R4000

Temperature Controller with 4 or 8 zones Heating/Cooling

Depth: 122mm
Format: 96mm x 96mm

DESCRIPTION AND OPERATING MANUAL

Contents

1 General Information

Symbols used:

www.elotech.de	Messages shown by the controller are written in this font.
MRS / MRE	**M**easuring **R**ange **S**tart / **M**easuring **R**ange **E**nd
<§>	Symbolizes the value of the factory adjustment of the respective parameters.

2 Installation 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 (Window: System) are generally to be selected first.

Disclaimer of Liability

The contents of this document is 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.

3 Type Code

R4000 - aa - y - 000 - dd - 5

Power Supply:

5	24 VDC

Fieldbus Interface:

00	No
03	RS 232-C + RS 485 + 0/20mA TTY
07	CAN
09	Profibus-DP

Heater Current Monitoring:

0	No
5	Yes (Logic outputs only)

Zones:

04	4-zones
08	8-zones
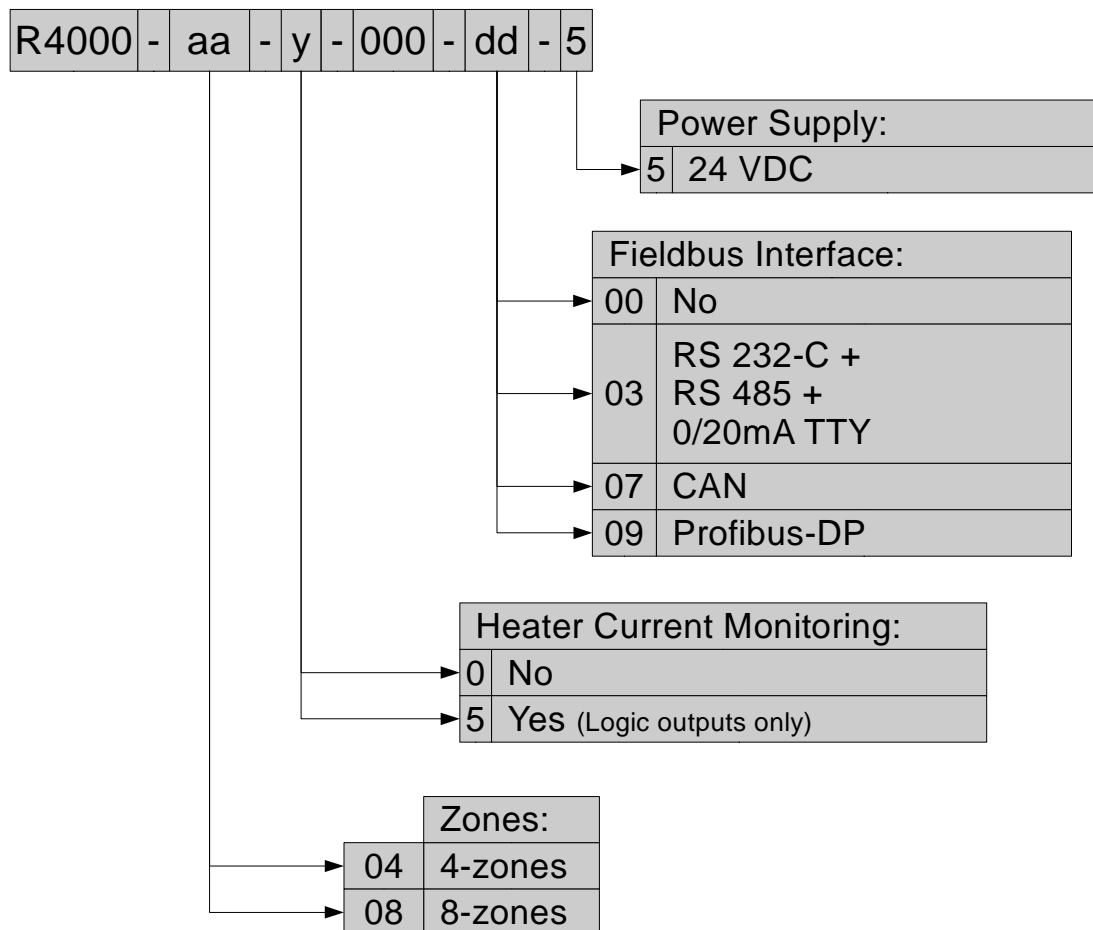
4 Connection Diagram
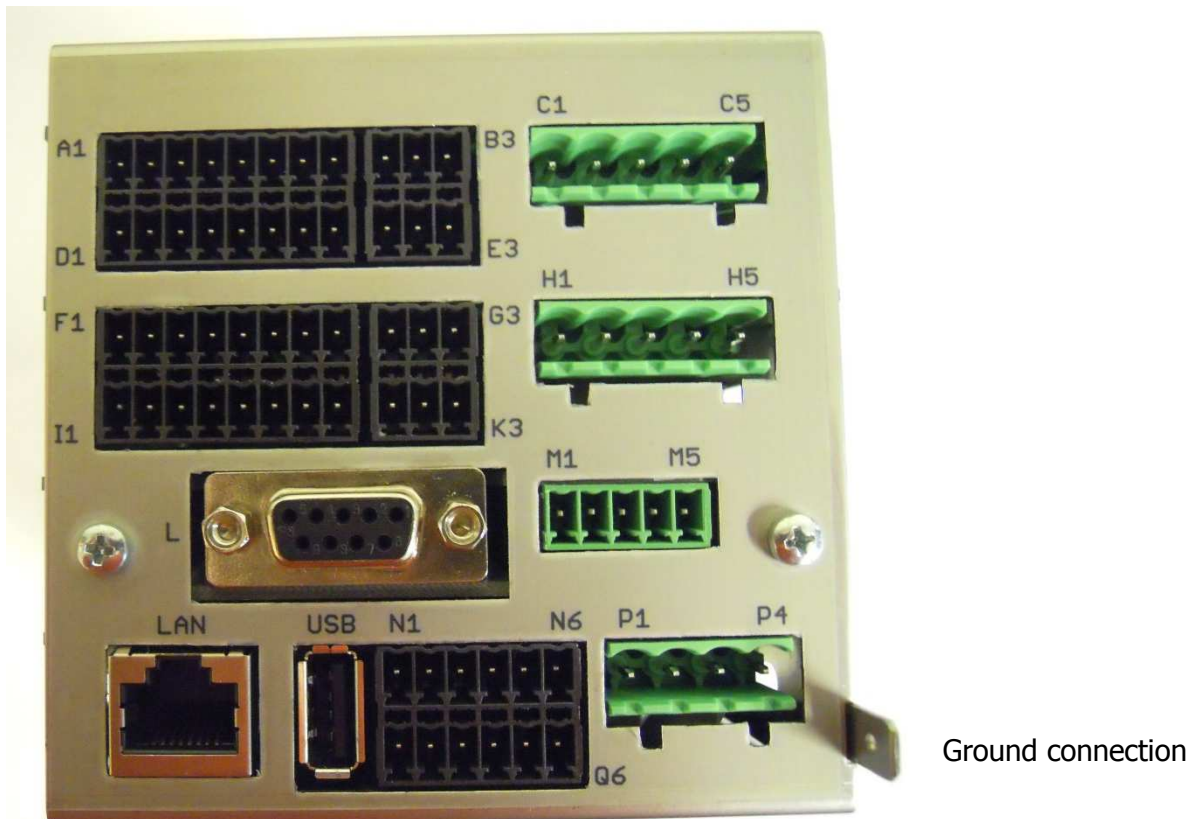
Ground connection

