Регулятор температуры RES-5002

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-5002*.

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-5002*, beginning with firmware version 305.

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 of device

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-5010*
	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

- Applicable safety regulations required by DIN, EN and VDE
- DIN 46228 End sleeves
- DIN EN 60715:2018-07/VDE 0660-520:2018-07 Dimensions of low-voltage switchgear and controlgear - Standardized mounting on rails for mechanical support of switchgear, controlgear and accessories
- 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)
- Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC/IEEE 8802-3
- DIN EN IEC 60947-1:2022-03/VDE 0660-100:2022-03 Low-voltage switchgear and control gear - Part 1: General rules
- IEC 61010:2010 A1:2016 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

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-5002* 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-5002* measures and evaluates the change in resistance. Based on the adjustment and the setpoint, the temperature controller RESISTRON® *RES-5002* 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 extremely compact.

4.2 Application

The temperature controller RESISTRON® *RES-5002* is part of the series 5000.

The temperature controller RESISTRON® *RES-5002* 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 Overview

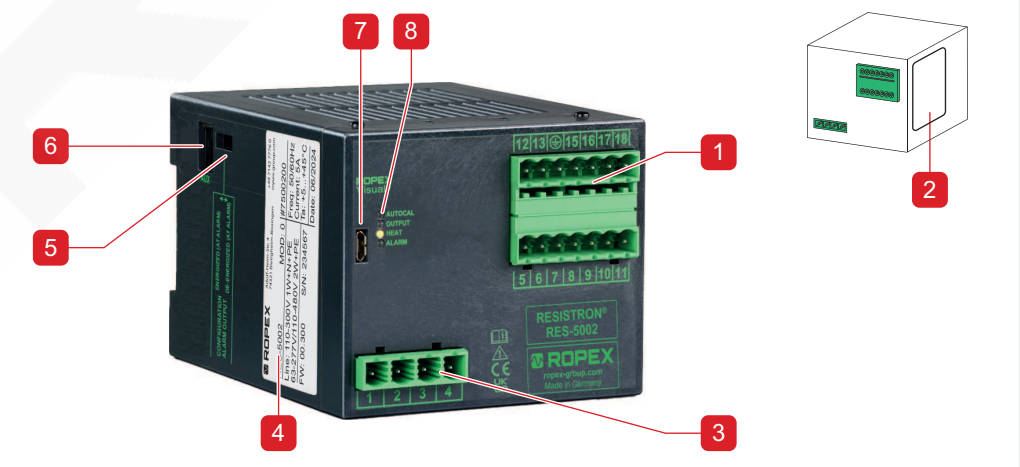


Illustration 1: Overview of temperature controller RES-5002

1	Terminals 5 to 18	2	Terminal diagram
3	Terminals 1 to 4	4	ID plate
5	Alarm output jumper	6	AUX port

7	USB port	8	LEDs

4.3.1 ID plate

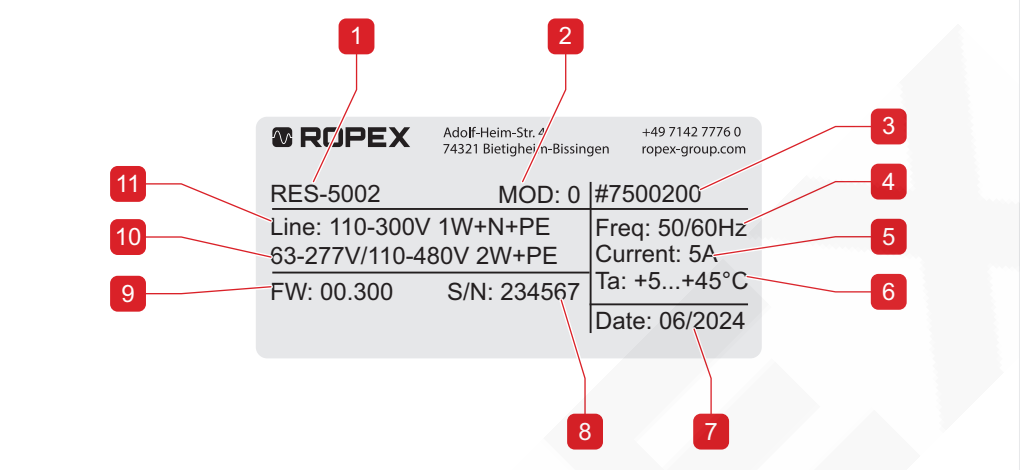


Illustration 2: ID plate on temperature controller 5002

1	Temperature controller RES-5002	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 side of the device.

4.3.2 Dimensions

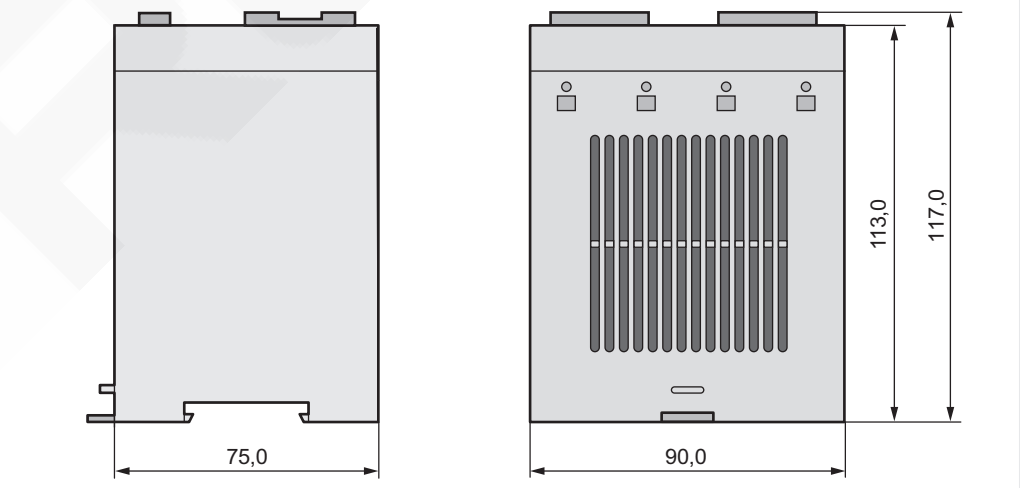


Illustration 3: Dimensions in mm (without terminals)

4.4 Essential system components

4.4.1 Control loop components

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

4.4.2 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-5002*.

Ends of heating elements The ends of the heating elements can be coated, e.g. with copper or silver. Coating the ends of the heating elements 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-5002*.

The temperature coefficient is not variable.

Use only the following alloy:

Heating element alloy	Unit	Temperature coefficient (TCR)
Alloy 20	ppm/K	1100

Notes

- The measurement principle requires a unique temperature coefficient (TCR) of the heating element 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 [▶ 51].

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 [▶ 51].

4.4.3 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
- 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.

4.4.4 Current transformer

NOTICE

Malfunction due to use of devices from other manufacturers

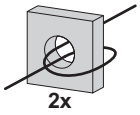
Devices from other manufacturers can lead to malfunctions in the control loop.

- ▶ 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.
- 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.

4.4.5 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.

4.4.6 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.

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

Observe this warning before beginning any work on the system:

⚠ 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.

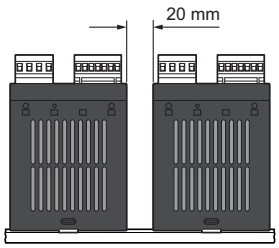
- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the voltage supply or line voltage.
- ▶ Secure to prevent it from being switched on again.
- ▶ Verify that there is no voltage being supplied.

To attach the temperature controller, proceed as follows:

Prerequisite

✓ Line voltage and the 24 VDC supply voltage are switched off and secured from being switched on again.

1. Verify that the circuit is de-energized.
2. Attach the temperature controller to a top hat rail TS35 (DIN EN 50022) in the electrical cabinet.
   The moving clip required for fastening faces down for mounting on a horizontal top hat rail.
   End holders to mechanically fix the device must be fitted at both ends.
3. A minimum safety clearance of 20 mm all round (e.g. from other devices and wiring) must be allowed when installing the device.



Example of installation in electrical cabinet

An example of the layout and wiring of system components can be found in the Appendix [▶ 51].

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 and the 24 VDC supply voltage are switched off and secured 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 [▶ 19], section Connection diagram [▶ 21], section Control loop components [▶ 13] 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 re-

[1] Examples:
- Circuit breaker pursuant to EN 60898 (characteristic B, C, D, K or Z)
- Fuse gG pursuant to IEC 60269

port.
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.).

