Регулятор температуры RES-5200

Инструкция по эксплуатации

По вопросам продаж и поддержки обращайтесь:

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Table of Contents

1 Information on these operating instructions

1.1 Purpose of operating instructions

These operating instructions are a component of the product and provide information on the temperature controller RESISTRON® *RES-5200*.

They contain information on these and other topics:

- Assembly
- Installation
- Operation
- Maintenance

1.2 Target group

These instructions are intended to be used by qualified specialists.

1.3 Validity of the operating instructions

These operating instructions apply to all models of the temperature controller RESISTRON® *RES-5200* manufactured March 2024 and later.

1.4 Related documents

- Data sheets and instructions for the line filters *LF-06480*, *LF-35480*, *LF-10520, LF-20520, LF-30520* and *LF-50520*
- Operating instructions for the current transformer *PEX-W5*
- Data sheet and manufacturer's documentation for the pulse transformer
- Your application report

1.4.1 Related software applications

- Operating instructions for the visualization software *ROPEXvisual*®
- Operating instructions for the application software *ROPEXupdate*

1.5 Storing documentation

▶ Keep these operating instructions for later reference.

▶ Ensure that all information and functions that the user may require are readily available.

1.6 Quality

For quality assurance purposes, the device is repeatedly inspected over the course of manufacturing. This ensures that the device leaves ROPEX in perfect condition.

1.7 Typography

These instructions apply the following typography rules:

Text	Product name and designation Example: *RES-5200*
	References to other documents Example: Refer to the *Application report* for more information.
"Text"	Composite terms and references to illustrations Examples: Position "0", thermal pre-treatment of heating element "burned in"
TEXT	Function Example: Activate AUTOCAL LED Example: LED AUTOCAL
`Text`	Menu item Example: Touch `Update`button Key Example: Touch `Manual` button Bit Example: Bit `Start`
`Text > Text`	Menu path Example: `Help > Supported devices`
[►24]	Reference to page number Example: Further information can be found in the section "Technical data" [►24]
…	How to show "to" Example: The cold resistance of the heating element decreases by approx. 2…3 %.

Single-step instructions

For single-step instructions or instructions where the chronology is not important, single-step instructions are used as follows:

✓ One or more prerequisites (optional) to be able to perform the next step.

► Step.

Multiple-step instructions

For multiple-step instructions and instructions where the chronology is important, multiple-step instructions are used as follows:

✓ One or more prerequisites (optional) to be able to perform the next steps.

1. First step
   ⇨ Intermediate result
2. Second step
   ⚠ **WARNING! Warning note as part of a step.**

⇨ Result

2 Intended use

The device has been designed and tested in accordance with the latest state of technology. To prevent personal injury as well as damage to equipment, use the device properly and only as intended.

The temperature controller regulates the temperature of heating elements used to seal and cut thermoplastic films.

The temperature controller may be operated only with suitable adhesives in a proper and complete control loop.

The device may be used only when it is completely assembled and is functioning as intended. The device may never be opened, repaired or modified in any way.

The device is developed, designed and built for industrial and commercial use only.

Personal use, e.g. in private households, is prohibited.

The device is intended to be used only by persons with the following knowledge and skills:

- Qualified technicians who, based on their professional training or experience, are familiar with pulse sealing.

Any other use besides the intended use is prohibited. The manufacturer will not be liable for damage resulting from unintended use. When any changes are made to the product, including in the course of assembly and installation, all warranty claims will be forfeited.

Consult all instructions and follow them carefully whenever working on the device.

2.1 Ambient conditions

Ambient conditions	Limits
Altitude	Up to 2000 m
Ambient temperature	+5…+45 °C
Maximum relative humidity	80 % at temperatures up to +31 °C decreasing linearly to 50 % relative humidity at +45 °C

3 Safety

3.1 Safety regulations

Always read the safety regulations carefully before using the device!

Install device

Installation, startup and work on the device may be carried out only by qualified professionals. The persons must be familiar with the inherent dangers and warranty conditions.

- ▶ Install the device according to generally accepted engineering standards.

Preventing electric shock

Line voltage is being applied to the electrical connections. This can cause electric shock.

- ▶ Before beginning any work, switch off the voltage supply and secure it to prevent it from being switched on again.
- ▶ Protect the device from humidity.

Requirements at installation site

The device can malfunction or be damaged if the temperature is too high or too low, or if the humidity is too high.

- ▶ Install the device indoors in a dry room that is always frost-free.
- ▶ Never install the device outdoors.
- ▶ Comply with the ambient temperature indicated on the ID plate and in the applicable documentation.
- ▶ Protect the device from liquids and sustained high humidity. Never allow condensation to form in the device.
- ▶ Never cover the device with any objects.
- ▶ Comply with the specified minimum distance between devices.

Safe operation of the device

- ▶ Operate the device only fully assembled and installed.
- ▶ Make sure that the device is undamaged, complete and correctly assembled.
- ▶ In addition to these device instructions, observe the prohibition, warning and mandatory signs on the device.

3.2 How warnings are structured

These instructions contain various warnings of varying degrees, each preceded by a symbol or signal word. The symbol and the signal word indicate the hazard level.

How warnings are structured

Warnings that precede an action to be taken are shown as follows:

⚠ DANGER

Type and source of hazard

Explanation of type and source of hazard / description of consequences

- ▶ Measures to avert the hazard

Meaning of signal words

Signal	Definition
DANGER	Imminent risk of casualties or serious injury, if the hazard cannot be averted.
WARNING	Possible risk of serious injury, if the hazard cannot be averted.

Signal	Definition
CAUTION	Possible risk of minor injury, if the hazard cannot be averted.
NOTE	Property damage or malfunction, if the hazard cannot be averted.

Meaning of symbols

Symbol	Definition
	General indication of hazard
	Danger, high voltage
	Fire hazard
	Note indicating potential property damage

3.3 Symbols on the device

Symbol	Definition
	Conformity of the temperature controller is valid only when the device is used with the required components. Read the operating instructions thoroughly before using the device. Observe all warnings contained in the instructions.
	Protective grounding to discharge transient overvoltage.
	Read the operating instructions thoroughly before using the device.

3.4 Conformity

We confirm as the manufacturer that this product has been developed and manufactured according to relevant standards and guidelines.

3.5 Rules

Comply with the following rules and regulations:

Legal requirements

- Statutory provisions regarding accident prevention
- Statutory provisions regarding environmental protection
- Occupational safety regulations

Standards and guidelines

- Applicable safety regulations required by DIN, EN and VDE

Standards

- DIN 46228 End sleeves
- IEC 61010:2010 A1:2016 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
- DIN EN 55011/VDE 0875-11 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
- DIN EN 55032:2016-02/VDE 0878-32:2016-02 Electromagnetic compatibility of multimedia equipment - Emission Requirements
- DIN EN IEC 61558-1/VDE 0570-1 Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests (IEC 61558-1)
- DIN EN IEC 61784-2 Industrial communication networks - Profiles - Part 2: Additional field bus profiles for real-time networks based on ISO/IEC 8802-3
- DIN EN IEC 60947-1:2022-03/VDE 0660-100:2022-03 Low-voltage switchgear and control gear - Part 1: General rules

Directives

- 2014/30/EU Electromagnetic compatibility
- 2014/35/EU Low voltage
- 2011/65/EU Directive on the use of certain restricted substances in electrical and electronic equipment (RoHS directive).

3.6 Obligation of user

To ensure that the device functions properly, follow these instructions:

- To ensure safe operation, comply with the safety and warning notes contained in these instructions.
- Read the operating instructions thoroughly before using the device.
- Always operate the device in compliance with the conditions stated under "Technical Data."
- Store the operating instructions near the device.
- Only properly trained electricians may perform installation, startup and maintenance. Such persons are familiar with the equipment and the warranty conditions.

4 Description of project

4.1 Functioning

The temperature controller RESISTRON® *RES-5200* works in the control loop like this:

The resistance of the heating element changes along with the temperature of the heating element.

The resistance of the heating element is determined by measuring the current and voltage. This value is then used to calculate and display the actual temperature of the heating element, as well as to compare it to the specified setpoint.

The measurement is taken at a 50 Hz grid, corresponding to 50 times/sec or a 60 Hz grid, corresponding to 60 times/sec.

When the measurements deviate from the setpoint, the pulse transformer primary voltage is adjusted applying the phase angle principle. The resulting change of current in the heating element causes a temperature change, thus leading to a change in resistance. The temperature controller RESISTRON® *RES-5200* measures and evaluates the change in resistance. Based on the adjustment and the setpoint, the temperature controller RESISTRON® *RES-5200* adjusts the control variables.

Even the smallest thermal loads are detected by the heating element and can be quickly and precisely corrected. The measurement of purely electrical variables and the high measuring rate create a highly dynamic, thermo-electrical control loop. The principle of primary transformer control has proven particularly beneficial, as it enables a wide range of secondary current with only minimal power dissipation. This facilitates optimal adaptation to the load and to the desired dynamic, even when the device is compact.

4.2 Application

The temperature controller RESISTRON® *RES-5200* is part of the series 5000.

The temperature controller RESISTRON® *RES-5200* is used to regulate the temperature of heating elements used to seal and cut thermoplastics. The temperature controller can also be used for other sealing work, such as controlling hot air applications.

4.3 Properties

The temperature controller has the following properties:

- Calibration of the heating elements through AUTOCAL, the automatic zero-point setting
- Eight channels permit switching of the calibration parameters during tool change
- Control dynamics through AUTOTUNE, automatic adjustment to the controlled system
- Flexibility due to AUTORANGE The AUTORANGE feature covers a secondary voltage range of 0.4 V to 120 V and a current range of 30 A to 500 A
- Automatic adjustment of the line frequency
- Wide voltage range for flexible use (Limits can be found on the ID plate)
- System diagnosis and process visualization with the *ROPEXvisual*® software
- Output for connecting a booster
- Process reliability due to comprehensive options for evaluating parameter data, e.g.
  - Temperature diagnosis
  - Heatup timeout

The process data is shown on a color screen.

The language of the display can be changed.

The actual heat-sealing band temperature is shown in the display as a digital value in °C. A progress bar shows the actual temperature as a graph.

In addition, the actual temperature of the heating element is output via an electrically isolated analog output 0…10 VDC. This means that the actual temperature of the heat-sealing band can be displayed on an external instrument (e.g. ATR-x).

The temperature controller RESISTRON® *RES-5200* also has an integrated error diagnosis feature that monitors the external system (e.g. heating element, wiring, etc.) as well as the internal electronics and, in the event of malfunction, issues a differentiated error message.

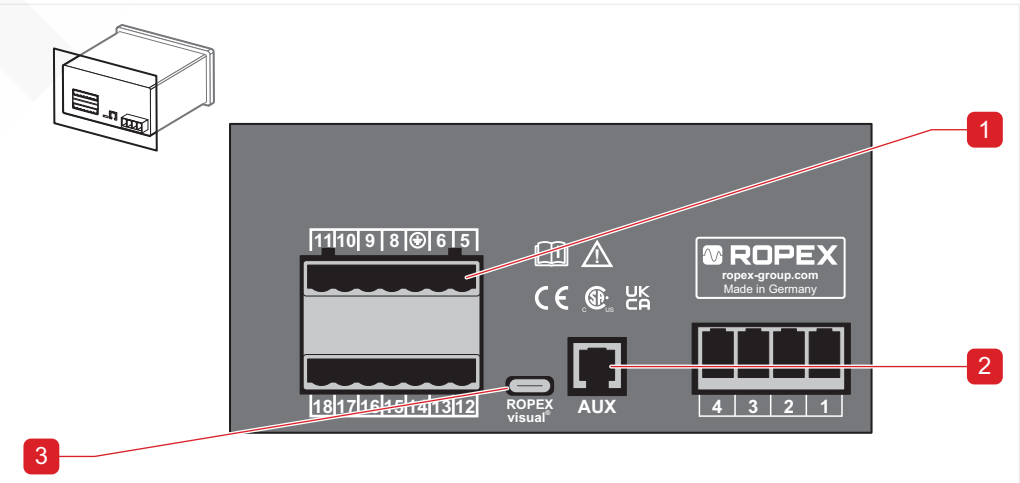
To improve operational safety and immunity to interference, all of the 24 VDC logic signals are electrically isolated from the heating circuit.

Adjustments for different heat-sealing band alloys (alloy 20, LEX3500, etc.) and selection of the temperature range (0…300 °C, 0…500 °C, etc.) can be done in the temperature controller menu.

The temperature controller RESISTRON® *RES-5200* is intended to be mounted in a cut-off of the control panel. The compact design of the device along with the plug-in terminals make installation easier.

4.4 Overview

1	Screen	2	Operating buttons
3	Terminal diagram	4	ID plate
5	Fixing hook		



1	Terminals	2	AUX interface
3	USB interface		

4.4.1 ID plate

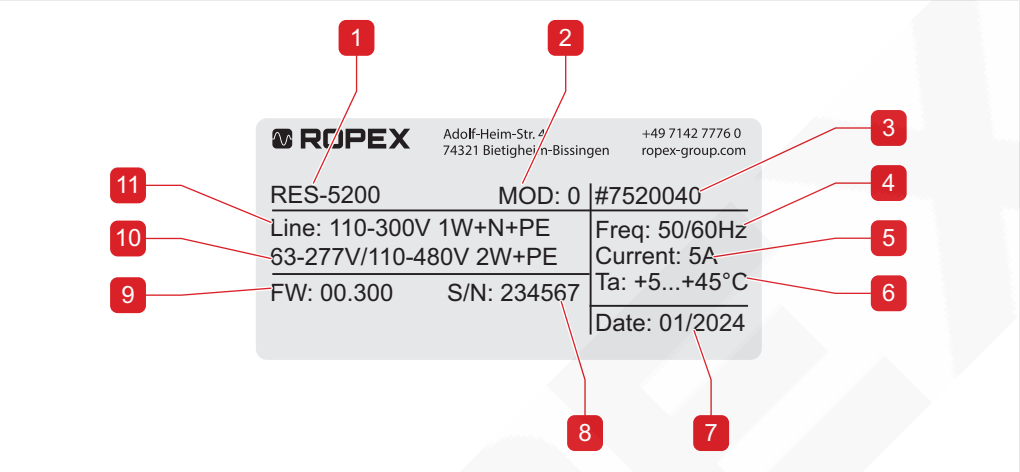


Illustration 1: ID plate temperature controller RES-5200, example

1	Temperature controller RES-5200	2	Modification
3	Article number	4	Frequency
5	Continuous current	6	Ambient temperature
7	Manufacturing date	8	Serial number
9	Firmware version	10	Line voltage / connection, two-phase
11	Line voltage / connection, single-phase		

The ID plate is located on the top of the device.

4.5 Essential system components

4.5.1 Control loop components

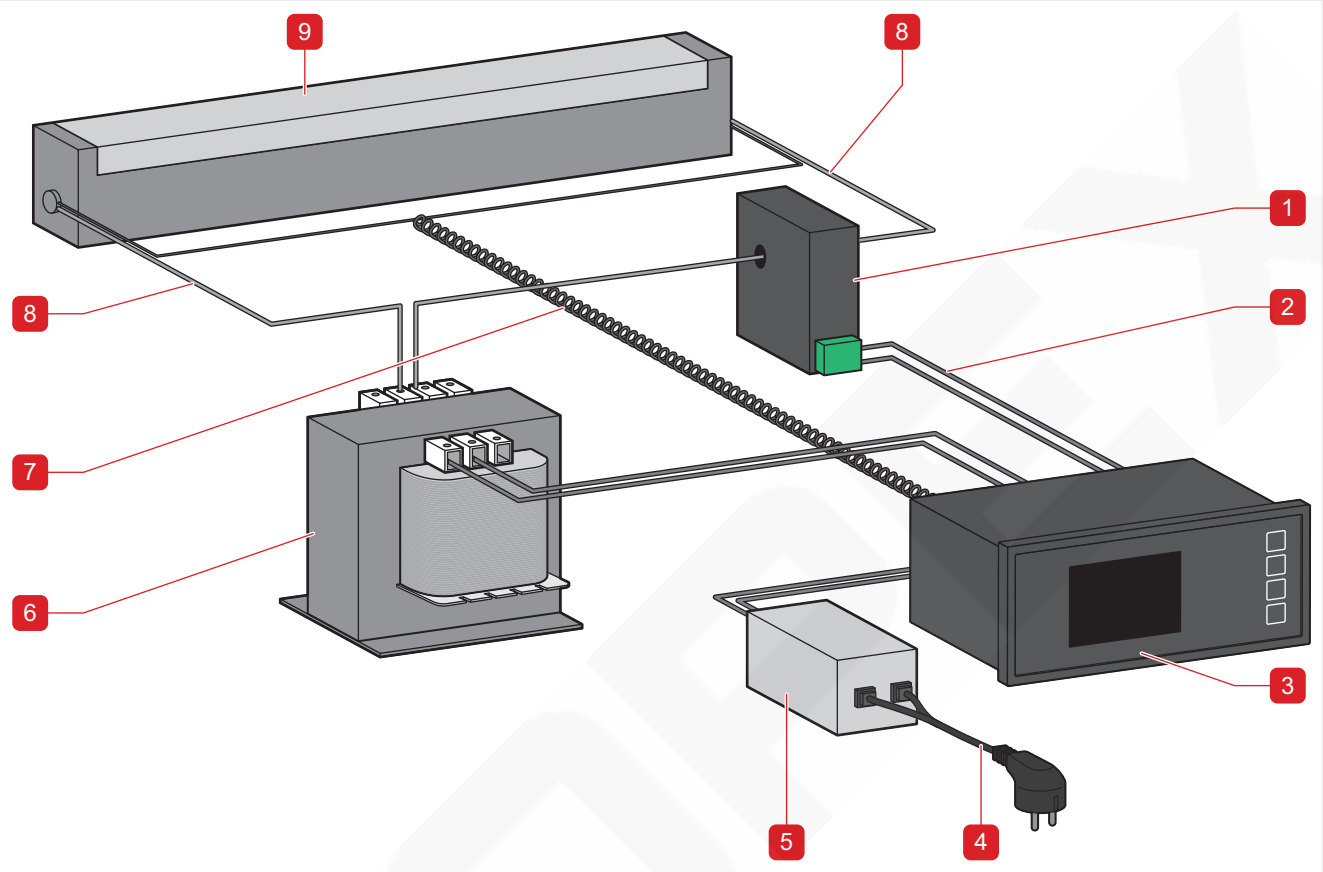


Illustration 2: Control loop components (diagram)

Pos.	Component	Other notes and requirements
1	Current transformer	Refer to section Current transformer [▶ 17]
2	Measurement cable, current I_R	
3	Temperature controller	
4	Power supply	
5	Line filter	Refer to section Line filters [▶ 18]
6	Pulse transformer	Refer to section Pulse transformer [▶ 17]
7	Measurement cable U_R	Refer to section Measurement cable [▶ 18]
8	Secondary circuit lines	
9	Sealing bar with heating element	Refer to section Heating element [▶ 16]

Note The application report is needed to position and determine the essential components.

4.5.2 Heating element

⚠ DANGER

Fire hazard due to overheating of heating element

A defect in the control loop can cause the heating element to overheat and components to catch fire.

- ▶ Install a contactor Kb in the control loop.
- ▶ Install a temperature monitor at the sealing bar.

⚠ DANGER

Fire hazard due to unsuitable heating element

An unsuitable heating element can overheat and cause components to catch fire.

- ▶ Use only heating elements intended specifically for this purpose.
- ▶ Comply with the application report.

Unsuitable heating elements

Low-ohm heating elements, e.g. NiCr 80/20, are **not** suitable for use with the temperature controller RESISTRON® *RES-5200*.

Heat-sealing band ends

The ends of heat-sealing bands can be coated, e.g. with copper or silver.
Coating the ends of the heat-sealing bands changes the electrical properties. The ends remain cold, and more direct temperature control is then possible in the active zone. Coating also extends the serviceable life of the heating element.

Temperature coefficient

Always use a heating element with a positive temperature coefficient in order to guarantee trouble-free operation of the temperature controller RESISTRON® *RES-5200*.

Example

Heat-sealing band alloy	Unit	Temperature coefficient (TCR)
Alloy 20	ppm/K	1100
Alloy L	ppm/K	780
LEX3500	ppm/K	3500

The temperature controller RESISTRON® *RES-5200* has to be set and coded according to the temperature coefficient of the heating element.

The temperature coefficient can be found in your application report.

Notes

- The measurement principle requires a unique temperature coefficient (TCR) of the heat-sealing band alloy.
- If the temperature coefficient of the heating element is greater than the set value, the actual temperature is lower than the displayed temperature. But if the temperature coefficient of the heating element is less than the set value, the actual temperature is higher than the displayed temperature.
- The resistance value rises as the heating element gets warmer. If the temperature coefficient of the heating element is below the permitted range, the control loop can fluctuate or the heating element can overheat.

Assembly and installation

The following are important for the assembly and installation of the heating element:

Parallel connection of heating elements

To ensure that the temperature of both heating elements is consistent, cables of the same length and same cross-section have to be used.

Examples of parallel connection can be found in section Appendix [▶ 75].

