

RES-440

®

Operating Instructions



Important features

- Microprocessor technology
- LC display (green), 4 lines, 20 characters, (multilingual)
Alternatively:
VF display (blue), 4 lines, 20 characters, (multilingual)
- Automatic zero calibration (AUTOCAL)
- Automatic optimization (AUTOTUNE)
- Automatic frequency adjustment
- Large current and voltage range
- Booster connection as standard
- Heatsealing band alloy and temperature range selectable
- Time control, heatsealing time and cooling time settable
- Preheating
- Configurable relay output, e.g. "end of cycle"
- Time or temperature-controlled cooling phase
- Signal output for "Temperature OK"
- 0...10VDC analog output for ACTUAL temperature
- Alarm function with fault diagnosis

Identical design to and compatible with RES-222, -230, -241, -242

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1 Safety and warning notes

This RESISTRON temperature controller is manufactured according to DIN EN 61010-1. In the course of its manufacture it passed through quality assurance, whereby it was subjected to extensive inspections and tests.


It left the factory in perfect condition.

The recommendations and warning notes contained in these operating instructions must be complied with, in order to guarantee safe operation.

The device can be operated within the limits indicated in the "Technical Data" without impairing its operational safety. Installation and maintenance may only be performed by technically trained, skilled persons who are familiar with the associated risks and warranty provisions.


1.1 Use

RESISTRON temperature controllers may only be used for heating and temperature control of heatsealing bands which are expressly suitable for them, and providing the regulations, notes and warnings contained in these instructions are complied with.

 **In case of non-compliance or use contrary to the intended purpose, there is a risk that safety will be impaired or that the heatsealing band, electrical wiring, transformer etc. will overheat. Ensuring such compliance is the personal responsibility of the user.**

1.2 Heatsealing band

A basic prerequisite for reliable and safe operation of the system is the use of suitable heatsealing bands.


 **The resistance of the heatsealing band which is used must have a positive minimum temperature coefficient in order to guarantee trouble-free operation of the RESISTRON temperature controller.**

The temperature coefficient must be specified as follows:

$$TCR \geq 10 \times 10^{-4} \text{ K}^{-1}$$

e.g. Alloy-20: TCR = 1100 ppm/K
NOREX: TCR = 3500 ppm/K

The RESISTRON temperature controller must be set and coded according to the temperature coefficient of the heatsealing band.

 **The use of incorrect alloys with too low a temperature coefficient and incorrect coding of the RESISTRON temperature controller leads to uncontrolled heating and ultimately to burn-out of the heatsealing band!**

The heatsealing bands that were originally supplied must be identified by their detailed specification, part number or some other means to ensure that all replacement bands are identical.


1.3 Impulse transformer

A suitable impulse transformer is necessary to ensure that the control loop functions perfectly. This transformer must be designed according to VDE 0570/EN 61558 (isolating transformer with reinforced insulation) and have a one-section bobbin. When the impulse transformer is installed, suitable shock protection must be provided in accordance with the national installation regulations for electrical equipment. In addition, water, cleaning solutions and conductive fluids must be prevented from seeping into the transformer.

 **Incorrect installation of the impulse transformer impairs electrical safety.**

1.4 Current transformer PEX-W2

The current transformer supplied with the RESISTRON temperature controller is an integral part of the control system.

 **Only the original ROPEX PEX-W2 current transformer may be used. Other transformers may cause the equipment to malfunction.**

The current transformer may only be operated if it is connected to the RESISTRON temperature controller correctly (see section 9, "Startup and operation"). The relevant safety instructions contained in section 8.3, "Power supply", must be obeyed. External monitoring modules can be used in order to additionally increase operating safety. They are not included in the scope of

supply of the standard control system and are described in a separate document.

1.5 Line filter

The use of an original ROPEX line filter is mandatory in order to comply with the standards and provisions mentioned in section 1.7 "Standards / CE marking" on page 4. This device must be installed and connected according to the instructions contained in section 8.3, "Power supply" as well as the separate documentation enclosed with the line filter.

1.6 Warranty provisions

The statutory provisions for warranties apply for a period of 12 months following the delivery date.

All devices are tested and calibrated in the factory. Devices that have been damaged due to faulty connections, dropping, electrical overloading, natural wear, incorrect or negligent handling, chemical influences or mechanical overloading as well as devices that have been modified, relabeled or otherwise altered by the customer, for example in an attempt to repair them or install additional components, are excluded from the warranty.

Warranty claims must be examined in the factory and approved by ROPEX.

1.7 Standards / CE marking

The controller described here complies with the following standards, provisions and directives:

DIN EN 61010-1 (VDE 0411-1)	Safety provisions for electrical measuring, control and laboratory devices (low voltage directive). Overvoltage category III, pollution severity 2, safety class II.
DIN EN 60204-1	Electrical equipment of machines (machinery directive)
EN 50081-1	EMC interference emissions according to EN 55011, group 1, class B
EN 50082-2	EMC interference immunity: ESDs, RF radiation, bursts, surges.

Compliance with these standards and provisions is only guaranteed if original accessories and/or peripheral components approved by ROPEX are used. If not, then the equipment is operated on the user's own responsibility.

The CE marking on the controller confirms that the device itself complies with the above-mentioned standards.

It does not imply, however, that the overall system also fulfils these standards.

It is the responsibility of the machine manufacturer and of the user to verify the completely installed, wired and operationally ready system in the machine with regard to its conformity with the safety provisions and the EMC directive (see also section 8.3, "Power supply"). If peripheral components (e.g. the transformer or the line filter) from other manufacturers are used, no functional guarantee can be provided by ROPEX.

2 Application

This RESISTRON temperature controller is an integral part of the "series 400", the outstanding feature of which is its microprocessor technology. All RESISTRON temperature controllers are used to control the temperature of heating elements (heatsealing bands, beaded bands, cutting wires, heatsealing blades, solder elements etc.), as required in a variety of heatsealing processes.

The controller is most commonly used for impulse-heatsealing PE and PP films in:

- Vertical and horizontal f/f/s machines
- Pouch, filling and sealing machines
- Film wrapping machines
- Pouch-making machines
- Group packaging machines
- L-sealers

- etc.

The use of RESISTRON temperature controllers results in:

- Repeatability of the heatseals under any conditions
- Increased machine capacity
- Extended life of the heatsealing bands and teflon coatings
- Simple operation and control of the sealing process

3 Principle of operation

The resistance of the heatsealing band, which is temperature-sensitive, is monitored 50x per second (60x at 60Hz) by measuring the current and voltage. The temperature calculated with the help of these measurements is displayed and compared with the set point.

The primary voltage of the impulse transformer is adjusted by phase-angle control if the measured values deviate from the set point. The resulting change in the current through the heatsealing band leads to a change in the band temperature and thus also its resistance. This change is measured and evaluated by the RESISTRON temperature controller.

The control loop is closed: ACTUAL temperature = SET temperature. Even minute thermal loads on the heatsealing band are detected and can be corrected quickly and precisely.

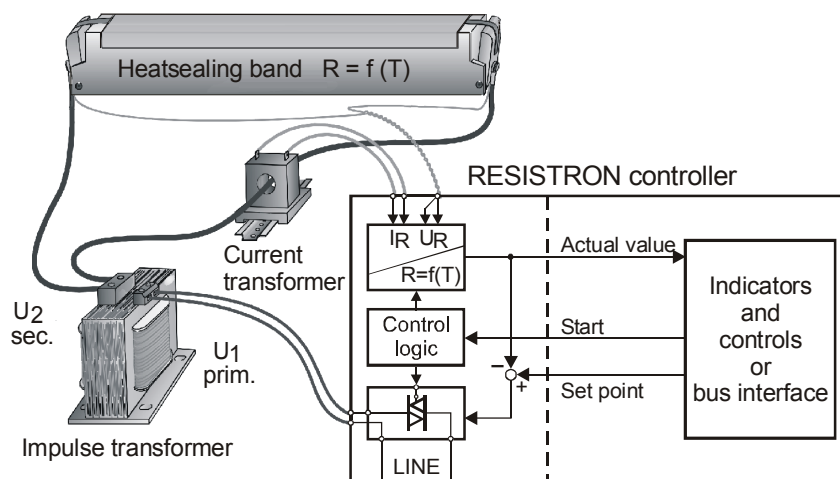
The thermoelectric control loop which is formed has a highly dynamic response because purely electrical variables are measured at a high sampling rate. A high secondary current can be controlled with only minimal power loss because power is controlled on the primary

side of the transformer. This allows optimum adaptation to the load and to the required dynamic range despite the exceptionally compact dimensions of the controller.

PLEASE NOTE!

RESISTRON temperature controllers play a significant role in enhancing the performance of modern machines. However, the full benefit can only be obtained from the advanced technology offered by this control system if all the system components, in other words the heatsealing band, the impulse transformer, the wiring, the timing signals and the controller itself, are compatible with one another.

We will be pleased to contribute our many years of experience towards optimizing your heatsealing system.



4 Description of the controller

The microprocessor technology endows the RESISTRON temperature controller RES-440 with previously unattainable capabilities:

- Very simple operation thanks to AUTOCAL, the automatic zero calibration function.
- Good dynamic response of the control system thanks to AUTOTUNE, which adapts automatically to the controlled system.
- High precision thanks to further improved control accuracy and linearization of the heatsealing band characteristic.
- High flexibility: the secondary voltage range from 1V to 120V is covered with only 3 DIP switches, with 2 DIP switches for the current range from 30A to 400A.
- Automatic adjustment to the line frequency in the range from 47Hz to 63Hz.
- Increased protection against dangerous conditions, such as overheating of the heatsealing band.

A time control (timer) function integrated in the controller enables the complete heatsealing process to be controlled on simple machines, such as table heatsealing tools. A configurable relay output can be used to drive motors, energize magnets etc.

The process data is represented on an LC display with 4 lines and 20 characters. Devices with a VF display are available as an option. Various display languages can be selected.

In addition to the digital and bar indications on the display, the ACTUAL temperature of the heatsealing band is supplied to an analog 0...10VDC output. The real heatsealing band temperature can thus be displayed on an external temperature meter (e.g. ATR-x).

The RESISTRON temperature controller RES-440 also features an integrated fault diagnosis function, which tests both the external system (heatsealing band, wiring etc.) and the internal electronics and outputs a selective error message in case of a fault.

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

The menu in the temperature controller itself can be used to adapt to different heatsealing band alloys (Alloy-20, NOREX etc.) and set the required temperature range (0...300°C, 0...500°C etc.).

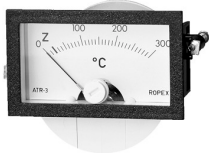
The RESISTRON temperature controller RES-440 is designed for installation in a front panel cutout. The compact design and the plug-in connections make this controller easy to install.