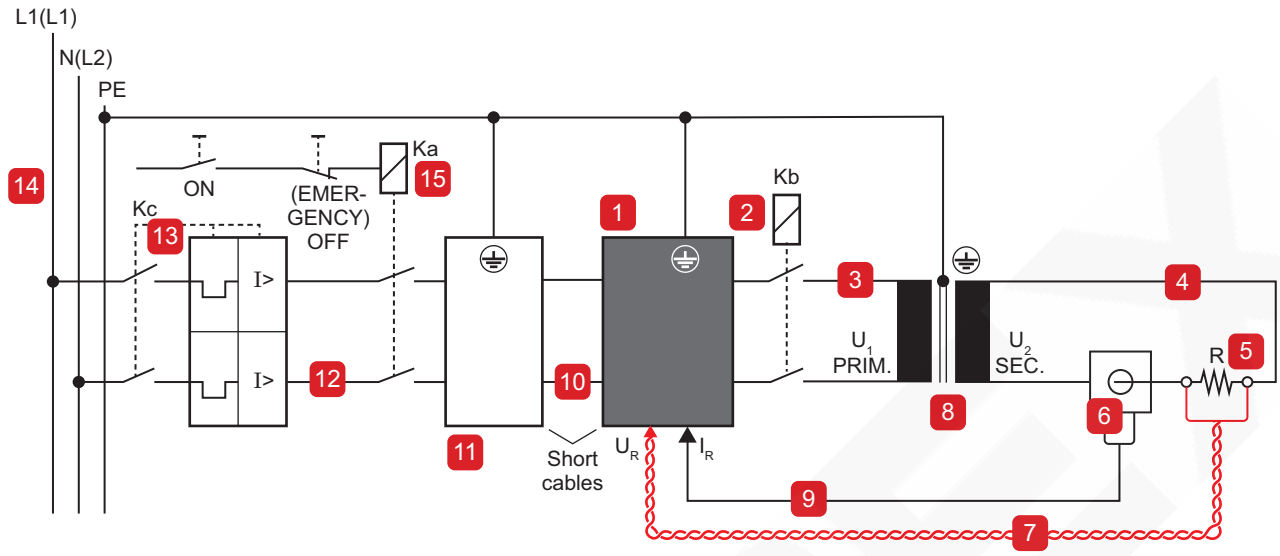
4. Provide a disconnecting device when the system is installed; it must be marked as belonging to the system and placed in a readily accessible position.
   If a circuit breaker is used, it can also perform the function of this device.
5. Check all of the terminals in the system to ensure that they are mounted tightly, including the terminals for the pulse transformer windings.

Notes

- The system components have to be properly dimensioned for the control loop to function properly. Refer to the application report for information on dimensioning system components.
- 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.



7 Always twist (min. 20 twists/meter → "Twisted test lead" accessory)

4 9 Twisting (min. 20 beats/meter) necessary if several control circuits are used together are relocated ("crosstalk").

3 10 12 Twisting (min. 20 beats/meter) is recommended to improve the EMC behavior.

Pos.	Component	Notes and requirements	Refer to section
1	Temperature controller		
2	Contactor Kb	To increase machine safety	Contactor Kb [▶ 20]
3	Primary pulse transformer lines		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.	Application report
5	Heating element		Heating element [▶ 13] Application report
6	Current transformer	**NOTICE! Observe the number of ducts for passing the secondary cable through the current transformer.**	Current transformer Application report
7	Measurement cable U_R	**NOTICE! Use twisted measuring cables provided by ROPEX.** **NOTICE! Input voltage max. 120 V.**	Measurement cable [▶ 15] Application report
8	Pulse transformer		Pulse transformer [▶ 14] Application report
9	Measurement cable, current I_R	**NOTICE! Use twisted measuring cables provided by ROPEX.**	Measurement cable [▶ 15] Application report

Pos.	Component	Notes and requirements	Refer to section
10	Filtered lines (lines between line filter and temperature controller)		Application report
11	Line filter	**NOTICE! Do not install unfiltered and filtered lines in the same wiring duct.**	Line filters [▶ 15] Application report
12	Unfiltered lines (lines between voltage supply and line filter)		Application report
13	Overcurrent protective device Kc	Example: 2-pin circuit breaker or fuses **NOTICE! Protects only from short-circuit. Does not protect the temperature controller.**	Application report
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)	

Also refer to the section Connection diagram [▶ 21] as well as to your application report.

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.

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 as well as to the application report.

The following illustration shows an example of a standard application.

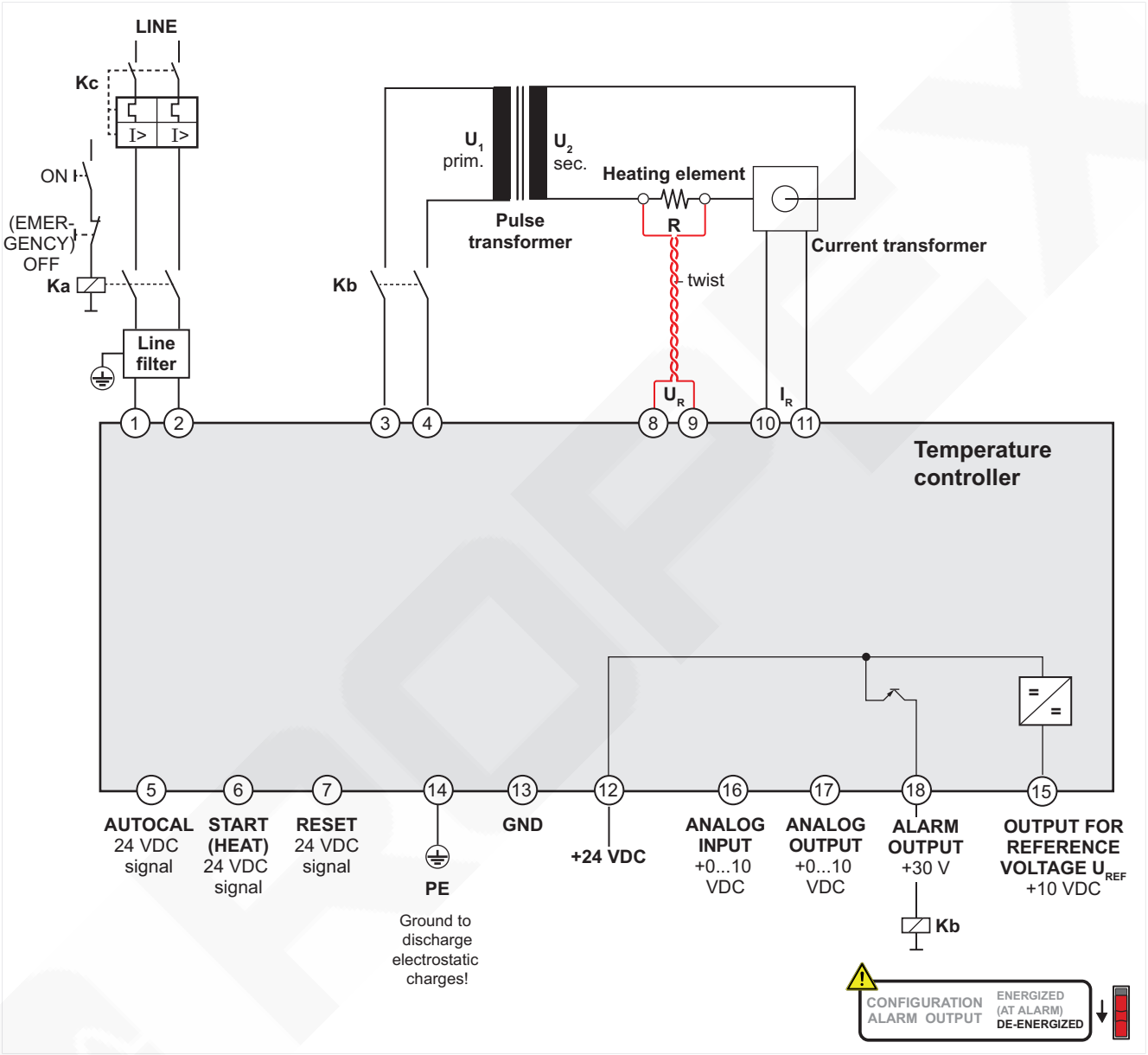


Illustration 4: Connection diagram, example

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 Example of electrical cabinet wiring [▶ 52].

6 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.

Proceed as follows to start up the temperature controller:

6.1 Initial startup

Prerequisites The following requirements have to be met:

- The device is completely assembled; refer to section Assembling device [▶ 16].
- The device is completely connected; refer to section Installing device [▶ 17].
- Line voltage and 24 VDC supply voltage are switched off.
- Confirmation that equipment is de-energized.
- Heating element is cold.

	Startup step	Reaction of temperature controller	
1.	Switch on the 24 VDC supply voltage.		**AUTOCAL** flickers or flashes briefly, indicating that switchon has been done correctly.
2.	After successful switchon.		**AUTOCAL** flashes slowly (1 Hz)
3.	Switch on line voltage.		**AUTOCAL** goes off
			**ALARM** flashes quickly (4 Hz), if AUTOCAL is necessary[2)]
4.	Activate AUTOCAL (terminals 5+13)		**AUTOCAL** is illuminated for the duration of calibration (approx. 10…15 seconds).
			**ALARM** goes off
		During this process, there is voltage of approx. 0 VDC at the actual value output (terminals 17+13). If an analog temperature display is connected, it shows 0…3 °C.	
5.	Check whether zero calibration was successful.	**Zero calibration was successful:**	
			**AUTOCAL** goes off
		Voltage of 0.66 VDC appears at the actual value output.	
		Zero calibration failed:	
			**ALARM** flashes slowly (1 Hz)

2 AUTOCAL may be required even if ALARM is not flashing quickly.

	Startup step	Reaction of temperature controller	
5.	Check whether zero calibration was successful.	The temperature controller is not configured properly; refer to section Error messages [▶ 37]. Repeat zero calibration.	
6.	Check the heatup and control function at the actual value output: 1. Define a temperature (setpoint) and create the START (HEAT) signal. 2. Read the temperature via the analog output.		**HEAT** illuminated.
			**OUTPUT** illuminated analog to the phase-angle control. The heating element heats up.
7.	End startup		
	When the heating element is not burned in: ▶ Burn in the heating element; refer to Burning in heating element [▶ 26].		
	The temperature controller is ready.		

6.2 Restarting device

The system has to be restarted when any changes are made, e.g. replacement of the heating element.

Prerequisites The following requirements have to be met:

- The device is completely assembled; refer to section Assembling device [▶ 16].
- The device is completely connected; refer to section Installing device [▶ 17].
- Line voltage and 24 VDC supply voltage are switched off.
- Confirmation that equipment is de-energized.
- Heat-sealing band is cold.

