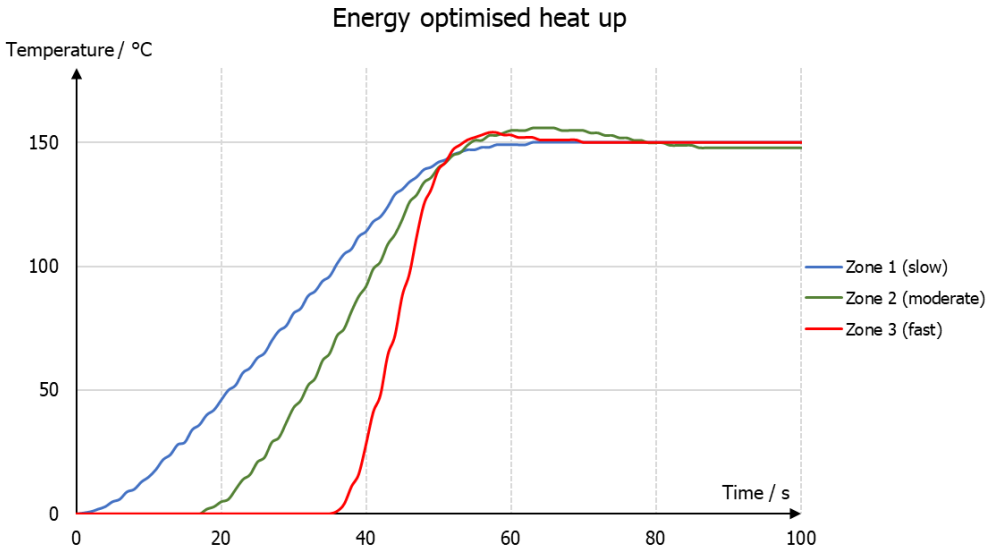
In this chapter the three heating modes **compound heating**, **energy-optimised heating** and **heating without heating mode** (parameter: **OFF**) will be compared graphically.

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.

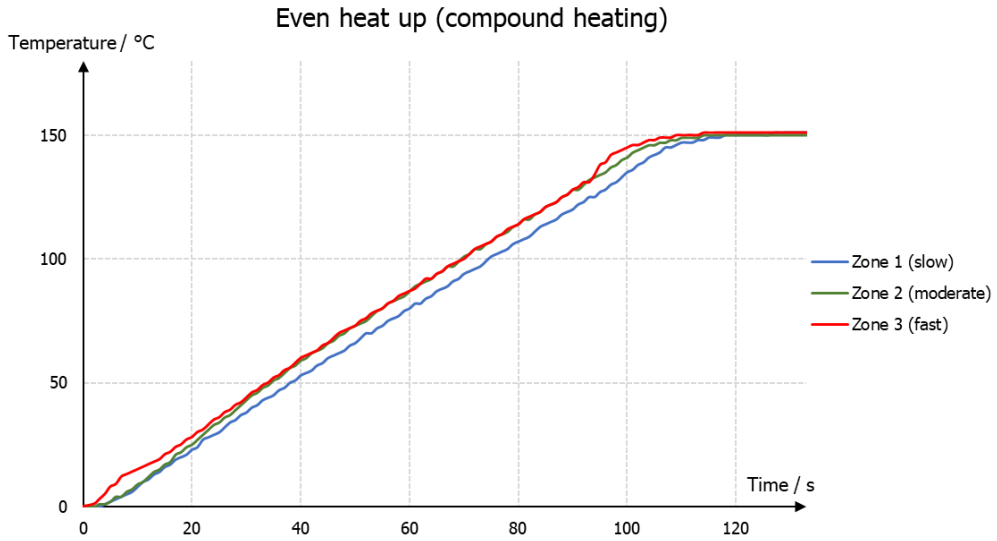
If the device is started **without heating mode**, all activated zones begin to heat at the same time. Faster zones (e.g. small components such as nozzles) reach their setpoints much earlier than slower zones. Note that the zones have not been optimised in the following illustration. The deviations of the actual values from the setpoint are minimised by a completed optimisation (↗11.1.1).



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.