5 Accessories and modifications

A wide range of compatible accessories and peripheral devices are available for the RESISTRON temperature controller RES-440. They allow it to be optimally adapted to your specific heatsealing application and to your plant's design and operating philosophy.

5.1 Accessories

The products described below are only a few of the wide range of accessories available for RESISTRON temperature controllers (↪ "Accessories" leaflet).



Analog temperature meter ATR-x

For front panel mounting or mounting on a top hat rail (DIN TS35).






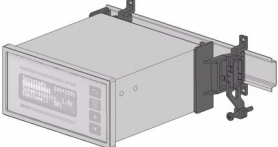


Analog indication of the ACTUAL temperature of the heatsealing band in °C. The meter damping of the unit is optimized for the abrupt temperature changes that occur in impulse mode.



Digital temperature meter DTR-x

For front panel mounting or mounting on a top hat rail (DIN TS35).

Digital indication of the ACTUAL temperature of the heatsealing band in °C, with HOLD function.

	<p>Line filter LF-xx480 Essential in order to ensure CE conformity. Optimized for the RESISTRON temperature controller.</p>
	<p>Impulse transformer ITR-x Designed according to VDE 0570/EN 61558 with a one-section bobbin. Optimized for impulse operation with RESISTRON temperature controllers. Specified according to the heatsealing application (↪ ROPEX Application Report).</p>
	<p>Booster B-xxx400 External switching amplifier, necessary for high primary currents (continuous current > 5A, pulsed current > 25A).</p>
	<p>Monitoring current transformer MSW-1 For detecting frame short-circuits on the heatsealing band. Used as an alternative to the standard PEX-W2 current transformer.</p>
	<p>Transparent front cover TFA-1 For increasing the degree of protection on the front of the controller to IP65. Also facilitates applications in the food technology sector (GMP).</p>
	<p>Adapter for top hat rail mounting, HS-Adapter-01 For mounting the RESISTRON temperature controller RES-440 on a top hat rail (DIN TS35). Allows the controller to be installed in the electrical cabinet, for instance, where it is only accessible to authorized persons.</p>
	<p>Lockable door TUER-S/K-1 Transparent door (with lock) for mounting on the bezel of the controller. The display is clearly legible at all times. The keyboard can only be operated, however, by authorized persons in possession of a key.</p>
	<p>Measurement cable UML-1 Twisted measurement cable for the U_R voltage measurement. Trailing cable, halogen and silicone-free.</p>

5.2 Modifications (MODs)

Owing to its universal design, the RESISTRON temperature controller RES-440 is suitable for a very wide range of heatsealing applications.

Modifications (MOD) are available for the RESISTRON temperature controller RES-440 for implementing special applications.

MOD 01

Amplifier for low secondary voltages ($U_R = 0.25 \dots 16 \text{VAC}$). This modification is necessary, for example, for very short or low-resistance heatsealing bands.

MOD 33

(Software revision 010 or higher)

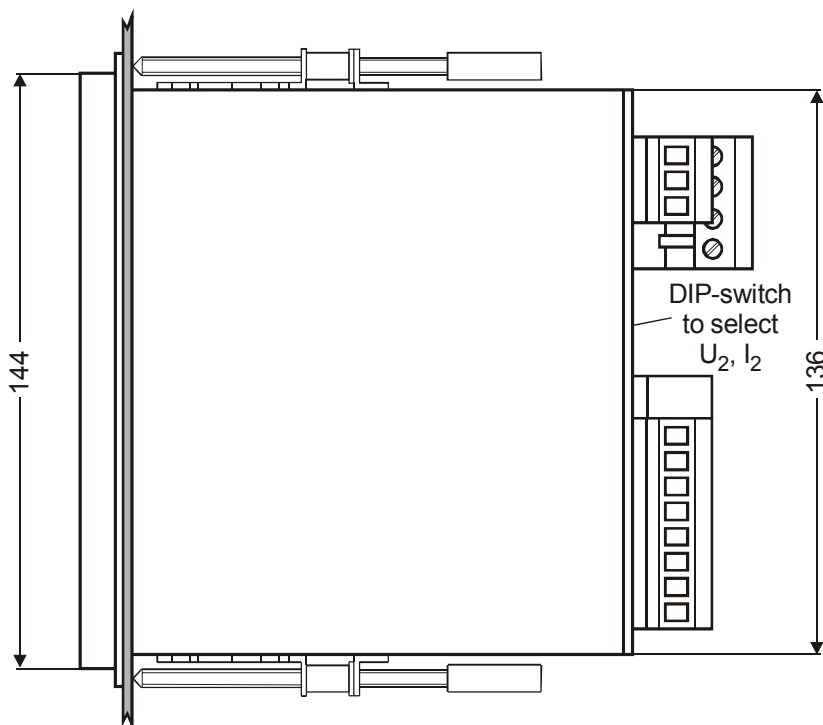
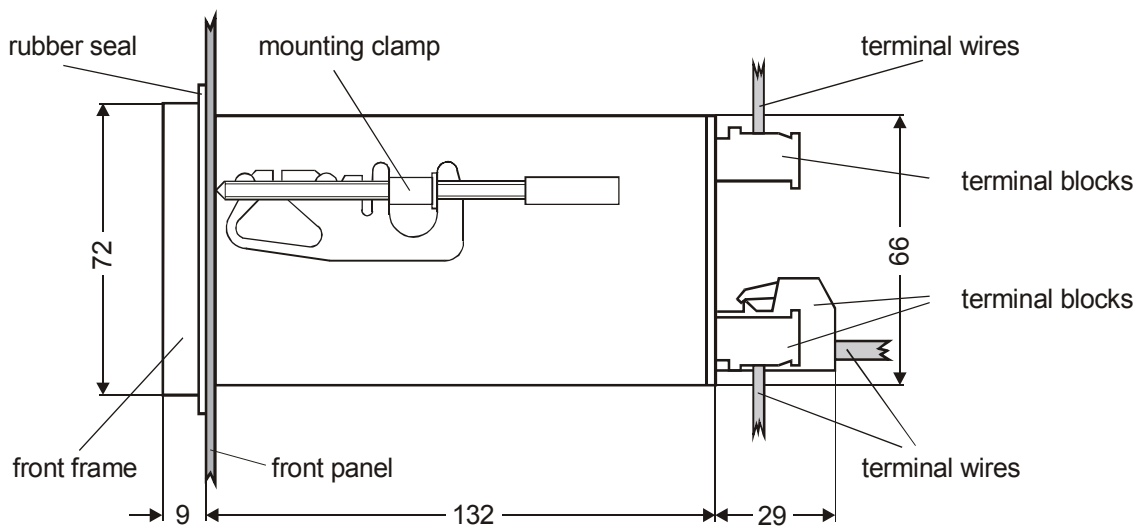
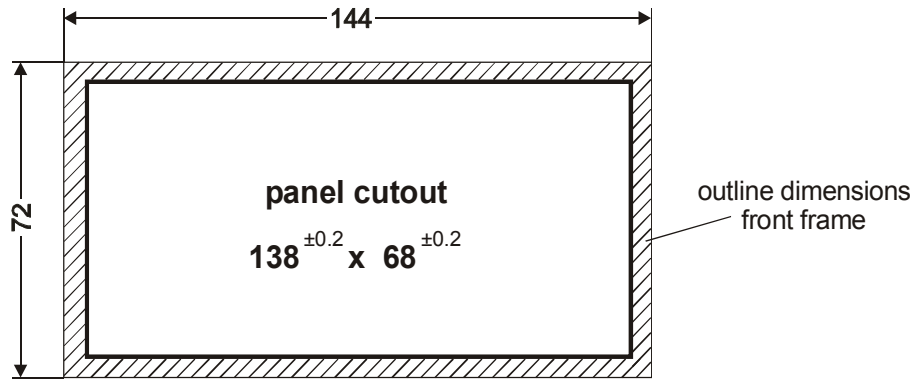
Important heatsealing process data can be output and logged via a serial RS232 interface (↪ §MOD 33" documentation).

6 Technical data

Type of construction	Housing for front panel mounting Dimensions (W x H): 144 x 72mm; depth: 161 mm (incl. terminals)
Line voltage	<p><u>All controllers manufactured as of January 2004:</u> 115VAC version: 115VAC -15%...120VAC +10% (equivalent to 98...132VAC) 230VAC version: 230VAC -15%...240VAC +10% (equivalent to 196...264VAC) 400VAC version: 400VAC -15%...415VAC +10% (equivalent to 340...456VAC)</p> <p><u>All controllers manufactured up to December 2003:</u> 115VAC, 230VAC or 400VAC, tolerance: +10% / -15%</p> <p>depending on device version (↪ Kap. 13 „How to order“ auf Seite 52)</p>
Line frequency	47...63Hz, automatic adjustment to frequencies in this range
Heatsealing band type and temperature range	<p>Several different ranges can be selected on the controller in the Configuration menu:</p> <p>Temperature coefficient 410ppm, 0...300°C (SW revision 021 or higher) Temperature coefficient 460ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 510ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 570ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 630ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 700ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 780ppm (e.g. Alloy L) 0...200°C, 0...300°C, 0...400°C, 0...500°C (SW revision 011 or higher)</p> <p>Temperature coefficient 870ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 980ppm, 0...300°C (SW revision 019 or higher) Temperature coefficient 1100ppm (e.g. Alloy 20): 0...200°C, 0...300°C, 0...400°C, 0...500°C</p> <p>Temperature coefficient 3500ppm (e.g. NOREX): 0...200°C, 0...300°C</p>
Set point selection	Via the Settings menu in the controller
Analog output (actual value) Terminals 23+24	0...10VDC, $I_{max} = 5\text{mA}$ Equivalent to 0...300°C or 0...500°C
Digital logic levels Terminals 3, 4, 22	LOW (0V): 0...2VDC HIGH (24VDC): 12...30VDC (max. current input 6mA) Electrically isolated, reverse polarity-protected
START with contact Terminals 2+7	Switching threshold: 3.5VDC, $U_{max} = 5\text{VDC}$, $I_{max} = 5\text{mA}$
Switching output for "Temp. OK" signal Terminals 20+21	$U_{max} = 30\text{VDC}$, $I_{max} = 50\text{mA}$ $U_{ON} < 2\text{V}$ (saturation voltage) Transistor conductive if the temperature is inside the tolerance band.
Alarm relay Terminals 5+6	Contact, potential-free, $U_{max} = 50\text{VDC}$, $I_{max} = 0.2\text{A}$
Relay K1 Terminals 16, 17, 18	Changeover contact, potential-free, $U_{max} = 240\text{VAC}/100\text{VDC}$, $I_{max} = 1.5\text{A}$ Interference suppression with 47nF / 560ohms for each terminal

Maximum load (primary current of impulse transformer)	$I_{\max} = 5\text{ A}$ (duty cycle = 100%) $I_{\max} = 25\text{ A}$ (duty cycle = 20%)
Display	LC display (green), 4 lines, 20 characters, alternatively: VF display (blue), 4 lines, 20 characters
Ambient temperature	+5...+45°C
Degree of protection	Front: IP42 (IP65 with transparent front cover, Art. No. 887000) Back: IP20
Installation	Installed in front panel cutout with (W x H) $138^{(+0.2)} \times 68^{(+0.2)}\text{ mm}$ Fastened with clips
Weight	Approx. 1.0kg (incl. connector plug-in parts)
Housing material	Black plastic, type Noryl SE1 GFN2
Connecting cable Type / cross-sections	Rigid or flexible; $0.2 \dots 2.5\text{ mm}^2$ (AWG 24...12) Plug-in connectors

7 Dimensions/front panel cutout



8 Installation

↪ See also Kap. 1 „Safety and warning notes“ auf Seite 3.