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

4.1 Connection Diagram:
   Power supply, Logic Inputs and Heater Current
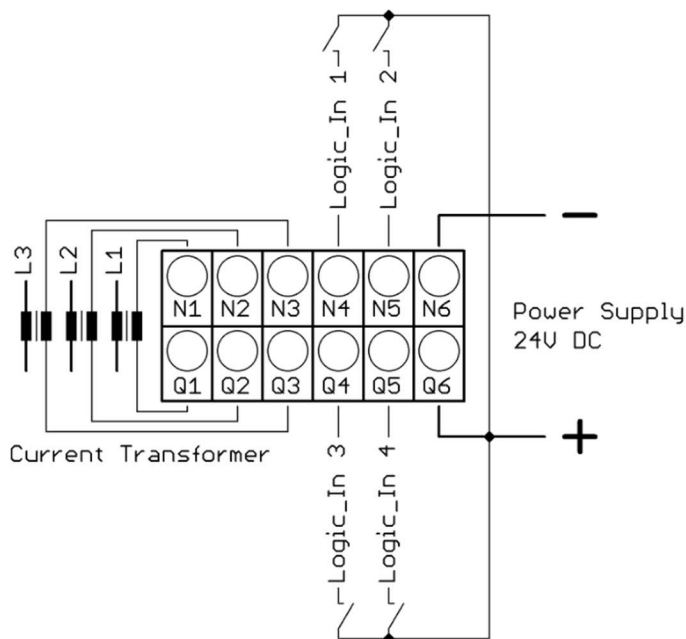
Function of the logic inputs:

In_1: 0 = Setpoint 1 active for all zones.
      1 = Setpoint2 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
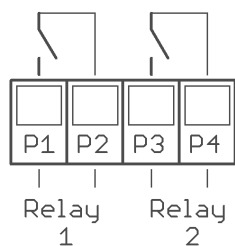
4.3 Connection Diagram: Sensor Inputs
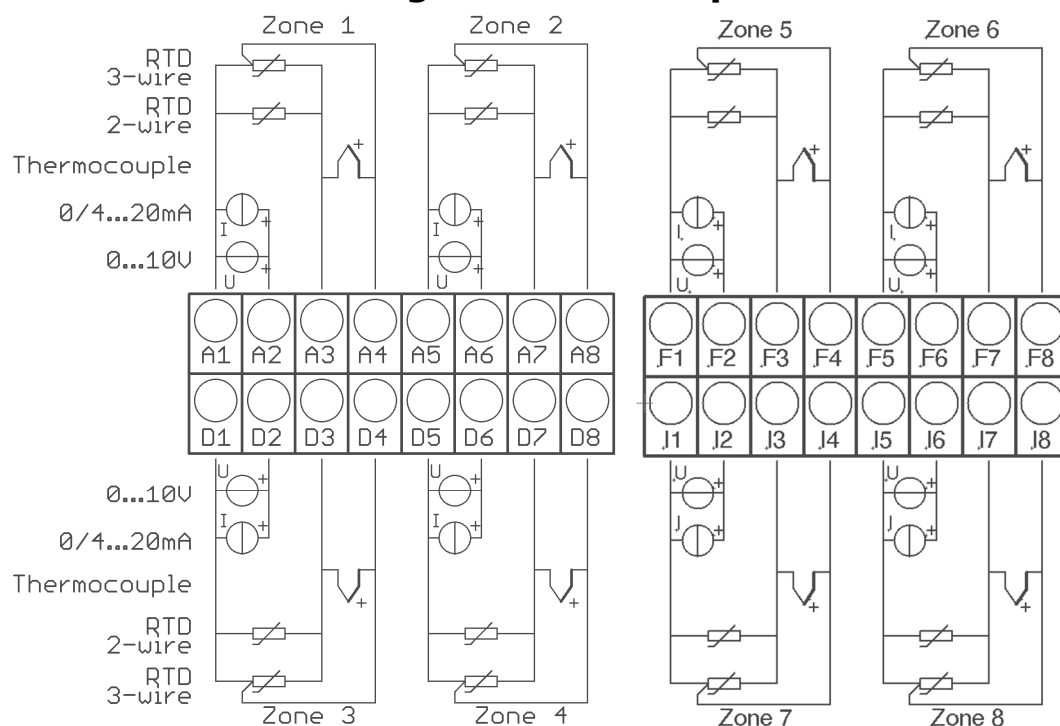
It is not permitted to connect the grounds of the sensor-inputs and logic-outputs with each other!

RTD: The parameter "Sensor Settings / Sensor" has to be set accordingly to the connection diagram (2-wire/3-wire)

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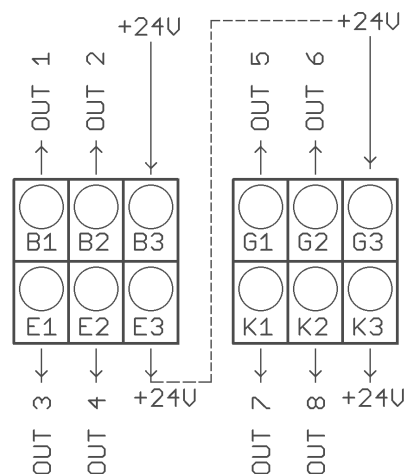
The power supply for the logic outputs has to be wired externally:
+24V have to be applied to the terminals B3 and G3.

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

4.5 Connection Diagram: Relay Outputs

C1	C2	C3	C4	C5		H1	H2	H3	H4	H5
Relay 1	Relay 2	Relay 3	Relay 4	Com		Relay 5	Relay 6	Relay 7	Relay 8	Com

4.6 Connection Diagram: Fieldbus Interfaces

Type 03 / 07 : Serial Interface / CAN
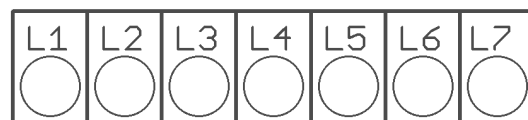
L1	L2	L3	L4	L5	L6	L7	Bus	Type	Remark
	A	B					RS485	03	Parameter HW-config = RS232 / RS485
			RxD	TxD	GND		RS232	03	Parameter HW-config = RS232 / RS485
					-	+	TTY	03	Parameter HW-config = TTY (current loop)
	H	L					CAN	07	Not available at the moment

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.
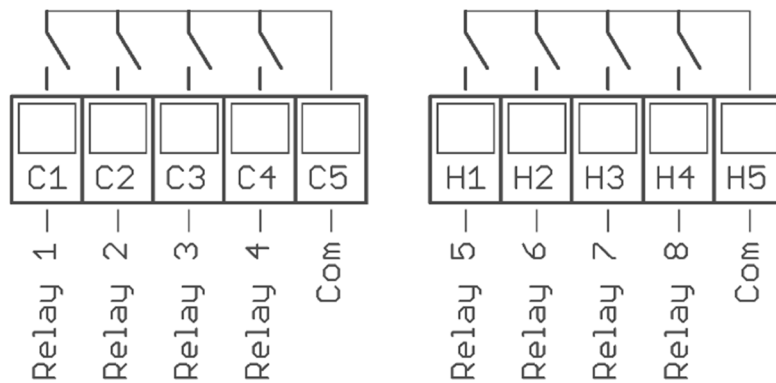
Typ 09: Profibus
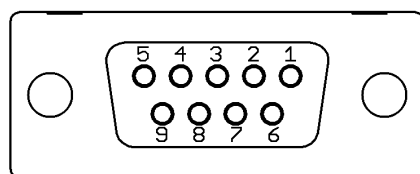
Pin 3	Data RxD / TxD - P
Pin 5	GND
Pin 6	+5V
Pin 8	Data RxD / TxD - N

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

4.7 Connection Diagram: LAN and USB

USB: Save process data, configuration data and alarm data on an USB-Stick.
Write back configuration data from USB-Stick to the controller.
Make a Firmwareupdate. (Please use FAT formatted USB flash drives.)