12.6 Configuration current alarm (option)

The heater current monitoring function is valid for all connected zones. Only zones with logic output for the heating signal will take part in current monitoring. Ensure that the limit value is set correctly to avoid false alarms in case of supply voltage changes. The alarm can be delayed by selecting a delay time to avoid false alarms caused by single disturbances. The heater current measuring is designed for a current transformer 1:1000.

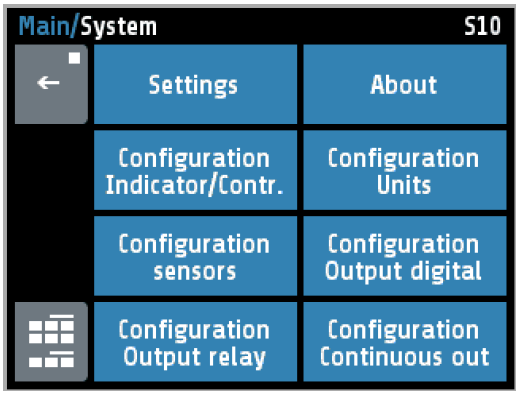
Accessory type: M2000 1:1000 max. 60A

When using other transformers the ratio can be modified.

Parameter	Setting range / Description	
Current alarm limits / Undercurrent alarm value	**OFF(*); 0.1 ... 99.9 A**	Zone parameter: Absolute value Currents below this value will cause an alarm.
Current alarm limits / Overcurrent alarm value	**OFF(*); 0.1 ... 99.9 A**	Zone parameter: Absolute value Currents above this value will cause an alarm.
Reststrom Grenze *Monitoring an impermissible continuous current*	Setting range: **OFF**; **0,0 ... 0,3**(*) ... **99,9 A** SSRs (especially if they are combined with RC-combinations) normally have small leakage currents. These currents add up and the sum can lead to a permanent leakage current. A leakage current limit value is programmable. All values below this limit will not be considered in the alarm monitoring. The field "act. Leakage current" displays the leakage current that has just been measured. If a permanent current (SSR short circuit) is detected the alarm will be activated. The zone with a permanent current can be detected by observing the actual process values (proves value too high).	
Act. Leakage curr.	Display of the actual leakage current.	
Current transformer	**1:100 ... 1:9999**	Turns ratio of the current transformer. Standard: **1:1000** for M2000
Cycle time	**1 ... 2**(*)**... 60 s**	Time interval between the current measurements of two successive zones.
Delay	Settings in 5 steps, unit: seconds The values depend on the cycle time and the number of active controller zones. **Off**(*) = no delay time active	

(*): Factory setting

13 System



Pressing the configuration key leads to windows in which the associated parameters can be selected or set.

Pressing the key **About** shows hardware information of the controller.

The continuous outputs menu appears only for controllers with the option "continuous". The relay outputs are lost in this case.

	Touch < 1 sec. = Back to previous menu Touch > 1 sec. = Go to ↗Home
	Go to ↗Main menu

13.1 Settings

Parameter	Setting range / Description	
Language	**Deutsch (German)** (*)	
	English (English)	
Device name	Alphanumerically adjustable name for the controller. The name is displayed in the header of the basic screen and is used to generate log file names.	
Authorisation (LOC)	**All Parameter adjustable** (*)	All parameters adjustable
	Setp. and ramps adjustable	Setpoint values, alarm values and ramps are adjustable. All other parameters are locked.
	Only setpoints adjustable	All other parameters are locked.
	Setp. and clock adjustable	Setpoint values are adjustable and time/date is adjustable. All other parameters are locked.
	All parameters locked	No parameter is adjustable.
	Change Lock code	Here the code (start value = 0000) can be changed to a different value.
The old code is requested before the setting of the new code. The new Code has to be entered twice. The parameters that have been locked can be displayed but not changed. This parameter cannot be changed if the logic input In_2 is active, or the lock code is not known. The value of the factory setting is **0000**		
Time	**Hours**	Number value 0 … 23
	Minutes	Number value 0 … 59
Day / Month	**Day**	Number value 1 … 31
	Month	Number value 1 … 12
Year	**2000 … 2150**	Adjustment of calendar year