⚠ Installation and startup may only be performed by technically trained, skilled persons who are familiar with the associated risks and warranty provisions.

8.1 Installation procedure

Proceed as follows to install the RESISTRON temperature controller RES-440:

1. Switch off the line voltage and verify that all circuits are deenergized.
2. The supply voltage specified on the nameplate of the RESISTRON temperature controller must be identical to the line voltage that is present in the plant or machine. The line frequency is

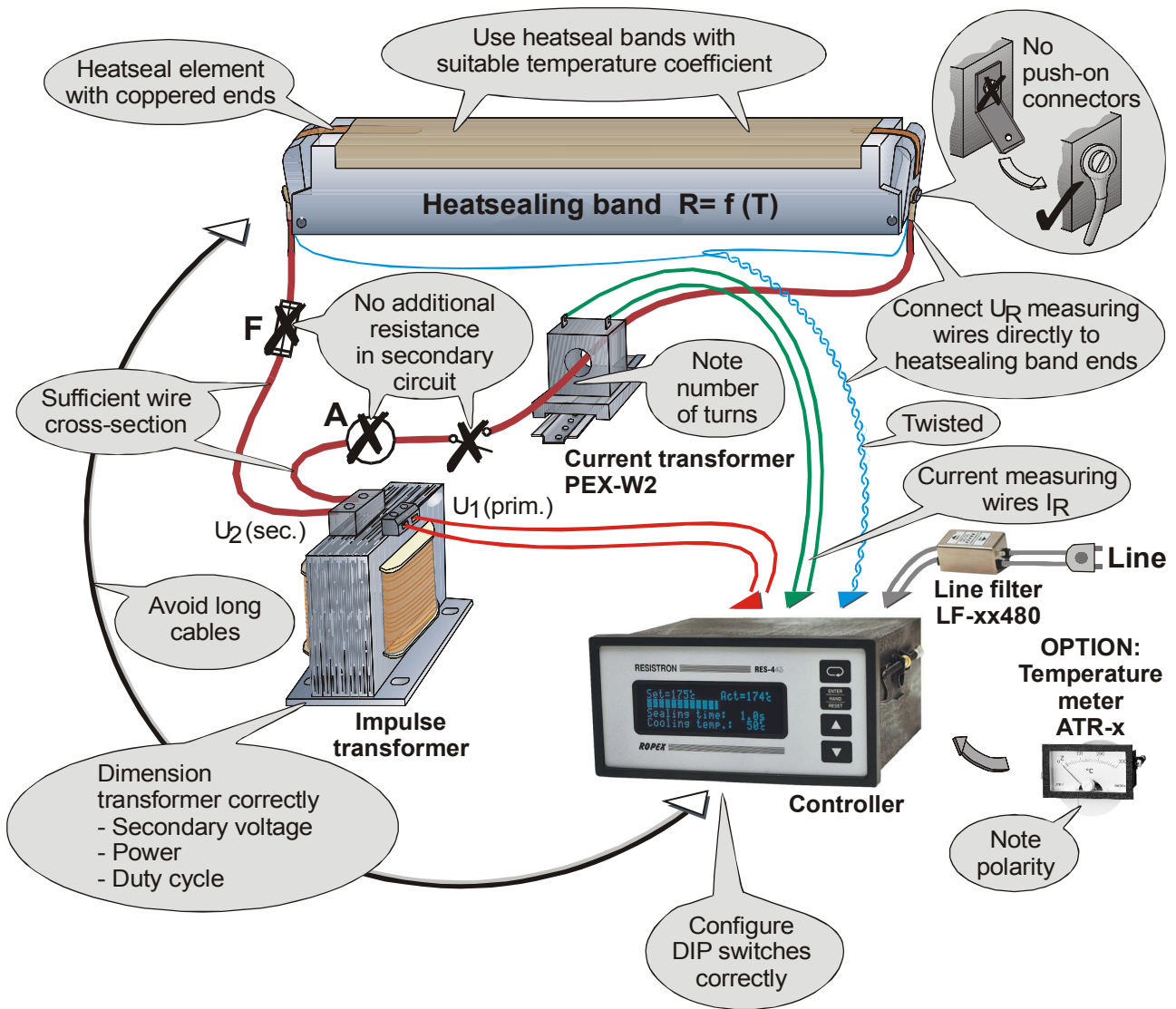
automatically detected by the temperature controller in the range from 47Hz to 63Hz.

3. Install the RESISTRON temperature controller in the front panel cutout. It is fastened by means of two clips which snap onto the side of the controller housing.
4. Wire the system in accordance with the instructions in Kap. 8.3 „Power supply“ auf Seite 14, Kap. 8.6 „Wiring diagram (standard)“ auf Seite 16 and the ROPEX Application Report. The information provided in Kap. 8.2 „Installation steps“ auf Seite 13 must be heeded additionally.

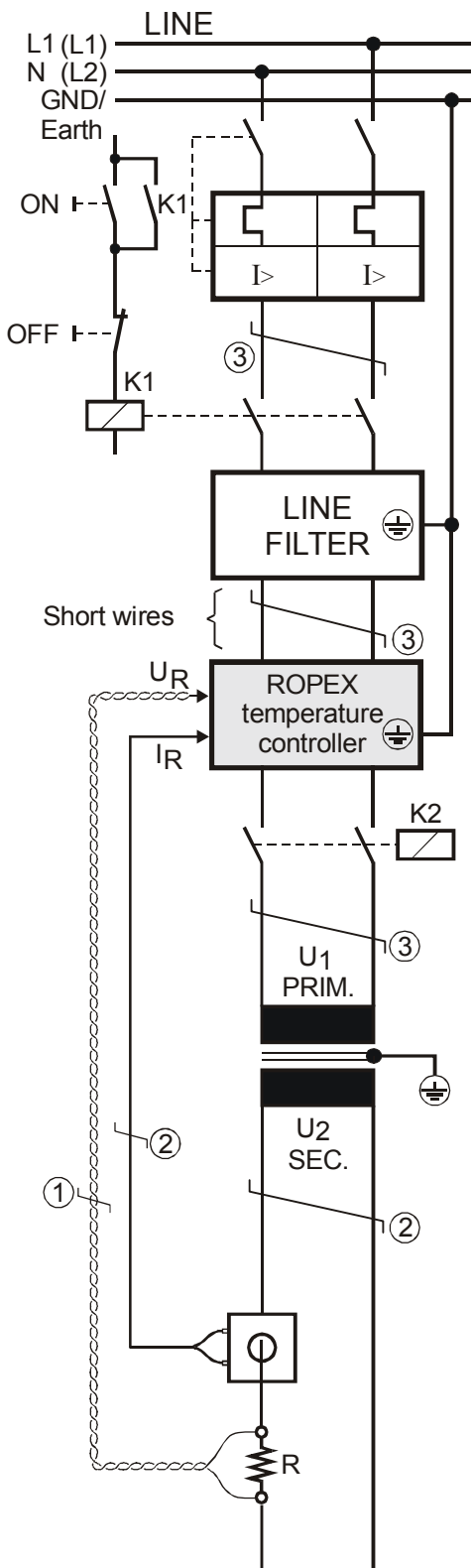
⚠ Check the tightness of all the system connections, including the terminals for the impulse transformer windings.

5. Make sure that the wiring conforms to the relevant national and international installation regulations.

8.2 Installation steps



8.3 Power supply



Line

115VAC, 230VAC, 400VAC

Circuit breaker

Double-pole, Z characteristic

Rated current: 16A, e.g. ABB-STOTZ, Type S282-Z16 (for all applications)

⚠ Short-circuit protection only.

RESISTRON temperature controller not protected.

Relay K1

For "HEAT ON - OFF" function (all-pole) or "EMERGENCY STOP".

Line filter

The filter type and size must be determined according to the load, the transformer and the machine wiring (☞ ROPEX Application Report).

⚠ Do not lay the filter supply wires (line side) parallel to the filter output wires (load side).

RESISTRON temperature controller belonging to the "series 4xx".

Relay K2

Load break (all-pole), e.g. in combination with the alarm output of the temperature controller.

Impulse transformer

Designed according to VDE 0570/EN 61558 (isolating transformer with reinforced insulation). Connect core to ground.

⚠ Use transformers with a one-section bobbin. The power, duty cycle and voltage values must be determined individually according to the application (☞ ROPEX Application Report and "Accessories" leaflet for impulse transformers).

Wiring

The wire cross-sections depend on the application (☞ ROPEX Application Report).

Guide values:

Primary circuit: min. 1.5mm², max. 2.5mm²

Secondary circuit: min. 4.0mm², max. 25mm²

① These wires must always be twisted (>20/m)

② These wires must be twisted (>20/m) if several control loops are laid together ("crosstalk").

③ Twisting (>20/m) is recommended to improve EMC.

8.4 Line filter

To comply with EMC directives – corresponding to EN 50081-1 and EN 50082-2 – RESISTRON control loops must be operated with line filters. These filters damp the reaction of the phase-angle control on the line and protect the controller against line disturbances.

! The use of a suitable line filter is part of the standards conformity and a prerequisite of the CE mark.

and wired correctly, they guarantee compliance with the EMC limit values.