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

5 Display and Keyboard

The device is equipped with a backlight color 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 Window-Overview
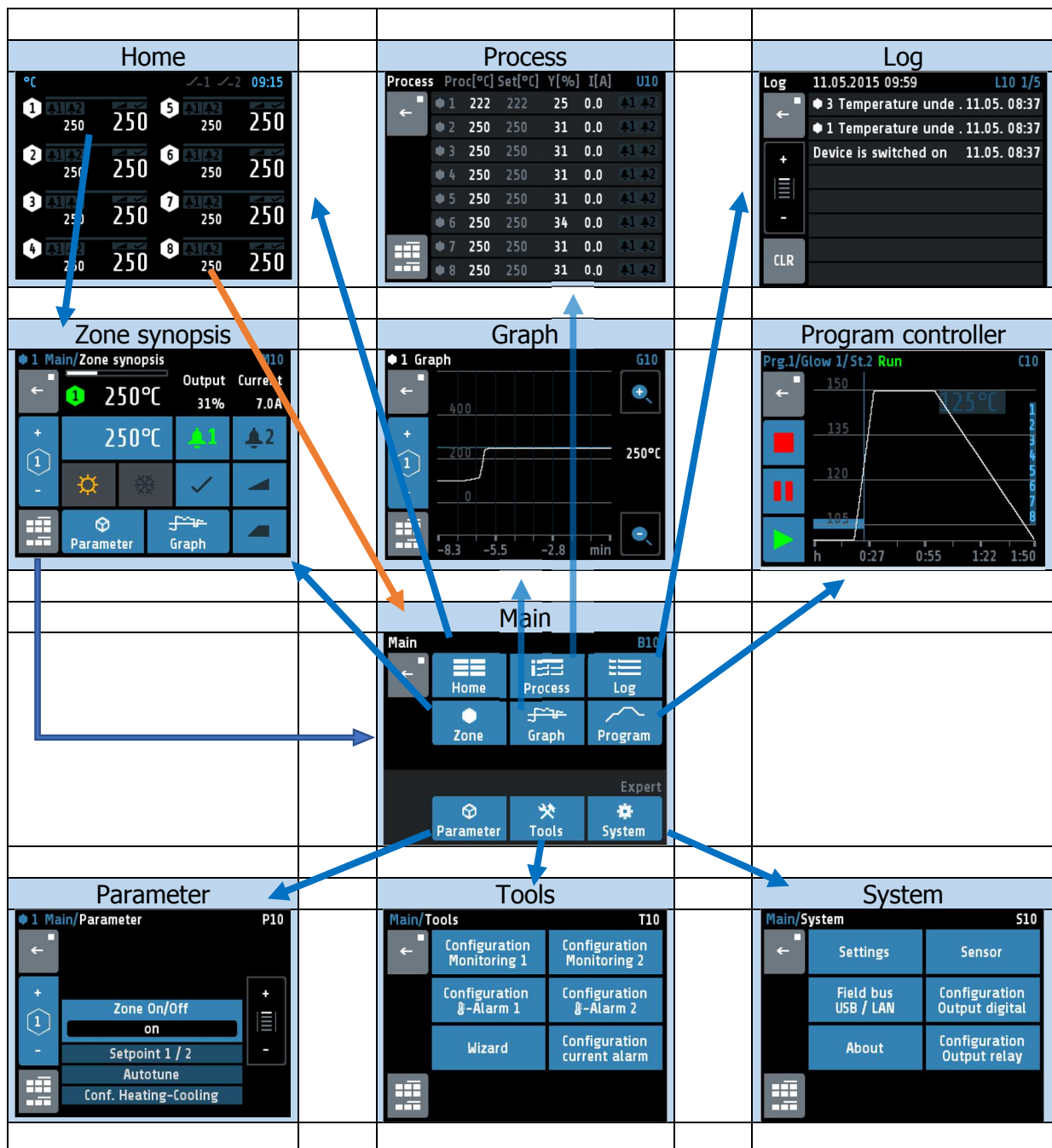
= Hold down the key (> 2 s)

5.2 Display screens (Windows)
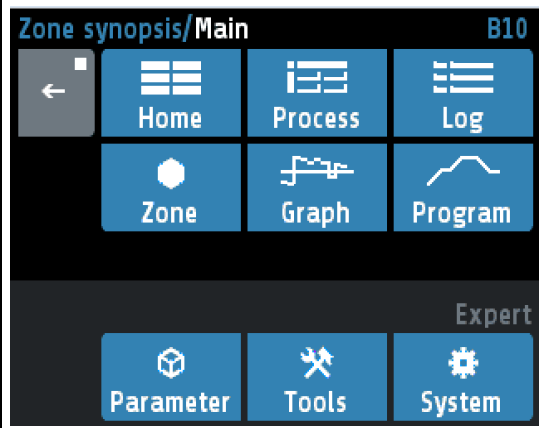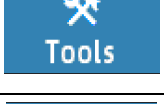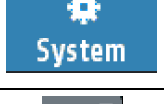
5.2.1 Window: Actual Process Values

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 showing the number of the zone is grey. 8-zone-controller: For every zone the actual process value is written in large and the setpoint in small numbers. 4-zone-controller: For every zone the actual process value (in the right column) and the setpoint (in the left column) is displayed.
	Monitoring 1 of zone 4 is active.
	Monitoring 2 of zone 8 is active. At this point the signal has an enable function. Therefore the colour green was chosen.
	Ramps of zone 3 and 6 are active.
	Soft start function of zone 7 is active.
	Auto tune of zone 2 is active.
	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 (>2s) leads to the main.

5.2.2 Window: Main
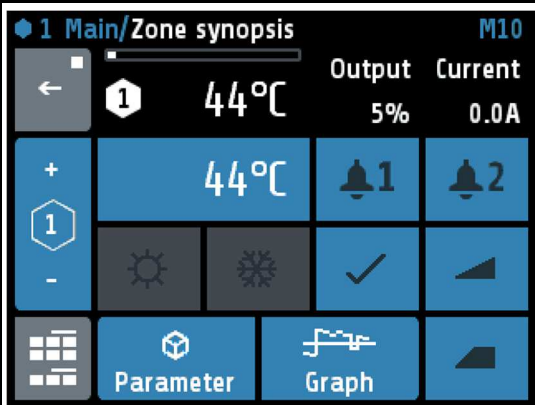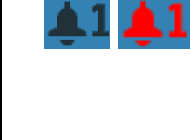
This window contains a summary of the other function windows.

	One gets to this window by pressing the area of a selected zone in the window "Actual Process Value" for more than 2 seconds. Likewise, you come into this window by pressing the following icon. In different windows this symbol appears in the lower left corner.