Series connection of heating elements

To prevent overcurrent and consequential spot overheating when heating the heating elements from both sides, the heating elements may not touch one another.

Examples of series connection can be found in section Appendix [▶ 75].

4.5.3 Pulse transformer

⚠ DANGER

Danger, high voltage and overheating

Incorrect assembly and installation of the pulse transformer impair electrical safety.

- ▶ Install touch protection.
- ▶ Select the proper cable cross-section.
- ▶ Comply with the application report.

The pulse transformer is a component of the control loop. It is attached between the temperature controller and the voltage supply connection to the heating element. The pulse transformer supples the voltage required by the heating element and is designed for the individual application; refer to the application report.

The following requirements have to be met:

- The dimensions of the pulse transformer should be suitable for the control loop.
  - Primary and secondary voltage
  - Output
  - Duty cycle of transformer
- This transformer must be designed according to EN 61558 or UL 5085 (isolating transformer with reinforced insulation)
- Single-chamber model

Assembly and installation

The following are important for the assembly and installation of the pulse transformer:

- The touch protection must comply with national installation and construction requirements.
- Use the cable cross-sections stated in the application report.
- Clamp the cables to the pulse transformer terminals. Check the terminals regularly to ensure that they are mounted tightly.

4.5.4 Current transformer

NOTICE

Malfunction due to use of devices from other manufacturers

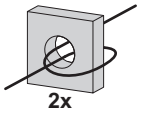
Devices from other manufacturers can lead to malfunctions in the control loop.

- ▶ Use only original ROPEX current transformers or ROPEX monitoring current transformers.

The current transformer is a component of the control loop. It may be used only to measure the current, enabling the temperature controller to determine the heating element temperature.

Observe the following notes and comments:

- The current transformer may be started up only when it is properly connected to the temperature controller; refer to section Connection diagram.



- If the secondary peak current I_2 is less than 30 A, the secondary high-current wire must be passed through the current transformer at least twice; refer to the application report.
- If the cross-section is too large or the insulation too thick, use an *HCB-1* high-current rail to route the cable through the current converter. Further information can be found in the respective operating instructions.
- ROPEX monitoring assemblies such as the Current Balance Monitor *CBM-2* can be used to increase operating safety. Further information can be found in the respective operating instructions.
- External monitoring assemblies such as insulation monitors or a voltage monitoring device can also be used. Refer to the manufacturer's operating instructions for more information.

4.5.5 Line filters

CE conformity of the temperature controller can only be achieved with the line filters recommended and supplied by ROPEX. The line filters damp the reaction of the phase-angle control on the line and protect the temperature controller against line disturbances.

Observe the following notes and comments:

- ▶ Always use a ROPEX line filter.
- ▶ Install unfiltered and filtered lines in separate wiring ducts.
- ▶ Follow the instructions in the line filter operating instructions.
- ▶ Comply with the application report.

4.5.6 Measurement cable

Use a twisted measurement cable supplied by ROPEX (*UML-1 or UML-2)*. Connect the measurement cable directly to the clamping head on the sealing bar.

The measurement cables *UML-1 and UML-2* are twisted cables used for voltage measurement in conjunction with RESISTRON® and CIRUS® temperature controllers.

Further information can be found on the measurement cable data sheet.

4.6 Optional system components

4.6.1 Booster

If the continuous current is greater than 5 A or the pulsed current is greater than 25 A, use abooster; refer to section How to order. Refer to the application report for more detailed information.

5 Assembly and installation

5.1 Transporting and checking device

To prevent damage, always transport and store the device in the original box.

After transporting the device, visually inspect the device for any damage.

5.2 Scope of delivery

Check the delivery for damage and verify that it is complete.

Delivery includes:

- Temperature controller with terminal strips in place.

5.3 Installation site requirements

Installation site

NOTICE

Liquids and dust can damage the equipment

Liquids and dust that penetrate the device can impair proper functioning. Electrical components can become corroded.

- ▶ Set up and operate the device only in a clean, dust-free environment.
- ▶ Protect the device from moisture, water, cleaning solutions and conductive liquids.
- ▶ Ensure that the area is well ventilated.

The installation site must be dry and frost-free at all times.

Machine-side supply voltage

NOTICE

Equipment damage caused by incorrect supply voltage

Supply voltage that is too high or too low can damage the device.

- ▶ Adjust the machine-side supply voltage to suit the permitted voltage and frequency range of the temperature controller.
- ▶ Observe the information on the ID plate.

5.4 Device assembly

⚠ DANGER

Risk of death by electric shock

There is dangerous voltage at the electrical connections to the temperature controller, the system components and the heat-sealing bar.

- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the voltage supply or line voltage.
- ▶ Secure to prevent it from being switched on again.
- ▶ Verify that there is no voltage being supplied.

5.4.1 Mounting temperature controller in cut-out in control panel

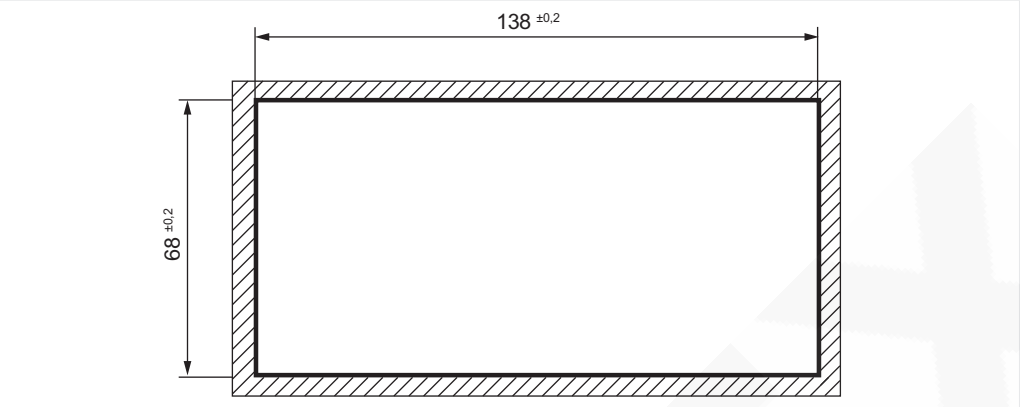


Illustration 3: Dimensions of cut-out in control panel

Prerequisite ✓ Line voltage is switched off and secured to prevent it from being switched on again.

1. Verify that the circuit is de-energized.
2. Place the temperature controller into the cut-out.
3. Secure with two fixing hooks.
   ⇨ Then click into place on the side of the housing.
4. A minimum safety clearance of 20 mm all round (e.g. from other devices and wiring) must be allowed when installing the device.

5.4.2 Overview of housing

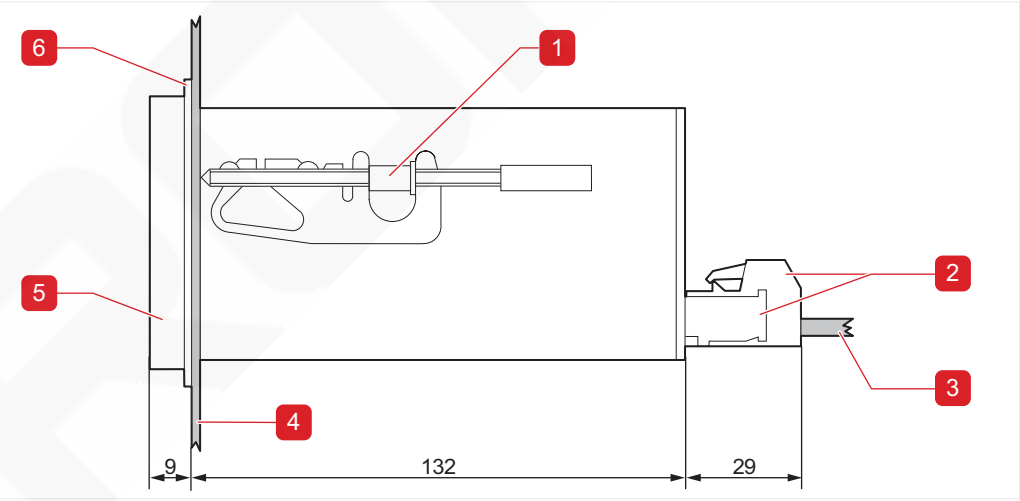


Illustration 4: Housing

1	Fixing hook	2	Terminals
3	Stranded wire	4	Control panel
5	Front frame	6	Rubber seal

5.5 Installation of device

⚠ DANGER

Risk of death by electric shock

There is dangerous voltage at the electrical connections to the temperature controller, the system components and the heat-sealing bar.

- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the voltage supply or line voltage.
- ▶ Secure to prevent it from being switched on again.
- ▶ Verify that there is no voltage being supplied.

Proceed as follows to install the temperature controller:

Prerequisite

- ✓ Line voltage is switched off and secured to prevent it from being switched on again.
- ✓ Installation of the temperature controller is completed.

1. Completely wire the system; refer to section Rules [▶ 10], section Power supply [▶ 22], section Connection diagram, section Control loop components and to the application report.
   Note: Wires used for control or measuring connections must always be laid inside the building.
2. Check that the wiring complies with applicable national and international installation requirements.
3. An overcurrent protective device with a maximum rating of 10 A must be installed [1].
   ⇨ If one such device is not adequate for the heat-sealing application, two separate overcurrent protective devices should be provided – one for the temperature controller and one for the sealing application: refer to the application report.
   The overcurrent protective device must be located directly adjacent to the device.
   The minimum possible specification for this device based on the calculated currents is indicated in the application report. If a larger overcurrent protective device is fitted, match the current carrying capacity of the other components accordingly (e.g. cables, pulse transformer, etc.).
4. Provide a disconnecting device when the system is installed; it must be marked as belonging to the system and placed in a readily accessible position.
   If a circuit breaker is used, it can also perform the function of this device.
5. Check all of the terminals in the system to ensure that they are mounted tightly, including the terminals for the pulse transformer windings.

Notes

- The control loop can function properly only when the system components are the right size. Refer to the application report for more information.

[1] Examples:

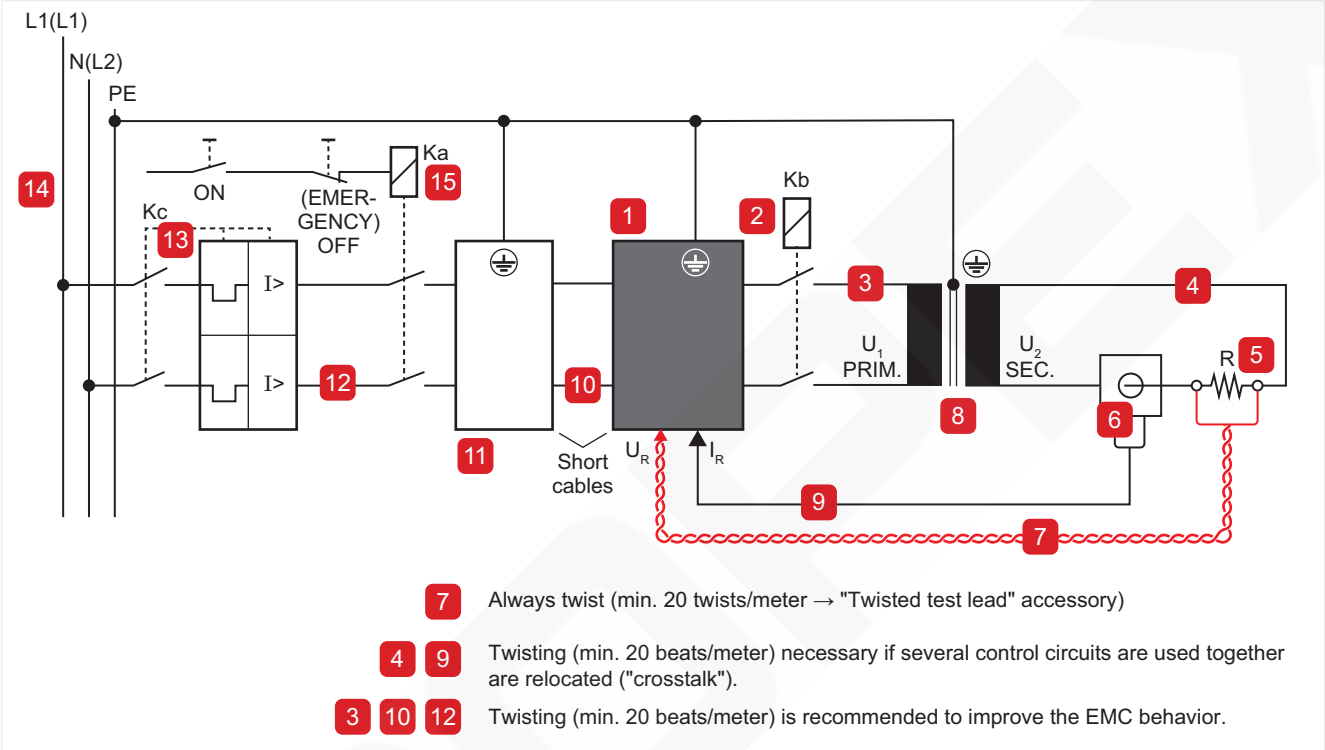
- Circuit breaker pursuant to EN 60898 (characteristic B, C, D, K or Z)
- Circuit breaker pursuant to UL 489 (characteristic B, C, D, K or Z)
- Fuse gG pursuant to IEC 60269
- Fuse "class CC" or "Class JJ pursuant to UL 248

- To ensure proper and stable control, do **not** install additional resistance in the secondary circuit. Additional resistance in the secondary circuit, e.g. circuit breakers, long lines, plug connections, etc. have an impact on control and can cause the system to malfunction.

5.5.1 Power supply

The following illustration shows a standard application.

When making electrical connections, also refer to the section Connection diagram as well as to the application report.



Pos.	Component	Notes and requirements
1	Temperature controller	
2	Contactor Kb	To increase the safety of machine operation, refer to the section Contactor Kb [▶ 23].
3	Primary pulse transformer lines	Refer to the application report.
4	Secondary line	Sealing bar connection to the pulse transformer. Use high-quality connecting elements that ensure low contact resistance with long-term stability. Refer to the application report.
5	Heating element	Refer to section Heating element [▶ 16] and to the application report.
6	Current transformer	**NOTICE! Observe the number of ducts for passing the secondary cable through the current transformer.** Refer to section Current transformer [▶ 17] and to the application report.

Pos.	Component	Notes and requirements
7	Measurement cable U_R	**NOTICE! Use twisted measuring cables provided by ROPEX.** **NOTICE! Input voltage max. 120 V.** Refer to section Measurement cable [▶ 18] and to the application report.
8	Pulse transformer	Refer to section Pulse transformer [▶ 17] and to the application report.
9	Measurement cable, current I_R	**NOTICE! Use twisted measuring cables provided by ROPEX.** Refer to section Measurement cable [▶ 18] and to the application report.
10	Filtered lines (lines between line filter and temperature controller)	Refer to the application report.
11	Line filter	Do not install unfiltered and filtered lines in the same wiring ducts. Refer to section Line filters [▶ 18] and to the application report.
12	Unfiltered lines (lines between voltage supply and line filter)	Refer to the application report.
13	Overcurrent protective device Kc	Example: 2-pin circuit breaker or fuse; refer to the application report. **NOTICE! Protects only from short-circuit. Does not protect the temperature controller.**
14	Grid	To improve the immunity to interference, the system can be connected to the same phase when the output is low. Observe the requirements specified by the electric company in regard to a symmetrical grid load.
15	Contactor Kb	For EMERGENCY OFF or EMERGENCY STOP (all-pole)

5.5.1.1 Contactor Kb

A contactor Kb can be installed in the control loop to increase the safety of the machine.

The contactor Kb causes load break (all-pole), e.g. in conjunction with the alarm output of the temperature controller

A contactor Kb can also be installed in the control loop, e.g. when the system has to be switched off by the machine controller (PLC) or when a door contact is required.

The load on the contactor Kb is a factor of the specific application; refer to the application report.

Tips Trigger the contactor Kb via the temperature controller alarm relay.

- ▶ To do this, set the alarm output to inverse (menu number 405) and connect the 24 VDC supply voltage for the contactor to the NO and C contacts of the alarm relay.

To prevent errors, first switch on the 24 VDC supply voltage before switching on the supply voltage to the temperature controller.

5.5.2 Connection diagram

Additional protective equipment as well as the controller for the equipment should be provided on site.

When making electrical connections, also refer to the section Power supply [▶ 22] as well as to the application report.

The following illustrations show examples of standard applications.

Connection diagram for system without booster

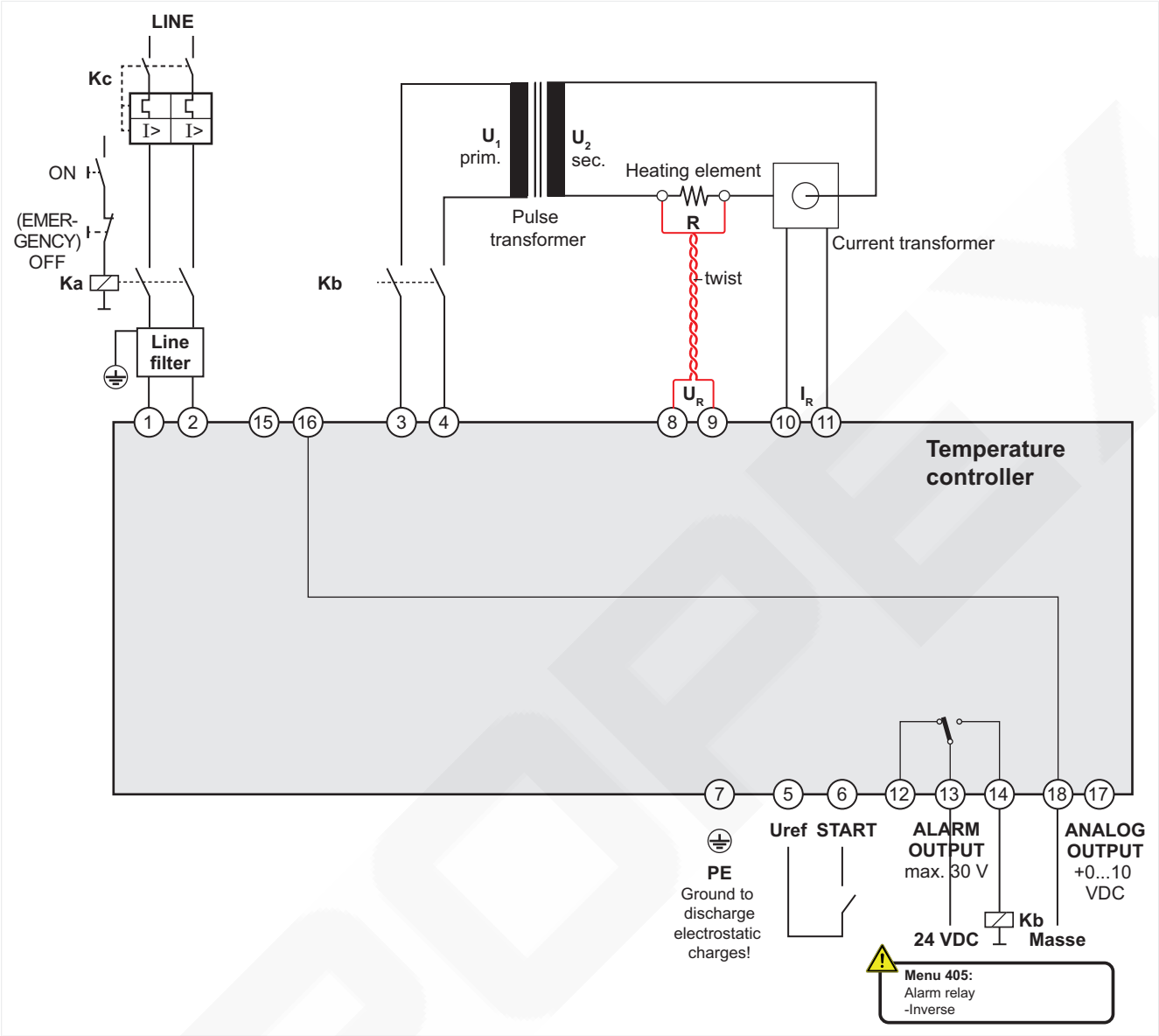


Illustration 5: Connection diagram, example of system without booster

Connection diagram for system with booster

NOTICE

Electromagnetic compatibility disruption as a result of cables that are too long

If the lines to the external booster are too long or the wires are not twisted, errors can occur when triggering the pulse transformer.

- ▶ The connecting line should be no longer than 1 m.
- ▶ Twist the wires.