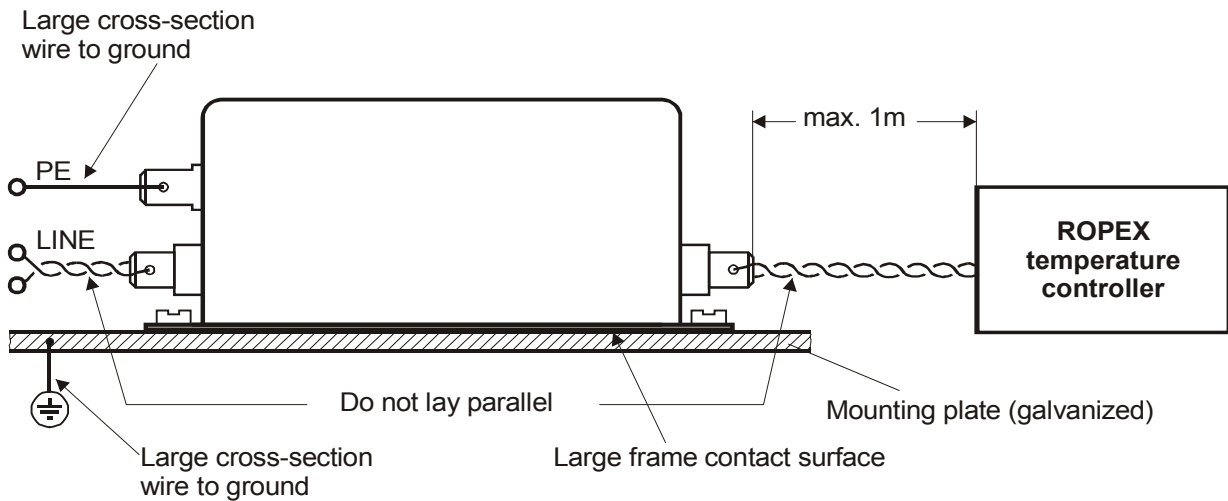
You can find the exact specification of the line filter in the ROPEX Application Report calculated for your particular heatsealing application.

For more technical information: ↪ "Line filter" documentation.

! It is permissible to supply several RESISTRON control loops with a single line filter, providing the total current does not exceed the maximum current of the filter.

ROPEX line filters are specially optimized for use in RESISTRON control loops. Providing they are installed

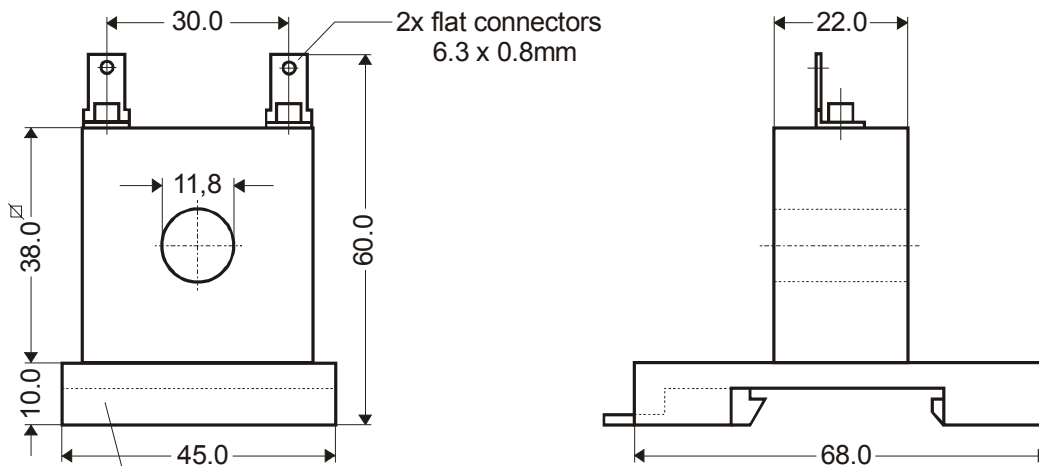
The wiring instructions contained in section 8.3 "Power supply" on page 14 must be observed.



8.5 Current transformer PEX-W2

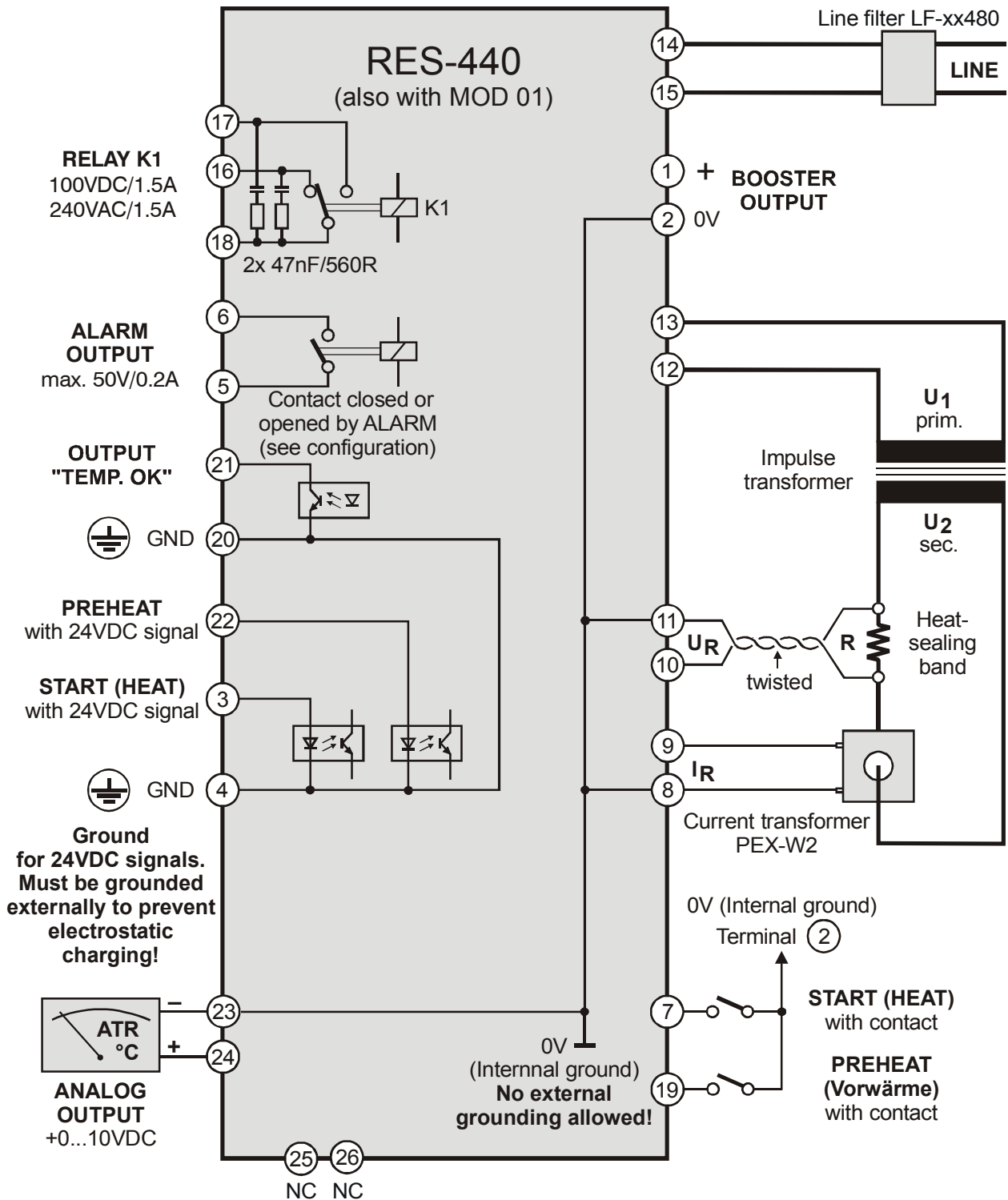
The PEX-W2 current transformer supplied with the RESISTRON temperature controller is an integral part

of the control system. The current transformer may only be operated if it is connected to the temperature controller correctly (↪ section 8.3 "Power supply" on page 14).



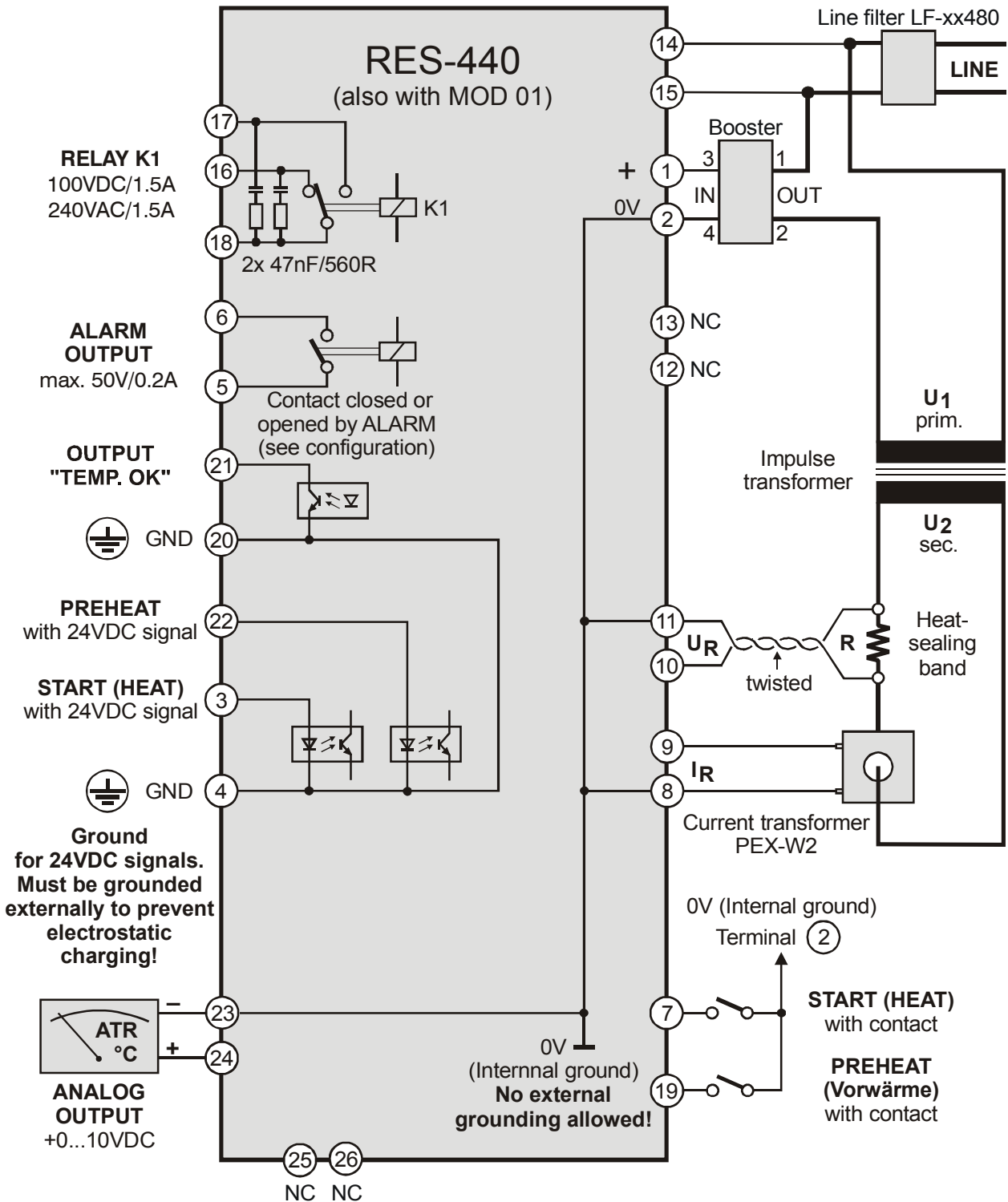
Snap-on plate for top hat rail (DIN TS35 rail), 35 x 7.5mm or 35 x 15mm, acc. DIN EN 50022

8.6 Wiring diagram (standard)



⚠ Terminals 19, 25 and 26 are only available in devices supplied after October 2002.