(*): Factory setting

Parameter	Setting range / Description
Sample rate *Scanning time for recorder function*	Time interval between the current measurements of two successive zones. In brackets the complete time interval as shown on display: **2,5 s (Total time: 8,2 Min)** **5 s (Total time: 16,5 Min)** **10 s (Total time: 33 Min)** (*) **30 s (Total time: 99 Min)** **1 Min. (Total time: 3,3 h)** **5 Min. (Total time: 16,5 h)** **10 Min.(Total time: 33 h)** A maximum of 198 temperature points can be saved.
Zone offset	**OFF**(*) The adjusted offset value is added to the displayed zone numbers **1 … 91** in the windows. Therefore a continuous numbering of the zones can be achieved if more than one device is used.
Zone numbers	Visible only when zone offset is off.
Zone 1…n	**OFF**(*)**;** With this parameters, individual numbers can be assigned to the **1 … 99** zones. In all windows these values are displayed, instead of the real zones.
Restart lock-out	**aus**(*)**;** After power-on all zones are switched off and a message is **ein** displayed. Switch on must be acknowledged. After acknowledgement all zones, that were on before the power fail, will be switched on again. In addition, the alarm **Restart lock-out** will be set and can be handled in the monitoring.

(*): Factory setting

13.2 About (firmware updates)

Firmware	Displays the current firmware and language version.
Firmware update	Start the firmware update by selecting the button "Start Update" and confirm with SAVE.

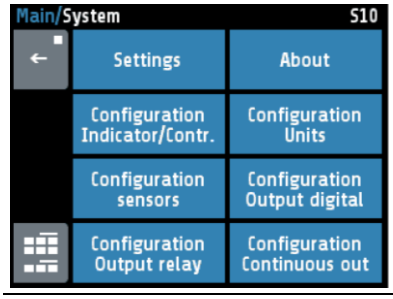
A confirmation prompt opens. If this window is confirmed with YES, the unit turns into the loader mode. When the loader mode is accidentally turned on, you can switch back by mains reset into the existing user program.
If an update should be performed, a USB flash drive must be plugged in with the new firmware. After a short time the firmware folder appears in the line "Folder" e.g. „EL4000.01_V20xx_xx.ELO".
Now you can start the loading process by touching the touch screen. The controller must not be disconnected from the power supply until the download is complete!
After finished loading the new user program is started by a power interruption.

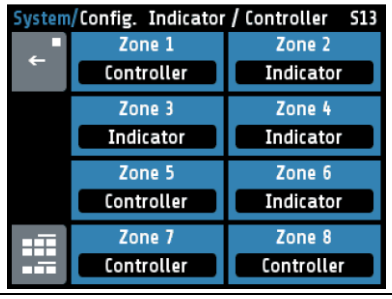
Typ R4000-0-x-x-000-0x-5	Type key of the controller.
Factory setting	Reset to factory delivery status. With the help of this parameter, all settings are deleted and reset to the delivery status.

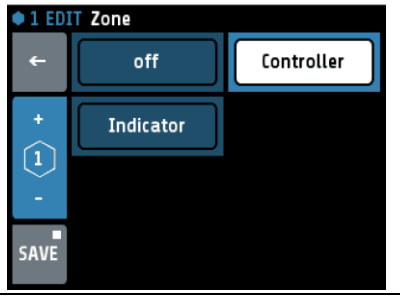
Typ R4010-0-x-0-000-00-5	Only with zone extension 12 or 16. Type code of the additional module.
Zonenerweiterung	Only available for the 8-zone version (**off** (*)) 12: Extended to 12-zone controller. Requires module R4010-04 16: Extended to 16-zone controller. Requires module R4010-08

13.3 Configuration indicator / controller

For each zone you can choose here whether you want to serve as a pure indicator zone or as a control zone. Also, the zone can be switched off.