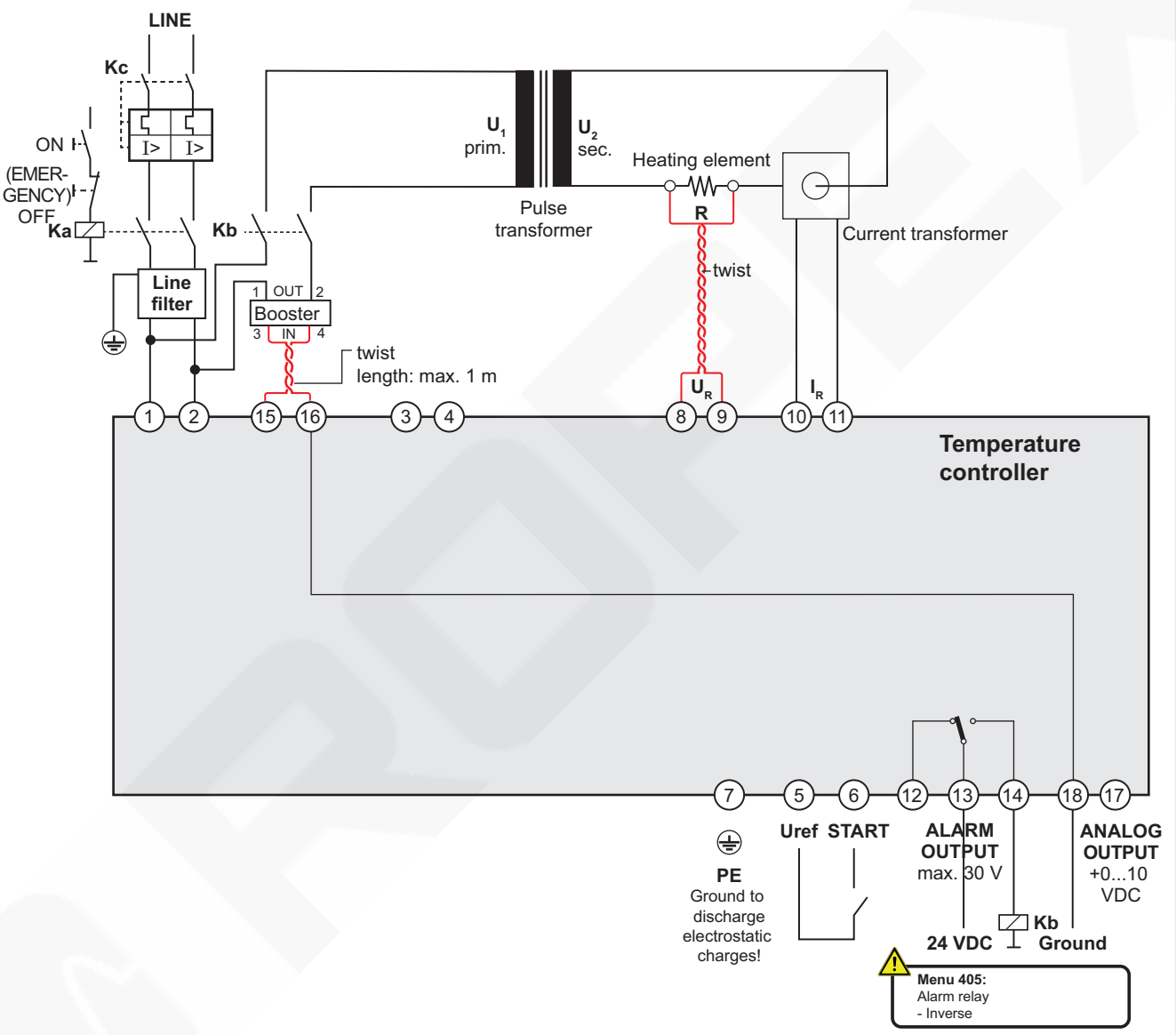


Illustration 6: Connection diagram, example of system with booster

Observe booster polarity

- ▶ Connect the booster to terminals 15+16.
  - Connect booster terminal 3 to the temperature controller terminal 15
  - Connect booster terminal 4 to the temperature controller terminal 16

Wiring in electrical cabinet

An example of the layout and wiring of system components in the electrical cabinet can be found in the appendix under .

5.5.3 Supply voltage

NOTICE

Property damage caused by incorrect line voltage

Incorrect line voltage can cause faulty sealing.

- ▶ Use an external voltage monitoring device

Prerequisite Trouble-free operation of the temperature controller is guaranteed within the line voltage and tolerance range specified in section Technical data.

6 Startup

6.1 Note on startup

NOTICE

Malfunctioning due to use of devices from other manufacturers

Devices from other manufacturers can lead to malfunctions in the control loop.

- ▶ Use only original ROPEX accessories.
- ▶ Use only system components manufactured by ROPEX or that are approved for use with ROPEX equipment.

6.2 Initial startup

Prerequisite

When the temperature controller is started for the first time and when it is restarted after changing the heat-sealing band, proceed as follows:

The following requirements have to be met:

- ✓ The device is completely assembled; refer to section Device assembly [▶ 19].
- ✓ The device is completely connected; refer to section Installation of device [▶ 21].
- ✓ Line voltage is switched off.
- ✓ Confirmation that equipment is de-energized.
- ✓ Heating element is cold.

1. Verification that no START signal is activated.
2. Switch on line voltage.
   A switchon message appears on the screen for approx. 2 sec, showing the proper way to switch on the temperature controller.

Screen content	Measure
Standard content	Proceed with the next step.
Error codes 104, 105, 106, 111, 112, 113, 211 These error codes indicate errors that can be remedied in the course of startup.	
Other error codes	For error diagnosis, refer to section Error messages [▶ 61]

- ▶ Configure the device.
  Perform this step only upon initial startup.
  The following settings are essential:

Setting	Menu number
Language	201 (`Operation` menu)
Reset to defaults	202 (`Operation` menu)
Temperature range and heat-sealing band alloy	301, 302, 305 (`Heating element` menu)

3. If the heating element is cold, activate the AUTOCAL feature:
   - Via the `Settings` menu, menu number 107

   ⇨ A counter in the screen shows the calibration process (approx. 10…15 sec). During this process, there is voltage of approx. 0 VDC at the actual value output (terminals 17+18). If a temperature display is connected, it shows 0…3 °C.

⇨ When zero calibration is completed, the standard display with an actual value of 20 °C appears on the screen. Voltage of 0.66 VDC is automatically set at the actual value output (at the 300 °C range and with a AUTOCAL = 20 °C) or 0.4 VDC (at the 500 °C range). When a temperature display ATR-x is connected, it is set to "Z".

⇨ If zero calibration is **not** performed correctly, an error message with the number 104, 105, 106 or 211 appears. The temperature controller is not configured properly (Refer to section Temperature controller configuration [▶ 28] and to the application report).
Configure the temperature controller and then perform zero calibration again.

4. Set the desired sealing temperature in the `Settings` menu, menu number 101.
5. Start heatup:
   - Touch `Manual` (standard display) *or*
   trigger the START signal (terminals 6+18).
   ⇨ The heatup and control process can be observed on the screen.
   When the temperature rises steadily, the function is working properly.
   If the temperature jumps around, fluctuates or briefly moves in the wrong direction, this is an indication that the $U_R$measuring line has been laid incorrectly. Refer to section Error messages [▶ 61] for further information.
6. If the heating element alloy has not been thermally pre-treated ("burned in"), burn in the heating element; refer to section Burning in heating element [▶ 29] and repeat AUTOCAL.

⇨ The temperature controller is ready.

6.3 Temperature controller configuration

⚠ WARNING

Danger, supply voltage at device

Line voltage is being applied to the electrical connections on the device.

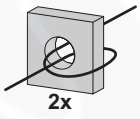
- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the current supply.
- ▶ Secure the current supply to prevent it from being switched on again.

Prerequisite

- The temperature controller is voltage-free.

6.3.1 Current transformer configuration

Configuration of the current transformer for the secondary peak current is set within the range 30…500 A.



When the secondary current I_2 is set to less than 30 A, check that the secondary high-current wire has been laid at least twice through the current converter; refer to the application report.

6.3.2 Setting alloy and temperature coefficient

⚠ DANGER

Fire hazard due to uncontrolled heatup

Using alloys with temperature coefficients that are too low or incorrect coding of the temperature controller causes uncontrolled heatup. The heating element can burn up.

- ▶ Use a heating element with the proper temperature coefficient.
- ▶ Set the correct temperature coefficient in the temperature controller.
- ▶ Set the correct temperature range in the temperature controller.

Set the heating element alloy and the corresponding temperature coefficient in the `Heating element` menu, menu numbers 301 and 302:

Preset values for the alloy as well as the temperature coefficients can be selected in menu number 301:

Temperature coefficient	Example of heat-sealing band alloy
780 ppm	Alloy L
1100 ppm (default)	Alloy 20
3500 ppm	LEX3500
400…4000 ppm	Set the temperature coefficient in menu 302.[2)]

6.3.3 Setting temperature range

Set the temperature range for the temperature controller in the `Heating element` menu, menu number 305.

The following temperatures are possible:

- 200 °C
- 300 °C (default)
- 400 °C
- 500 °C

6.4 Burning in heating element

Burning-in effect

The first time the device is heated, some alloys undergo a one-time change in the material properties.

Consequences:

- The electrical properties of the heating element may change.
- This causes the displayed temperature of the cooled heating element to change.

Remedy:

- Burn in heating element

2 Prerequisite: "Variable" is set in menu number 301.

Burning-in process

⚠ CAUTION

Hot surfaces pose a risk of burns

The surface of the heating element as well as the sealing bars get very hot during operation.

▶ Install touch protection.

⚠ CAUTION

Moving parts pose a risk of crushing

When the sealing bars move during operation, there is a risk of getting trapped.

▶ Install appropriate protective measures, e.g. monitoring sensors.

▶ Install touch protection.

To burn in the heating element, proceed as follows:

Prerequisite ✓ The sealing bars are open.

1. Perform AUTOCAL; refer to section Automatic zero calibration AUTOCAL (AC).
   ⇨ The temperature controller calibrates itself to the cold resistance of the heating element.
2. Heat the heating element to 250 °C
   (at least 50 °C above the sealing temperature as a factor of the application).
3. Once the setpoint temperature has been reached, maintain it for 3 sec.
   ⇨ The alloy undergoes a one-time change in resistance; refer to burning-in effect.
4. Allow all parts (e.g. heating element, base, body) to completely cool off.
5. Perform AUTOCAL again when the heating element is cold.
   ⇨ The temperature controller calibrates itself to the new cold resistance of the heating element.

⇨ The heating element is burned in and the change in resistance stabilizes. The system is now ready for operation.

Note The burn-in effect described can be omitted if the heating element has already been thermally pretreated by the manufacturer. Take into consideration the later sealing temperature for the specific application.

7 Display and operating elements

Illustration 7: Display and operating elements

1	Button `Menu`	2	Button `Enter`
3	Buttons `Up` and `Down`	4	Screen

Operation via screen

Operate the temperature controller as follows:

Button		Meaning
`Menu`	Press < 1 sec	Next menu item
	Press 1- 2 sec	Previous menu item
	Press > 2 sec (hold)	Return to standard screen
`Enter`	Enter	Save values
	Manual	Manual mode
	Reset	Reset after alarm
`Up` and `Down`	Press < 2 sec	Change values step-by-step
	Press > 2 sec (hold)	Change values quickly

7.1 Switching on device

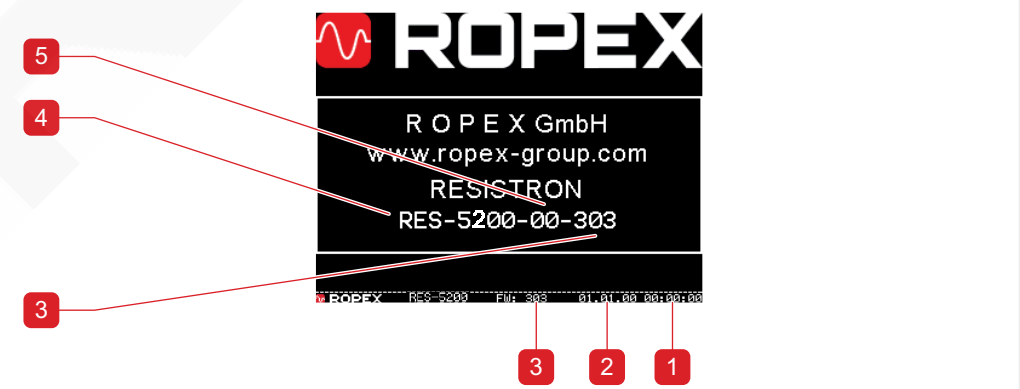


Illustration 8: Switchon message

1	Time	2	Date
3	Firmware version	4	Temperature controller type *RES-5200*
5	Software ID number		

The switchon message is displayed for approx. 2 sec after the temperature controller is switched on. The screen also provides information on the software version.

7.2 Screen view

7.2.1 Standard screen

If no settings are made to the temperature controller and there are no error messages, the screen remains in the standard view.

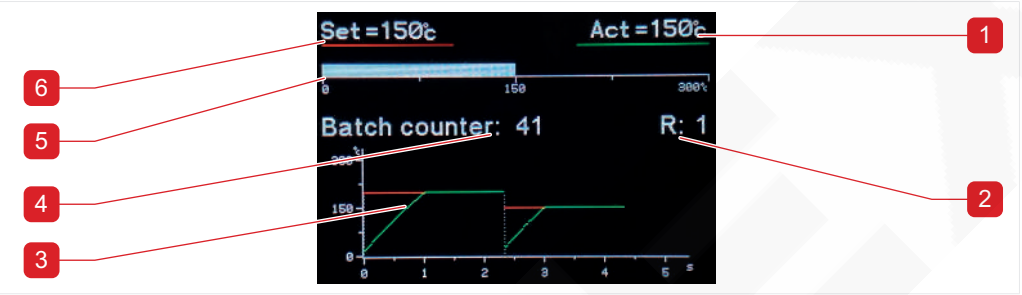


Illustration 9: Standard screen

1	Actual temperature	2	Active reset
3	Course of setpoint and actual temperature, shown as a graph	4	Number of resettable counter
5	Actual temperature, progress bar	6	Setpoint temperature (specified heating temperature), numerical display

7.2.2 Adjusting screen brightness

When the standard screen is displayed, the brightness can be adjusted with `Up` and `Down`.

7.2.3 Error message

Error diagnosis of the temperature controller is always active. When an error is detected, it immediately appears in the screen as an error message. For more information on error messages, refer to System monitoring and alarm output [▶ 60].

Illustration 10: Error message

1	Description of error	2	Error code
3	Cause of error	4	Indication that `Reset` has to be pressed.
5	QR code with link to ROPEX website, where more information on how to remedy errors can be found	6	URL with link to ROPEX website, where more information on how to remedy errors can be found

8 Functions and settings

8.1 Settings

8.1.1 Settings menu / configuration menu

Parameters are set at multiple menu levels:

- `Settings` menu (operating menu; menu numbers 1xx): To access the `Settings` menu, press the `Menu` button for < 1 sec.
- `Configuration` menu: To access the `Configuration` menu. press the `Menu` button for > 2 sec.
  - `Operation` menu (menu numbers 2xx)
  - `Heating element` menu (menu numbers 3xx)
  - `Machine` menu (menu numbers 4xx)
  - `Diagnosis` menu (menu numbers 5xx)
  - `Information` menu (menu numbers 6xx)

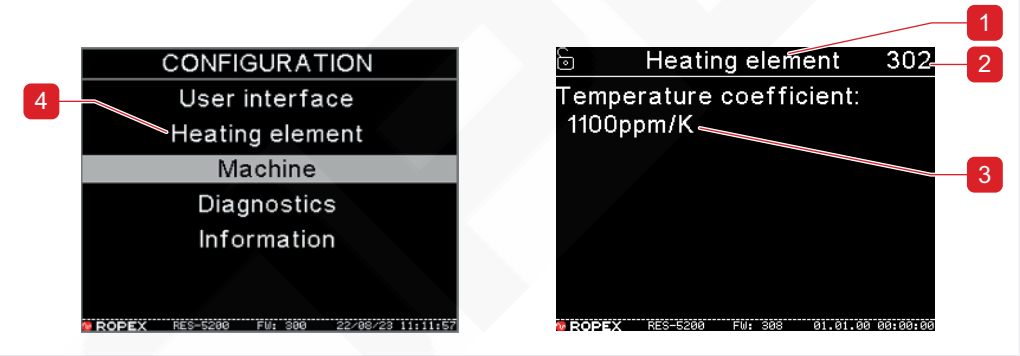


Illustration 11: Configuration menu and heating element menu

1	Indication of menu level (in this case: `Heating element` menu)	2	Indication of position in the menu (menu step)
3	Menu content	4	`Configuration` menu

8.1.1.1 Settings

In the `Setting` menu, briefly press `Menu` to advance to the next menu item. Press `Menu` for > 2 sec to access the `Configuration` menu.

Menu number	Menu item	Description	Setting range
	Standard content	The set setpoint and the current actual value are shown numerically. The actual value is also indicated by the progress bar. The setpoint and actual value are shown as a graph as well. Touch `Manual` to begin manual heatup (to the set sealing temperature).	

Menu number	Menu item	Description	Setting range
101	Heating temperature / constant regulation ratio	Specified heating temperature (constant regulation ratio (menu number 301) not active): Press `Up` and `Down` to set the desired sealing temperature (setpoint). The maximum setpoint can be limited in menu number 305 or in menu number 306. The setpoint is shown in the standard screen. Specification of constant regulation ratio (constant regulation ratio (menu number 310), if START is active): Press `Up` and `Down` to set the desired constant regulation ratio. The setpoint is shown in the standard screen.	Sealing temperature: Depending on the setting in menu number 305: 0 °C, 40 °C … maximum temperature (menu number 306) Constant regulation ratio: 5 % … 100 %
107	AUTOCAL	This function adjusts the temperature controller to the current and voltage signals present in the system. Press `Up` and `Down` to set the desired calibration temperature. Apply the set value and start AUTOCAL by pressing `Enter` During AUTOCAL, the message "Calibration" appears on the screen and a timer counts down from 15 to 0. When calibration has been completed successfully, the display goes directly to the standard screen if AUTOCOMP is switched off. If AUTOCOMP is switched on, the screen changes to menu number 108 (AUTOCOMP is set in menu number 309). If calibration cannot be performed, AUTOCAL is canceled and a corresponding error code appears on the screen. Start AUTOCAL by briefly (< 2 sec) pressing `Enter`. Start MASTER-AUTOCAL by pressing `Enter` for longer than 2 sec. Refer to section Automatic zero calibration AUTOCAL (AC) [▶ 44] for further information.	0…40 °C
108	AUTOCOMP request	Start AUTOCOMP by pressing `Enter` within 2 sec. If `Enter` is not pressed within 2 sec, the display returns to the standard screen. The menu number is shown automatically after successful AUTOCAL and when AUTOCOMP is switched on (Set AUTOCOMP in menu number 309).	
111	Counter	In this menu number, press `Enter` to reset the counter shown in the standard screen to zero.	
112	Load recipe	The values loaded into the selected recipe are restored. The loaded values also remain valid when the temperature controller is switched off and then back on.	

8.1.1.2 Configuration

In the `Configuration` menu, briefly press `Menu` to advance to the next menu item. Press `Menu` for > 2 sec to access the `Configuration` menu.