	Jump to window "Actual Process Value" Display for all zones: Actual process value, setpoint, output ratio, alarms, ramp, autotune, softstart
	Jump to window "Zone synopsis" Display and entry for selected zone: Actual process value, setpoint, output ratio, current, monitoring state, ramp, autotune, softstart
	Jump to window "Process" (List view) Display for all zones: Actual process value, setpoint, output ratio, current, monitoring state
	Jump to window "Graph" Display for selected zone: Graphical display of the actual value process-temperature over time
	Jump to window "Log" Display for all zones: Alarm- und status messages
	Jump to window "Parameter" Display and entry for all zones: All zone-parameter

	Jump to window "Tools"
	    Configuration of the monitoring, the alarms and power-on mode.
	    Calling of the Wizard (set-up assistance)

	Jump to window "System" Configuration inputs, outputs and interfaces
	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"
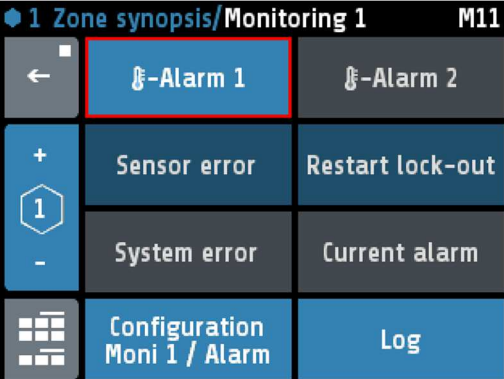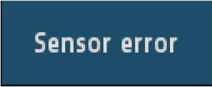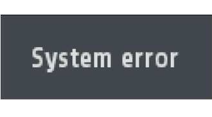
5.2.3 Window: Zone synopsis

This window contains the most important information of the selected zone.
The window appears after the area of the zone in the window "Actual Process Value" has been briefly pressed.

◆ 1 Main/Zone synopsis M10 ← ① 44°C Output 5% Current 0.0A ＋ ① − 44°C ♪1 ♪2 ☼ ❄ ✓ ◢ ▦ ⬡ Parameter Graph ◣	In the header the currently selected zone is shown. Underneath from left to right the following is displayed: Actual process value, output ratio and heater current. Negative output ratio implies cooling mode.
250°C	Shown is the current setpoint. When editing the setpoint the blue area has to be pressed.
② 300°C	Setpoint 2 is active. It is not allowed to edit setpoint 2 in this window.
♪1 ♪1	Display of monitoring 1. Grey = signal not active. Colored = signal active Pressing the area leads to the window "Monitoring display". The same applies to monitoring 2.
▭ ▭	Output ratio shown as bar. White bar: positive output ratio (heating). Blue bar: negative output ratio (cooling).
✓ ✓	Autotune: grey = not active, yellow = active Pressing the area leads to the window "Autotune"
◢ ◢	Ramp: grey = not active, yellow = active Pressing the area leads to the window "Ramp rising/falling"
◣ ◣	Softstart: grey = not active, yellow = active Pressing the area leads to the window "Softstart"
☼ ☼	Heating: grey = Heater switched off, yellow = Heater switched on.
❄ ❄	Cooling: grey = Cooler switched off, blue = Cooler switched on
＋ ② −	"+" switchover to the next zone. Display of the current zone number " - " switchover to the previous zone.
▦	Jump to window "Main"
⬡ Parameter	Jump to window "Parameter"
Graph	Jump to window "Graph"

5.2.4 Window: Monitoring display

	In the header the currently selected zone is shown. The key "configuration Moni x / Alarm" leads to the configuration of monitoring and alarms. See chapter 5.4.8.1 The key "Log" leads to the alarm logbook for further information regarding the occurred alarms
	The light blue background and the colored frame shows that the event " ⌀-Alarm 1" has triggered the monitoring. In case the event needs an acknowledgement it must be done by pressing the button.
	The dark blue background shows that the event "Sensor error" is programmed for triggering the monitoring. The event is not active.
	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.
	"+" switchover to the next zone. Display of the current zone number " - " switchover to the previous zone.
	Jump to window "Main"
	Return to previous window

5.3 Adjusting windows

5.3.1 Window: Entering number value

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

1 EDIT Setpoint 1 ← 2. Para 1 2 3 °C 250 4 5 6 0 .. 800 7 8 9 SAVE ⌫ 0 -/.	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.
°C 250 0 .. 800	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). The allowed range is displayed at the bottom (0...800).
2. Para	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.
OFF	This key is visible when the parameter has a valid value "OFF". "OFF" can be selected like a number key.
1	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
←	Return to previous window
SAVE	Saving of what has been entered and return to previous window. By pressing "SAVE" for > 2s., a selection window appears, in which parameter values can be saved for other zones simultaneously. See 5.3.4 Window: Saving to multiple zones.

5.3.2 Window: Selection with tiles

	The header displays the zone number and the parameter name on the left, here "Zone On/Off". 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.
	Selected element.
	Not 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 >2s a selection window opens up, in which the parameter value can be saved onto other zones simultaneously. See 5.3.4 Window: Saving to multiple zones
	Return to previous window

5.3.3 Window: Selection List view

	The header displays the zone and the parameter name, here "Zone On/Off". 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 >2s a selection window opens up, in which the parameter value can be saved onto other zones simultaneously. See 5.3.4 Window: Saving to multiple zones
	Return to previous window

5.3.4 Window: Saving to multiple zones

◆ 1 EDIT Setpoint 1 Save value to zone: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ESC 1 … 8 SAVE	The zone (here 1) that now has to be saved is selected and cannot be deactivated. By tapping the relevant zone field another zone can be added or deleted. Black number on white symbol means "Zone chosen to be saved" The lowest key "1…8" selects all zones at the same time. "ESC" closes the window without saving. "SAVE", saves the adjusted parameter value for all zones selected and closes the window.

5.3.5 Window: Setting text

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

EDIT Program 1/Glow 1 ← Glow 1 ⟨×⟩ 0 1 2 ABC 3 DEF Clear all 4 GHI 5 JKL 6 MNO SAVE ABC 7 PQRS 8 TUV 9 WXYZ	The header displays the actual program number and the actual program name. By pressing the number keys „0 … 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.
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.
←	Return to previous window
SAVE	Saving of the new text and return to previous window.

5.4 More display screens (more Windows)

5.4.1 Window: Process

This window displays an overview of all zones.

	Six columns display the following for all zones: 1. Zone number 2. Actual Process Value (Proc[°C]) 3. Actual Setpoint (Set[°C]) 4. Output ratio (Y[%]) 5. Heater current (I[A]) 6. Monitoring 1+2 (bell symbols)
	Display of Monitoring 1 (2). Grey = signal not active. Coloured = signal active
	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"
	Jump to window "Main"
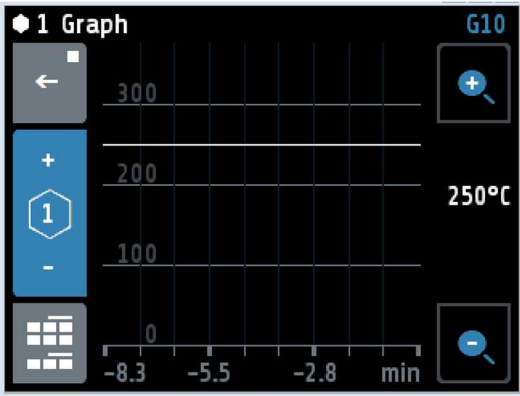
5.4.2 Window: Graph

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 window "System/Settings". Turning off the device causes deletion of the values.
	"+ " switchover to the next zone. Display of the current zone number " - " switchover to the previous zone.
	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"
	Jump to window "Main"

5.4.3 Window: Log (Logbook)

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

Log 11.05.2015 12:10 L10 1/5 ← ◆ 3 Temperature unde . 11.05. 08:37 ◆ 1 Temperature unde . 11.05. 08:37 **+** Device is switched on 11.05. 08:37 ≣ **-** **CLR**	The header displays the current date and time, the window number and page. Pressing the log-texts displays the full text if it is are 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.
+ ≣ **-**	Switching between the logbook-pages "+" previous page; " - " next page Alternatively press the upper or lower areas of the list for switching.
←	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"
CLR	Deletion of the logbook-entries

5.4.4 Window: Program (Program controller graph)

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

Prg.1/Glow 1/St.2 Run C10 ← 150 ■ 135 125°C 1 2 3 4 ❚❚ 120 5 6 7 8 ▶ 105 h 0:27 0:55 1:22 1:50	The header displays the current program, the current 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.
■ Edit ❚❚ ❚❚ ▶ ▶	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. If the total time of the program has expired (Stop displayed), the setpoint of the last program step is retained.
←	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"

5.4.5 Window: Program controller Selection/Setting

This window gives an overview of the 8 control programs. One arrives on the Edit button in the "Program controller graph" into this menu.