	Startup step	Reaction of temperature controller	
1.	Switch on the 24 VDC supply voltage.		**AUTOCAL** flickers or flashes briefly, indicating that switchon has been done correctly.
2.	AC flashes slowly after the switchon process.		**AUTOCAL** flashes slowly (1 Hz)
3.	Switch on line voltage.		**AUTOCAL** goes off
			**ALARM** flashes quickly (4 Hz), if AUTOCAL is necessary
4.	Activate AUTOCAL (terminals 5+13)		**AUTOCAL** is illuminated for the duration of calibration (approx. 10…15 seconds).
			**ALARM** goes off
		During this process, there is voltage of approx. 0 VDC at the actual value output (terminals 17+13). If an analog temperature display is connected, it shows 0…3 °C.	
5.	Check whether zero calibration was successful.	**Zero calibration was successful:**	
			**AC** goes off
		Voltage of 0.66 VDC appears at the actual value output.	

	Startup step	Reaction of temperature controller	
5.	Check whether zero calibration was successful.	**Zero calibration failed:**	
			**ALARM** flashes slowly (1 Hz)
		The temperature controller is not configured properly; refer to section Error messages [▶ 37]. Repeat zero calibration.	
6.	Check the heatup and control function at the actual value output: 1. Define a temperature (setpoint) and create the START (HEAT) signal. 2. Read the temperature via the analog output.		**HEAT** illuminated.
			**OUTPUT** illuminated analog to the phase-angle control. The heating element heats up.
7.	End startup		
	When the heating element is not burned in: ▶ Burn in the heating element; refer to Burning in heating element [▶ 26].		
	The temperature controller is ready.		

6.3 LED behavior upon startup

During startup, the LEDs can behave as follows:

("O" means: LED is OFF)

LED AUTOCAL	LED ALARM	LED OUTPUT	Causes and measures
Flickers 2 s and flashes briefly	O	O	Boot loader starts. Switchon was done properly ▶ Continue startup
Flashes slowly (1 Hz)	Flashes briefly 	O	Configuration has been changed. 1. Check temperature controller configuration. 2. Perform AUTOCAL again.
Flashes slowly (1 Hz)	O	O	No line voltage being applied. ▶ Switch on line voltage.
Flickers 2 s and flashes briefly, repetitively 	O	O	The 24 VDC supply voltage is too low or not stable. ▶ Check the 24 VDC supply voltage.
O	O	Brief pulses every 1.2 s 	Continue startup
O	FLASHES quickly (4 Hz) 	O	Continue startup

LED AUTOCAL	LED ALARM	LED OUTPUT	Causes and measures
O	Remains ON ●	O	For error diagnosis, refer to Error messages.

Further information on LED behavior can be found in section .

6.4 Temperature controller configuration

⚠ WARNING

Danger, supply voltage at device

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

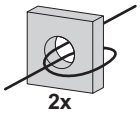
- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the current supply.
- ▶ Secure the current supply to prevent it from being switched on again.

Prerequisite

- The temperature controller is voltage-free.

6.4.1 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.

6.4.2 Configuring output ALARM

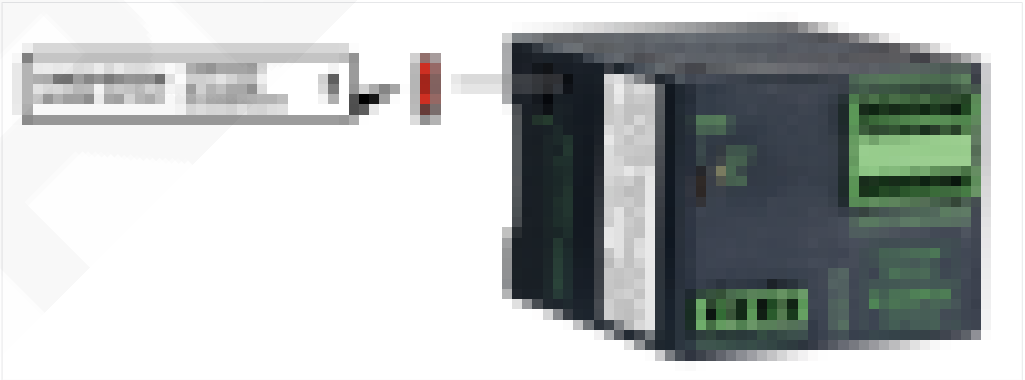
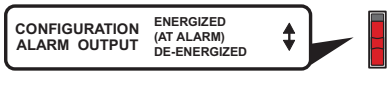


Illustration 5: Configuring output ALARM

Jumper position	Meaning
	ENERGIZED: Output ALARM is active when an alarm occurs. (default)
	DE-ENERGIZED: Output ALARM is inactive when an alarm occurs.

6.5 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

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 [▶ 31].
   ⇨ 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

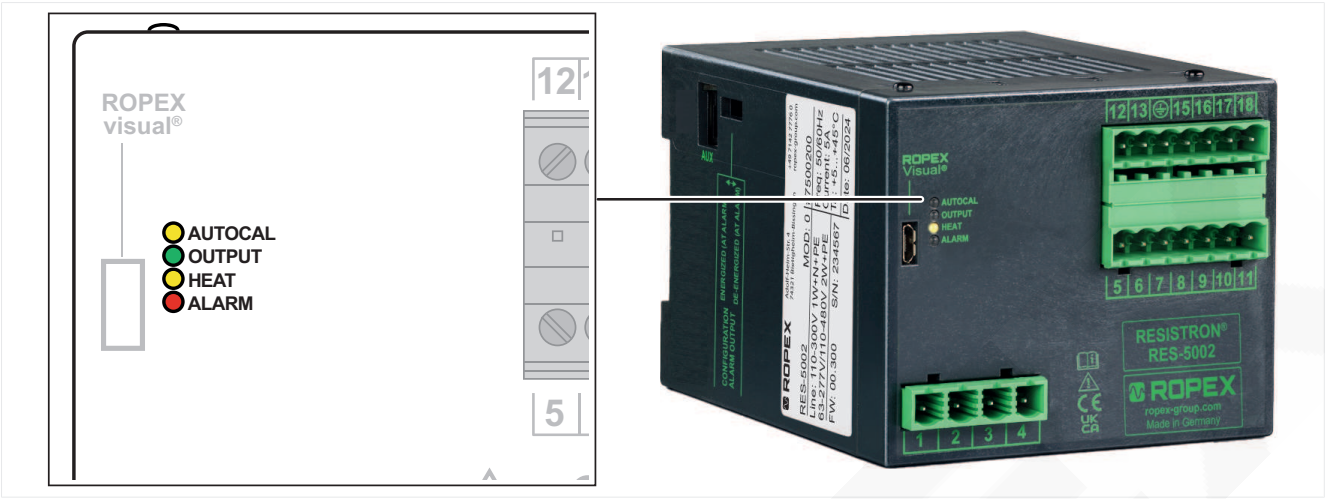


Illustration 6: Display of operating status

The LEDs indicate the operating status of the temperature controller.

Type of flashing

LED	Status	
●	Remains on/off	
☀	Flashing	1 Hz (slowly)
☀		2 Hz
☀		4 Hz (quickly)
☀	Flickers	8 Hz

Overview of LEDs

LED	Flashes slowly (1 Hz)		Flashes quickly (4 Hz)		Remains on	
AUTOCAL	Input RESET is active (terminal 7) or is waiting for line voltage; refer to Standby active [▶ 33].	☀	AUTOCAL requested but feature is blocked (e.g. START is active); refer to section START signal [▶ 32].	☀	AUTOCAL is performed.	●
	LED flashes at different frequency: 24 VDC supply is too low.					
	LED flickers approx. 2 seconds: Boot loader starts.					
OUTPUT	—		In control mode, the brightness is proportional to the heating current. In measuring mode or during the cooling phase of the heating element, the LED indicates the measuring pulses by flashing briefly.			●

LED	Flashes slowly (1 Hz)		Flashes quickly (4 Hz)		Remains on	
HEAT	—		START requested but function is blocked (e.g. AUTOCAL is active, set-point < 40 °C); refer to START signal [▶ 32].		START is performed.	
ALARM	Configuration error, AUTOCAL was not successful; refer to section Error messages [▶ 37].		Temperature controller calibrated incorrectly; perform AUTOCAL.		For a list of errors, refer to section Error messages [▶ 37].	

8 Functions and settings

8.1 Setpoint

The sealing temperature can be set by

- Applying voltage of 0...10 VDC to the analog input (terminals 16+13)
- Connecting a linear 2-kΩ potentiometer (e.g. *PD-3*) to the terminals 13, 14, 15 and 16.

Minimum setpoint	40 °C Note: When the setpoint is specified to be below 40 °C, activating the START signal does not trigger heating.
Maximum setpoint	300 °C

Note If 0 VDC is applied to the setpoint input or if no potentiometer is connected, the setpoint is = 0.

Applying voltage to analog input

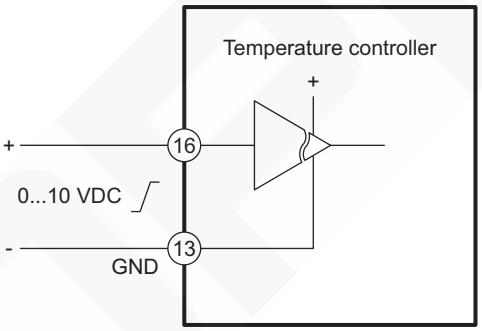


Illustration 7: Applying voltage to analog input

Voltage values

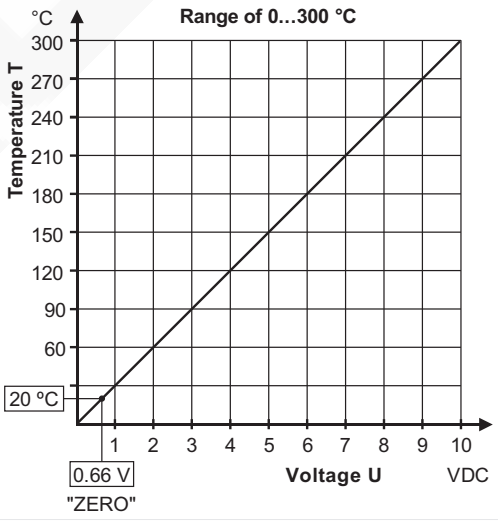


Illustration 8: Graph showing temperature display

The correlation between the voltage applied and the setpoint temperature is linear.