Operation menu

Menu number	Menu item	Description	Setting range
201	Language	Select the desired language.	• German • English • French • Italian • Dutch • Spanish • Swedish • Polish • Portuguese • Finnish • Danish • Turkish • Greek
202	Default	Press `Enter` to reset the temperature controller to the default; refer to section Resetting to defaults [▶ 43].	–
203	Hold mode	When hold mode is activated, the last value measured at the end of the heating phase is saved and shown on the screen. In the standard screen, ACTUAL is replaced by HOLD. This process is repeated for each cycle and the displayed value is updated. HOLD is masked for 100 ms before the update. When 2 sec is selected, after 2 sec the screen returns from hold mode to the actual value display in realtime. Hold mode is not activated for 2 sec again until the end of the next cycle.	ON OFF 2 sec
204	Temperature unit	Unit for temperature display and input	• Celsius • Fahrenheit
205	AUTOCAL button	Specify here whether AUTOCAL can be started by pressing `Enter` in menu 107.	• Active • Disabled
206	MANUAL button	Specify the function of the `Manual` button in the standard screen: • Start heating • Button disabled	• Starts heating • Disabled
207	Record measured values	Specify how the temperature course is shown in the graph in the standard screen: • Heating phase: Measured temperature values are recorded only during the heating phase (START active). • Continuous: Measured temperature values are recorded continuously.	• Heating phase • Continuous
208	Return time	If for 30 sec no button is touched in a menu item, the system automatically returns to the standard screen. • 30 sec: automatic return to the standard screen after 30 sec. • No automatic return	• 30 sec • Never

Menu number	Menu item	Description	Setting range
209	Screen saver	To extend the serviceable life of the screen, the time after which the screen goes dark can be adjusted in this menu item. • OFF: The display remains illuminated. Th screen saver works only in the standard screen. The screen is activated again when any button is touched or when an alarm occurs.	• OFF • 1…99 min
212	Save recipe	Saves the current values to the selected recipe. Press `Enter` to save the currently set values to the selected recipe. Refer to section Recipe control [▶ 52] for further information.	• -1…9
213	Usable recipes	The usable recipes can be set in this menu. A checkmark indicates that the recipe is usable. An X indicates that the recipe is not usable. Refer to section Recipe control [▶ 52] for further information.	✓ ✕
214	Recipe mode	When recipe mode is switched on, only the usable recipes can be loaded. Parameters cannot be saved outside of the recipe. Refer to section Recipe control [▶ 52] for further information.	• OFF • ON

Heating element menu

Menu number	Menu item	Description	Setting range
301	Temperature coefficient	Various heat-sealing band alloys can be selected. The characteristic curve for the control parameters is calculated on the basis of this setting. **Always verify that the correct alloy of the heat-sealing band material is selected.**	• TCR 780 ppm • TCR 1100 ppm • TCR 3500 ppm • Variable
302	Temperature coefficient	If the setting `Variable` was selected in menu number 301, the temperature coefficient of the heat-sealing band material can be set in this menu item using the `Up` and `Down` buttons.	400…4000 ppm
304	TCR calculator	Available only when `Variable` has been selected in menu number 301. Refer to section TCR calculator [▶ 55] for further information.	
305	Temperature range	Various temperature ranges can be selected. The temperature controller is adjusted for the required temperature range by setting the temperature range accordingly. This determines scaling of the progress bar in the standard screen.	• 200 °C • 300 °C • 400 °C • 500 °C
306	Maximum temperature	The maximum setpoint (menu number 101) that can be chosen within the range defined in menu number 305.	100 °C to max. temperature range (menu number 305)
307	Measuring pulse duration	Change the measuring pulse duration; refer to section Measuring pulse duration [▶ 57].	1.7…3.0 ms

Menu number	Menu item	Description	Setting range
308	Maximum measurement pause	Refer to section Maximum measurement pause [▶ 57] for further information.	0…10 periods
309	AUTOCOMP	Activate AUTOCOMP here. Refer to section Automatic phase correction (AUTOCOMP) [▶ 57] for further information.	• OFF • ON • Automatic
310	Constant regulation ratio	Activate the `Constant regulation ratio` function.	• Never • WHEN START is active
311	Calibration channel	The calibration channel used can be set here. Refer to section Channel selection (CH0…CH2) [▶ 55] for further information.	0…7
312	Number of passes through current transformer	Number of conductors through the current transformer. In this menu number, enter the number of times that the secondary current line should pass through the current transformer. Refer to section Current transformer configuration [▶ 28] for further information.	1…9

Machine menu

Menu number	Menu item	Description	Setting range
405	Alarm relay	Alarm relay switching can be configured here. • Normal: In the event of an alarm, the alarm relay output (terminals 12, 13, 14) functions as a make contact. • Inverse: In the event of an alarm, the alarm relay output (terminals 12, 13, 14) functions as a break contact.	• Normal • Inverse
406	Analog output supplies	Select which information should be provided at the actual value output (terminals 17+18).	• Actual temperature • 10 V reference • Regulation ratio • OFF
413	Restart delay after reset	Adjust the restart time after a RESET signal. Can be adjusted for contactors that switch slowly. Refer to section Restart delay after reset [▶ 46] for further information.	0…9.99 s

Diagnosis menu

Menu number	Menu item	Description	Setting range
501	Setpoint reached	Set the low temperature threshold for temperature diagnosis (menu number 503). The value is stated in Kelvin (K) and is added to the setpoint to calculate the temperature threshold.	-3…-99 K
502	Setpoint exceeded	Set the high temperature threshold for temperature diagnosis (menu number 503). The value is stated in Kelvin (K) and is added to the setpoint to calculate the temperature threshold.	+3…+99 K
503	Temperature diagnosis	If this value is set to ON, an alarm with error code 307/308 is generated when the temperature leaves the tolerance range.	• OFF • ON
504	Temperature diagnosis delay	The delay begins as soon as the actual temperature is within the tolerance range. The temperature tolerance with alarm generation is not active until this time has elapsed. Available only when temperature diagnosis (menu number 503) is switched on.	0.00…9.98 sec
505	Heatup timeout	If the actual temperature is not within the temperature tolerance range when the time (after activation of the START signal) set here has elapsed, an alarm with error code 304 is generated.	• OFF • 0.02…99.98 s
506	Maximum start temperature permitted	Maximum temperature permitted upon START.	20 °C … maximum temperature (menu number 306)

Information menu

Menu number	Menu item	Description	Setting range
601	Cycle counter	The number of heating pulses is counted and displayed. Starting the heating process by touching `Manual` is not counted. Reset the counter by pressing `Enter`, `Down` and then `Enter` again. The total cycles as well as the operating hours of the temperature controller are displayed. These values cannot be reset.	
602	Cycle counter (calibration channel)	The number of pulses (not manual pulses) for each calibration channel is counted and shown in this menu number. Press `Enter` to select the counter. Reset the counter by pressing `Down` and then `Enter` again.	
603	Date Time	The date and time are displayed. To change the date or time, press `Enter` to select the position to be changed. Press `Up` and `Down` to adjust the selected value.	

Menu number	Menu item	Description	Setting range
604	ID plate	Shows the following information regarding the temperature controller: • Device type • Article number • Serial number • Firmware version • Hardware version • Modification • Number of entries in error protocol • Number of operating hours	
605	Display of protocol entries	The following events are entered into the protocol: • Alarms • Execution of AUTOCAL and MASTER-AUTOCAL • Time and date settings • Loading and saving of recipes • Firmware update When the protocol memory is full, the oldest protocol entry is overwritten. Navigate through the protocol entries by pressing `Up` and `Down`. Protocol entry 1 always shows the most recent event.	

8.1.2 Menu navigation without alarm

Proceed as follows to navigate through the various menu items and levels:

1. Press `Menu` briefly (< 1 sec)
   ⇨ to move to the next menu item.
2. Press `Menu` for longer than 2 sec.
   ⇨ The system then returns to the standard display, except when there is a temperature controller alarm. In this case, the systems jumps back to the alarm menu.

If the display shows the standard screen or an alarm, proceed as follows to move to the configuration level:

▶ Press `Menu` for longer than 2 sec.
   ⇨ The temperature controller changes to the configuration level.

If `Menu` is pressed for 1 - 2 sec, the system returns to the previous menu item.

Return to standard screen The system returns to the standard screen if no button is pressed for 30 sec. This does not apply when the temperature controller is in AUTOCAL or ALARM position.

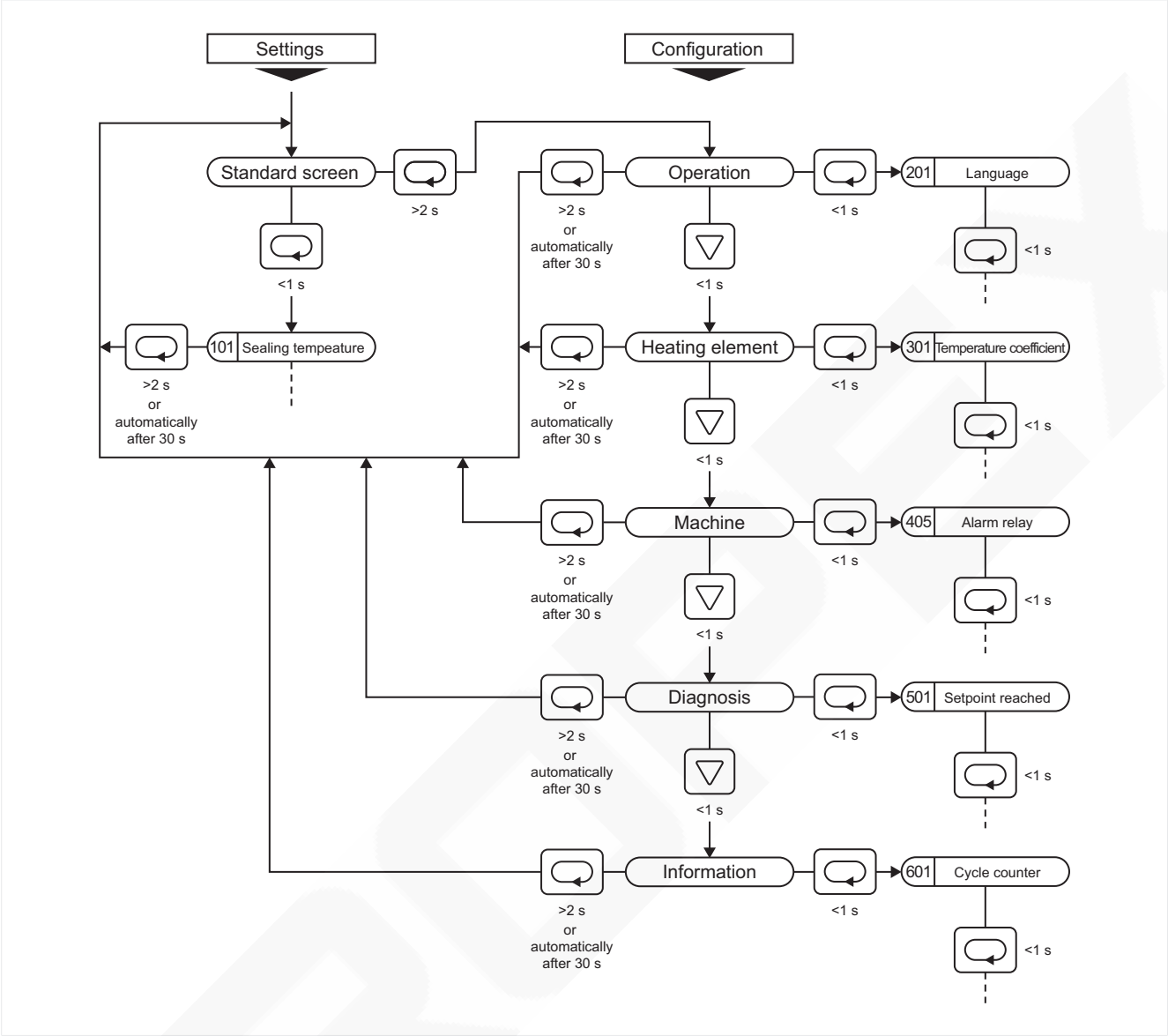


Illustration 12: Menu navigation without alarm

8.1.3 Menu navigation in the event of an alarm

Acknowledge error

If the event of an alarm, the temperature controller goes to the `Alarm` menu. To acknowledge an error, proceed as follows:

- Press `Reset`.
  A list of the errors that can be acknowledged by pressing `Reset` can be found in System monitoring and alarm output [▶ 60].
  - ⇨ The temperature controller returns to the standard screen after acknowledgment.

Change to AUTOCAL

In the menu item AUTOCAL, some errors can be remedied with the AUTOCAL function. To change to the menu item AUTOCAL, proceed as follows:

1. Press `Menu` briefly (< 2 sec) to move to th menu item AUTOCAL (menu item 107).

2. Press `Enter`
   ⇨ The AUTOCAL function starts.

Move to the configuration level

To change the configuration level, proceed as follows:

1. Press `Menu` in the `Alarm` menu for longer than 2 sec.
   ⇨ The temperature controller changes to the configuration level
2. To return to the `Alarm` menu, press `Menu` in the `Configuration` menu for longer than 2 sec or do not touch any button for 30 sec.

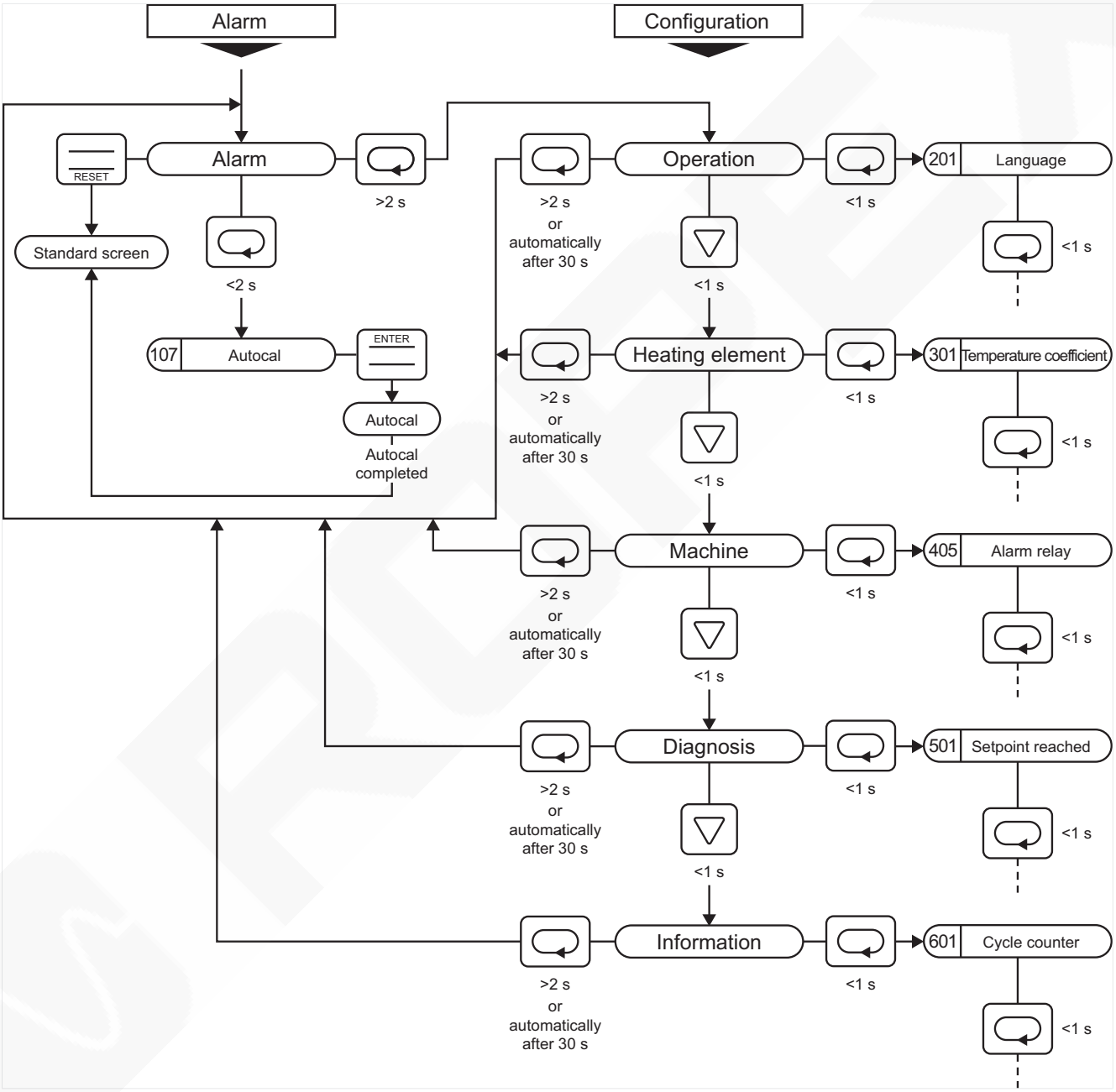


Illustration 13: Menu navigation in the event of an alarm

8.1.4 Default

The default configuration for the temperature controller is as follows:

Menu	Menu number	Menu item	Setting
Setting	101	Heating temperature / constant regulation ratio	Sealing temperature: 0 ° Constant regulation ratio: 5 %
	107	AUTOCAL temperature	20 °C
	111	Counter	0
	112	Load recipe	
Configuration	201	Language	German
	202	Default	
	203	Hold mode	OFF
	204	Temperature unit	Celsius
	205	AUTOCAL button	Active
	206	MANUAL button	Starts heating
	207	Record measured values	Heating phase
	208	Return time	30 sec
	209	Screen saver	OFF
	212	Save recipe	
	213	Usable recipe	All can be used
	214	Recipe mode	OFF
Heating element	301	Temperature coefficient	1100 ppm/K
	302	Temperature coefficient	1100 ppm/K
	304	TCR calculator, measured temperature	300 °C (value not saved)
	305	Temperature range	Max. 300 °C
	306	Maximum temperature	300 °C
	307	Measuring pulse duration	17 (1.7 ms)
	308	Maximum measurement pause	10 periods
	309	AUTOCOMP	OFF
	310	Constant regulation ratio	Never
	311	Calibration channel	0
	312	Number of passes through current transformer.	1
Machine	405	Alarm relay	Normal
	406	Analog output supplies	Actual temperature

Menu	Menu number	Menu item	Setting
Machine	413	Restart delay after reset	0.2 sec
Diagnosis	501	Setpoint reached	-10 K
	502	Setpoint exceeded	10 K
	503	Temperature diagnosis	OFF
	504	Temperature diagnosis delay	0 sec
	505	Heatup timeout	OFF
	506	Maximum start temperature permitted	100 °C
Information	601	Cycle counter	Cycles: 0
	602	Cycle counter (calibration channel)	For all channels: 0
	603	Date and time	
	604	ID plate	
	605	Protocol entries	

The parameters saved in the recipes contain the same standard values as the respective single parameters.

Proceed as follows to reset the temperature controller to the defaults:

1. Select the `Operation` menu, menu number 202.
2. Press Enter.
3. Press Enter again to confirm the security prompt.
   ⇨ The confirmation appears on the screen for 2 sec.

8.1.4.1 Resetting to defaults

Preventing malfunctions

If the temperature controller settings are not known upon initial startup, reset the temperature controller to the defaults to prevent malfunctions.

Resetting to defaults

Reset the internal temperature controller settings in the `Operation` menu, menu number 202. The language setting in the `Operation` menu, menu number 201 is the only setting that is not changed by resetting to the defaults.

For more information on the defaults, refer to Werkseinstellung [▶ 41].

8.2 Basic functions

8.2.1 Setting language

Select the language in which the menus should appear in the `Operation` menu, menu number 201.

The following languages are available:

- German
- English
- Italian
- French
- Italian

- Dutch
- Spanish
- Swedish
- Polish
- Portuguese
- Finnish
- Danish
- Turkish
- Greek

The language can be changed during operation.

The language remains unchanged if the temperature controller is reset to the default.

8.2.2 Temperature setting (specified setpoint)

Set the sealing temperature in the `Settings` menu, menu number 101.

Setpoint

The setpoint specified as the sealing temperature has to be greater than 40 °C. If the setpoint is lower, activation of the START signal or touching `Manual` does not trigger heating.

8.2.3 Automatic zero calibration AUTOCAL (AC)

NOTICE

Property damage if the heating element overheats

When the function AUTOCAL is performed while the heating element is warm, zero calibration will be faulty, leading to poor sealing results.

▶ Wait until the heating element and tool have cooled off.

Variable calibration temperature

Automatic zero calibration AUTOCAL (AC) means that manual zero calibration on the temperature controller is not necessary. This function adjusts the temperature controller to the current and voltage signals present in the system.

To activate this function:

- Press `Enter` in the `Settings` menu, menu number 107.

Settings menu

The base temperature of the sealing bar(s) to be used for calibration can be set within the range 0…40 °C beforehand. Press `Up` and `Down` in menu number 107 to set the temperature.

The default zero point is calibrated to 20 C.

The automatic calibration takes approx. 10…15 sec. The heating element is not heated additionally during this process. During AUTOCAL, the message "Calibration - please wait" appears on the screen and a timer counts down from 15 to 0. The actual value output (terminals 17+18) changes to 0…3 °C (corresponds to approx. 0 VDC) during this time.

Fluctuating temperature

If the temperature of the heating element fluctuates, the AUTOCAL function is executed a maximum of three times. If the function still cannot be executed successfully, an error message appears; refer to section Error messages [▶ 61].

AUTOCAL function is disabled

AUTOCAL is disabled if any of the following conditions occur:

- In the first 10 sec, if the temperature controller does not report an alarm after being switched on reset, and the cooling rate is lower than 0.1 K/sec. The temperature controller indicates in the `Settings` menu, menu number 107 "Heat-sealing band still warm! Please wait..."

- The cooling rate of the heating element is greater than 0.1 K/sec. The temperature controller indicates in the `Settings` menu, menu number 107: "Heat-sealing band still warm! Please wait..."
- The START signal is active. The temperature controller indicates in the `Settings` menu, menu number 107: "AUTOCAL disabled! (START signal active...)."
- Error codes 101…103, 201…203 or 9xx occur directly after switching on the temperature controller; refer to section Error messages [▶ 61]. The temperature controller indicates in the `Settings` menu, menu number 107 "AUTOCAL disabled! (ALARM active)."
- if the temperature controller has operated correctly at least once after being switched on and error codes 201 to 203 or 9xx occur; refer to section Error messages [▶ 61]. The temperature controller indicates in the `Settings` menu, menu number 107: "AUTOCAL blocked! (ALARM active)."