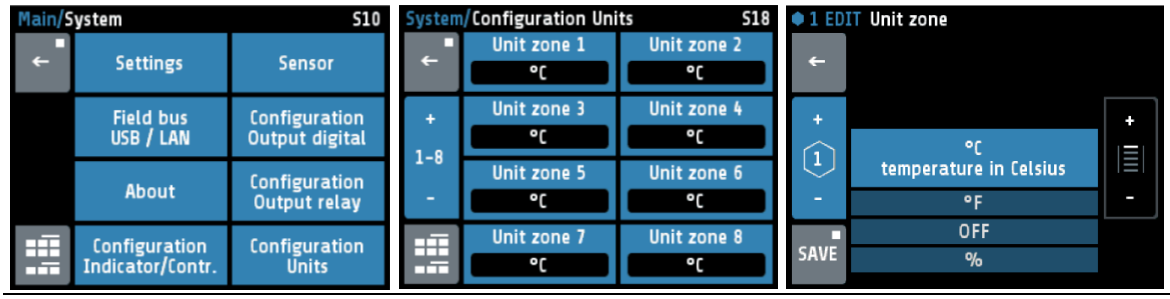




Indicator/Contr. Zone 1 … x	Description see ↗11.1 Zone parameter list: **Config. Indicator/Contr.**

13.4 Configuration units

For each zone, the unit to be displayed can be selected here. In case of control zones, the unit can be °C or °F, for indicator zones, additional unit (OFF),%, A, V, Hz, rpm, rpm, bar, psi, Pa, l/min, m³, l, m/s, m²/s, kg, N, Nm, J, J/m³, s, min or h can be selected.



Unit zone Description see: ↗11.7 **Einheit Zone**

13.5 Configuration sensors

Sensor	**Linear 0...10 V**	Voltage 0...10 V	
	Linear 0...20 mA	Current 0...20 mA	
	Linear 4...20 mA	Current Live Zero 4...20 mA	
	PT100 2-wire	Pt 100 (RTD) 2-wire connection -100...800 °C	
	PT100 3-wire	Pt 100 (RTD) 3-wire connection -100...800 °C	
	Ni120 2-wire	Nickel 120 2-wire connection 0...250 °C	
	Ni120 3-wire	Nickel 120 3-wire connection 0...250 °C	
	(TC) Fe-CuNi (J)	Thermocouple Type J	0...800 °C
	(TC) NiCr-Ni (K)	Thermocouple Type K	0...1200 °C
	(TC) Fe-CuNi (L)	Thermocouple Type L	0...800 °C
	NiCrSi-NiSi (N)	Thermocouple Type N	0...1200 °C
	(TC) PtRh-Pt (S)	Thermocouple Type S	0...1600 °C

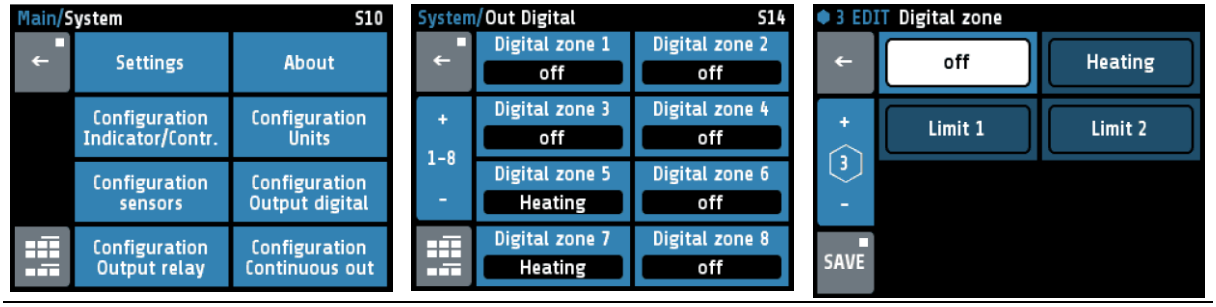
CAUTION!

If the sensor selection is changed and the value is out of the new measuring range, the following parameters will be reset.