These are the correlations:

- 0 VDC: 0 °C
- 10 VDC: 300 °C

Connecting 2-kΩ potentiometer

The temperature controller supplies reference voltage (U_{ref} 10 VDC ± 5%) to terminal 15.

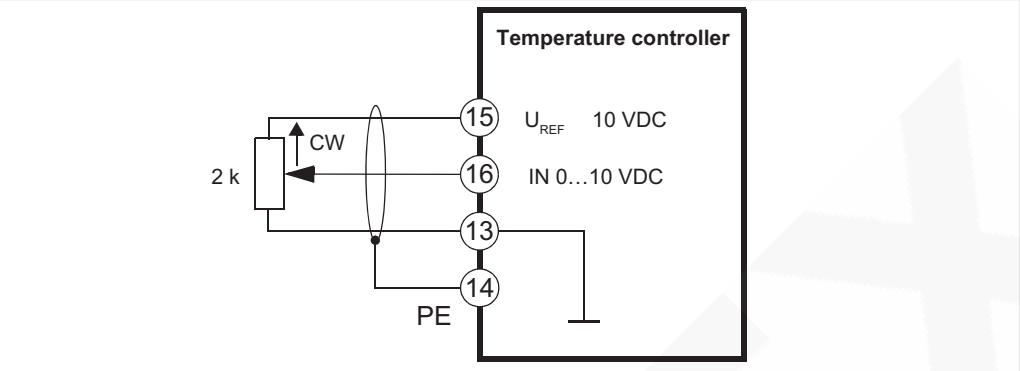


Illustration 9: Connecting potentiometer

When connecting the potentiometer, observe the following:

- ▶ Shield the connecting line between the temperature controller and the potentiometer
- ▶ Observe the direction of rotation

The correlation between the setting on the potentiometer (R = 2 kΩ) and the setpoint temperature is linear.

These are the correlations:

- 0 kΩ: 0 °C
- 2 kΩ: 300 °C

Tip When installing the potentiometer *PD-3* use the numbers in the fine adjustment knob display to set the setpoint temperature. The number corresponds to the setpoint temperature (°C).

8.2 Analog temperature display

The temperature controller supplies an analog voltage signal 0…10 VDC at the terminals 17+13. The voltage signal is proportional to the actual temperature.

To allow the temperature of the heating element to be displayed, connect a temperature gauge to the actual value input.

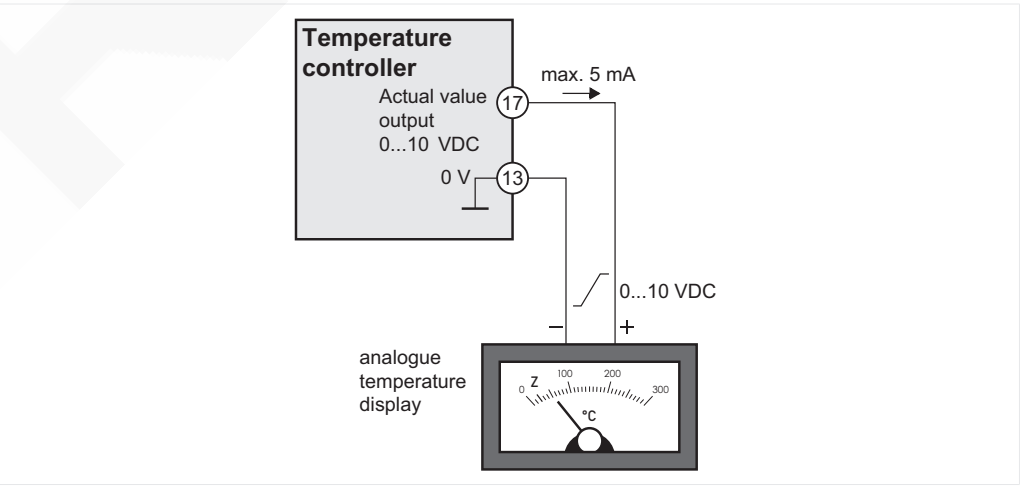


Illustration 10: Example of temperature controller with analog temperature display

The analog temperature display can be used e.g.

- To compare the setpoint to the actual temperature.
- To specify the heat-up rate.

- To check whether the setpoint is reached within the required time.
- To observe how the heating element cools off.
- To detect disruptions in the control circuit (loose connections, contact and cabling problems, power disruptions).
- To detect adjacent control loops that disturb one another.

When an alarm occurs, the actual value output shows differentiated error messages; refer to section Error messages [▶ 37].

8.3 Automatic zero calibration AUTOCAL

NOTICE

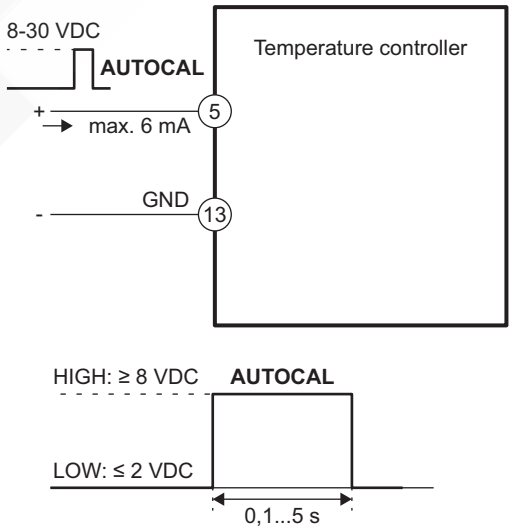
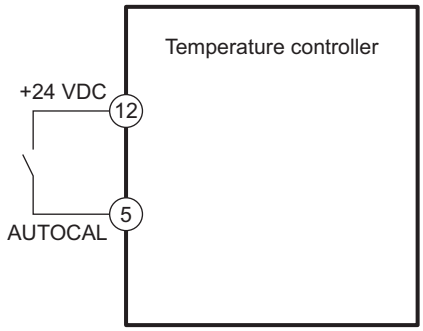
Property damage if the heating element overheats

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.

Automatic zero calibration AUTOCAL 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.

The automatic zero calibration AUTOCAL can be activated as follows:

Via the terminals	Triggering by	
5+13	24 VDC signal	
5+12[4)]	Control contact	

[4] Use in the event that the temperature controller RESISTRON® *RES-401* or *RES-402* is to be replaced with the RESISTRON® *RES-5002*.

The automatic calibration takes approx. 10…15 sec. The heating element is not heated additionally during this process. The actual value output (terminals 17+13) 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 [▶ 37].

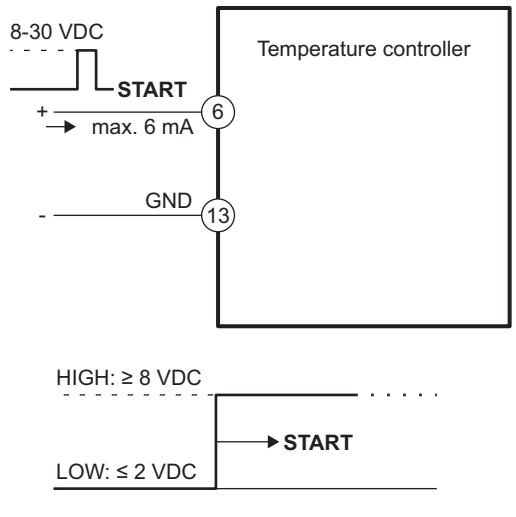
AUTOCAL function is blocked

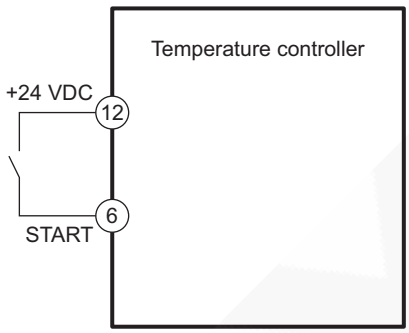
AUTOCAL is blocked if any of the following conditions occur:

- During the first 10 seconds after both voltage supplies are switched on, if no alarm is reported.
- During the first 10 seconds after resetting the temperature controller, if no alarm is reported.
- If the cooling rate of the heating element is greater than 0.1 K/s.
  Note:
  If the signal AUTOCAL is activated and the cooling rate has fallen below 0.1 K/s, the temperature controller carries out the AUTOCAL function.
- When the signal START is activated (24 V).
  The HEAT LED is illuminated or flashing.
- When the signal RESET is activated (24 V).
  The AUTOCAL LED flashes slowly (1 Hz).
- If error codes 101 to 103, 201 to 203 or 9xx occur directly after switching on the temperature controller; refer to section Error messages [▶ 37].
- 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 Fehlermeldungen [▶ 37].
- If the line voltage is missing.
  The AUTOCAL LED flashes slowly (1 Hz).

8.4 START signal

The START signal can be triggered as follows:

Via the terminals	Triggering by	
6+13	24 VDC signal	

Via the terminals	Triggering by	
6+12	Control contact	

A START request is not processed as long as:

- The AUTOCAL function is active.
- The temperature controller indicates an alarm.
- The setpoint is lower that 40 °C.

The ALARM output 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 [▶ 37].

8.5 Standby active

The temperature controller is waiting for line voltage.