8.2.4 Configuring alarm relay

The alarm relay can be configured in the `Machine` menu, menu number 405. The following settings are possible:

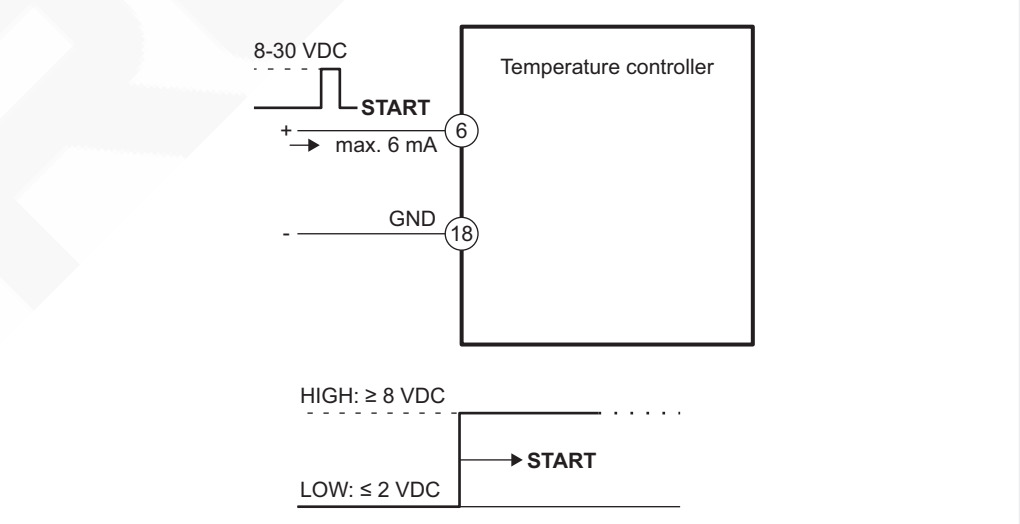
Setting	Description
Normal	Alarm relay contact closes when an alarm occurs.
Inverse	Alarm relay contact opens when an alarm occurs.

8.2.5 START signal

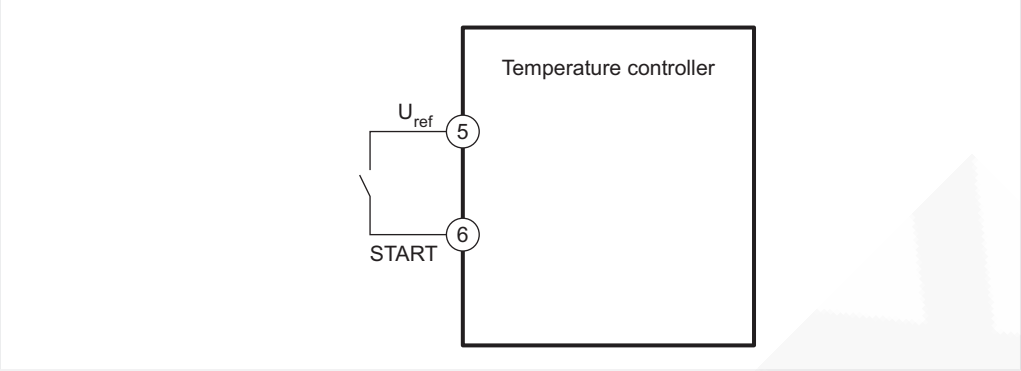
When the START signal is activated, the device's internal set/actual comparison is enabled. The heating element is heated to the setpoint temperature. This continues until the signal is switched off. Unrelated to the START signal, this process can be triggered by pressing `Manual` – when the standard screen is shown in the display. Starting heating by pressing `Manual` can be deactivated in the `Operation` menu, menu number 206.

The START signal can be triggered in two different ways.

- Apply a 24 VDC signal to terminals 6+18.



- Apply a control contact to terminals 5+6.



Start request is not processed

A start request is not processed if any of the following conditions occur:

- AUTOCAL function is active.
- The temperature controller indicates a fault.
- The setpoint is lower than 40 °C.

The alarm relay is switched if the START signal is activated while a warning with error code 104…106, 111…114, 211, 302, or 303 is indicated. Heating no longer occurs.

Information on the warnings with the respective error codes can be found in section Error messages [▶ 61].

8.3 Inputs and outputs

8.3.1 Restart delay after reset

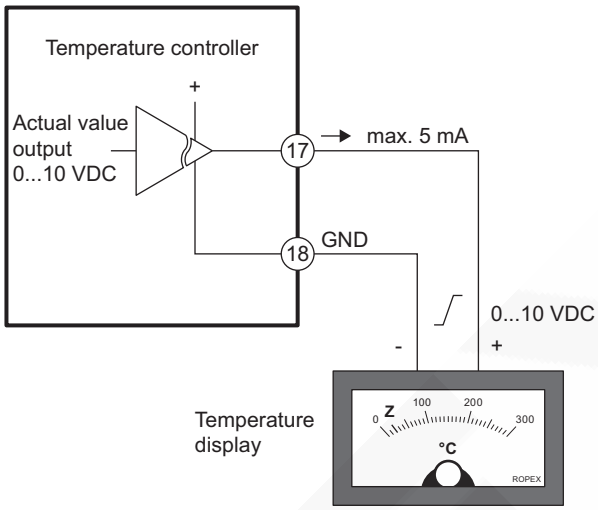
After acknowledging an alarm, the temperature controller waits until any contactor connected has closed the heating circuit again. When the waiting time has elapsed, the temperature controller generates measuring pulses again. With the aid of the measuring pulses, the temperature controller determines the current actual temperature and performs error diagnosis.
The restart delay is 0.2 sec by default and can be adjusted in the `Machine` menu, menu number 413. This allows slower switching contactors to be used.

8.3.2 Temperature display / actual value output

When the standard screen is displayed, the actual temperature is shown as a digital numerical value, as a progress bar and as a graph.

This allows not only comparisons of the setpoint and actual value. Other criteria such as the heatup rate, reaching the setpoint in the specified time, cooling of the heating element, etc. can be evaluated. Faults in the control loop (e.g. loose connections, contact and wiring problems), such as power disruptions, can be detected and interpreted as well. This also applies when multiple adjacent control loops influence one another mutually.

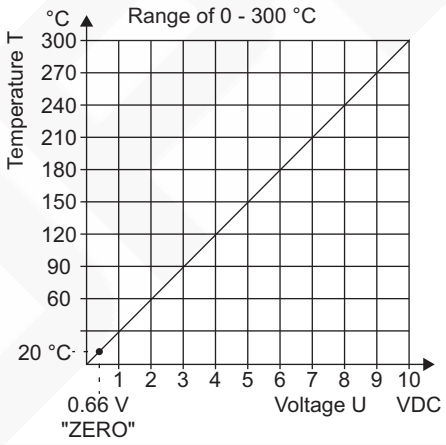
The temperature controller supplies an analog signal 0…1 VDC that is electrically isolated from the heating circuit to terminals 17+18 and that is proportional to the actual temperature.

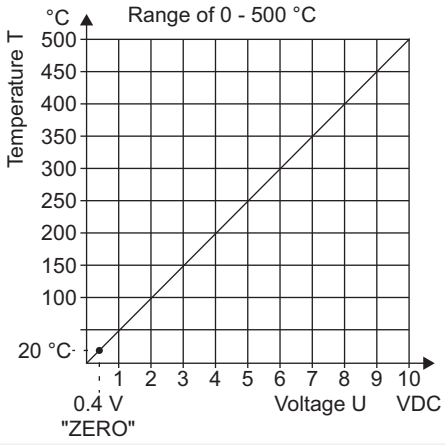


Voltage values

- 0 VDC: 0 °C
- 10 VDC: 300 °C or 500 °C (depending on device configuration)

The correlation between the change in the output voltage and the actual temperature is linear.





Temperature range

Only two temperature ranges – 300 °C or 500 °C – can be output at this actual value output. A temperature range of 200 °C for the temperature controller set in the `Heating element` menu, menu number 305 is output at this output within the range of 0…300 °C. The temperature range 400 °C is output with 0…500 °C. A display instrument can be connected to this output to show the heat-sealing band temperature.

Analog output Various information can be output at the analog output (terminals 17+18). The temperature controller is configured in the `Machine` menu, menu number 406.

The following functions can be adjusted:

Setting	Description
Actual temperature (default)	The analog output indicates the current actual value at output voltage of 0...10 VDC. In the event of an alarm, this analog output is used – in addition to the indication on the screen – ito output differentiated error messages.
10 V reference	A fixed reference of 10 VDC is output at the actual value output.
Regulation ratio	The analog output supplies the current regulation ratio of the temperature controller. The range 0...10 VDC show 0…100 % of the phase-angle control of the line voltage.
OFF	The analog output is deactivated.

8.3.3 USB interface

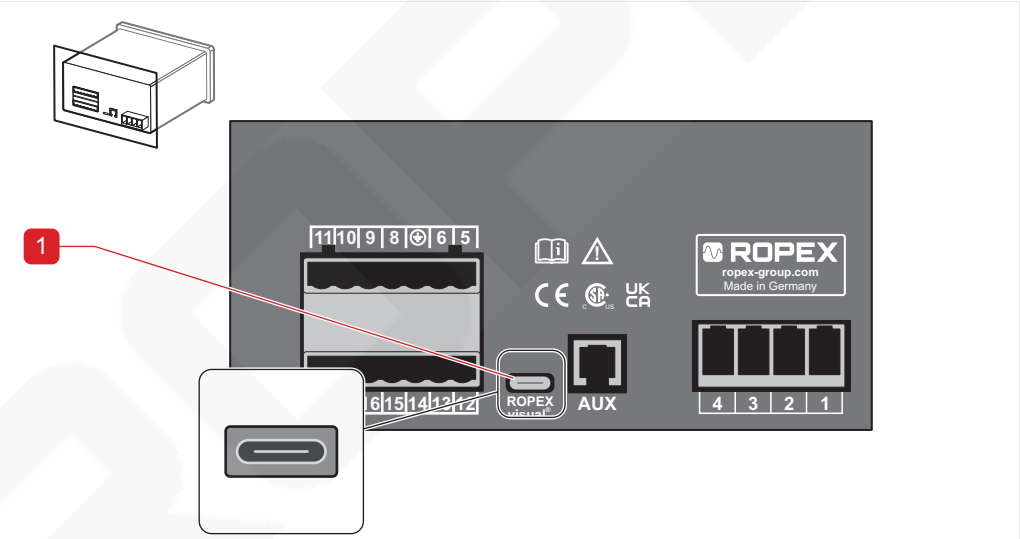


Illustration 14: USB interface

The temperature controller has a USB interface (1).

The USB-C interface enables a data connection to be set up to *ROPEXvisual*®, the ROPEX visualization software.

The visualization software is used for system diagnostics and process visualization.

Downloads Further information can be found in the operating instructions for the visualization software *ROPEXvisual*®. The operating instructions and software can be found on the following website:

Menu path `Products > Downloads > ROPEXvisual®`

8.3.4 AUX interface

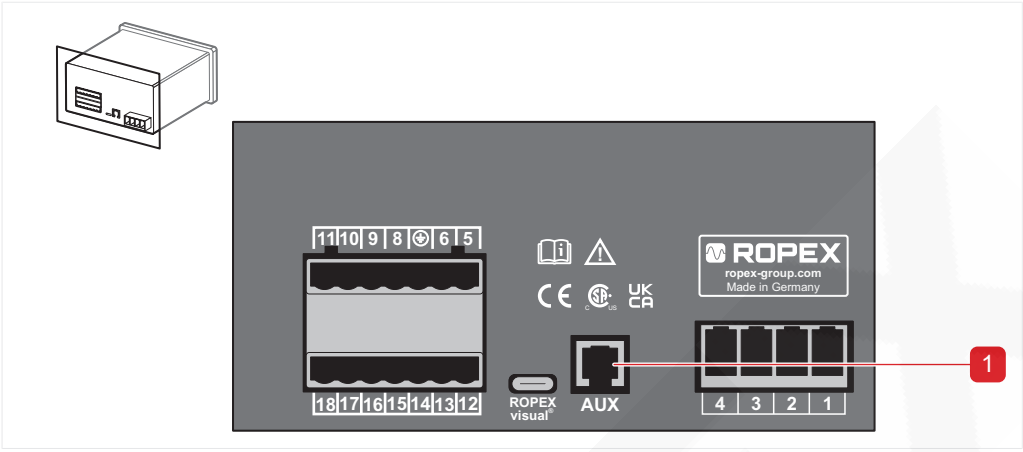


Illustration 15: AUX interface on temperature controller

The temperature controller has an internal AUX interface (1).

The AUX interface is used for diagnostics and maintenance purposes.

8.4 Diagnosis

8.4.1 Temperature diagnosis

Temperature diagnosis can be activated in the `Diagnosis` menu, menu number 503. The temperature controller checks whether the actual temperature is within an adjustable tolerance range ("OK window") above and below the setpoint temperature. The low ($\Delta\vartheta_{low}$) and high ($\Delta\vartheta_{high}$) tolerance limits can be changed independently of one another in the `Diagnosis` menu, menu numbers 501, 502 (default: -10 K or +10 K).

If the ACTUAL temperature is within the specified tolerance range when the START signal is activated, the temperature diagnosis is activated as well. If the ACTUAL temperature leaves the tolerance range, the corresponding error code (307, 308) appears and the alarm output is switched; refer to section Error messages [▶ 61].

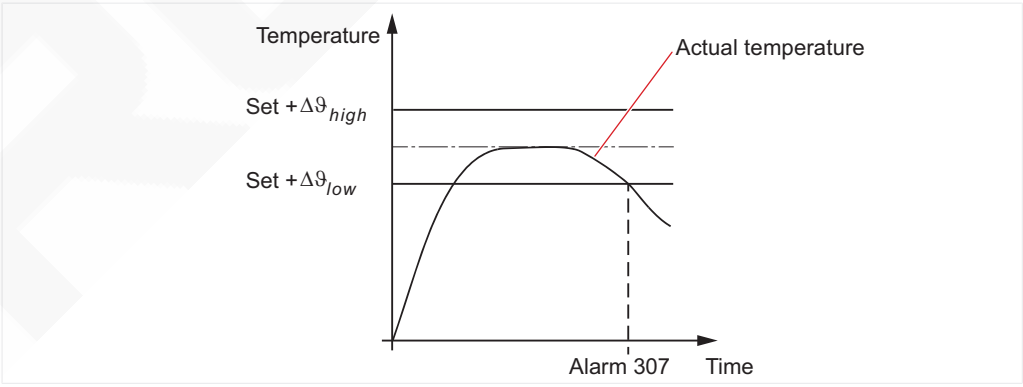


Illustration 16: Temperature diagnosis

If the actual temperature does not exceed the low tolerance limit or fall below the high tolerance limit, the corresponding error code (309, 310) appears and the alarm relay is switched. Temperature diagnosis was not switched on until the START signal was deactivated.

When temperature diagnosis is switched on, an additional delay for temperature tolerance can be set within the range 0...9 sec in the `Diagnosis` menu, menu number 504.

The first time the value exceeds the low tolerance limit, temperature diagnosis is not activated until the configured delay time has elapsed. The temperature diagnosis function can thus be selectively deactivated, e.g. if the temperature drops when the sealing jaws are closed.

8.4.2 Heatup timeout

An additional heatup timeout can be activated in the `Diagnosis`, menu, menu number 505.

Default

- Heatup timeout off (default)

Heatup timeout is activated when the START signal is activated. The temperature controller monitors the time that it takes for the actual temperature to reach 95 % of the setpoint temperature. If this time is longer than the configured time, the corresponding error code (304) appears and the alarm relay switches; refer to section .

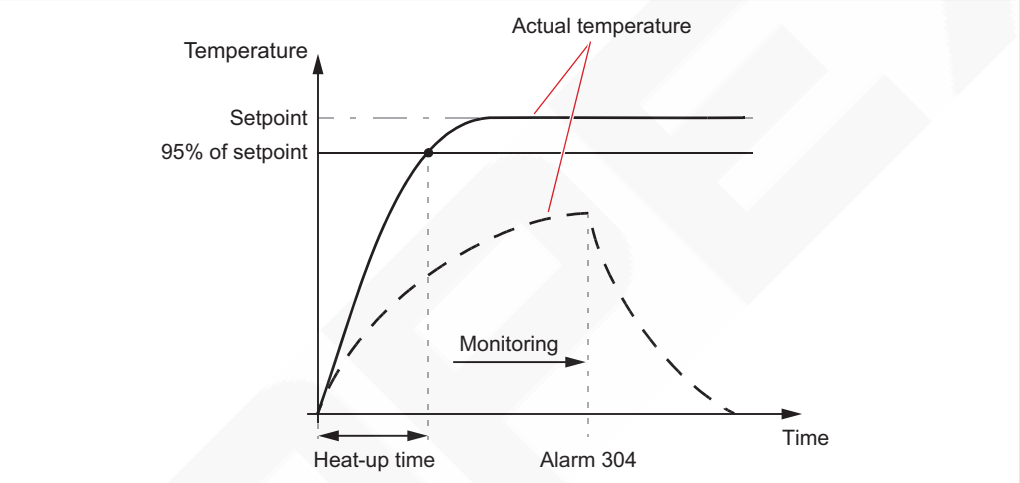


Illustration 17: Heatup timeout

8.4.3 Cycle counter

Activations of the START signals during operation are compiled by a cycle counter in the temperature controller. Starting the heating process by touching `Manual` is not counted.

The counter is shown in the `Information` menu, menu number 601.

Resetting cycle counter

To reset the cycle counter to 0, proceed as follows:

1. Press `Enter`.
2. Press `Down`.
3. Press `Enter`.
   ⇨ The cycle counter is reset to 0.

Exceeding counting range

When the counting range of 999,999,999 is exceeded, the counter continues with 0 when counting the next cycle.

8.5 Adjusting operation

8.5.1 Configuring the Manual button

The function of the `Manual` button can be configured in the `Operation` menu, menu number 206.

The following settings are possible:

Setting	Description
Start heating	In the standard screen, pressing `Manual` triggers manual heating. Heating continues for as long as `Manual` is pressed.
Key disabled	In the standard screen, `Manual` is disabled, meaning it has no function. This prevents `Manual` from being pressed and heating to begin unintentionally.

8.5.2 Setting temperature unit

Select the unit to be used for temperature display and input in the `Operation` menu, menu number 204.

The following temperature units are available:

- Celsius (°C)
- Fahrenheit (°F)

The temperature unit can be changed while the temperature controller is operating.

If the temperature unit Fahrenheit was selected, the temperature controller still continues to work with Celsius internally. Converting from Celsius to Fahrenheit can cause the values shown in the temperature display and input to jump around accordingly, meaning that they might not precise.

8.5.3 Hold mode

Set the behavior of the digital display of the actual temperature in the standard screen in the `Operation` menu, menu number 203. Proceed as follows:

Setting	Meaning
Off (default)	The current actual temperature is shown in realtime.
On	The current actual temperature is output at the end of the last heat-sealing phase. When the temperature controller is switched on, the current temperature is indicated up until the end of the first heating phase.
2 sec	The current temperature is shown as a digital value for an additional 2 sec at the end of a heat-sealing phase. Then the actual temperature is shown in realtime until the end of the next heat-sealing phase.

Hold mode applies only to the digital value shown in the screen. For all of the settings, the progress bar and the actual value output always show the actual temperature in realtime.

The various hold modes are shown below:

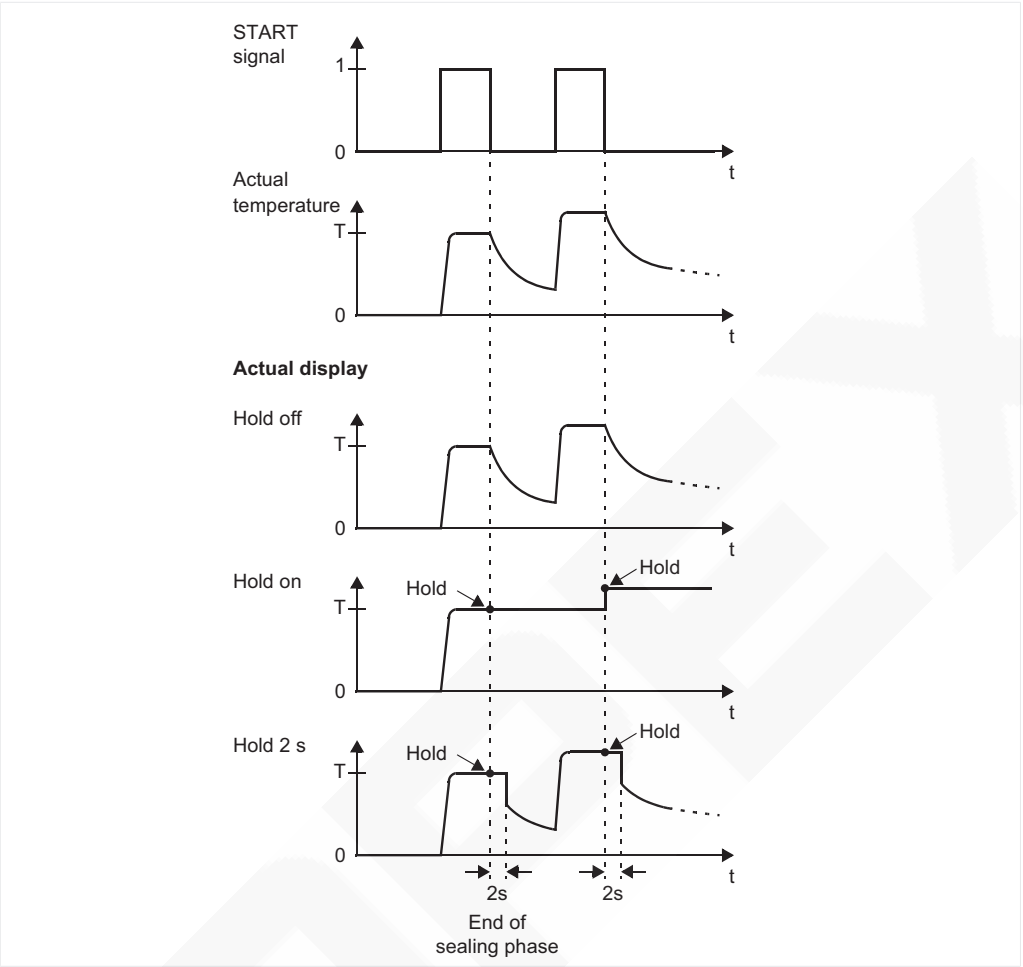


Illustration 18: Hold mode

Temperature values are labeled "Hold" when displayed in hold mode. "Hold" appears in the screen for approx. 100 ms to indicate that the hold value has been updated.