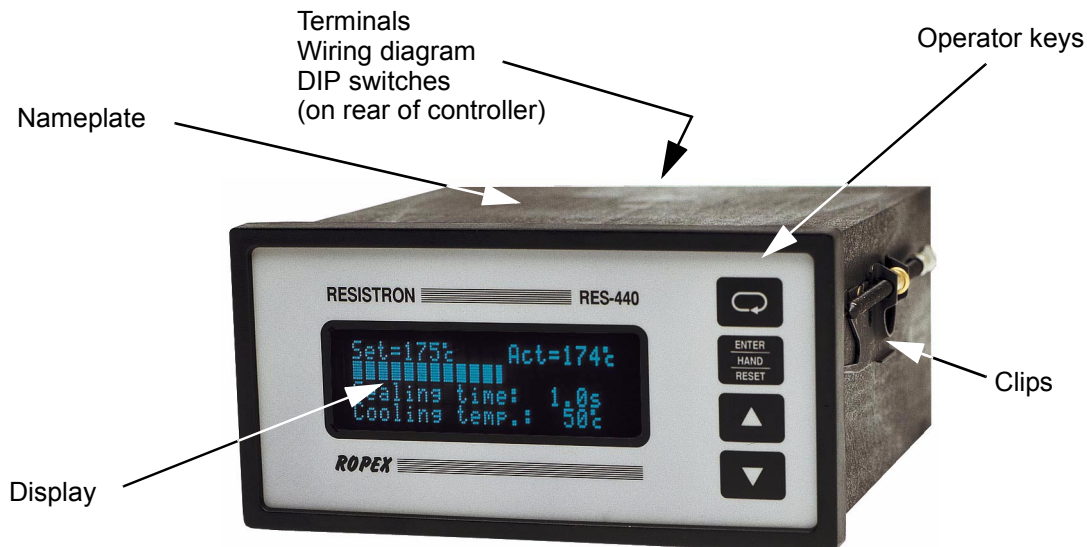
8.7 Wiring diagram with booster connection



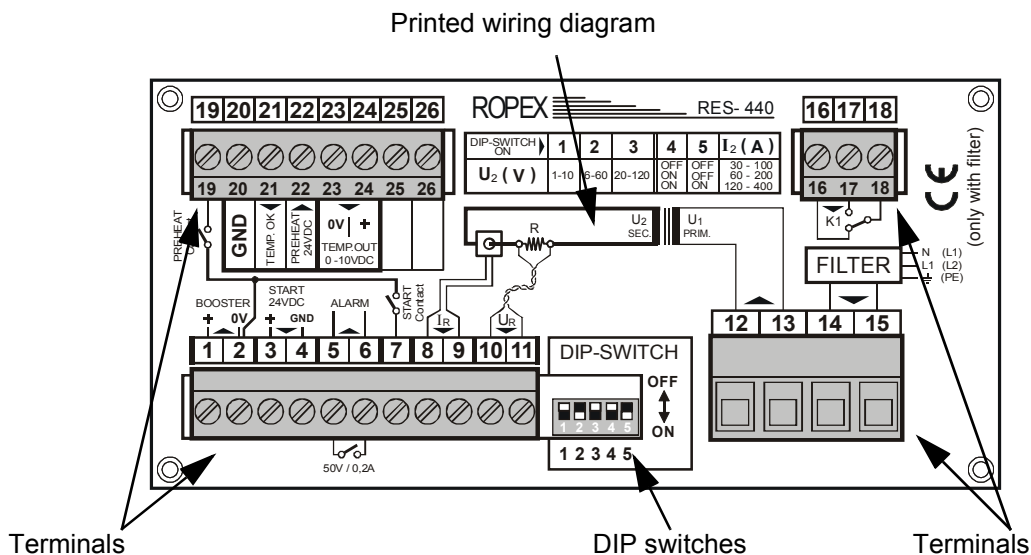
! Terminals 19, 25 and 26 are only available in devices supplied after October 2002.

9 Startup and operation

9.1 Front view of the controller



9.2 Rear view of the controller



Terminals 19, 25 and 26 are only available in devices supplied after October 2002.

Kap. 9.5.1 „Initial startup“ auf Seite 21 to start up the controller for the first time.

9.3 Controller configuration

The possible controller configurations are explained in the following sections. Proceed as described in

9.3.1 Configuration of the DIP switches for secondary voltage and current



The controller must be switched off in order to configure the DIP switches.

Set the DIP switches for matching the secondary voltage U_2 and the secondary current I_2 to the correct position for **your** application.

! You can find the exact configuration of the DIP switches in the ROPEX Application Report calculated for your particular application.

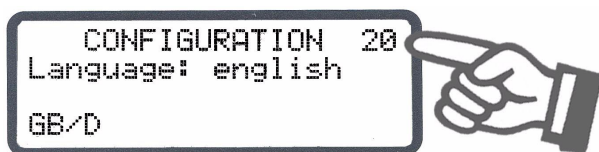
U_2	DIP switch			I_2	DIP switch	
	1	2	3		4	5
1...10V	ON	OFF	OFF	30...100A	OFF	OFF
6...60V	OFF	ON	OFF	60...200A	ON	OFF
20...120V	OFF	OFF	ON	120...400A	ON	ON

If the secondary current I_2 is less than 30A, the PEX-W2 current transformer must have two turns (↪ ROPEX Application Report).



9.3.2 Setting the language

The menu language can be changed on the controller without interrupting operation. It is set with step 20 in the Configuration menu:



The following settings are possible:
 English, German, Italian
 SW revision 015 or higher also:
 French, Spanish, Dutch, Danish, Finnish, Swedish, Greek, Turkish.
 SW revision 024 or higher also: Portuguese.

! The language which is selected in this menu remains set even if the factory settings are restored (step 21 in the Configuration menu).

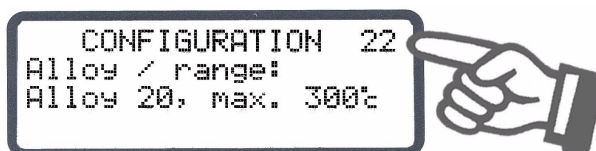
9.3.3 Restoring the factory settings

The internal controller settings can be reset to the factory settings with step 21 in the Configuration menu. Only the language setting (step 20 in the Configuration menu) remains unchanged. Please refer to Kap. 11 „Factory settings“ auf Seite 50 for more information about the factory settings.

! If the controller settings are unknown when it is started up for the first time, the factory settings must be restored in order to prevent malfunctions.

9.3.4 Configuration of the alloy and the temperature range

These parameters are set with step 22 in the Configuration menu:




Several different ranges can be selected:

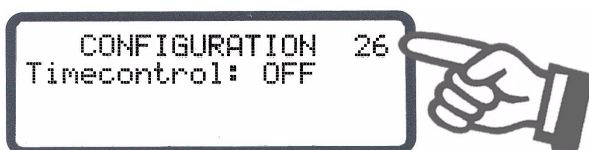
1. **Temperature coefficient 410ppm, 0...300°C** (software revision 021 or higher)
2. **Temperature coefficient 460ppm, 0...300°C** (software revision 019 or higher)
3. **Temperature coefficient 510ppm, 0...300°C** (software revision 019 or higher)

4. **Temperature coefficient 570ppm, 0...300°C**
(software revision 019 or higher)
5. **Temperature coefficient 630ppm, 0...300°C**
(software revision 019 or higher)
6. **Temperature coefficient 700ppm, 0...300°C**
(software revision 019 or higher)
7. **Temperature coefficient 780ppm, 0...200°C**
(e.g. Alloy L, software revision 011 or higher)
8. **Temperature coefficient 780ppm, 0...300°C**
(e.g. Alloy L, software revision 011 or higher)
9. **Temperature coefficient 780ppm, 0...400°C**
(e.g. Alloy L, software revision 011 or higher)
10. **Temperature coefficient 780ppm, 0...500°C**
(e.g. Alloy L, software revision 011 or higher)
11. **Temperature coefficient 870ppm, 0...300°C**
(software revision 019 or higher)
12. **Temperature coefficient 980ppm, 0...300°C**
(software revision 019 or higher)
13. **Temperature coefficient 1100ppm, 0...200°C**
(e.g. Alloy-20)
14. **Temperature coefficient 1100ppm, 0...300°C (•)**
(e.g. Alloy-20)
15. **Temperature coefficient 1100ppm, 0...400°C**
(e.g. Alloy-20)
16. **Temperature coefficient 1100ppm, 0...500°C**
(e.g. Alloy-20)
17. **Temperature coefficient 3500ppm, 0...200°C**
(e.g. NOREX)
18. **Temperature coefficient 3500ppm, 0...300°C**
(e.g. NOREX)

9.3.5 Configuration of the timer function

 The necessary controller settings are explained in the detailed functional descriptions in Kap. 10.5 „Menu steps“ auf Seite 28 and Kap. 10.18 „Time control (timer function)“ auf Seite 40. They are only allowed to be entered by technically trained persons.

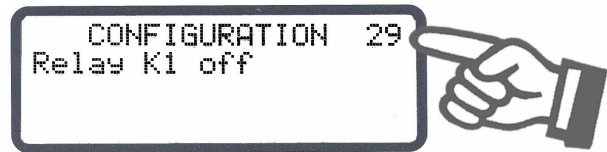
The timer function is activated with step 26 in the Configuration menu:



(•) Factory setting

9.3.6 Relay K1 (without time control)

The function of relay K1 is specified with step 29 in the Configuration menu:



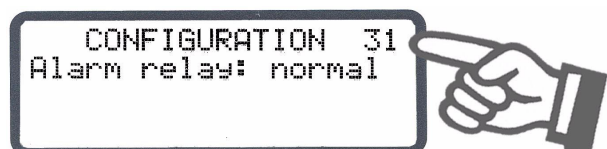
The following settings are possible when time control is deactivated:

1. **"Off"(••)**
Relay K1 has no function
2. **"Active if Tact = Tset"**
Relay K1 is switched according to the "Temperature OK" signal. This relay thus has the same function as the output at terminals 20+21 (☞ Kap. 10.11 „Temperature OK" signal“ auf Seite 37).