Setpoint 1, Setpoint 2:	Setpoint limitation min.
Setpoint min.:	Measuring range bottom
Setpoint max:	Measuring range top
Setpoint ramp rising/falling:	off
Limit values:	off
Actual process value offset:	off
Setpoint softstart:	setpoint min.
softstart:	off

13.6 Configuration digital outputs

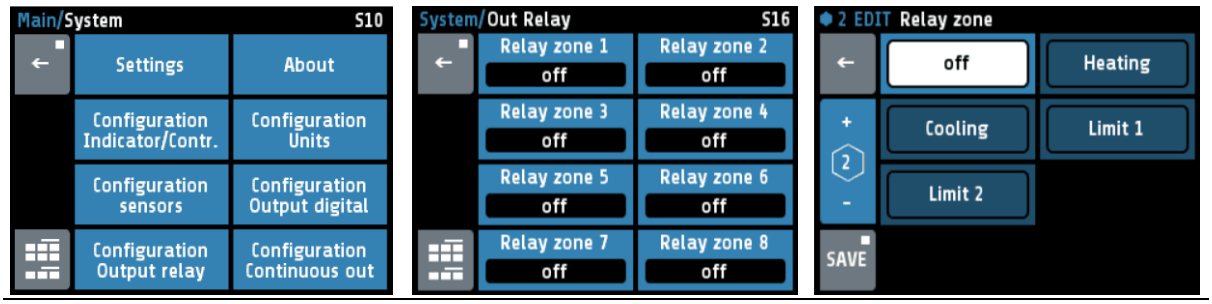
A digital output (logic output) is available for each zone. Select the desired output signal. Configurations that are not possible are not displayed. Like "cooling" in this example.



Digital 1 ... x Description ↗11.8 Control outputs

13.7 Configuration relay outputs

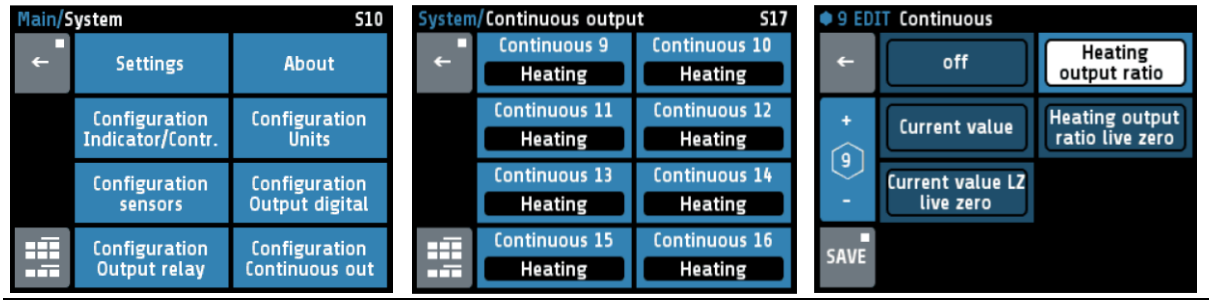
For every zone one relay output is available. Select the desired output signal.
When using it as a control output, make sure that the switching cycle time is set as long as possible to minimize contact wear on the relay.
Configurations that are not possible are hidden. In the example, heating and cooling can be selected because the zone has been configured as a "heating-cooling" zone (3-point heating cooling).



Relays 1 ... x Description ↗11.8 Control outputs

13.8 Configuration continuous outputs (option)

A continuous output is available for each zone. Select here the desired output signal.
Configurations that are not possible are hidden, such as "Cooling output level" and "Cooling output level". Live Zero ", in the picture below.



Continuous 1 ... x Description ↗11.8 Control outputs

14 Error messages

Error message	Cause	Possible remedy
At actual process value maximum value flashes	Top range end has been exceeded, sensor defect	Check sensor and cable
At actual process value minimum value flashes	Bottom range end has been exceeded, sensor defect	Check sensor cable Check process value offset TC connected with inverted polarity
REMOTE: Parameter locked	Adjusting of parameters is not allowed. Device is controlled by fieldbus.	Profibus: The parameter "Remote" in the menu Field bus is set to "on".
EloVision is active!	Adjusting of parameters is not allowed. Device is controlled by EloVision.	The configuration-tool EloVision is active. Please close EloVision, or switch to the visualisation page of von EloVision.
Field bus module unavailable		The controller is not fitted with the correct hardware for the selected protocol.
Zone synopsis: Current: --.-A	No current measurement	Set the logic output of the corresponding zone to heating.
DfErr	Text display error	Please send the controller back to the manufacturer.
ERR0	System error	Please send the controller back to the manufacturer.
ERR8	System error	Quit error message. Check the parameters. If the error is still there, send the controller back to the manufacturer.
ERR IO	Error I/O board See logbook: Error IO board 1 or 2 Error IO board 3 or 4	The connection to the input/output circuit board is broken. -> Internal card defective, please send the controller back to the manufacturer. -> If zone extension (↗13.2) is set to 12 or 16, the required additional module R4010 may not be connected. Switch off zone extension if necessary. *Info: All 4 sensors of the faulty card are set to sensor break.*