8.6 Recipes

8.6.1 Recipe control

Recipe control enables quickly changing between various configurations of the temperature controller. All of the menu items relevant to a sealing process are saved in a recipe. This allows various products that are to be produced to be saved in the temperature controller.

Nine different recipes can be saved in the temperature controller.

Menu items in a recipe

The following menu items are saved in a recipe:

Menu item	Menu number
Sealing temperature	101
Constant regulation ratio	101; applied with configuration `Constant regulation ratio` (menu number 310) when START is active
AUTOCAL temperature	107
Temperature coefficient	302
Calibration channel	311

The values set in the known menu numbers apply to all settings not listed here.

Saving a recipe

To save a recipe, proceed as follows:

1. Set the desired values in the menus (menu numbers 101, 107, 302 and 311).
2. Move to the `Operation` menu, menu number 212 (Save recipe).
3. Press `Up` and `Down` to select a recipe number (1...9).
4. Press `Enter`.
   ⇨ The recipe is saved. The confirmation appears on the screen for 2 sec. The values are saved in the recipe.

Loading a recipe

To load a recipe, proceed as follows:

1. Move to the `Settings` menu, menu number 112 (Load recipe).
2. Press `Up` and `Down` to select a recipe number (1...9).
3. Press `Enter`.
   ⇨ The recipe is loaded. The confirmation appears on the screen for 2 sec. The values contained in the recipe are restored.

Recipe mode

Recipe mode makes it possible to use only saved recipes for configuration of the temperature controller. The values in menu number 101 cannot be adjusted outside of the recipe. This menu is faded out in the menu navigation. For example, the sealing temperature cannot be set in recipe mode. It can be changed only by loading a recipe.

Recipe mode ensures that the correct settings are used for products to be manufactured.

To activate recipe mode, proceed as follows:

1. Move to the `Operation` menu, menu number 214 (Recipe mode).
2. Press `Up` and `Down` to select ON.
3. Press `Enter`.

Usable recipe

Which recipes can be used is specified in the `Operation` menu, menu number 213. Which recipes can be e.g. tested and enabled is specified in this menu.

To set the recipes that can be used, proceed as follows:

1. Move to the `Operation` menu, menu number 213 (Usable recipe).
2. Press `Enter` to select a recipe.
3. Use `Up` and `Down` to select the checkmark to confirm or the X to deselect.
4. Press `Enter`.

Tip Use the configuration block to protect the values in the `Configuration` menu from being changed unintentionally; refer to section Blocking configuration menu [▶ 54]. This prevents any more recipes from being saved. Usable recipes can no longer be configured.

Using recipe mode in conjunction with the configuration block allows only enabled recipes to be used in the temperature controller.

Active recipe The standard screen shows the recipe number of the recipe that is currently active. This is done by comparing the currently set values to the content of the recipes. If a recipe corresponds to the currently active settings, its recipe number is displayed. If no recipe corresponds to the currently active settings, a line appears.

Tip Recipes are easy to process with the aid of the visualization software *ROPEXvisual*®. The following functions can be performed in the visualization software *ROPEXvisual*®.

- Change recipe names
- Change recipes
- Load recipes
- Compare recipes

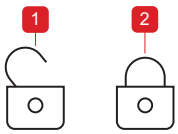
Section USB interface [▶ 48] explains how to download the visualization software *ROPEXvisual*®.

8.6.2 Blocking configuration menu

The ability to change values and parameters can be blocked in the `Configuration` menu. This prevents unpermitted changes to the temperature controller configuration.

Proceed as follows to to block or unblock:

1. Switch off the temperature controller.
2. Press and hold down the `Menu` button.
3. Switch on the temperature controller.
4. Hold down the `Menu` button until the switchon message is no longer visible.
   ⇨ The message "Configuration menu BLOCKED" or "Configuration menu NOT BLOCKED" appears in the display for three secs.
   ⇨ Then the standard screen appears.



If the `Configuration` menu is blocked, the individual menu numbers or menu items are displayed. Values cannot be entered or changed. In the `Configuration` menu, an open (1) or closed (2) lock symbol indicates whether or not values can be changed.

Default The default setting of the `Configuration` menu is that it is not blocked.

8.7 Functions for special applications

8.7.1 Constant regulation ratio (KS)

⚠ DANGER

Fire hazard due to uncontrolled heatup

Using alloys with temperature coefficients that are too low or incorrect coding of the temperature controller cause uncontrolled heatup. The heating element can burn up.

- ▶ Use a heating element with the proper temperature coefficient.
- ▶ Set the correct temperature coefficient in the temperature controller.
- ▶ Set the correct temperature range in the temperature controller.

NOTICE

Property damage if the heating element overheats

High regulation ratios cause the heating element to heat up quickly. The heating element can burn up.

- ▶ Operate the machine under real conditions.
- ▶ Determine the regulation ratio by trial and error.
- ▶ When determining the value, start at 10 % and increase the value in small increments.

The `Constant regulation ratio` function can be activated in the `Heating element` menu, menu number 310 (if START is active). By activating the function, a constant power regulation ratio will be output. The temperature is not controlled when the constant regulation ratio is active.

The setpoint for the constant regulation ratio is set in the `Settings` menu, menu number 101.
The power regulation ratio is stated as a percentage of the maximum power. The permitted range of values is 0…100 %.

8.7.2 Channel selection (CH0…CH2)

The temperature controller has separate memories for up to eight calibration data records. A calibration data record contains the values determined by the temperature controller during the AUTOCAL function.

Storing the calibration data records allows the operator to alternate between different heat-sealing bands without having to run the AUTOCAL function every time the heat-sealing band is changed. AUTOCAL has to be executed only when a new heating element is connected.

Since different calibration values, AUTOCAL temperatures and temperature coefficients are stored in the temperature controller for this purpose, the desired calibration data record 0…7 can be selected in the `Heating element` menu, menu number 311.

Example This function is useful, for instance, in applications where frequent changes in format are necessary.
The tools can then be changed as required in order to handle the different formats.

A channel containing the relevant calibration data record is assigned to each tool. Once all tools have been calibrated with a unique channel assignment, they can be changed at any time simply by selecting the appropriate channel.

Tip If the application does not require any format changes, the channel can remain set to 0.

8.7.3 TCR calculator

The TCR calculator can be used to determine the temperature coefficient (TCR) of the heating element used.

⚠ DANGER

Fire hazard due to uncontrolled heatup

Using alloys with temperature coefficients that are too low or incorrect coding of the temperature controller causes uncontrolled heatup. The heating element can burn up.

- ▶ Use a heating element with the proper temperature coefficient.
- ▶ Set the correct temperature coefficient in the temperature controller.
- ▶ Set the correct temperature range in the temperature controller.

⚠ DANGER

Fire hazard due to uncontrolled heatup

Setting temperature coefficients that are too high leads to uncontrolled heatup. The heating element can burn up.

- ▶ Use only temperature coefficients that are plausible for the heating element.

Application The real temperature coefficient of the heating element often differs from the standard value. The material composition and processing influence the properties of the heating element. This causes the temperature display of the temperature controller to differ

from the real temperature of the heating element. Using the TCR calculator allows the TCR value to be easily corrected and the temperature display of the temperature controller and the real temperature of the heating element to be better matched.

Settings

- The constant regulation ratio is switched off (`Heating element` menu, menu number 310, `Never`)
- The temperature coefficient is variable (`Heating element` menu, menu number 301, `Variable`)
- A typical temperature setpoint for the sealing application is selected (`Settings` menu, menu number 101)

Note

In the `Diagnosis` menu, menu number 503, switch off temperature diagnosis while the TCR calculator is in use. This prevents unintentional alarms when changing the temperature coefficients.

Calculation

To calculate the TCR value, the temperature at the heating element is measured in control mode using an external temperature sensor (e.g. a thermocouple). Set the externally measured temperature with `Up` and `Down` in menu number 304.

▶ Give the START signal.

⇨ The following information is shown in the `Heating element` menu, menu number 304:

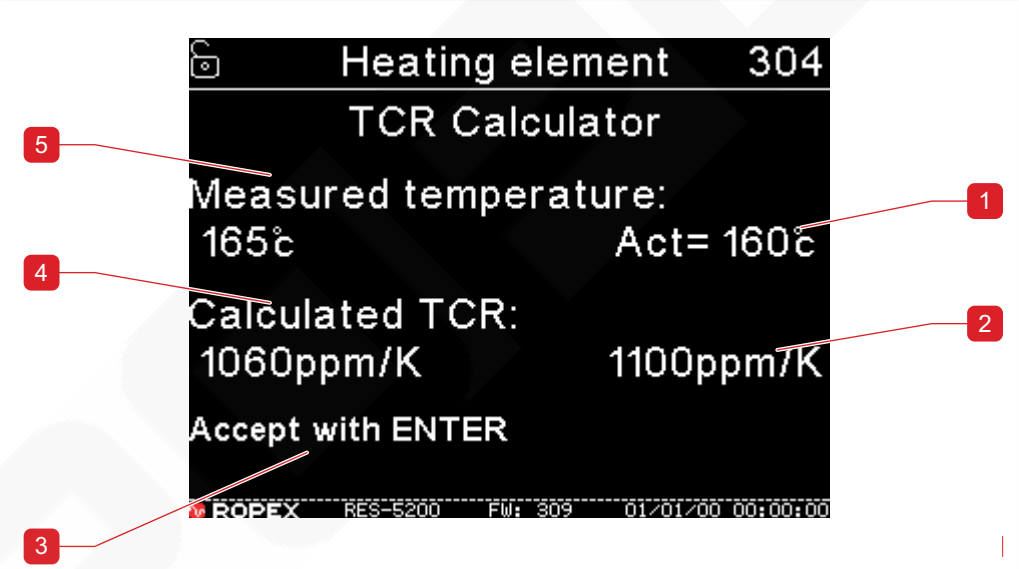


Illustration 19: TCR calculator

1	Setpoint or temperature measured by the temperature controller	2	Currently set temperature coefficient
3	Newly calculated temperature coefficients for calculation of the temperature Note: Apply the newly calculated temperature coefficient only if it is plausible.	4	Newly calculated temperature coefficient (TCR) (based on externally measured temperature and currently set temperature coefficient)
5	Current temperature of the heating element measured with an external thermometer (externally measured temperature entered by the user)		

More information on the TCR calculator can be found in the download area on the

8.8 Adapting to special sealing applications

8.8.1 Measuring pulse duration

The length of the measuring pulses generated by the temperature controller can be set with this parameter.

It may be necessary to set a measuring pulse longer than the default 1.7 ms for certain applications. Refer to the application report for more detailed information, or consult support: 8.8.2 Maximum measurement pause

If the temperature controller determines in control mode (START signal active) that the current actual temperature is greater than the setpoint, the power supply to the heating element is reduced.

If the power reduction is not sufficient, the low-power measuring pulses, which determine the current actual temperature, are paused. This measurement pause can last up to 10 periods in the default setting. During this measurement pause, the temperature controller cannot react to a change in the actual temperature.

In certain applications it may be useful to shorten this maximum measurement pause, e.g. if the higher actual temperature values are caused by measurement errors. In this case, the maximum measurement pause can be shorted in the `Heating element` menu, menu number 308.

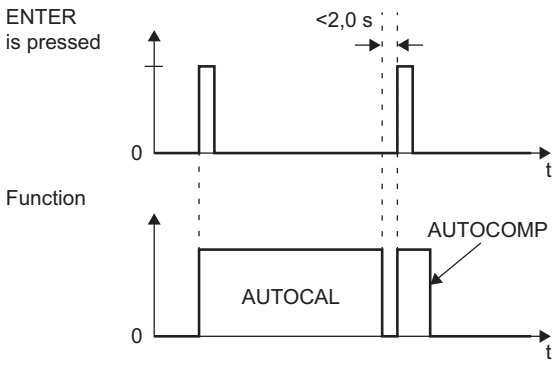
Note A measurement pause that is set too short can lead to an increased temperature if the system is incorrectly dimensioned (secondary voltage of the pulse transformer is too high) or if the sealing temperatures are low.

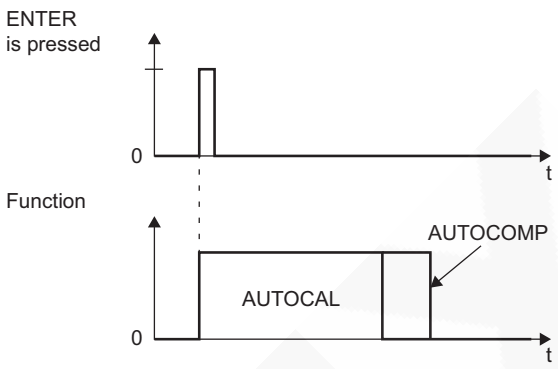
8.8.3 Automatic phase correction (AUTOCOMP)

It may be necessary to compensate the phase angle displacement between the U_R and I_R measuring signals for specific heat-sealing applications. The AUTOCOMP function may be needed for this purpose.

AUTOCOMP can be parameterized in the `Heating element` menu, menu number 309.

The following settings are possible:

Setting	Meaning	
Off	AUTOCOMP function switched off. (default)	
On	When AUTOCAL has been executed successfully, press `Enter` to perform AUTOCOMP. The pause at the end of the function must be shorter than 2.0 sec. During the pause, "Start AUTOCOMP? Start with ENTER" appears on the temperature controller display. AUTOCOMP execution takes approx. 2.0 sec. During this time, "- AUTOCOMP – please wait..." is shown in the display. If the pause after successful completion of AUTOCAL lasts longer 2.0 sec, the display jumps back to the standard screen without AUTOCOMP having been performed.	

Setting	Meaning	
AUTO	The AUTOCOMP function is automatically started after the AUTOCAL function has been successfully executed.	

When the AUTOCOMP function is executed, the actual value output (terminals 17+18) changes to 0…3 °C (corresponds to approx. 0 VDC).

9 Restarting device after changing heat-sealing band

NOTICE

Damage to heating element caused by overheating

Using unsuitable alloy, dimensions and copper coating will cause the heating element to overheat and malfunction.

- ▶ Select the proper alloy, dimensions and copper coating.

When the heating element has been replaced, the temperature controller has to be started up again and the function AUTOCAL performed. Details can be found in section Startup [▶ 27].

10 Monitoring and error detection

10.1 System monitoring and alarm output

To increase operational safety and prevent faulty heat-sealing, the temperature controller monitors both external wiring as well the internal system.

Error messages and diagnoses are detected by means of hardware and software applications. This allows the source of faulty operation of the temperature controller to be localized.

A system fault is reported or differentiated by means of the following indications.

Who reports?	How is the fault reported?	Meaning
Error message on screen	The alarm, the error code and the way in which the error message is reset are shown on the screen.	Indicates that there are faults. The fault contains an error code; refer to section .
Alarm relay (relay contact terminals 12, 13, 14) default[3)]	NOT ACTIVE	• Execute AUTOCAL functions (error codes 104…106, 211, 302, 303). Note: If a START signal is sent during this state, the alarm relay becomes active. • The system configuration is incorrect and zero calibration (AUTOCAL function) was unsuccessful (error codes 111…114); refer to section . Note: If a START signal is sent during this state, the alarm relay becomes active.
	ACTIVE	Indicates that there are faults that prevent startup (error codes 101…103, 107, 108, 201…203, 304, 307, 308, 9xx). Tip There are usually external wiring faults.

Error code indicated via the actual value output 0…10 VDC (terminals 17+18)

Since there is no need to show the temperature when a fault occurs, the actual value output is used to display the error in the event of an alarm.

For this purpose there are 13 voltage levels offered within the range 0…10 VDC, each of which is assigned an error code.

For statuses that require AUTOCAL, or if the device configuration is incorrect (error codes 104…106, 111…113, 211), the signal at the actual value output alternates at a rate of 1 Hz between the voltage value corresponding to the error and the end of the scale (10 VDC, i.e. 300 °C or 500 °C). If the START signal is present in one of these states, the voltage value does not change any more.

This means that, via the analog output of a PLC and a respective evaluation, selective error detection and error display are simple and inexpensive.

Measures to reset the alarm message

An error message can be reset by pressing `Reset` or by switching the temperature controller off and then back on again.

Invalid alarm messages

Because its operating status is not defined, invalid alarm messages may occur when the temperature controller is switched off. To prevent false alarms, this has to be taken into consideration for the evaluation in the higher-ranking controller (e.g. PLC).

3 If the alarm relay has a different configuration than the default, states are reversed.

10.2 Error messages

Tip To facilitate error diagnosis, the temperature controller emits 13 voltage levels via the analog output. In the temperature controller, the error messages are more precisely differentiated and encoded as error codes.

The three-digit error codes can be displayed as follows:

- Temperature controller screen
- For information on the visualization software, refer to the manual for the visualization software ROPEXvisual®.

Notes In order to avoid incorrect evaluations, the evaluation of the analog output for the detection of an error message – e. g. in the higher-level control unit – must be carried out with an adapted tolerance window.
Comply with the analog output tolerances; refer to Technical data [▸ 68].

The following three tables show the assignment of the three-digit error codes to the voltage level at the analog output. They also contain the causes and the measures required to remedy the error.

10.2.1 Part 1 of 3: Troubleshooting

The errors are reported as faults.

- The analog output emits constant voltage, the level of which is associated with a set of error codes.
- Screen content
- Alarm relay is active.

Error code	Analog signal voltage [V]	Cause	Measure during initial startup	Action if machine is already in operation, heating element not changed
101	0.66	No current signal	Fault area 1 [4]	
102	1.33	Voltage signal missing	Fault area 3 [4]	
103	2.00	Voltage and current signals missing	Fault area 2 [4]	Fault area 2 and 9
107	2.66	Temperature drop	Fault areas 4, 5 and 6 (loose wire)[4]	
108		Temperature spike		
307		Temperature too low, tolerance range was left	▶ Check dimensioning of the pulse transformer. ▶ Check heat extraction through the sealing process. ▶ Verify application through sealing tests.	
308		Temperature too high, tolerance range was left		
309		Temperature too low, tolerance range was not reached		
310		Temperature too high, tolerance range was not reached		
201	3.33	Line frequency missing/fluctuates	▶ Check mains power supply: • Line frequency • Harmonics • Voltage fluctuations	
202		Line frequency too high / fluctuates		
203		Line frequency too low / fluctuates		

[4] Refer to the wiring diagram Fault areas and causes [▸ 64] for further information.

Error code	Analog signal voltage [V]	Cause	Measure during initial startup	Action if machine is already in operation, heating element not changed
304	4.00	Heatup time too long	▶ Reset device ▶ Check dimensioning of the pulse transformer. ▶ Check parametrized heating time. ▶ Check lines and contacts.	▶ Reset device ▶ Check lines and contacts. ▶ Check sealing process.
305		Start temperature too high	▶ Reset device ▶ Check cooling system. ▶ Check maximum start temperature.	
901	4.66	Line voltage / synchronizing signal missing	▶ Check line voltage	
913		Triac defective	▶ Replace device.	
914 915		Internal error: Comparator in measuring module defective		
916		Internal error: Test mode not ended successfully		
919		Internal error: Comparator in measuring mode not plausible	▶ Replace device.	
920		• Voltage signal not plausible • Internal error: Voltage change-over in measuring module defective	▶ Check heating circuits: • Check relay Kb. • Check voltage signal. • Do not interrupt voltage signal during AUTOCAL. ▶ Reset device ▶ Restart AUTOCAL. ▶ Replace device.	
938 939 940 941		Internal error: Capacitor in measuring module defective	▶ Replace device.	

10.2.2 Part 2 of 3: Troubleshooting

The errors are initially reported as warnings.

- Analog output alternates between two values.
- Error message on screen
- Alarm relay not active.

After the START signal is activated, the errors are reported as faults.

- Analog output no longer alternates; refer to bold value (e.g. **5.33**).
- Error message on screen
- Alarm relay is active.

Error code	Analog signal voltage [V][5]	Cause	Measure during initial startup	Measure if machine is already in operation, heating element not changed
104	**5.33**/10	• Current signal incorrect • Pulse transformer incorrectly dimensioned	▶ Perform **AUTOCAL**. ▶ Check transformer specifications. Refer to fault areas 7 and 8 [6]	Refer to fault areas 4, 5 and 6 (loose wire)[6]
105		• Voltage signal incorrect • Pulse transformer incorrectly dimensioned		
106		• Voltage and current signal incorrect • Pulse transformer incorrectly dimensioned		
302		• Temperature too low • Calibration not performed • Loose contact • Ambient temperature fluctuates	▶ Perform **AUTOCAL**. And/or fault areas 4, 5 and 6 (loose contact)[6]	
303		• Temperature too high • Calibration not performed • Loose contact • Ambient temperature fluctuates		
211	**6.00**/10	Data error	▶ Perform **AUTOCAL**.	