Other settings are available in this menu when time control (timer function) is active. They are described in Kap. 10.18.7 „Relay K1 (with time control)“ auf Seite 43.

9.3.7 Configuration of the alarm relay

The alarm relay is set with step 31 in the Configuration menu:



There are two possible settings:

1. **"Normal" (•)**
Alarm relay contact closed by alarm
2. **"Inverse"**
Alarm relay contact opened by alarm

9.4 Heatsealing band

9.4.1 General

The heatsealing band is a key component in the control loop, since it is both a heating element and a sensor. The geometry of the heatsealing band is too complex to

(••)Factory setting

be discussed at length here. We shall therefore only refer to a few of the most important physical and electrical properties:


The measuring principle applied for this system necessitates a heatsealing band alloy with a suitable temperature coefficient TCR, i.e. one whose resistance increases as the temperature rises.

Too low a TCR leads to oscillation or uncontrolled heating.

When heatsealing bands with a higher TCR are used, the controller must be calibrated for this.

The first time the heatsealing band is heated to approximately 200...250°C, the standard alloy undergoes a once-only resistance change (burn-in effect). The cold resistance of the heatsealing band is reduced by approximately 2...3%. However, this at first glance slight resistance change results in a zero point error of 20...30°C. The zero point must therefore be corrected after a few heating cycles (↳ Kap. 9.4.2 „Burning in the heatsealing band“ auf Seite 21).

One very important design feature is the copper or silver-plating of the heatsealing band ends. Cold ends allow the temperature to be controlled accurately and increase the life of the teflon coating and the heatsealing band.

 **An overheated or burned-out heatsealing band must no longer be used because the TCR has been altered irreversibly.**


9.4.2 Burning in the heatsealing band

If a new heatsealing band has been used, the zero point is first of all calibrated while the band is still cold by activating the "AUTOCAL" function on the controller. When the "AUTOCAL" function has finished, the controller outputs the preselected calibration temperature (default value: 20°C). Adjust the set point to approximately 250°C and press the "HAND" key (display in home position) to heat for approximately 1 second. After recooling, the controller usually indicates a value less than 20°C. Repeat the "AUTOCAL" function. The heatsealing band has now been burned in and the change in the alloy properties stabilized.

The burn-in effect described here does not occur if the heatsealing band has already been thermally pretreated by the manufacturer.

9.4.3 Replacing the heatsealing band


All power supply leads must be disconnected from the RESISTRON temperature controller in order to replace the heatsealing band.

 **The heatsealing band must be replaced in accordance with the instructions provided by the manufacturer.**

Each time the heatsealing band is replaced, the zero point must be calibrated with the AUTOCAL function while the band is still cold, in order to compensate production-related resistance tolerances. The burn-in procedure described above must be performed for all new heatsealing bands.

9.5 Startup procedure

Please also refer to Kap. 1 „Safety and warning notes“ auf Seite 3 and Kap. 2 „Application“ auf Seite 4.

 **Installation and startup may only be performed by technically trained, skilled persons who are familiar with the associated risks and warranty provisions.**

9.5.1 Initial startup

Prerequisites: The controller must be correctly installed and connected (↳ Kap. 8 „Installation“ auf Seite 12).

The possible settings are described in detail in Kap. 9.3 „Controller configuration“ auf Seite 18 and Kap. 10 „Controller functions“ auf Seite 23.

The essential controller configurations are described below:

1. Switch off the line voltage and verify that all circuits are deenergized.
2. The supply voltage specified on the nameplate of the controller must be identical to the line voltage that is present in the plant or machine. The line frequency is automatically detected by the temperature controller in the range from 47 to 63Hz.
3. The settings of the DIP switches on the controller depend on the ROPEX Application Report and the heatsealing band that is used (Kap. 9.3 „Controller configuration“ auf Seite 18).
4. Make sure that a START signal is not present.
5. Switch on the line voltage.
6. A power-up message appears on the display for approximately 2 seconds when the controller is switched on to indicate that it has been started up correctly.

7. One of the following states then appears:

DISPLAY	ACTION
Main menu	Go to 8
Alarm signal with error codes 104...106, 111...113, 211	Go to 8
Alarm signal with error codes 101...103, 107, 108, 201...203, 801, 9xx	Fault diagnosis (↪ 10.20)

8. Set the controller configuration as described in Kap. 9.3 „Controller configuration“ auf Seite 18. The following settings are always required:

Setting	Step in Configuration menu
Language	20
Restore factory settings	21
Temperature range and heatsealing band alloy	22

9. Activate the AUTOCAL function while the heatsealing band is still cold (with step 7 in the Settings menu). The progress of the calibration process is indicated by a counter on the display (approx. 10...15s). A voltage of 0VDC appears at the same time at the actual value output (terminals 23+24). If an ATR-x is connected, it indicates 0°C. When the zero point has been calibrated, the display is reset to the home position and 20°C is indicated as the actual value. A voltage of 0.66VDC (for the 300°C range) or 0.4VDC (for the 500°C range, equivalent to 20°C, appears at the actual

9.5.2 Restart after replacing the heatsealing band

To replace the heatsealing band, proceed as described in Kap. 9.4 „Heatsealing band“ auf Seite 20.

value output. If an ATR-x is connected, it must be set to "Z" (20°C).

If the zero has not been calibrated successfully, an alarm signal indicates error codes 104...106, 211. In this case the controller configuration is incorrect (↪ Kap. 9.3 „Controller configuration“ auf Seite 18 and ROPEX Application Report). Repeat the zero point calibration after the controller has been configured correctly.

10. When the zero point has been calibrated successfully, the main menu appears on the display again. Then specify a defined temperature (heatsealing temperature) with step 1 in the Settings menu and activate the "START" signal (HEAT). Alternatively, a heatsealing process can be started by pressing the "HAND" key (display in home position). The indication of the ACTUAL temperature on the display (digital value and dynamic bar) permits the heating and control process to be monitored.

The controller is functioning correctly if the temperature indicated on the display has a continuous curve, in other words it must not jump abruptly, fluctuate or deviate temporarily in the wrong direction. This kind of behavior would indicate that the U_R measuring wire has been laid incorrectly. If an error code is displayed, please proceed as described in Kap. 10.20 „Error messages“ auf Seite 47.

11. Burn in the heatsealing band (↪ Kap. 9.4 „Heatsealing band“ auf Seite 20) and repeat the AUTOCAL function.

The controller is now ready

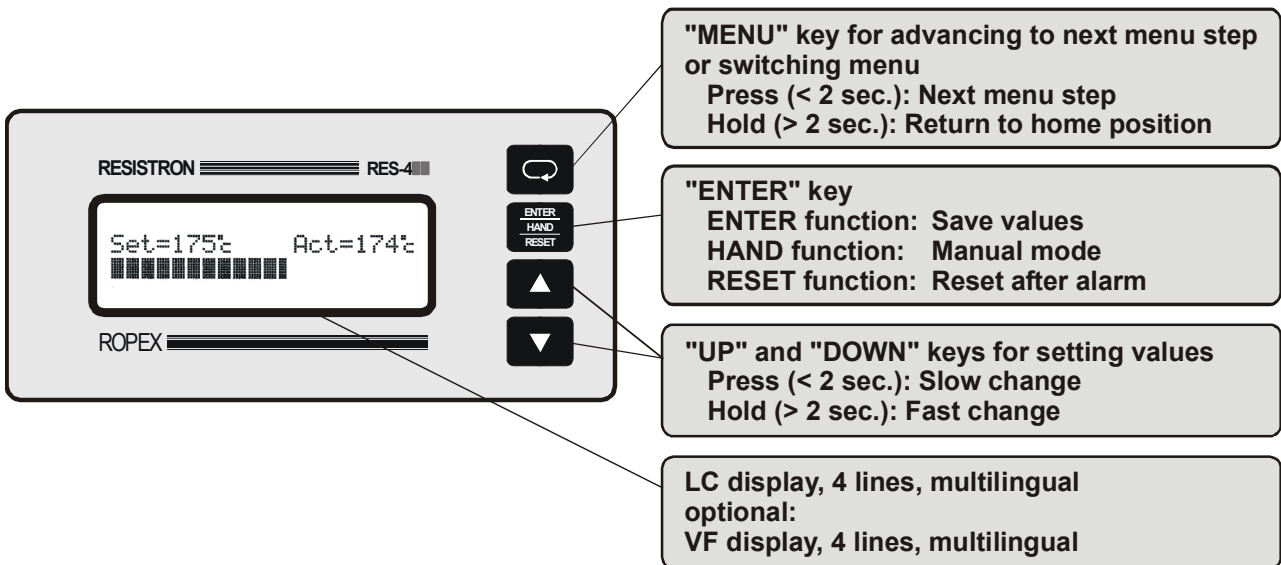
 **Always use a heatsealing band with the correct alloy, dimensions and copper-plating in order to avoid malfunctions and overheating.**

Continue with section 9.5.1, steps 9 and 10.

10 Controller functions

See also Kap. 8.6 „Wiring diagram (standard)“ auf Seite 16.

10.1 Indicators and controls

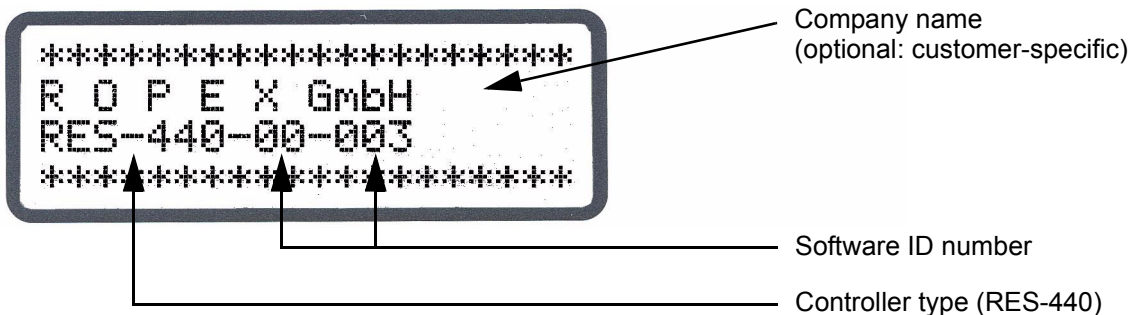


10.2 Display

switched on. This message also includes details of the software version.