The following prerequisite has to be met:

- The 24 VDC supply of the temperature controller is switched on.

Reaction of temperature controller

In order to be able to assess the behavior of the temperature controller, refer to the examples of the statuses of the supply voltage and the resulting statuses of the temperature controller in the table. The table represents a chronological sequence.

	24 VDC supply to temperature controller	Line voltage		Status of bits/result
1.	Off	Off		Temperature controller and machine control are not communicating.
2.	On	Off		No reset, standby active, no alarm
3.	On	On		No reset, no standby active, no alarm
				Sealing process is possible.
4.	On	Off		No reset, no standby active, alarm active
				Error code 201 Line voltage missing.
5.	On	On		No reset, no standby active, alarm active
				Error code 201 Line voltage is present, but the alarm is not acknowledged.
6.	On	On		Reset active, standby active, alarm active

	24 VDC supply to temperature controller	Line voltage		Status of bits/result
6.	On	On		Error code 201 The error number 201 is displayed for as long as reset is active. Refer to section Error messages for instructions on how to acknowledge the error.
7.	On	On	[5]	No reset, no standby active, no alarm
				The alarm is acknowledged, i.e. the error is cleared, and reset is completed. Sealing process is possible.

8.6 USB interface

Illustration 11: USB interface

The temperature controller has a USB interface.

The micro USB 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 ROPEX website, under Downloadbereich.

Menu path `Products > Downloads >` REGISTER

Tip Enter the search term "visual."

[5] If the alarm is acknowledged, but the line voltage is still switched off, error code 901 will immediately be displayed. If the line voltage is then switched on and the alarm is acknowledged once again, the temperature controller goes into measurement and control mode.

8.7 AUX interface

Illustration 12: AUX interface

The temperature controller has an AUX interface.

The AUX interface is used for diagnostics and maintenance purposes.

8.8 Built-in clock

The temperature controller has a built-in clock.

The built-in clock can be set and read out using:

- The visualization software; refer to the operating instructions for the visualization software *ROPEXvisual*®

A maintenance-free capacitor is used to operate the clock. No battery is needed for operation.

The temperature controller must remain switched on for at least 3 hours to make sure the clock's capacitor is fully charged. When the temperature controller is switched off, the fully charged capacitor can keep the clock running for approximately 2 to 4 weeks. If the temperature controller is switched off for longer, the date and time will have to be set again.

The capacitor is not charged when it leaves the factory.

The temperature controller can be operated even when the clock is not set. This does **not**, however, impact how the temperature controller behaves.

9 Monitoring and error detection

9.1 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
Red ALARM LED on temperature controller	Flashes quickly (4 Hz)	▶ Execute AUTOCAL functions (error codes 104…106, 211, 302, 303). Note: If a START signal is sent during this state, the LED remains illuminated.
	Flashes slowly (1 Hz)	The system configuration is incorrect and zero calibration (AUTOCAL function) was unsuccessful (error codes 111…114); refer to section Temperature controller configuration [▶ 25]. Note: If a START signal is sent during this state, the LED remains illuminated.
	Illuminated continuously	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.
Output ALARM (terminal 18) default[6)]	NOT ACTIVE	• When the red ALARM LED on the temperature controller flashes quickly. • When the red ALARM LED on the temperature controller flashes slowly.
	ACTIVE	• When the red ALARM LED on the temperature controller remains illuminated.
Error code indicated via the actual value output 0…10 VDC (terminals 17+13)	13 voltage levels	In the event of a fault, the temperature display is no longer required. This is why, in the event of an alarm, the analog output serves as the error output. Instead, 13 voltage levels between 0…10 VDC are output. The voltage levels are assigned to groups of error codes; refer to section Error messages.
	Error codes	For statuses that require AUTOCAL, or if the device configuration is incorrect (error codes 104…106, 111…114, 211, 302, 303), the signal at the actual value output alternates at 1 Hz between the voltage value corresponding to the error and the end of the scale (10 VDC, i.e. 300 °C). If the START signal is present in one of these states, the voltage value does not change any more.

6 If the output ALARM has a different configuration than the default, the states are reversed; refer to section Configuring output ALARM [▶ 25]

Who reports?	How is the fault reported?	Meaning
Error code indicated via the actual value output 0…10 VDC (terminals 17+13)	Temperature display	If a temperature meter is connected to the temperature controller's analog output, the temperature indication can be directly assigned to the group of the error codes.

Activating alarm messages

The alarm message can be reset by activating the input RESET or by switching the temperature controller on/off (24 VDC supply). If the RESET input is used, the alarm message is not reset until the RESET input is deactivated.

Tip

Invalid alarm messages can occur if the temperature controller is switched off. The alarm messages occur because the operating status of the temperature controller is not defined.
This must be taken into account when they are evaluated by the higher-level controller (e.g. a PLC) in order to avoid false alarms.

9.2 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:

- For information on the visualization software, refer to the operating instructions 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.

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.

9.2.1 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.
- ALARM LED remains illuminated.
- Alarm output is active.

Error code	Analog signal voltage [V]	Cause	Action if heat-sealing band started for the first time	Action if machine is already in operation, heat-sealing band not changed
101	0.66	No current signal	Fault area 1 [7]	
102	1.33	Voltage signal missing	Fault area 3 [7]	
103	2.00	Voltage and current signals missing	Fault area 2 [7]	Fault area 2 and 9 [7]
107	2.66	Temperature drop	And/or fault areas 4, 5 and 6 (loose contact)[7]	
108		Temperature spike		

[7] Refer to the wiring diagram Fault areas and causes [▶ 40] for further information.

Error code	Analog signal voltage [V]	Cause	Action if heat-sealing band started for the first time	Action if machine is already in operation, heat-sealing band not changed
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		
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		
917 918		Jumper for alarm output not plausible	▶ Check jumper.	
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.	

9.2.2 Part 2 of 3: Troubleshooting

The errors are initially reported as warnings.

- Analog output alternates between two values.
- ALARM LED flashes at 4 Hz.
- Alarm output is 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**).
- ALARM LED remains illuminated.
- Alarm output is active.

Error code	Analog signal voltage [V][8]	Error message and cause	Action if heat-sealing band started for the first time	Action if machine is already in operation, heat-sealing band 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 [9]	Refer to fault areas 4, 5 and 6 (loose wire)[9]
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): [9]:	
303		Temperature too high: • Calibration not performed • Loose contact • Ambient temperature fluctuates		
211	**6.00**/10	Data error	▶ Perform **AUTOCAL**.	

[8] The voltage at the analog output alternates between the two values.

[9] Refer to the wiring diagram Fault areas and causes [▶ 40] for further information.

9.2.3 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.
- ALARM LED flashes at 1 Hz.
- Alarm output is 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**).
- ALARM LED remains illuminated.
- Alarm output is active.

Error code	Analog signal voltage [V][10]	Cause	Action if heat-sealing band started for the first time	Action if machine is already in operation, heat-sealing band not changed
111	**6.66**/10	Current signal incorrect, calibration not possible	Fault area 8[11] ▶ Check configuration	Fault areas 4, 5 and 6 (loose wire)[11]
112	**7.33**/10	Voltage signal incorrect, calibration not possible	Fault area 7[11] ▶ Check configuration	
113	**8.00**/10	Voltage and current signal incorrect, calibration not possible	Fault areas 7 and 8[11] ▶ Check configuration	
114	**8.66**/10	Temperature fluctuates, calibration not possible	▶ Perform **AUTOCAL** And/or fault areas 4, 5 and 6 (loose contact)[11]	

9.3 Fault areas and causes

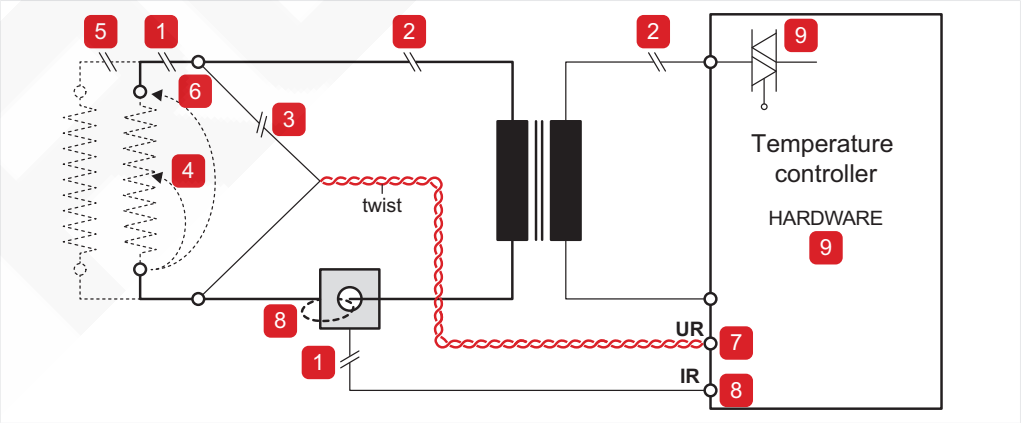


Illustration 13: Fault areas and causes

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.

[10] The voltage at the analog output alternates between the two values.

[11] Refer to the wiring diagram Fault areas and causes [▶ 40] for further information.

Fault area	Explanation	Possible causes
1	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.
	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 output defective or not in correct position. • No line voltage.

10 Replacing heating element

⚠ WARNING

Hot surfaces pose a risk of burns

The heating element is very hot when it is operating.

▶ Allow all system components to cool off.