15 Technical data

15.1 Inputs

Sensor inputs

Input Pt100 (DIN):	2- or 3- wire connection possible Built-in protection against sensor breakage and short circuit Sensor current: < 1 mA Accuracy: < 0,2 % Linear error: < 0,2 % Influence of the ambient temperature: < 0,01 %/K
Input Thermoelement:	Built-in internal compensation point and protection against sensor breakage and incorrect polarity. Accuracy: < 0,25 % Linear error: < 0,2 % Cold junction error: 0,5 K Influence of the ambient temperature: < 0,01 %/K
Inputs voltage 0…10 V:	Internal resistance > 100 k-Ohm Accuracy: < 0,25 % Linear error: < 0,2 % Influence of the ambient temperature: < 0,01 %/K
Input current 0…20 mA:	Internal resistance < 100 Ohm Accuracy: < 0,25 % Linear error:< 0,2 % Influence of the ambient temperature: < 0,01 %/K **CAUTION**: The input has high impedance when the controller is without supply voltage.
Logic input:	Internal resistance > 22 kΩ Level 0 < 2 V Level 1 > 9 V; max. 30 V

Measuring input heating current monitoring

Heater current monitoring:	Measuring input range: 0…100 mA corresponding 0,0…99,9 A when using a current transformer 1: 1000. If the range is exceeded, the controller may be damaged.

15.2 Outputs

Logic outputs:	Bist. voltage, 0/24 V DC, max. 500 mA, short-circuit proof
Relay outputs:	Relay; max. 250V AC, max. 2 A, resistive load
Continuous outputs:	0…20 mA maximal load 300 Ohm; 0…10 V minimal Load 5 kOhm. Automatic switching, depending on connected load.

15.3 Interfaces

Fieldbus

Fieldbus interfaces:	• Serial: RS232, RS485, TTY (20 mA) — All with optical isolation • Profinet • Profibus DP (EN 50170)
Service interface:	Ethernet: Modbus TCP
E-Bus:	Bussystem zur Verbindung des R4000 mit der Erweiterungsbaugruppe **R4010** zur Erweiterung der Zonenzahl auf 12 oder 16 Zonen. Serieller Bus: die Verbindungsleitung muss geschirmt sein.

USB

USB interface:	Host for USB-Stick; max. 100 mA

15.4 Electrical data

Supply voltage:	24 V/DC, +/- 25 %, ca. 6 W + Power of logic outputs
Electrical properties:	Service interface: Ethernet RJ45 USB interface: Type A Profibus: SUB-D 9 Others: spring-loaded push terminals, Protection mode IP 20, Isolation class C Cross-sections: Thermal groups: A, B, D, E, F, G, I, K, M, N, Q + C, H (cont.) = 1,5 mm^2 (for end sleeves with plastic collar 0,75 mm^2) Terminal groups: C, H, (Relay), P = 2,5 mm^2
Data protection:	EAROM, Semiconductor storage When using a Fieldbus interface please note: Permissible writing operations per parameter must not exceed 1 000 000.
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.

15.5 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

15.6 Display and operation

Display:	8,8 cm (3,5") RGB-display with LED-backlight. 320 x 240 pixel with resistive Touch-Panel
Real time clock:	Backup battery: Lithium CR2032

15.7 Housing

Housing type:	Control panel housing made of steel and Makrolon UL 94-V1
Protection mode:	IP 20, Front side: IP50
Protection class:	1
Weight:	Approx. 800 g, depends on the version of device
Dimensions [mm]:	96 x 96 x 122
Panel cut out [mm]:	Width: $92^{+0,5}$, Height: $90^{+0,5}$

Imprint

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