10.2.3 Part 3 of 3: Troubleshooting

Note This section shows error messages that may occur if the AUTOCAL function is not ended properly.

The errors are initially reported as warnings.

- Analog output alternates between two values.
- Error message on screen
- Alarm relay not active.

After the START signal is activated, the errors are reported as faults.

- Analog output no longer alternates; refer to bold value (e.g. **6.66**).
- Error message on screen
- Alarm relay is active.

5 The voltage at the analog output alternates between the two values.

6 Refer to the wiring diagram Fault areas and causes [▶ 64] for further information.

Error code	Analog signal voltage [V][7]	Cause	Measure during initial startup	Action if machine is already in operation, heating element not changed
111	**6.66**/10	Current signal incorrect, calibration not possible	Fault area 8[8] ▶ Check configuration	Fault areas 4, 5 and 6 (loose wire)[8]
112	**7.33**/10	Voltage signal incorrect, calibration not possible	Fault area 7[8] ▶ Check configuration	
113	**8.00**/10	Voltage/current signal incorrect, calibration not possible	Fault areas 7 and 8[8] ▶ Check configuration	
114	**8.66**/10	Temperature fluctuates, calibration not possible	▶ Perform **AUTOCAL** And/or fault areas 4, 5 and 6 (loose contact)[8]	
115		External calibration temperature too high, calibration not possible	▶ Perform **AUTOCAL** with external calibration temperature ≤ 40 °C.	
116		External calibration temperature fluctuates, calibration not possible	▶ Perform **AUTOCAL** with stable external calibration temperature.	

10.3 Fault areas and causes

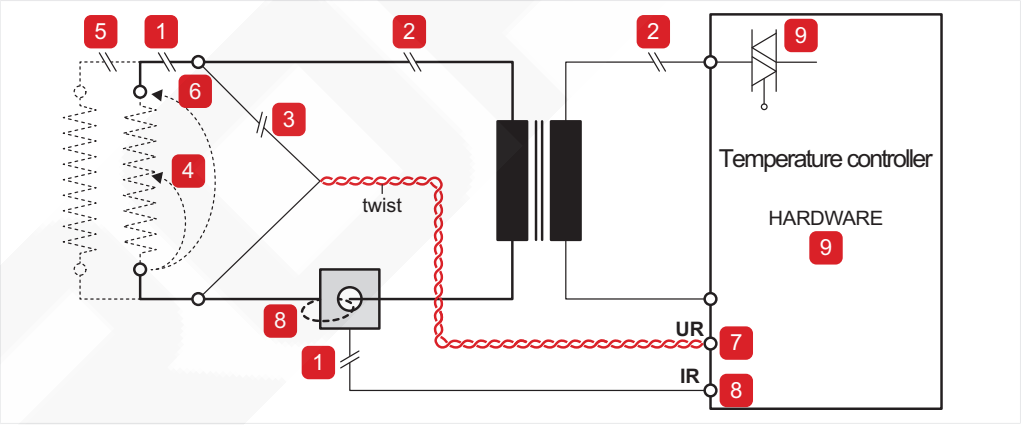


Illustration 20: Fault areas and causes

The following table explains the possible causes.

Fault area	Explanation	Possible causes
1	Load circuit interrupted after U_R pickup point	• Wire break, heating element break. • Contact to heating element is defective.
	Current transformer signal interrupted	• $I_R$measurement cable from current transformer interrupted.
2	Primary circuit interrupted	• Wire break, triac in controller defective. • Primary winding of pulse transformer interrupted. • Kb contactor open.

7 The voltage at the analog output alternates between the two values.

8 Refer to the wiring diagram Fault areas and causes [▶ 64] for further information.

Fault area	Explanation	Possible causes
2	Secondary circuit interrupted before U_R pickup point.	• Wire break • Secondary winding of pulse transformer interrupted.
3	No U_R signal	• Measurement cable interrupted.
4	Partial bypass (delta R)	• Heating element partially bypassed by conducting part, e.g. clamp, opposite heat-sealing bar.
5	Parallel circuit interrupted	• Wire break, heating element break. • Contact to heating element is defective.
6	Total bypass	• Heating element incorrectly installed, no insulation at heat-sealing bar ends or insulation incorrectly installed. • Heating element completely bypassed by conducting part.
7	U_R signal incorrect	• Secondary voltage U_2 outside of permissible range of 0.4…120 VAC.
8	I_R signal incorrect	• Current I_2 outside of permissible range of 30…500 A.
	Turns incorrectly passed through current transformer	▶ Check number of turns: Two or more turns required for currents < 30 A.
9	Internal device fault / no line voltage	• Hardware fault: ▶ Replace temperature controller. • Jumper for alarm relay defective or not in correct position. • No line voltage.

11 Maintenance

NOTICE

Dust deposits can impair proper functioning.

Dust can hinder proper functioning of the temperature controller.

- When it is de-energized, dust can be removed from the temperature controller with dry compressed air.
- Install a temperature controller in the electrical cabinet or terminal box for protection class IP 54 or higher.

NOTICE

Contamination with liquids can impair proper functioning

Contamination with liquids can hinder proper functioning of the temperature controller.

- Install a temperature controller in the electrical cabinet or terminal box for protection class IP 54 or higher.

The temperature controller requires no special maintenance.

Regular inspection and/or tightening of the terminals – including the terminals for the winding connections on the pulse transformer – is recommended.

12 Disposal

This device is subject to directive 2012/19/EU concerning the reduction of the increasing amount of waste of electrical and electronic equipment and the disposal of such waste in an environmentally sound way.

To guarantee proper disposal and/or to recover reusable materials, please take the device to a designated municipal collection point for electrical and electronic devices.

Observe local regulations.

The device can also be returned to the manufacturer instead.

The device shall not be disposed of as residual waste.

13 Technical data

13.1 Technical data

NOTICE

Risk of defects and loss of warranty when operation of the device does not comply with technical specifications

Operating the device in noncompliance with the technical specifications can cause defects and result in loss of warranty.

▶ Comply with the technical specifications.

Element	Technical data
Type of construction	Housing to mount control panel
Dimensions	Width × height: 144 × 72 mm (front frame) Width × height: 136 × 66 mm (housing) Depth (beginning at front of control panel): 161 mm (including terminals)

Line voltage	• Connected between neutral conductor and an outer conductor:
	  • 110 VAC -15 %…300 VAC +10 %
	or
	• Connected between two outer conductors:
	  • 110 VAC -15 %…480 VAC +10 %
	Note: The voltage between the line conductor and ground shall not be more than 300 VAC.

Power supply system	• Balanced TN or TT system • Installation category III Note: Operation in an IT system is permitted only in agreement with ROPEX. Consult ROPEX, e-mail
Line frequency	50/60 Hz (automatic frequency adjustment)
Heat-sealing band type and temperature range (Set in the `Heating element` menu)	• Temperature range: 200 °C, 300 °C, 400 °C or 500 °C • Temperature coefficient 400…4000 ppm/K (variable setting range) • Temperature coefficient 780 ppm/K (e.g. alloy L) • Temperature coefficient 1100 ppm/K (e.g. alloy 20) • Temperature coefficient 3500 ppm/K (e.g. LEX3500)
Analog output (actual value) Terminals 17+18	0…10 VDC, I_{max} = 5 mA, electrically isolated from heating circuit Equivalent to 0…300 °C or 0…500 °C Accuracy: ±1 % plus 50 mV
Digital logic level Terminals 6, 18	LOW (0 V): 0…2 VDC HIGH (24 VDC): 8…30 VDC (power consumption max. 6 mA) Electrically isolated from heating circuit, protected from polarity reversal
Alarm relay Terminals 12, 13, 14	U_{max} = 30 V (DC/AC), I_{max} = 1 A, changeover contact, potential-free
Output for reference voltage U_{REF} Terminal 5	+10 VDC ± 5%, `Imax` = 20 mA

Element	Technical data
Power consumption (pulse transformer primary current)	• I_{max} = 5 A (duty cycle = 100 %) • I_{max} = 25 A (duty cycle = 20 %, cycle duration 1 min)
Measuring range of secondary voltage U_R Terminals 8+9	0.4…120 VAC Refer to the application report for more information.
Measuring range secondary current I_R Terminals 10+11	30…500 A with PEX-W5 (signal level at current transformer PEX-W5: 50…850 mA) Use only in conjunction with ROPEX current transformer PEX-W4/W5. Refer to the application report for more information.
Booster output Terminals 15+16	Signal level max. 30 V/ 20 mA Use only in conjunction with ROPEX booster. Refer to the application report for more information.
Power loss	max. 25 W
Screen	TFT display with resolution of 320 × 240 pixels
Ambient conditions	• Max. altitude: 2000 m • Ambient temperature: +5…+45 °C • Maximum relative humidity: • 80% at temperatures up to +31 °C, decreasing linearly to 50% relative humidity at +45 °C.
Degree of protection	Front: IP40 Back: IP20
Protection class	Protection class I
Degree of contamination	PD2
Certification	CSA, file number 304066
Assembly	• Install in control panel cut-out (width: $138^{(\pm 0.2)}$ mm × height: $68^{(\pm 0.2)}$ mm) • Secure with fixing hooks
Weight (including plug-in terminal parts)	0.65 kg
Housing material	Black plastic, type Noryl SE1 GFN2 Front: Polycarbonate, Lexan 923A transparent 110 V0 Back panel: Polycarbonate, Lexan 503R black 739
Connecting cable terminal 1…4 (type/cross-section)	• Screw connection with tension bushing • Rigid or flexible; 0.2…4 mm² (AWG 24…10) plug-in terminals • Insulation length: 7 mm • Torque: 0.5…0.6 Nm (screwdriver: SZS 0.6 × 3.5 mm) Note: If ferrules are used, they must be crimped in accordance with DIN 46228 and IEC / EN 60947-1. This is essential to ensure proper electrical contact in the terminals.

Element	Technical data
Connecting cable terminal 5…40 (type/cross-section)	• Push-in spring clamp • Rigid or flexible; 0.2…2.5 mm² (AWG 24…12) plug-in terminals • Insulation length: 10 mm Note: If ferrules are used, they must be crimped in accordance with DIN 46228 and IEC / EN 60947-1. This is essential to ensure proper electrical contact in the terminals.

13.2 Modification

Owing to its universal design, the temperature controller is suitable for a wide range of heat-sealing applications.

There are device modifications available for special applications (MOD).

The modifications must be ordered separately.

Modification	Function	Use
MOD 01	Additional booster for low secondary voltage (U_R = 0.2…60 VAC).	Essential e.g. when using very short or low-resistance heating elements.

13.3 How to order

Illustration	Device	Article number
	**Temperature controller** RES-5200	7520040
	Modification MOD … (optional) Example: MOD 01 additional booster for low voltage[10)]	800001
System components		
	Current transformer PEX-W5	885107
	Line filter LF-06480 Continuous current 6 A, 480 VAC (with UL certification)	885500
	Line filter LF-35480 Continuous current 35 A, 480 VAC	885506
	Line filter LF-10520 Continuous current 10 A, 520 VAC (with UL and CSA certification)	885504
	Line filter LF-20520 Continuous current 20 A, 520 VAC (with UL and CSA certification)	885510
	Line filter LF-30520 Continuous current 30 A, 520 VAC (with UL and CSA certification)	885511
	Line filter LF-50520 Continuous current 50 A, 520 VAC (with UL and CSA certification)	885509
	Pulse transformer • For design and order specifications, refer to the application report • Design pursuant to EN 61558 • Available with UL certifications and thermal switch, if necessary.	An upstream transformer can be individually designed and supplied upon request.
	Booster B-075415 pulse loaded 75 A, 415 VAC	885302
	Booster B-075480 pulse loaded 75 A, 480 VAC	885306
	Booster B-100400 pulse loaded 100 A, 400 VAC	885304
	Booster B-100480 pulse loaded 100 A, 480 VAC	885307

[10] Example:
To order a temperature controller with additional booster for low voltage: RES-5200 + MOD 01
The order is then: Art. no. 7520040 + 800001.

Illustration	Device	Article number
	Top hat rail adapter HS adapter-01	887001
	Lockable front panel TUER-S-1	887101
	Lines	For design and order specifications, refer to the application report
Accessories		
	High-current rail HCB-1	885110
	High-current rail HCB-2	885218
	Current balance monitor CBM-2	885217

EU Declaration of Conformity

The Manufacturer

ROPEX Industrie-Elektronik GmbH
Adolf-Heim-Str. 4
74321 Bietigheim-Bissingen
Germany

hereby declare that the following product

Designation	RESISTRON® temperature controller		
Type	RES-5200 RES-5400	Article number	7520040 7540040
Operating principle	Impulse sealing of films and plastics		

is in conformity with the provisions of the following EU directives (inclusive amendments)

- 2014/30/EU Electromagnetic Compatibility Directive (EMC Directive)
- 2014/35/EU Directive on electrical equipment designed for use within certain voltage limits (Low Voltage Directive)
- 2011/65/EU Directive on the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive)

References of standards for this declaration of conformity, or parts thereof:
Harmonized standards of Europe:

- Safety
  - EN 61010-1:2010 A1:2019 / IEC 61010-1:2010 A1:2016
    Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
  - EN IEC 61010-2-030:2021 / IEC 61010-2-030:2017
    Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits
- Electromagnetic compatibility
  - EN IEC 61000-6-2:2019
    Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
    (Immunity: Severity level industrial)
  - EN IEC 61000-6-4:2019
    Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
    (Emission: Limit class A)
- Restriction of hazardous substances
  - EN IEC 63000:2018
    Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Note

This declaration of conformity certifies that the product itself complies with the above-mentioned directives.

The CE mark on the product does not relieve the machinery manufacturer of his duty to verify the conformity of the completely installed, wired and operationally ready system in the machine with the EMC directive.

Comments

RESISTRON® temperature controllers with accessories are not independently operable devices. They are used by the machinery manufacturer to form a sealing system by adding EMC-relevant components such as filters, transformers, heatsealing bands and wiring. The final configuration may vary significantly in terms of performance and physical dimensions.

All information provided by us in connection with the line filter is merely intended as a guide and is based on a typical system setup. It serves to demonstrate that compliance with the EMC directive can be achieved by using a line filter that is suitable for the overall system.

The line filter and current transformer must, however, be determined on the basis of the respective application.

We also wish to point out that the transformer which is used must be designed in accordance with VDE 0551/ EN 61558 or UL 5085 for safety reasons.

Bietigheim-Bissingen, March 1, 2024

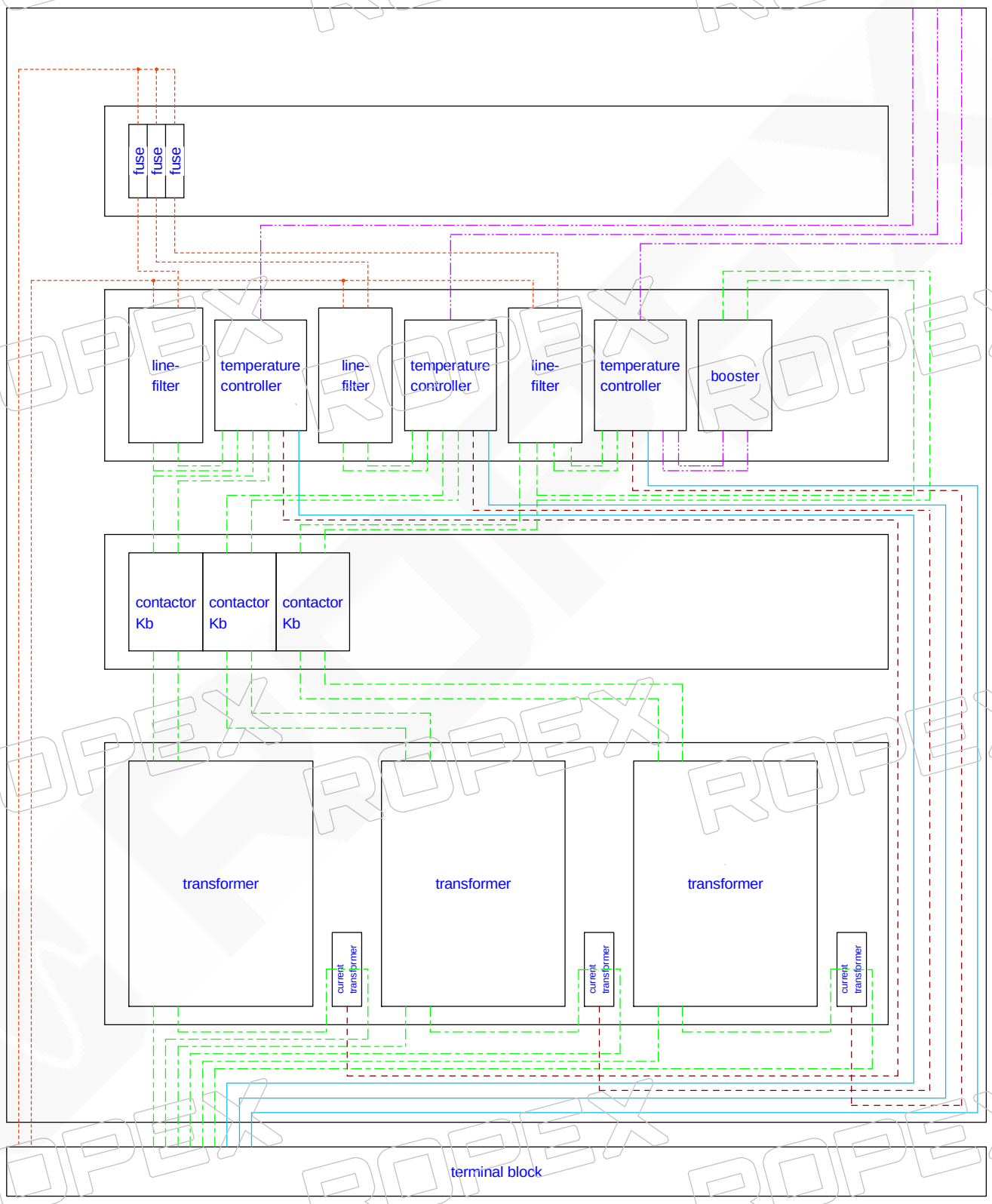
i.V.

Uwe Dietrich | Director Research & Development

15 Appendix

The following pages show examples for the arrangement and wiring of the system components in the electrical cabinet as well as examples comparing the right way and wrong way to wire the devices.

Arrangement and wiring inside the cabinet



legend:
- not filtered
- filtered
- IR measurement
- UR measurement
- control wires to PLC

15.2 Examples of electrical connections

Connection to one heating element

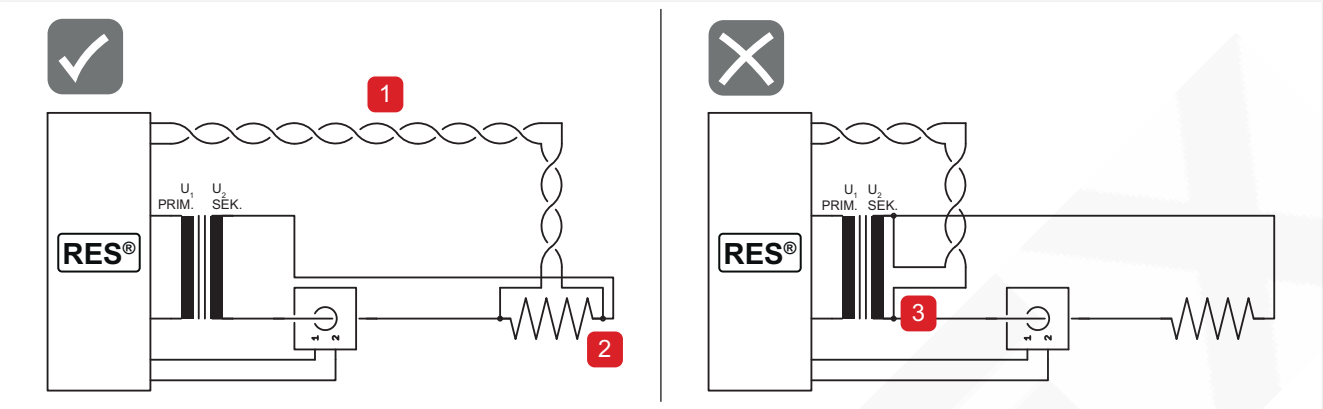


Illustration 21: Component wiring, example 1

Example 1

- ▶ Connect the measurement cable (1) directly to the heating element. Background information: To prevent measurement errors caused by unintentionally measuring the line resistances, do not connect to the pulse transformer (3).
- ▶ Lay the lines going in opposite directions close together.