10.2.1 Power-up message

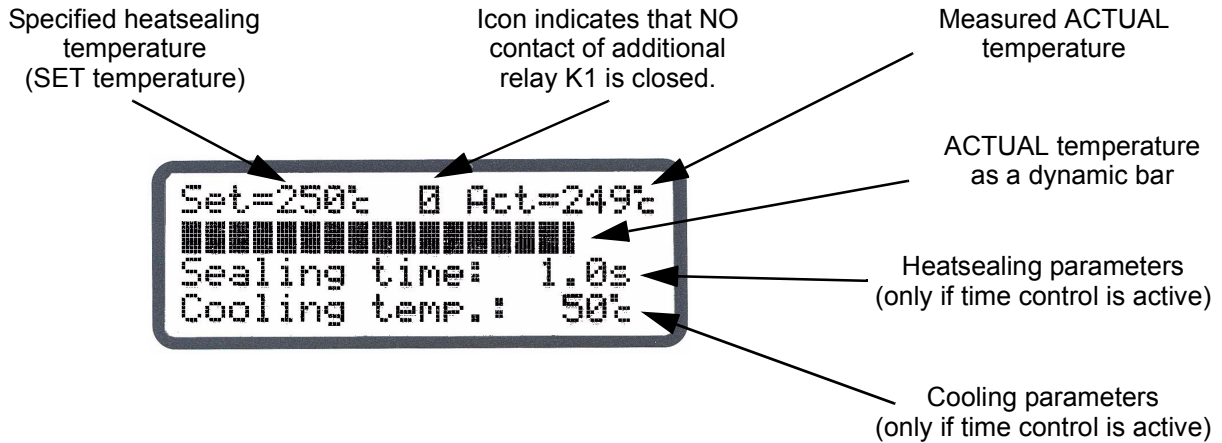
A power-up message appears on the display for approximately 2 seconds when the controller is



10.2.2 Display in home position

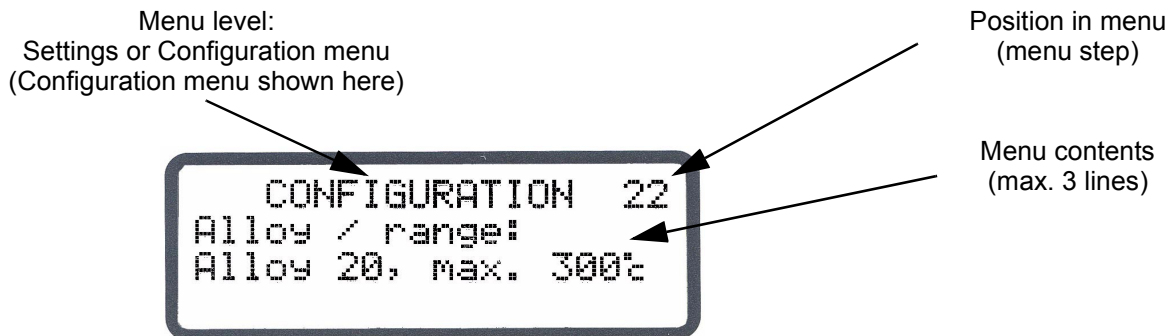
If no settings are entered on the controller and no alarm signals are present, the display is in the home position, in other words it indicates the SET temperature as a

digital value and the ACTUAL temperature as a digital value and a dynamic bar. If time control (timer function) is active, the time control settings are also displayed.



10.2.3 Settings/Configuration menus

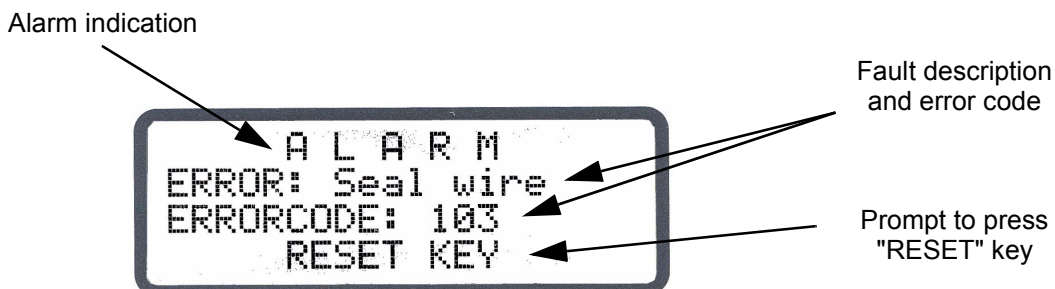
The required parameters are set on two menu levels: the Settings (control) menu and the Configuration menu (↳ Kap. 10.4 „Menu structure“ auf Seite 27).



10.2.4 Alarm signals

The fault diagnosis function of the controller is always active. If a fault is detected, it is indicated on the display

immediately in the form of an alarm signal (↳ Kap. 10.19 „System monitoring/alarm output“ auf Seite 46).



10.3 Navigation in the menus

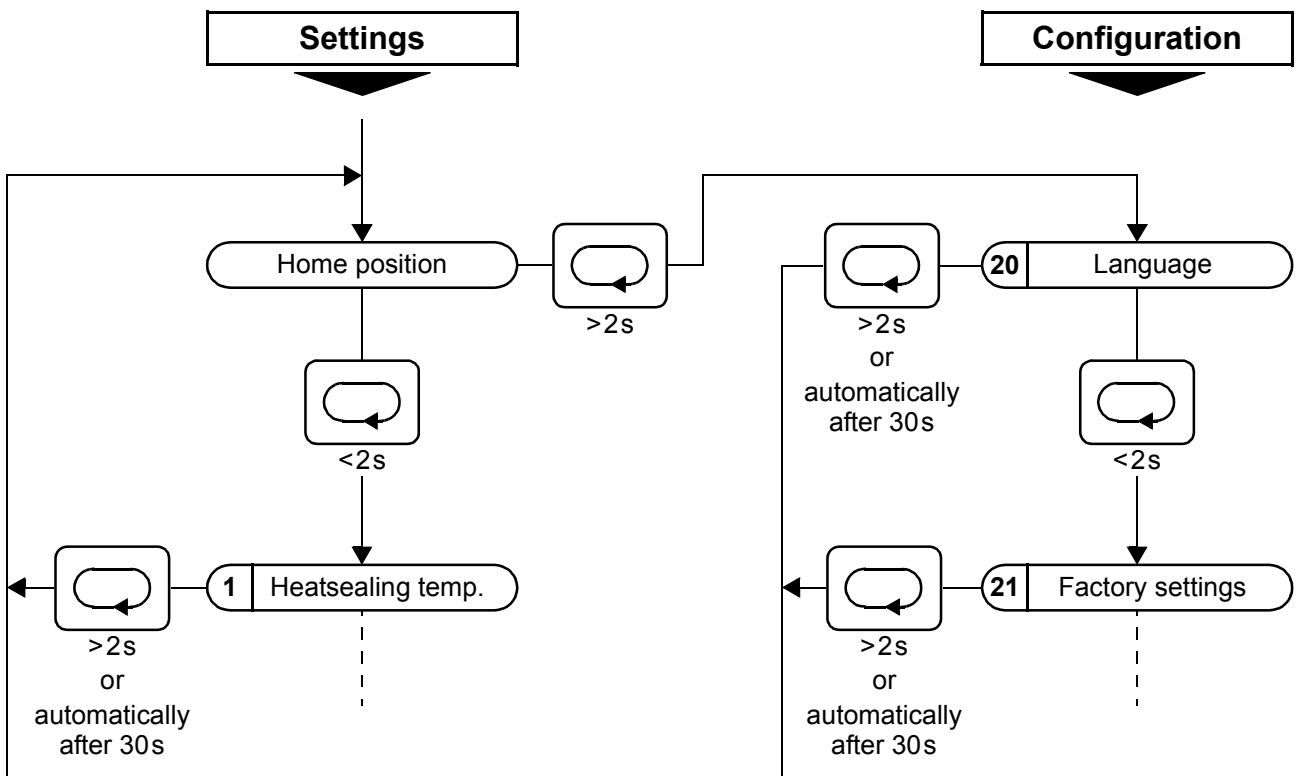
10.3.1 Navigation in menus without an alarm

A "MENU" key is provided for navigating through the various menu steps and levels. By pressing this key briefly (<2s) at any time, you can jump to the next menu step. By pressing the key for longer (>2s), you can return to the home position from anywhere in the menu

structure, providing a controller alarm is not active. In this case, the Alarm menu is opened instead.

If the display is in the home position or an alarm is indicated and you press the "MENU" key for longer than 2s, you are taken directly to the configuration level (starting at step 20).

In addition, you always return to the home position if you do not press any keys for a period of 30s. There is no automatic return after 30s from "AUTOCAL" or "Alarm".



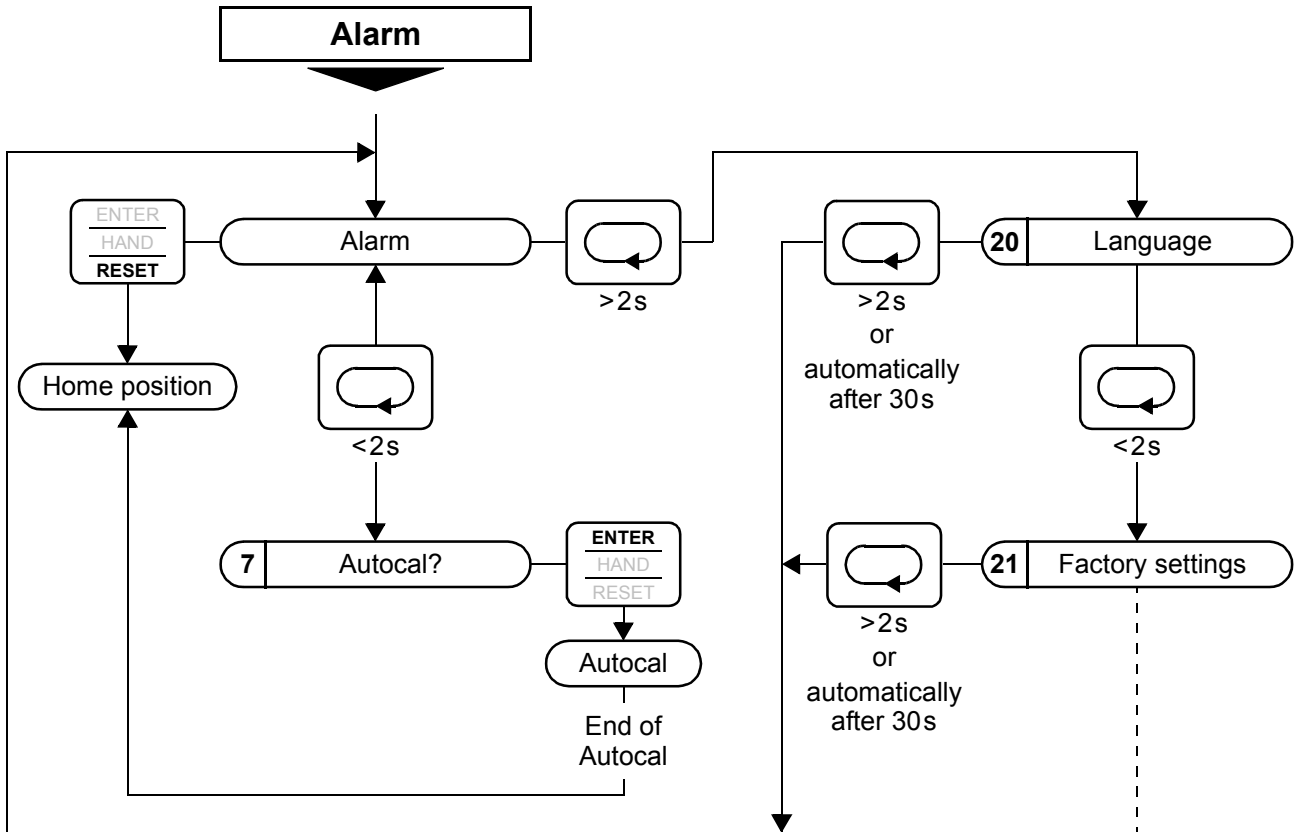
10.3.2 Navigation in menus with an alarm

If an alarm is signaled, the controller switches to the Alarm menu. Some faults can be acknowledged by pressing the "RESET" key (↵ Kap. 10.19 „System monitoring/alarm output“ auf Seite 46). In this case, the controller switches back to the home position.