Select the program	
	The green frame shows the selected program. Select a other program by pressing + and – keys. Press the respective program button branches to the setup menu of the program.
Adjust the program steps	
	From this window, the individual steps can be set. The name key is used to set the program name. With the key "For Zone", the zones that will follow the program are defined.
Headline Window: Actual Process Values „Home"	
	Headline of the screen: "Actual Process Values" Program controller active, Step2 is running. Top picture: Program running. Bottom picture: Program paused or stopped.

5.4.5.1 Course of program control:

Preliminary the time and temperature values for the desired steps have to be entered in the window "program steps setting".

The time for the first step is the dwell time on the associated setpoint.

The time for the subsequent steps describes the duration, the program needs to reach from the setpoint value of the previous step to the setpoint value of the current step.

For example.

Step 1: 0:20 h / 80 ° C -> Initially set the setpoint of 80 ° C for 20min.
Step 2: 0:30 h / 360 ° C -> After that the setpoint is continuously increased starting at 80 ° C, so that after 30 minutes 360 ° C has been reached.
Step 3: 0:20 / 360 ° C -> Holding setpoint 360 ° C for 20 min.
Step 4: 00:40 / 55 ° C -> Reducing the setpoint continuously within 40 minutes from

360 ° C to 55 ° C.
Step 5: OFF / 0 ° C -> This step is not executed.
The last step is the step before the step with time is set to OFF. If no time of the program is turned "OFF", this is the Step 8.

After the total time of a started program the last setpoint is maintained.

After a power failure, during the program was running, the controller switches to the program step again, in which the interruption happened.

5.4.6 Window: Parameter

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

(screen image: "1 Main/Parameter P10", with list items "Zone On/Off", "on", "Setpoint 1 / 2", "Autotune", "Conf. Heating-Cooling")	The header displays on the left the zone number and the window name, here "Main/Parameter".
	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.

(+ / 2 / - button)	"+" switchover to the next zone.
	Display of the current zone number
	" - " switchover to the previous zone.
(← button)	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"
(grid button)	Jump to window "Main"

5.4.7 Zone – Parameter list

Zone On/Off	On	Measuring- or controlling zone active **<§>**
	Off	Measuring- or controlling zone switched off

Setpoint 1 / 2		Setpoint 1 / Setpoint 2
Setpoint 1	Setpoint min … Setpoint max	Setpoint 1 **<§> =** 0
Setpoint 2	OFF(Setpoint min) … Setpoint max	Setpoint 2 **<§> =** OFF 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".

Autotune	off	Switches off autotune **<§>**
	on	Activates 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. (= 0.3 x D) 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. 5% of the measuring range.

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.
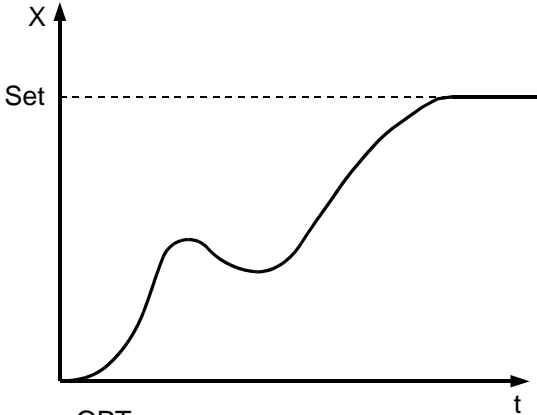
Selecting **Autotune** = ”off” will stop the autotune function.

Autotune active: Indication in display “Zone synopsis” and “Actual process values” as an orange symbol: ☑
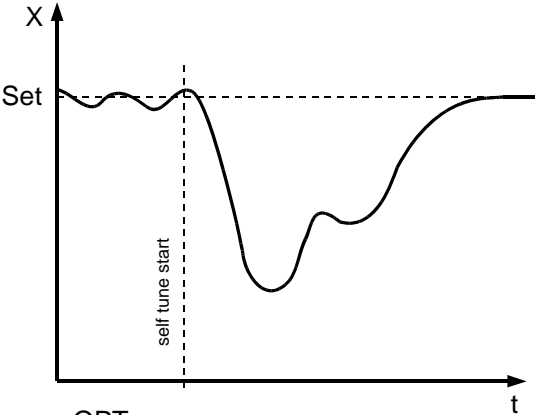
Autotune duration > 2 hours: autotune stops with an error message.

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

OPT on
self tune during start-up

OPT on
self tune, after the setpoint has
already been reached

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”
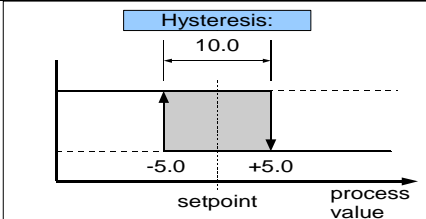
Hints for adjusting the control parameters:
As standard the controller operates in PD/I control mode, i.e. controlling without deviation and with practically no overshoot during start-up.
The control action can be altered in its structure by adjusting the following parameters:
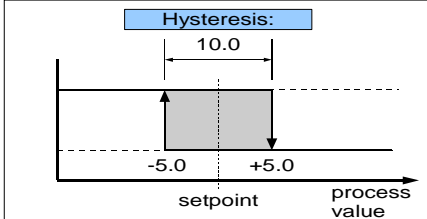
a. no control action (on-off)	Setting P = off Continuing with the parameter "switching difference"
b. P-action	Setting D and I = off
c. PD-action	Setting I = off
d. PI-action	Setting D = off
e. PD/I	Modified PID-mode (set: P,D,I)

Depending on the configuration, certain parameters are not visible.

5.4.7.1 Menu: Heating Control Parameter

Only visible in operating modes heating and heating-cooling

P (xp)	OFF, 0.1 ...400.0K	Proportional range **<§=10,0>** Unit: Kelvin
D (tv)	OFF, 1 ... 200s	Derivative time **<§=30s>**
I (tn)	OFF, 1 ... 1000s	Reset time **<§=150>**
Cycle-time	0.5 ... 240.0s	**<§=10,0s>** The switching frequency of the actuator can be determined through the cycle time. In this time interval the controller switches on and off once. <u>Voltage outputs for solid state relays (SSR):</u> Cycle time: 0,5...10 s Preferred settings for rapid control processes: 0,8s <u>Relay outputs:</u> Cycle time: > 10 s The cycle time should be adjusted to a time as long as possible in order to minimize wear of the relay contacts.
Max. Output ratio	0 .. 100%	**<§=100%>** The limitation of the output ratio is only necessary, if the heating energy supply is grossly overdimensioned compared to the power required. Normally it should be switched off (Setting: 100 %). The limitation becomes effective when the controller´s calculated output ratio is greater than the maximum permissible (limited) ratio. **Warning!** The output ratio limiting does not work during autotune.
Hysteresis	Only adjustable if "(xp)" = off (on-off action, without feedback)	
	OFF,0.1 ..80.0	For measuring range without decimal point**<§=0.1>**
	OFF, 0.01 .. 8.00	For measuring range with decimal point **<§=0.01>**