Replace the heating element in the event of:

- Mechanical defects, bending or deformation
- Scaled or oxidized ends of heating elements
- Burned in residue
- Damaged coatings, e.g. copper or Teflon surfaces

Prerequisite The following requirements have to be met:

- The heating element is cooled to ambient temperature.
- All of the components near the heating element have cooled off:
  - Silicone
  - PTFE cover
  - Sealing bar

To replace the heating element, proceed as follows:

1. Disconnect the supply voltage from the temperature controller (all-pole), verify that the circuit is de-energized and secure to prevent being switched on again.
2. Remove heating element.
3. Install heating element.
4. Burn in the device.
   Information can be found in the sections Burning in heating element [▶ 26] and Automatic zero calibration AUTOCAL [▶ 31].
5. Every time the heating element has been replaced, perform zero calibration with the function AUTOCAL.
   Reason: Tolerances related to the production process can impact the resistance of the heating element.
6. Check the temperature coefficients of the heating element.

⇨ Heating element has been replaced. Burning in and calibration have been performed.

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	• Installation in an electrical cabinet • Snaps onto a standard top hat rail TS35 (35 mm) pursuant to EN 50022
Dimensions	Base area 90 × 75 mm Housing depth: 113 mm Depth including terminals: 135 mm
Line voltage	If connected between neutral conductor and an outer conductor: • 110 VAC -15 %…300 VAC +10 % If connected between two outer connectors: • 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,
Line frequency	47…63 Hz automatic adjustment to frequencies in this range
Current consumption max. (primary current of pulse transformer)	• I_{max} = 5 A (duty cycle = 100 %) • I_{max} = 25 A (duty cycle = 20 %, cycle duration 1 min)
Supply voltage Terminals 5+7	• 24 VDC, I_{max} = 200 mA (control mode), 1 A (switch-on current) Tolerance: ±10 % • SELV or PELV supplied from max. 300 VAC, Cat II
Measuring range	• Secondary voltage U_R: 0.4…120 VAC • Secondary current I_R: 30…500 A (with current transformer PEX-W5) Refer to the application report for more information.
Temperature measurement and control range	300 °C
Temperature coefficient	1100 ppm/K

Element	Technical data
Analog/setpoint input Terminals 13, 14, 15, 16	• Terminals 13+16: Voltage 0…10 VDC, I_{max} = 5 mA 0…10 VDC corresponds to 0…300 °C • Terminals 13+14+15+16: linear potentiometer *PD-3* (R = 2 kΩ) 0…2 kΩ corresponds to 0…300 °C
Output for reference voltage U_{REF} Terminal 15	U_{REF} = +10 VDC/± 5%, I_{max} = 5 mA
Digital logic level Terminals 5, 6, 7	LOW (0 V): 0…2 VDC HIGH (24 VDC): 8…30 VDC (power consumption max. 6 mA) Protected from polarity reversal
Analog/actual output Terminals 17+13	0…10 VDC, I_{max} = 5 mA 0…10 VDC corresponds to 0…300 °C Precision: ±1 % plus 50 mV
Alarm output Terminal 18	U_{max} < 3 V (saturation voltage), short-circuit-proof I_{max} = 0.2 A Configurable with the aid of the jumper.
Power loss	max. 20 W
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	IP20
Protection class	Protection class I
Weight	Approx. 0.5 kg (incl. Terminal strip)
Housing material	Thermosplastic layer: Polycarbonate (PC)
Connecting cable (type / cross sections)	• Rigid or flexible; 0.2…2.5 mm² (AWG 24…12) plug-in terminals • Plug-in terminals: 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.

13.2 How to order

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.

Illustration	Device	Article number
	Temperature controller RES-5002	7500200
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.	
	Lines	For design and order specifications, refer to the application report
Accessories		
	Potentiometer PD-3 with digital knob	881103

Illustration	Device	Article number
	Upstream transformer An upstream transformer can be individually designed and supplied upon request.	

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-5002	Article number	7500200
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, May 15, 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

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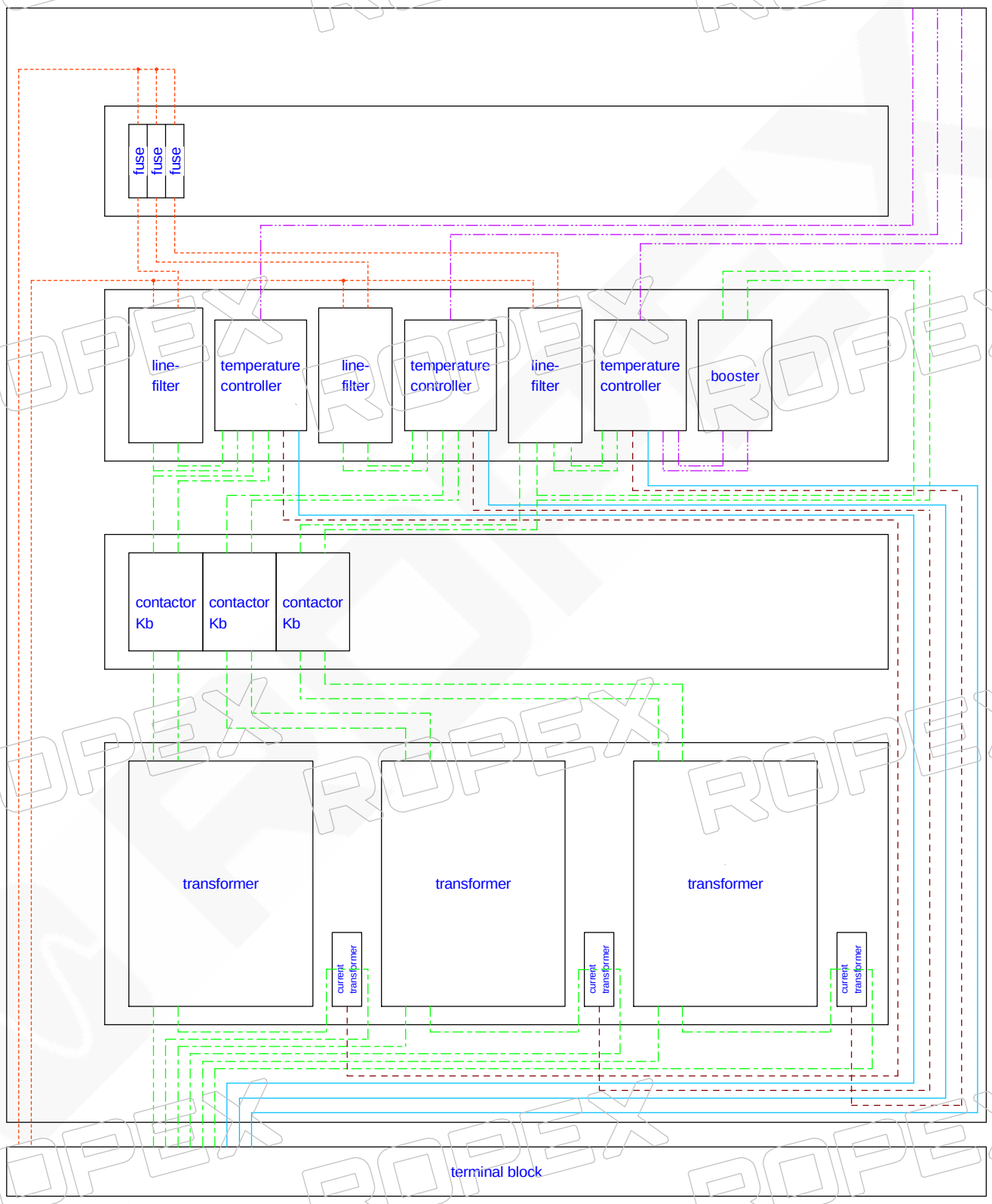

legend:
- not filtered
- filtered
- IR measurement
- UR measurement
- control wires to PLC

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15.2 Examples of electrical connections

Connection to one heating element

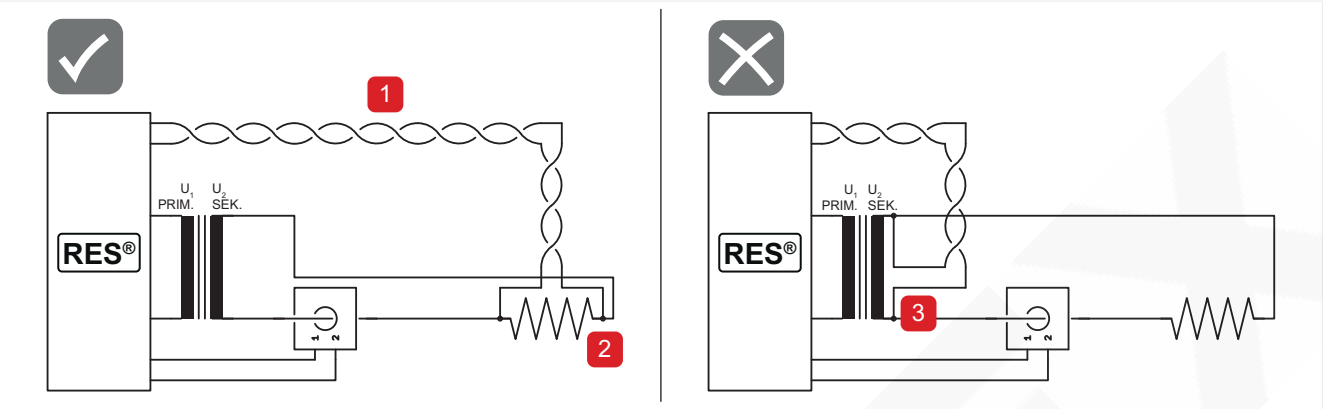

Illustration 14: Component wiring, example 1

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.