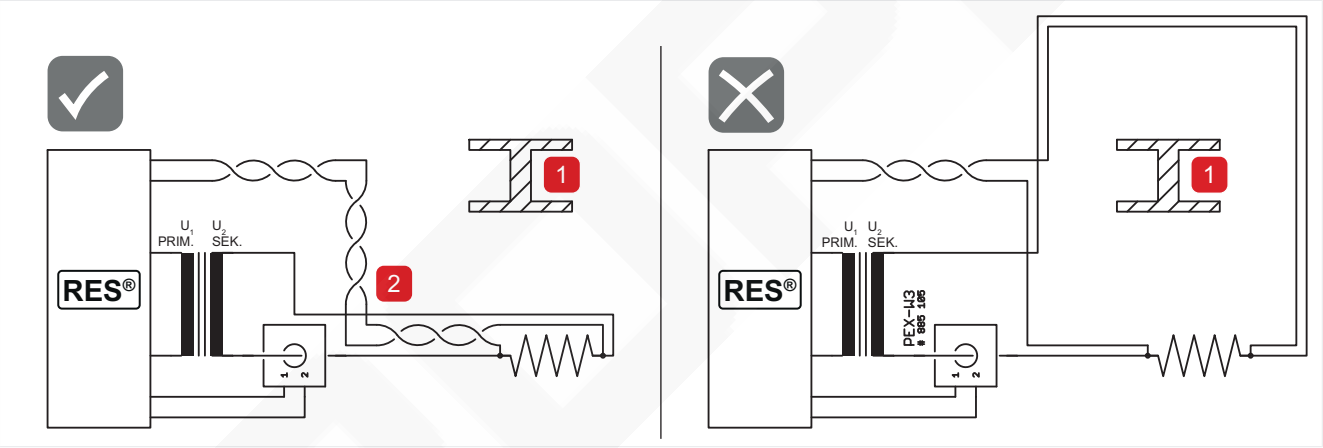


Illustration 22: Component wiring, example 2

Example 2

- ▶ When objects have to be circumvented, especially iron or steel parts such as I-beams (1), lay the lines going in opposite directions on the same side whenever possible.
- ▶ Laying measuring cable (2) as twisted pair.

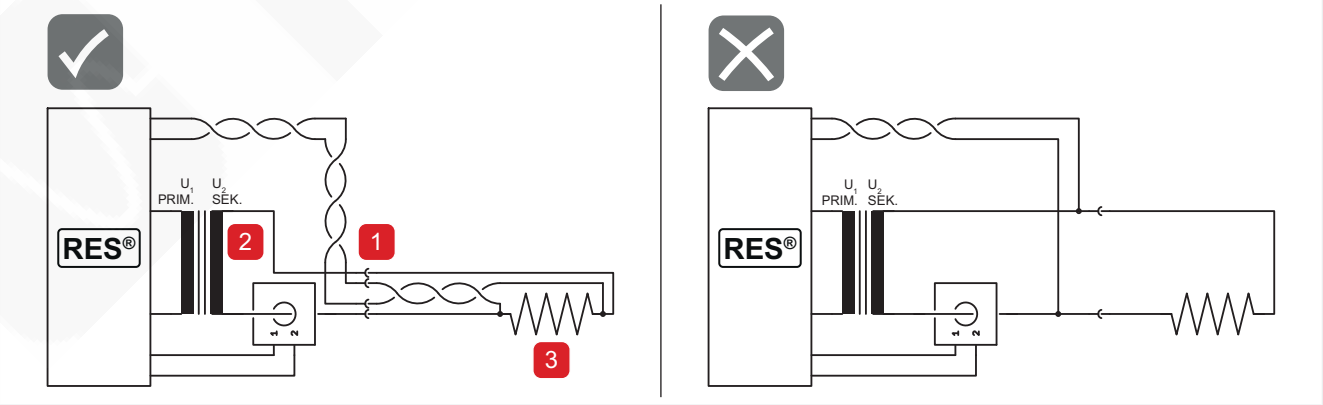


Illustration 23: Component wiring, example 3

Example 3 If plug connectors or clamping points (1) have to be installed between the pulse transformer (2) and the heating element, the measurement cable has to be connected with its own clamping points. This prevents measurement errors caused by low contact resistances in the clamping points.

Parallel connection

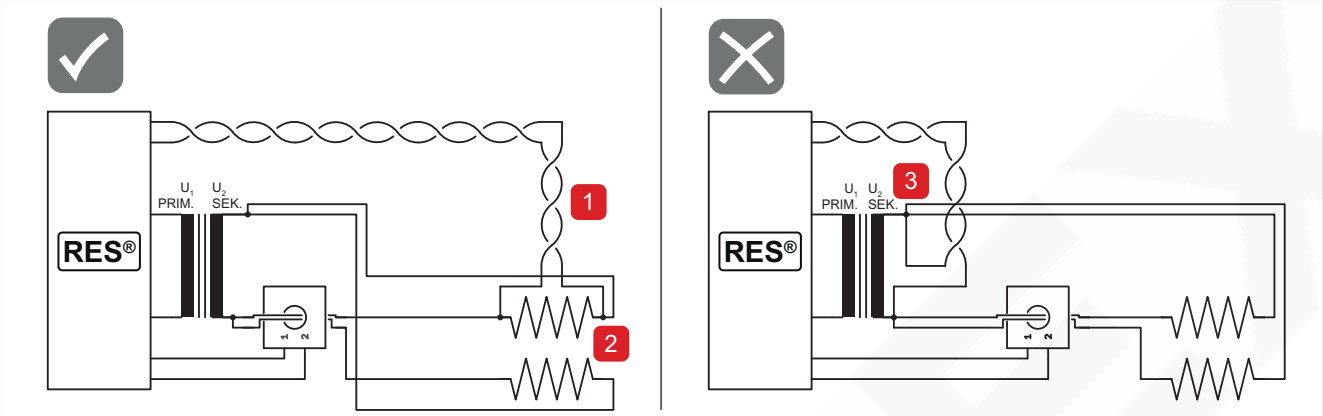


Illustration 24: Component wiring, example 4

Example 4
- Connect the measurement cable (1) directly to one of the two heating elements (2).
  Background information: To prevent measurement errors caused by measuring the supply line resistance, do not connect to the pulse transformer (3).

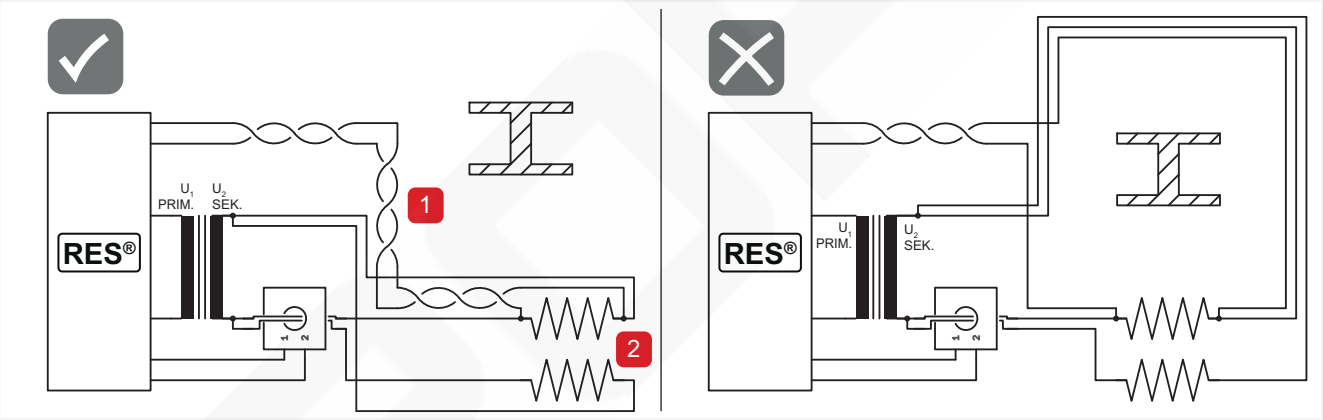


Illustration 25: Component wiring, example 5

Example 5
- When objects have to be circumvented, especially iron or steel parts such as I-beams (1), lay the lines going in opposite directions on the same side whenever possible.

▶ Laying measuring cable (2) as twisted pair.

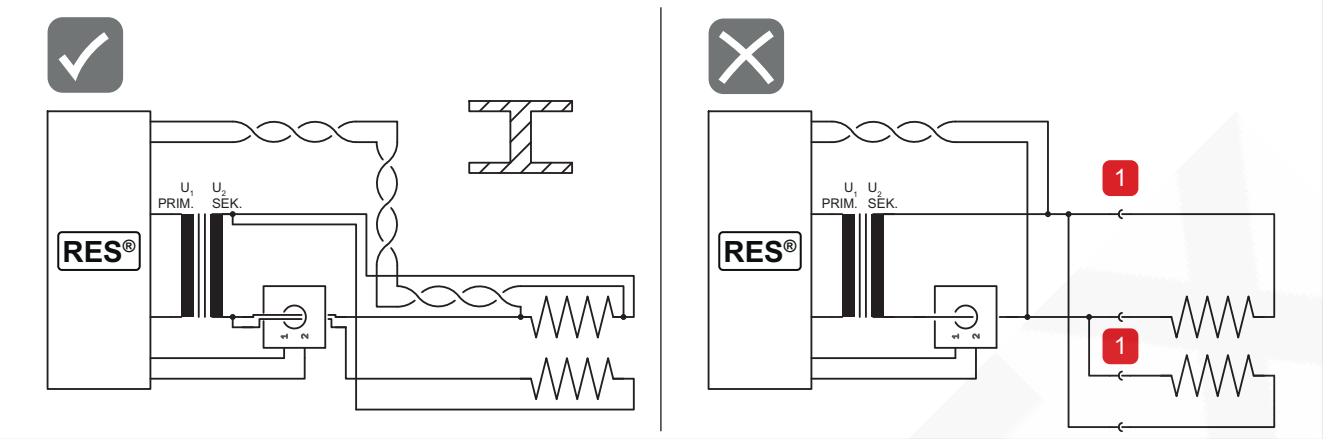


Illustration 26: Component wiring, example 6

Example 6 Using plug connectors (1) with parallel connection can negatively impact control accuracy.

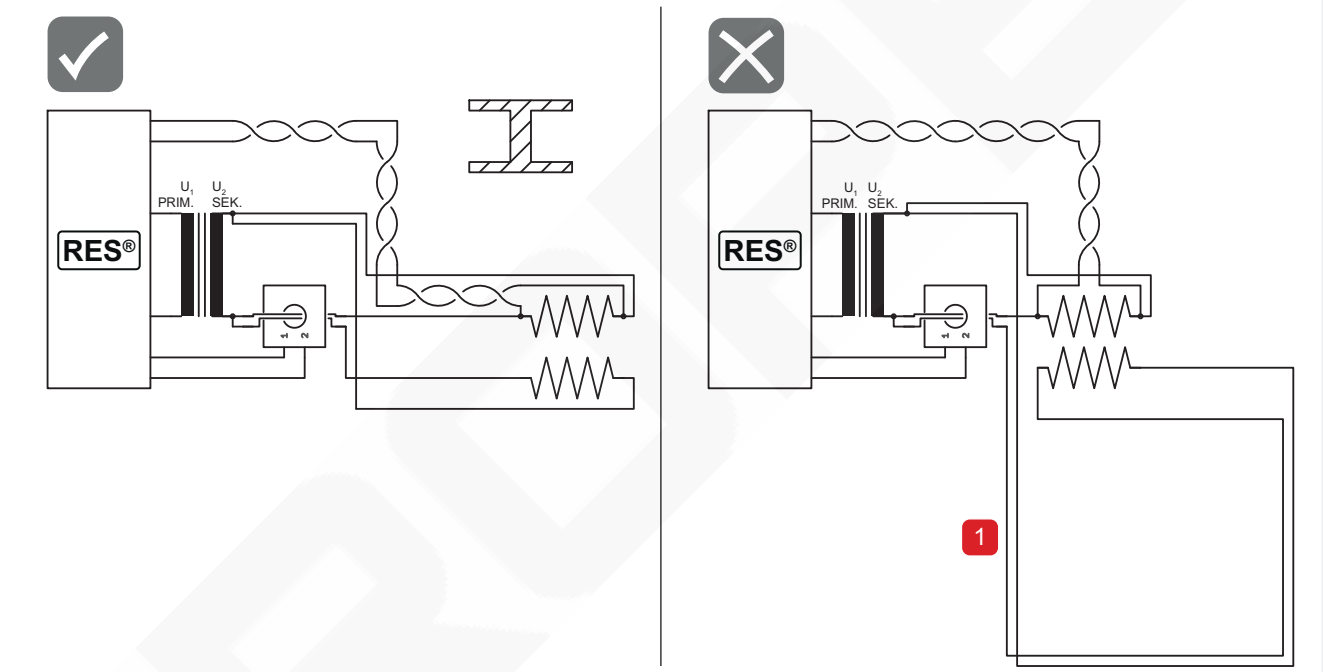


Illustration 27: Component wiring, example 7

Example 7 Significant differences in the length of the supply line (1) to the two heating elements negatively impact the accuracy of the temperature.

Series connection

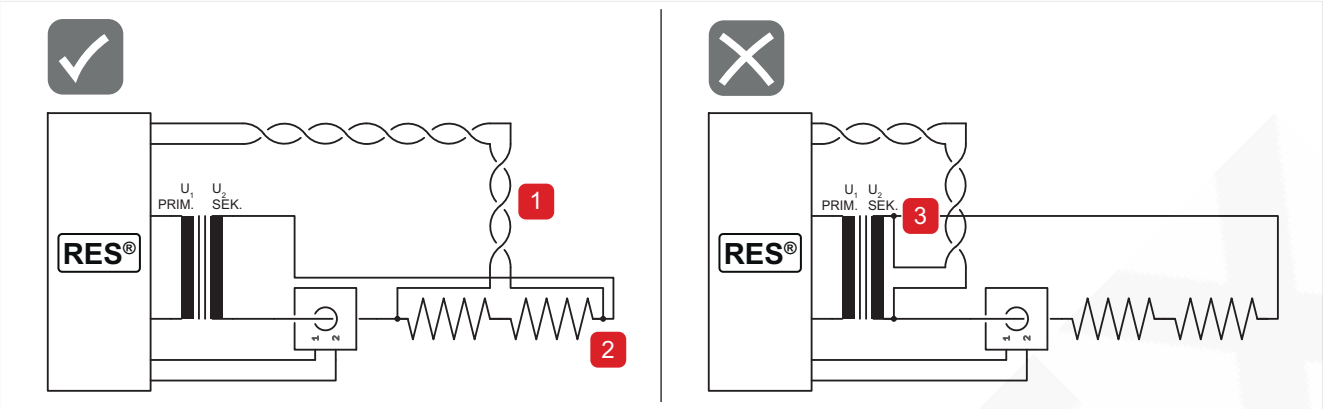


Illustration 28: Component wiring, example 8

Example 8

- Connect the measurement cable (1) directly to the heating element (2)
  Background information: To prevent measurement errors caused by unintentionally measuring the line resistances, do not connect to the pulse transformer (3).

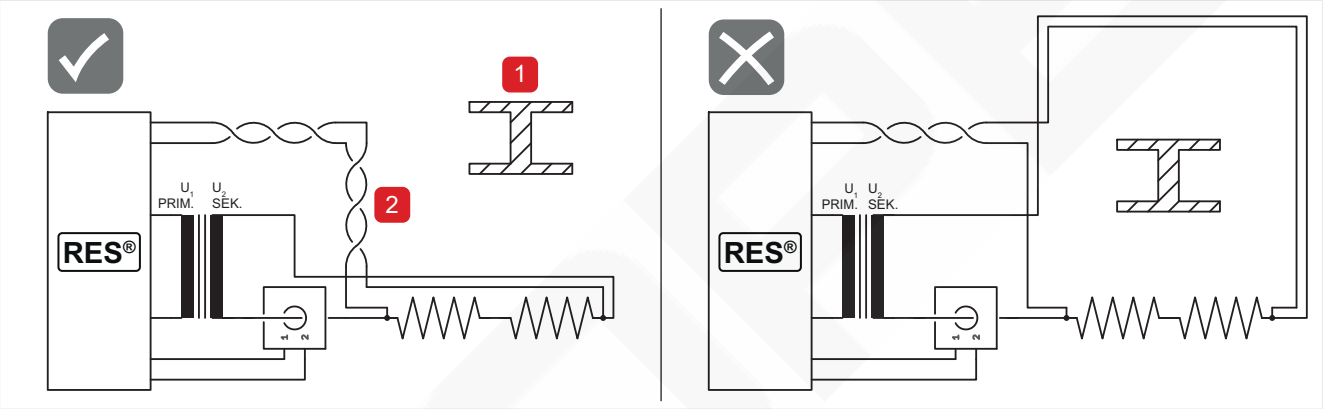


Illustration 29: Component wiring, example 9

Example 9

- When objects have to be circumvented, especially iron or steel parts such as I-beams (1), lay the lines going in opposite directions on the same side whenever possible.
- Laying measuring cable (2) as twisted pair.

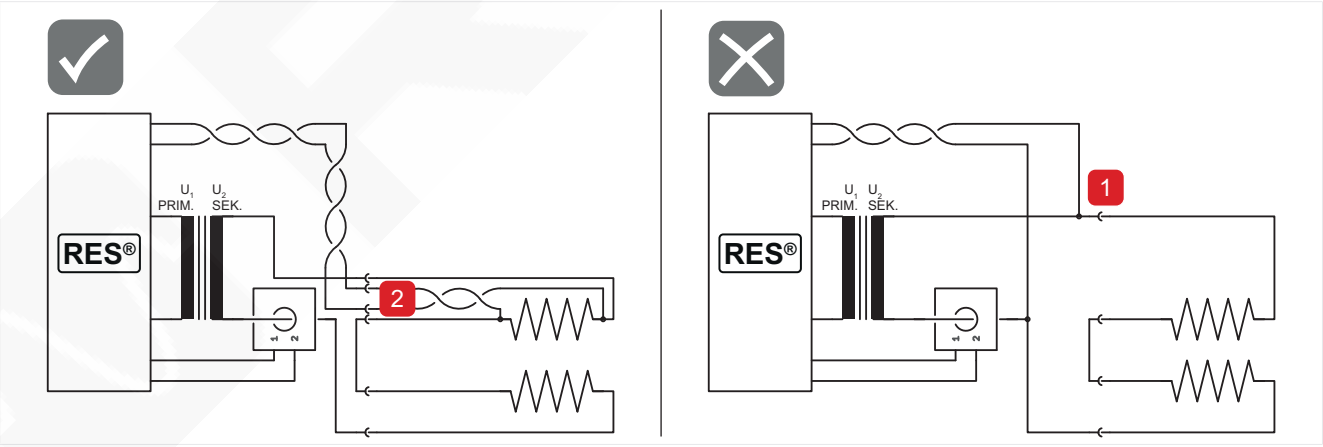


Illustration 30: Component wiring, example 10

Example 10 Installing plug connectors or clamping points (1) between the pulse transformer and the heating element can cause measurement errors.

- To prevent measurement errors caused by the contact resistances at the clamping points, use separate clamping points (2) to connect the measurement line to one of the two heating elements.

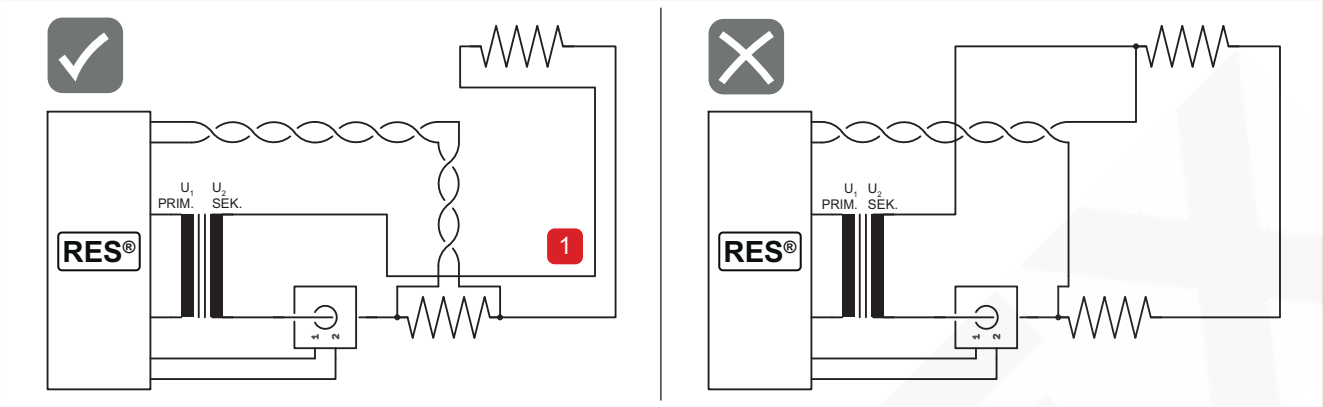


Illustration 31: Component wiring, example 11

Example 11

- If the heating elements switched in series are far apart from one another, lay the lines going in opposite directions (1) close together.
- To prevent measurement errors caused by the resistance of the connecting line, connect the measuring line (1) directly to one of the two heating elements.

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