5.4.7.2 Menu: Cooling Control Parameter

Only visible in operating modes Cooling and Heating-Cooling

P (xp)	**OFF, 0.1 … 400.0K**	Proportional band **<§=10,0>** Unit: Kelvin
D (tv)	**OFF, 1 … 200s**	Rate time **<§=30s>**
I (tn)	**OFF, 1 …1000s**	Reset time **<§=150>**
Cycle time	**0.5 … 240.0s**	**<§=10,0s>** The switching frequency of the actuator can be determined by adjusting the cycle time. In this time interval the controller switches on and off once. Voltage outputs for solid state relays (SSR): Cycle time: 0,5…10 s Optimal value for fast control loops: 0,8s Relay-Outputs: Cycle time: > 10 s In order to minimize the wear of the relay contacts the cycle time should be set as long as possible.
Max. Output ratio	**0 … 100%**	**<§=100%>** Limitation of the output ratio is only necessary, if the power supply of the control route is grossly overdimensioned. Normally it should be switched off (Setting: 100 %). Output ratio limiting interferes, if the calculated output ratio of the controller is higher than the max. output ratio that was set. **Caution!** Output ratio limiting does not work while auto-tune.

Hysteresis	Only adjustable if "P (xp)" = off (on-off action, without feedback)	
	OFF, 0.1 … 80.0	For measuring range without decimal point **<§=0.1>**
	OFF, 0.01 … 8.00	For measuring range with decimal point **<§=0.01>**

Deadband	Switching point distance "heating" and "cooling" This parameter is available for "heating and cooling" operations only. (Configuration Heating-Cooling = Heating-Cooling)	
	OFF, 0.1 … 80.0	For measuring range without decimal point **<§=0.1>**
	OFF, 0.01 … 8.00	For measuring range with decimal point **<§=0.01>**

5.4.7.3 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 pre-selected 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).
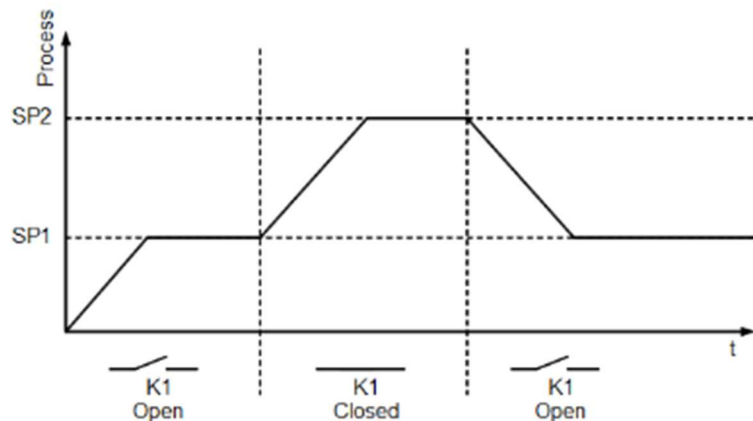
Ramp rising	OFF<§>, 0.1 ... 99,9	°K/min for measurement range without decimal point
	OFF<§>, 0.01 ... 9.99	°K/min for measurement range with decimal point
Ramp falling	OFF<§>, 0.1 ... 99,9	°K/min for measurement range without decimal point
	OFF<§>, 0.01 ... 9.99	°K/min for measurement range with decimal point

---

5.4.7.4 Menu: Softstart	Softstart-Function

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 pre-selected 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.
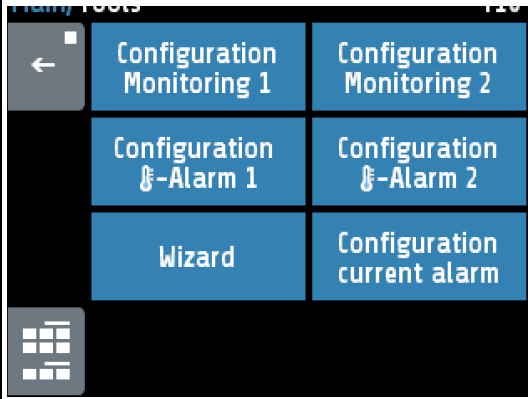
Softstart On/Off	Off	Softstart function not active. **<§>** The remaining softstart parameters are not displayed.
	On	Softstart function is active.
Softstart Output ratio	10 ... 100%	**<§ = 30>**
Softstart setpoint	Range: Setpoint min...setpoint max.	**<§ = 100°C>**
Duration time	Off, 0.1 ... 10.0 min	**<§ = 2.0 min>**

Output mode	Controller mode	Controller mode
	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.
	Mode MANUAL	The controller now operates as an actuator only. The control function is inactive Process display: Actual process value. Setpoint display: Display of current output ratio in %. The output ratio can be changed manually.

5.4.7.5 Menu: Alarm values		Adjustment of the alarm values. It is necessary to set the alarm configuration first. See: 5.4.8.2
🌡 **–Alarm value 1 _** Insufficient temperature Alarm 1	**OFF(MRS) … MRE**	For absolute temperature alarms **<§>** = OFF
	–100 … OFF(0)	For relative temperature alarms
🌡 **–Alarm value 1 ¯** Excessive temperature Alarm 1	**OFF(MRS) … MRE**	For absolute temperature alarms **<§>** = OFF
	OFF(0) … 100	For relative temperature alarms
🌡 **–Alarm value 2 _** Insufficient temperature Alarm 2	**OFF(MRS) … MRE**	For absolute temperature alarms **<§>** = OFF
	–100 … OFF(0)	For relative temperature alarms
🌡 **–Alarm value 2 ¯** Excessive temperature Alarm 2	**OFF(MRS) … MRE**	For absolute temperature alarms **<§>** = OFF
	OFF(0) … 100	For relative temperature alarms
Undercurrent val.	**OFF(0) … 99,9**	**<§>** = OFF
Overcurrent val.	**OFF(0) … 99,9**	**<§>** = OFF

5.4.7.6 Menu: Sensor settings		All parameters for sensor configuration
Sensor		See 0
Process offset	–999..0..1000°C	**<§= 0°C>** 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. If for example the offset value is set to +5°C, then the real temperature measured by the sensor is 5°C less than the displayed actual process value. Make sure that the adjusted actual temperature value should not fall below or exceed the measuring range limits.
Setpoint min.	MR–Start … Setpoint max.	Lowest adjustable setpoint value. **<§ = 0>** MR-Start: Start of measurement range
Setpoint max.	Setpoint min … MR–End	Highest adjustable setpoint value. **<§= 400>** MR-End: End of measurement range
The minimal span of linear value min. and max. is 100, the maximal span is 2000.		
Linear value min. For linear measurement range only	–900 … (Linear value max. –100)	Measuring range starting value of the linear scale. **<§= 0>**
Linear value max. For linear measurement range only	(Linear value min. +100) … 10.000	Measuring range final value of the linear scale. **<§= 1000>**
Lin–Exponent	0 … 2	Exponent of the linear measuring range. **<§= 0>**
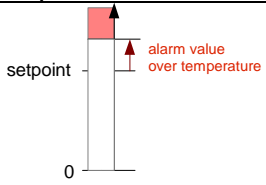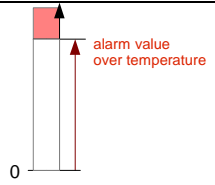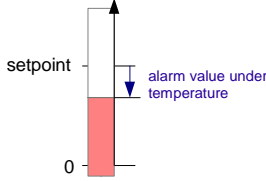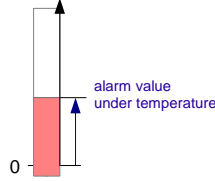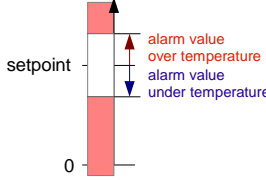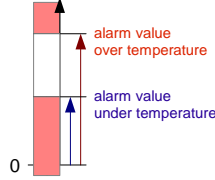
5.4.8 Window: Tools

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.