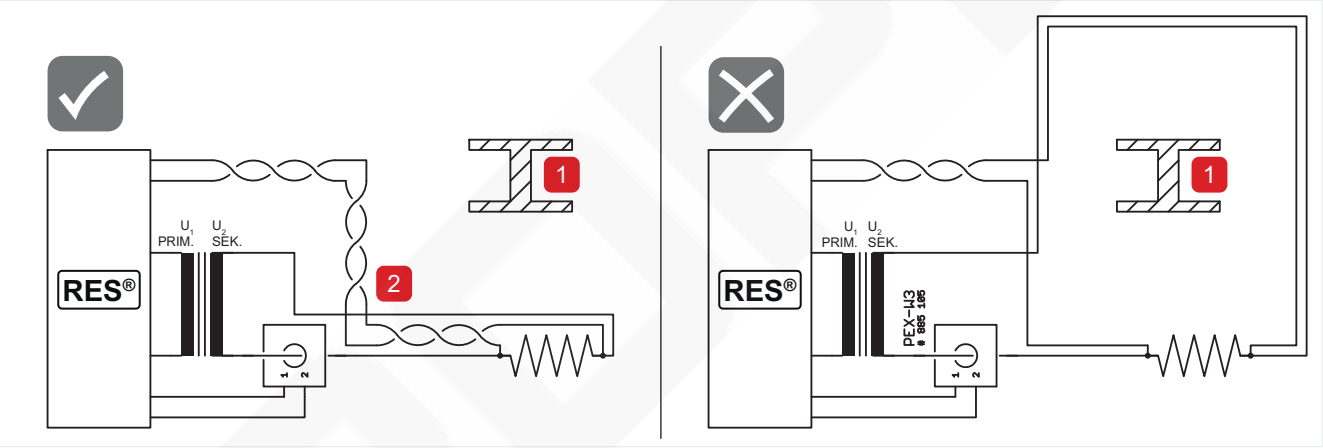

Illustration 15: Component wiring, example 2

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.

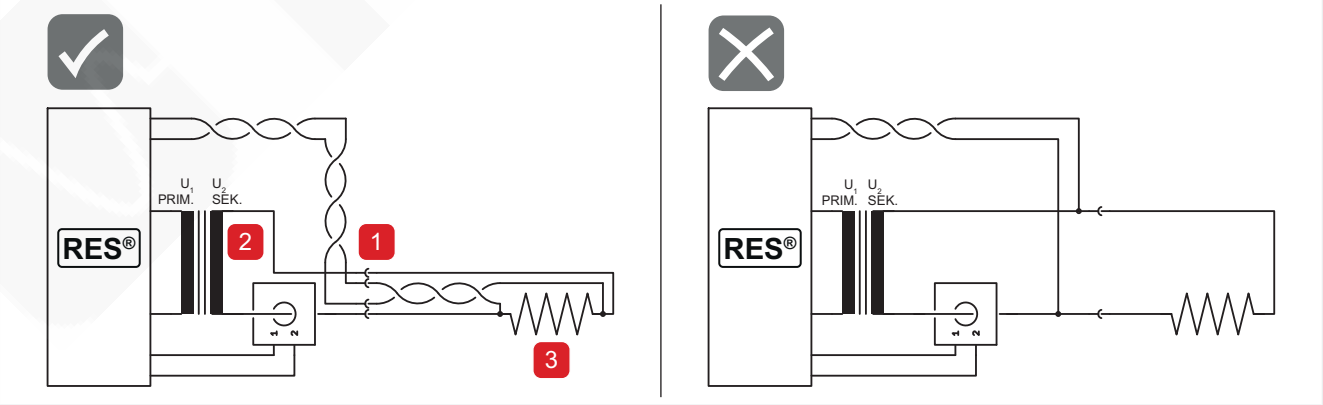

Illustration 16: Component wiring, example 3

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

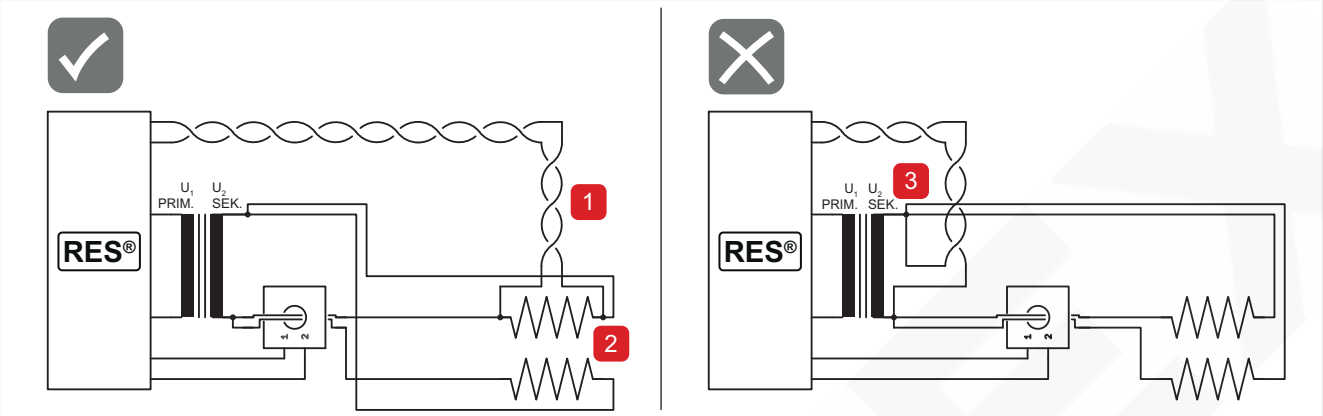

Illustration 17: Component wiring, example 4

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).

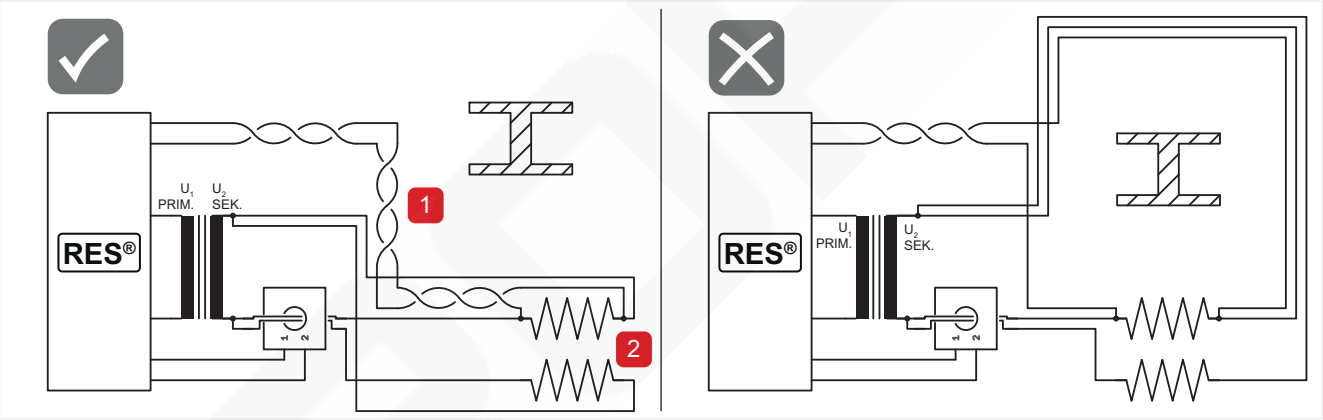

Illustration 18: Component wiring, example 5

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.