←	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual Process Value"
▦	Jump to window "Main"

5.4.8.1 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 (🔔1 🔔2). The colour of the symbols is programmable for the 🌡 -alarms and fixed for all other events.

In case of several events with different colours at the same time the priority of the colours is: red, yellow, green.

🌡 -Alarm 1	---	Not selected **<§** for Monitoring2**>**
	One zone => Message	Once 🌡 -alarm 1 is active in one zone, monitoring 1(2) is set. **<§** for Monitoring1**>**
	All zones => Message	Monitoring 1(2) is not set until 🌡 -alarm 1 is active in all zones.

🌡 -Alarm 2	---	Not selected **<§** for Monitoring1**>**
	One zone => Message	Once 🌡 -alarm 2 is active in one zone, monitoring 1(2) is set. **<§** for Monitoring2**>**
	All zones => Message	Monitoring 1(2) is not set until 🌡 -alarm 2 is active in all zones.

Sensor error Colour: red	---	Not selected **<§** for Monitoring2**>**
	Active	In the case of sensor break monitoring 1(2) is set. **<§** for Monitoring1**>**

Restart lock-out Colour: yel-low	---	Not selected**<§>**
	generate Signal	Monitoring 1(2) is set, if a restarting-incident triggered.

Current alarm Colour: red	---	Not selected **<§** for Monitoring1**>**
	Active	Monitoring 1(2) is set, if current alarm occurred. **<§** for Monitoring2**>**

System error Colour: red	---	Not selected **<§>**
	Active	Monitoring 1(2) is set, if system error occurred.

Moni 1(2) Relay	**Direct**	Relay switches on, if monitoring 1(2) is active. **<§>**
	Indirect	Relay switches off, if monitoring 1(2) is active.
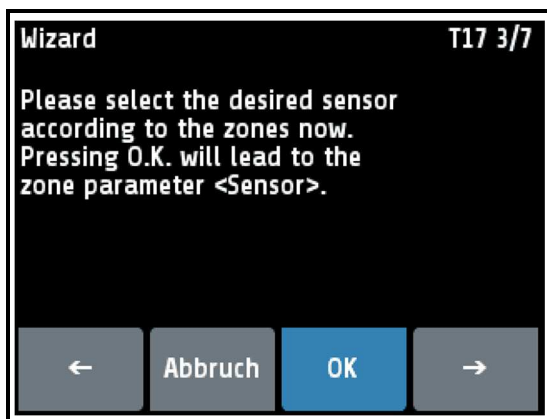
5.4.8.2 Configuration 🌡-Alarm 1+2

Settings for temperature alarm values and configuration of temperature alarm 1/2		
The controller features two independent temperature alarms.		
These temperature alarms can be connected to the monitoring relays via the monitoring function (5.4.8.1).		
Independent of this the 🌡-alarms can be connected to the zone relays or logic outputs.		
If a setpoint ramp has been programmed, the 🌡-alarms that are based on the setpoint follow the setpoint ramp.		
In case of sensor error the 🌡-alarms react in the same way as range override.		

Desired function	Setpoint based 🌡-alarm	Absolute 🌡-alarm
Single sided 🌡-alarm "top": (over temperature alarm) The temperature has to be higher to activate the alarm.	setpoint / alarm value over temperature / 0	alarm value over temperature / 0
Single sided 🌡-alarm "bottom": (under temperature alarm) The temperature has to be lower to activate the alarm.	setpoint / alarm value under temperature / 0	alarm value under temperature / 0
Both-sided 🌡-alarm: (limit-alarm) The temperature has to be outside the selected range.	setpoint / alarm value over temperature / alarm value under temperature / 0	alarm value over temperature / alarm value under temperature / 0

🌡-Alarm values Min/Max	Undertemperature Alarm 1 / 2	Relative to setpoint: -100...0(OFF**<§>**)	
		Absolute: MB-Start**<§>** ... MB-End	
	Overtemperature Alarm 1 / 2	Relative to setpoint: 0(OFF**<§>**)...100	
		Absolute: MB-Start**<§>** ... MB-End	
Type	**Absolute**	Absolute 🌡-alarm-limits. Not dependent on setpoint. **<§>**	
	Based on setpoint	🌡-Alarm-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		

5.4.8.3 Configuration Current alarm (option)
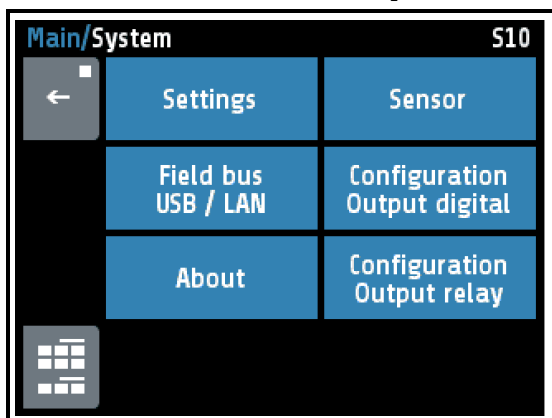
The heater current monitoring function is valid for all connected zones.
Only zones with logic output for the heating signal will take part in current monitoring.
Ensure that the limit value is set correctly to avoid false alarms in case of supply voltage changes. The alarm can be delayed by selecting 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.

Current alarm limits / Undercurrent alarm value	**OFF, 0.1 … 99.9 A**	Zone parameter: Absolute value **<§=OFF>** Currents below this value will cause an alarm.
Current alarm limits / Overcurrent alarm value	**OFF, 0.1 … 99.9 A**	Zone parameter: Absolute value **<§=OFF>** Currents above this value will cause an alarm.
Leakage limit Monitoring an impermissible continuous current	Limit value: OFF, 0,0...99,9 A **<§>=0,3A** 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 Turns ratio	1:100 … 1:9999	**<§ = 1:1000** for M2000**>**
Cycle time	1...60s	Time interval between the current measurements of two successive zones. **<§ = 2s>**
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 **<§=off>**	

5.4.9 Wizard

  Please select the desired sensor according to the zones now. Pressing O.K. will lead to the zone parameter <Sensor>. ← Abbruch OK →	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.

5.4.10 Window: System

Main/System S10 ← Settings Sensor Field bus USB / LAN Configuration Output digital About Configuration Output relay	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 .

	←	Hold down < 2 sec. = Return to previous window Hold down > 2 sec. = Jump to window "Actual process value"
	⊞	Jump to "Main"

5.4.10.1 Settings

Language	**Deutsch (German)**	German **<§>**
	English (English)	English

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

Zone Offset	**OFF**	**<§>**
	1 … 91	The adjusted offset value is added to the displayed zone numbers in the windows. Therefore a continuous numbering of the zones can be achieved if more than one device is used. Examples: Offset= OFF: Zone numbering: 1-8 　　　　　Offset=　　4: Zone numbering: 5-12

Authorisation (LOC)	**All Parameter adjustable**	All parameters adjustable **<§>**
	Only setpoint 1 adjustable	All other parameters are locked
	Setp. and ramps adjustable	Setpoints, alarm values and ramps are adjustable. All other parameters are locked.
	All parameters locked	No parameter is adjustable
	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.	

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.

Restart lock-out	**OFF**	No function **<§>**
	On	After power-on all zones are switched off and a message is 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.

5.4.10.2   Field bus / USB / LAN

Menu: Fieldbus		It depends on the installed field bus module what parameters will be visible.
Protocol	**off**	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
	Profibus DP	<PROFIBUS> Profibus DP
Status Display only	**---**	<SERIAL> No data communication
	Data Exchange	<SERIAL> Data communication is active <PROFIBUS> Data-Exchange-Mode
	Wait Param	<PROFIBUS> Controller waits for configuration / parametrisation
	No connection	<PROFIBUS> No master connected / Master not active
Baudrate <SERIAL>	**1.2 kBaud**	1.200 Bit/s
	2.4 kBaud	2.400 Bit/s
	4.8 kBaud	4.800 Bit/s
	9.6 kBaud	9.600 Bit/s **<§>**
	19.2 kBaud	19.200 Bit/s
	38.4 kBaud	38.400 Bit/s
Baudrate <PROFIBUS>	Display only	45,5 kBaud – 12Mbaud (forced by the master) Not detected = no master connected
Address	**1 ... 255**	**1<§> . . . 255** (ELOTECH-Standard) **1<§> . . . 247** (Modbus-RTU-Protocol) **1<§> . . . 32** (Arburg-Protocols) **2<§> . . . 125** (Profibus) At this address a master communicates with the controller. Each controller needs a unique address.
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.
	TTY	Signals see connection diagram.
Remote <PROFIBUS>	**On**	Profibus can read and write. Local operation is locked.
	Off	Profibus can read only. Local operation is permitted. **<§>**

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
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.
Separator		Delimiter symbol between single data sets:
	none <§>	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. The values setpoint, actual value, output ratio and current actual value of all zones are written out.
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 time-stamp, setpoint, the actual value, the output ratio and the actual current value of Zone 1 to Zone 4/8.		

Menü: LAN		Ethernet interface for connection to the configuration tool Elovision 3 or for a MODBUS-TCP communication. Default subnet mask: 255.255.255.0
IP–address 1		IP-Address **192** . 168 . 100 . 100 Part 1 **<§>**
IP–address 2		IP-Address 192 . **168** . 100 . 100 Part 2
IP–address 3		IP-Address 192 . 168 . **100** . 100 Part 3
IP–address 4		IP-Address 192 . 168 . 100 . **100** Part 4
MAC ID	549A11:5xxxxx	Display of the MAC-ID: 54:9A:11:5x:xx:xx

5.4.10.3   About / → Firmware update

Firmware	Displays the current firmware version.
Language version	Displays the current 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 a 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.
Type R4000-0x-x-000-0x-5	Type key of the controller

5.4.10.4   Sensor

Sensor	Linear 0…10 V	Voltage 0 to 10 V
	Linear 0…20 mA	Current 0…20mA
	Linear 4…20 mA	Current Live Zero 4…20mA
	PT100 2-wire	Pt 100 2-wire connection -100…800°C
	PT100 3-wire	Pt 100 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
	Please NOTE : If the sensor selection is changed, the following parameters will be reset:	
	Setpoint 1, Setpoint 2:	Setpoint limitation min.
	Lower setpoint limitation:	Measuring range bottom
	Highest setpoint limitation:	Measuring range top
	Setpoint ramp rising/falling:	off
	Alarm values:	off
	Actual process value offset:	off
	Setpoint softstart:	100°C
	softstart:	off

5.4.10.5 Configuration Output relay

For every zone one relay output is available. Select the desired output signal. When using as a control output, set the cycle time to a value as long as possible in order to minimize wear of the relay contacts.		
Relays 1 ... 8	**OFF**	No function
	Heating	Output heating-signal at relay x **<§>**
	Cooling	Output cooling-signal at relay x
	🌡 **–Alarm 1**	Output temperature alarm 1 at relay x
	🌡 **–Alarm 2**	Output temperature alarm 2 at relay x

5.4.10.6 Configuration Output digital

For every zone one digital output (logic out) is available. Select the desired output signal.		
Digital 1 ... 8	**OFF**	No function
	Heating	Output heating-signal at logic output x **<§>**
	Cooling	Output cooling-signal at logic output x
	🌡 **–Alarm 1**	Output temperature alarm 1 at logic-output x
	🌡 **–Alarm 2**	Output temperature alarm 2 at logic output x

6 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". The configuration-tool Elovision is active.
Field bus module unavailable		The controller is not fitted with the correct hardware for the selected protocol.
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.

7 Technical Data

Input Pt100 (DIN)	2- or 3- wire connection possible Built-in protection against sensor breakage and short circuit Sensor current: … < 1 mA Calibration accuracy: … < 0,2 % Linear error: … < 0,2 % Influence of the ambient temperature: … < 0,01 % / K
Input Thermocouple	Built-in internal compensation point and protection against sensor breakage and incorrect polarity. Re-calibration not required for a line resistance of up to 50 Ohm. Calibration accuracy: … < 0,25 % Linear error: … < 0,2 % Cold junction error: 0,5K Influence of the ambient temperature: … < 0,01 % /
Input voltage 0…10V	Internal resistance > 100 k-Ohm Calibration: < 0,25 % Linearity error: < 0,2 % Ambient temperature influence: < 0,01 % / K
Input current 0…20mA	Internal resistance < 100 Ohm Calibration < 0,25 % Linearity error: < 0,2 % Ambient temperature influence: < 0,01 % / K ! No input current when the controller is without supply voltage.
Logic input	Internal resistance > 22k-Ohm Level 0 < 2V Level 1 > 9V; max 30V
Heater current monitoring	Measuring input range: 0… 100mA corresponding 0,0…99,9A when using a current transformer 1: 1000. If the range is exceeded, the controller may be damaged.
Logic outputs	Bist. voltage, 0/24 V DC, max. 500 mA, short-circuit proof
Relay outputs/ Alarm outputs	Relay; max. 250V AC, max. 2A, resistive load
Fieldbus Interface:	Depends on the version of the device: - Serial: RS232, RS485, TTY (20mA) - Profibus DP, according to EN 50170 All with optical isolation.
Service-Interface	Ethernet: Modbus TCP
USB-Interface	Host for USB-Stick; max. 100mA
Supply voltage	24 V DC, +/-25 %, appr. 6W + Power of logic outputs
LCD-Display	8,8 cm (3,5") RGB-display with LED-backlight. 320 x 240 pixel with resistive Touch-Panel
Data protection	EAROM, Semiconductor storage When using a Fieldbus interface please note: Permissible writing operations per parameter must not exceed 1 000 000.

Casing	Format, case:	96x96mm, acc. DIN 43700, Installation depth 122 mm
	Panel cut-out:	92 +0,5 mm x 92 +0,5 mm
	Material:	Sheet steel and Makrolon UL 94-V1
	Protection mode:	IP 20 (DIN 40050), Front side: IP 50
Connectors	Service-Interface: Ethernet RJ45 USB-Interface: Type A Profibus: SUB-D 9 Others: Screw terminals, Protection mode IP 20 (DIN 40050), Insulation class C	
Real time clock	Backup battery: Lithium CR2032	
Weight	Approx. 800g, depends on the version of the device	
Permissible operating conditions	Operating:	0...50°C / 32...122°F
	Temperature:	-30...70°C / -22...158°F
	Storage temperature:	KWF DIN 40040; equivalent to annual average
	Climate class:	max. 75% rel. humidity, no condensation
CE - mark	EN 61326-1:2013 / EN 61000-3-2:2006+A1:2009+A2:2009 EN 61000-3-3:1995+A1:2001+A2:2005 Electrical safety: EN 61010-1	

Subject to technical improvements.