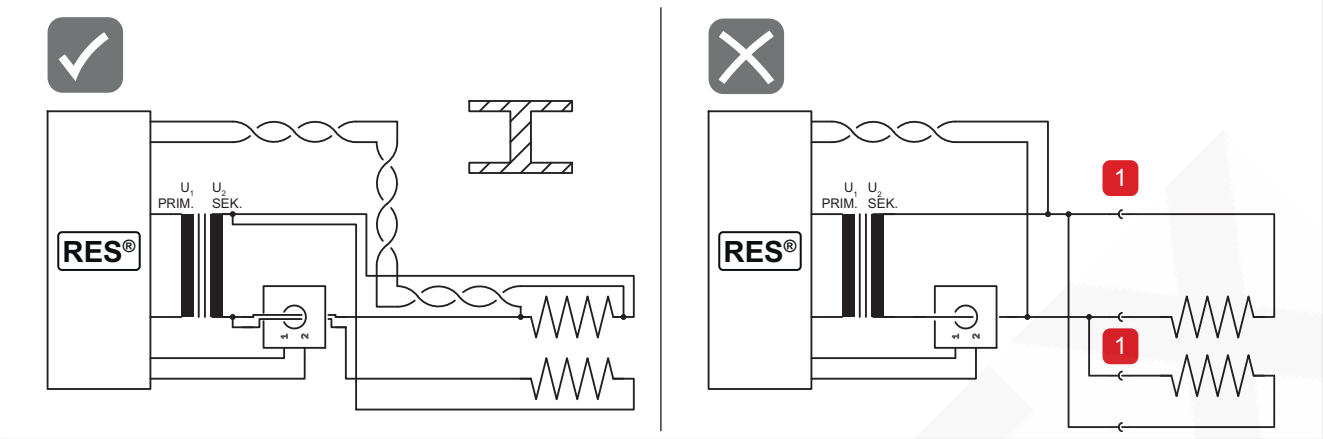

Illustration 19: Component wiring, example 6

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

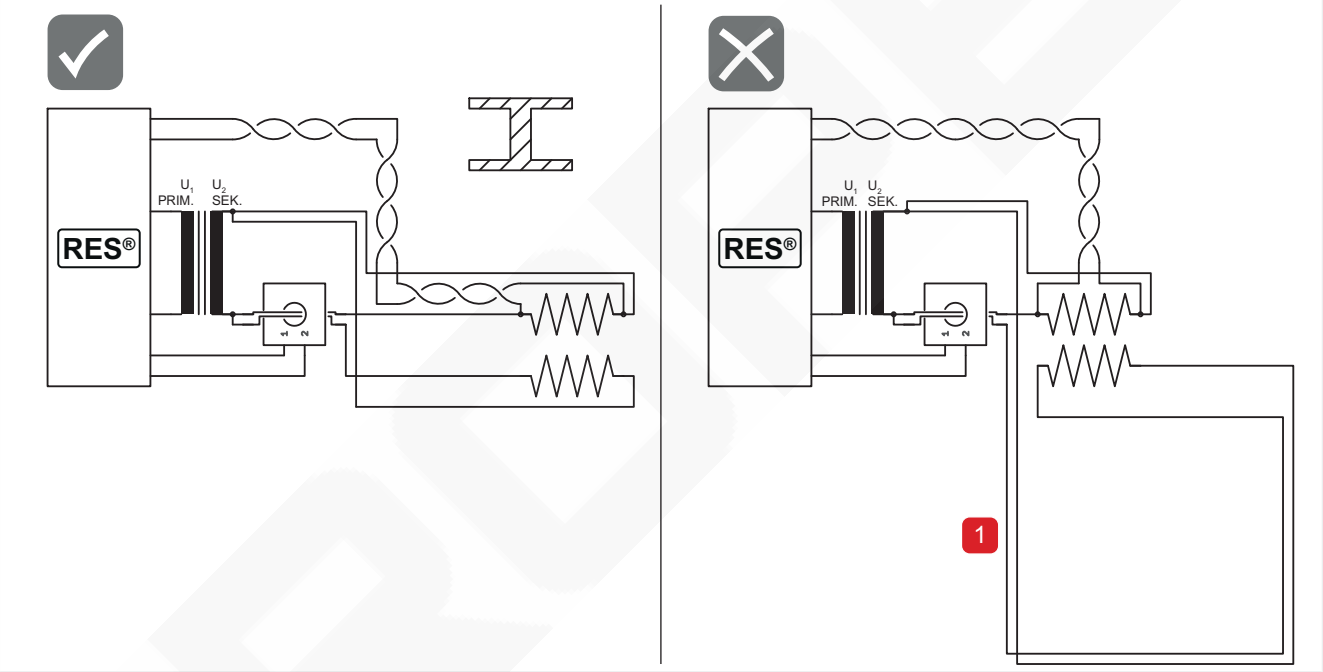

Illustration 20: Component wiring, example 7

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

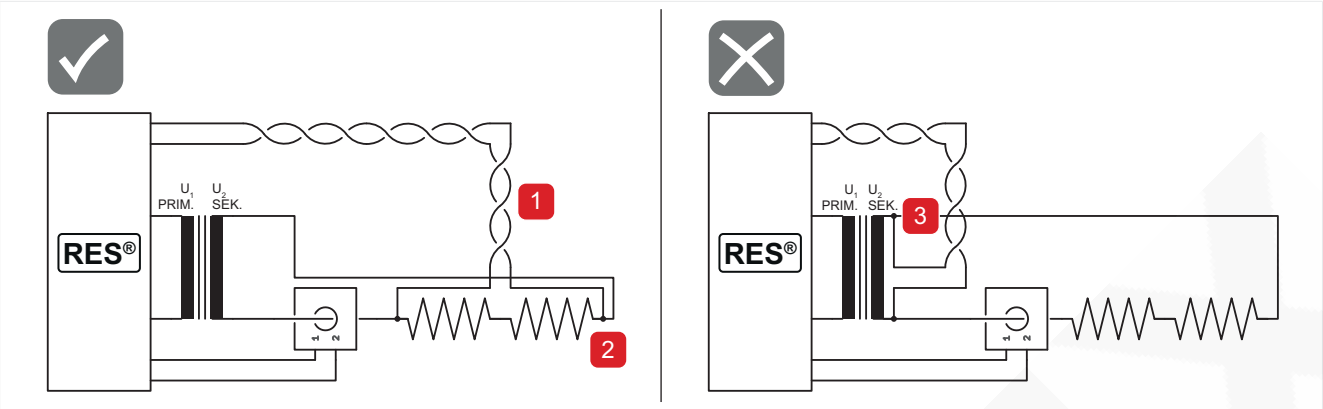

Illustration 21: Component wiring, example 8

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).

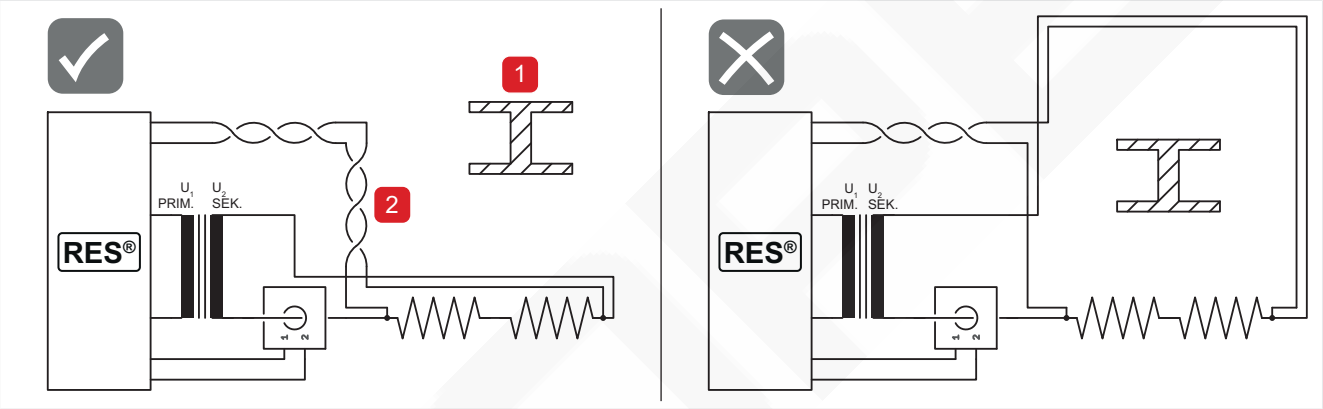

Illustration 22: Component wiring, example 9

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.

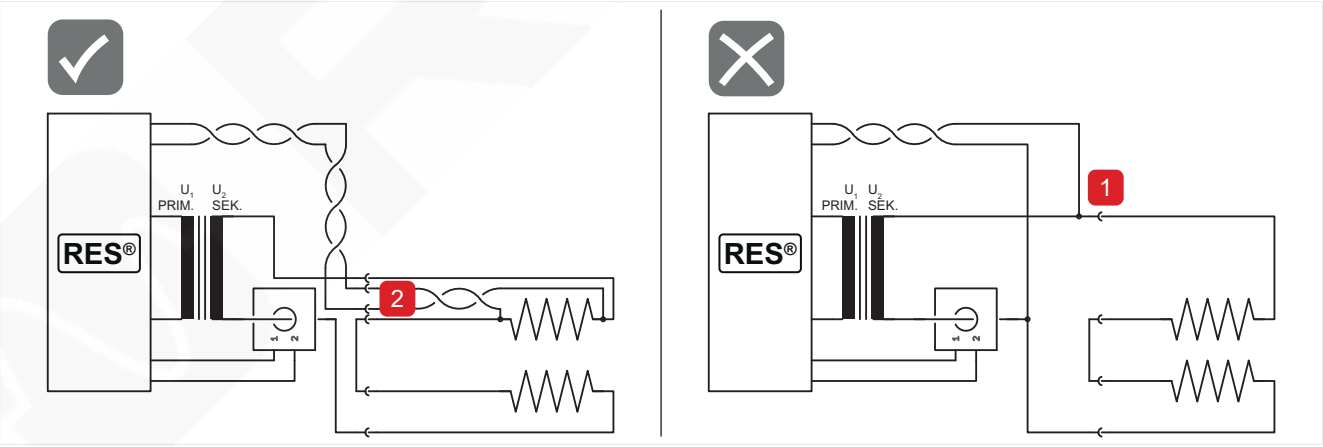

Illustration 23: Component wiring, example 10

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.

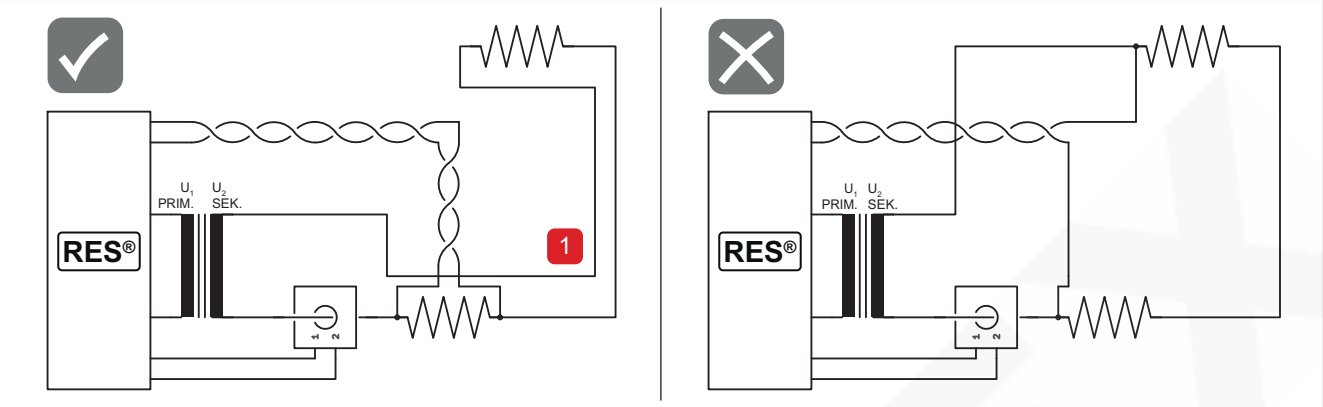

Illustration 24: Component wiring, example 11

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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