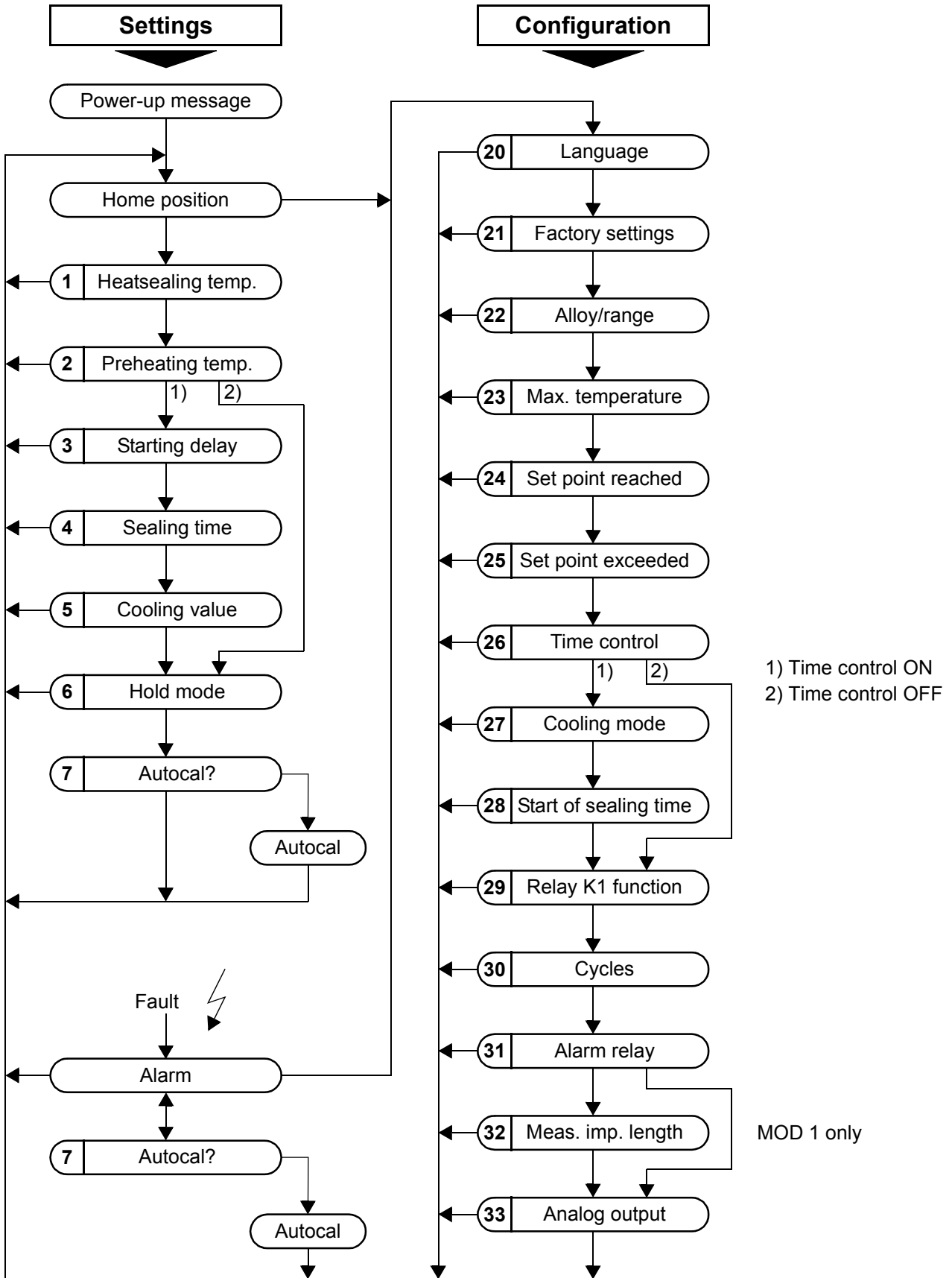
If the fault can be rectified by executing the AUTOCAL function, you can select the "AUTOCAL" menu step directly by briefly pressing the "MENU" key (<2s). You

can then activate the "AUTOCAL" function by pressing the "ENTER" key (↵ Kap. 10.8 „Automatic zero calibration (AUTOCAL)“ auf Seite 34).

If you press the "MENU" key for longer than 2s in the Alarm menu, you are taken directly to the configuration level (starting at step 20). You can return from the Configuration menu to the Alarm menu either by pressing the "MENU" key for longer than 2s or by not pressing any keys for 30s.




10.4 Menu structure



10.5 Menu steps

No.	Name	Description	Setting range
	Home position	The specified set value and the current actual value are displayed in digital form. The actual value is also represented as a dynamic bar. If time control (step 26) is active, the heatsealing time and the cooling value are also displayed. The heatsealing band can be heated manually (to the specified heatsealing temperature) by pressing the "HAND" key.	
1	Heatsealing temperature	The required heatsealing temperature (set point) can be set with the "UP" and "DOWN" keys. The maximum selectable set point can be limited with step 22 (alloy/range) and step 23 (max. temperature). The set point is indicated in the home position.	Depends on setting of step 22: 0, 40°C...maximum temperature (step 23)
2	Preheating temperature	The required preheating temperature can be set with the "UP" and "DOWN" keys. The maximum temperature (step 23) applies to both the heatsealing temperature and the preheating temperature. The preheating function can be deactivated by entering 0°C.	Depends on setting of step 22: 0, 40°C...maximum temperature (step 23)
3	Starting delay	This option allows the heatsealing time to be preceded by a starting delay. This delay time begins as soon as the start signal is applied. When it elapses, the heatsealing time is activated. This function can only be selected if time control (step 26) is active.	0...9.9s
4	Heatsealing time	The length of the heatsealing pulse can be set with the "UP" and "DOWN" keys. The specified heatsealing time is indicated in the home position. This function can only be selected if time control (step 26) is active.	0...99.9s, EXT

No.	Name	Description	Setting range
5	Cooling value	<p>The cooling value can be specified here according to the cooling mode (absolute, relative, time) selected with step 27.</p> <ul style="list-style-type: none"> • Absolute: The cycle ends if the "cooling temperature" falls below the set value (in °C). • Relative: The cycle ends if the "cooling temperature" falls below the set percentage value, whereby 100% corresponds to the specified set point (step 1). • Time: The cycle ends when the set "cooling time" in seconds has elapsed. The current cooling value is indicated in the home position. <p>This function can only be selected if time control (step 26) is active.</p>	<p>50°C to maximum temperature (step 23)</p> <p>40%...100%</p> <p>0...99.9s</p>
6	Hold mode	<p>If the "Hold" function is activated, the last measured value at the end of the heating phase is stored and displayed.</p> <p>The "ACT" (actual value) information in the home position is replaced by "Hold". This procedure is repeated for every cycle and the displayed value is updated. The word "Hold" is invisible for 100ms before the value is updated.</p> <p>If you select the "2 second hold" function, the display changes back from hold mode to the actual value in real time after 2 seconds. The hold function is then activated again for 2 seconds at the end of the next cycle.</p>	<p>ON</p> <p>OFF</p> <p>2 s</p>
7	Autocal	<p>The AUTOCAL function matches the controller to the current and voltage signals that are present in the system.</p> <p>The required calibration temperature can be set with the "UP" and "DOWN" keys. Pressing the "ENTER" key stores the set value and starts the "AUTOCAL" function.</p> <p>The word "- Calibration -" appears on the display while the AUTOCAL function is executing and a counter counts down from 13 to 0. When the controller has been calibrated successfully, the display switches back directly to the home position.</p> <p>If the controller cannot be calibrated, the AUTOCAL function is aborted and an error message is displayed instead.</p>	<p>0...40°C</p>

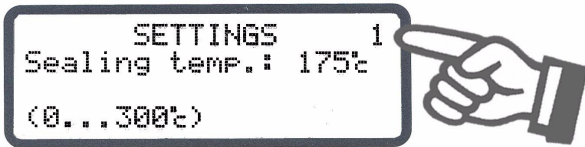
No.	Name	Description	Setting range
20	Language	The desired display language can be selected with this menu step.	English German Italian SW revision 015 or higher also: French, Spanish, Dutch, Danish, Finnish, Swedish, Greek, Turkish. SW revision 024 or higher also: Portuguese.
21	Factory settings	The controller can be reset to the factory settings by pressing the "ENTER" key. The default values are loaded in the controller again (↳ Kap. 11 „Factory settings“ auf Seite 50).	
22	Alloy/range	<p>Various heatsealing band alloys and temperature ranges can be selected here. The corresponding characteristic for the controller parameters is calculated on the basis of this setting.</p> <p> Please be very careful to select the heatsealing band material with the correct alloy.</p> <p>The temperature range setting permits the controller to be matched to the required operating range. This also determines the scale for the bar display and the analog output.</p>	(Availability depends on SW revision) TCR 410ppm, 300°C TCR 460ppm, 300°C TCR 510ppm, 300°C TCR 570ppm, 300°C TCR 630ppm, 300°C TCR 700ppm, 300°C TCR 780ppm, 200°C TCR 780ppm, 300°C TCR 780ppm, 400°C TCR 780ppm, 500°C TCR 870ppm, 300°C TCR 980ppm, 300°C TCR 1100ppm, 200°C TCR 1100ppm, 300°C TCR 1100ppm, 400°C TCR 1100ppm, 500°C TCR 3500ppm, 200°C TCR 3500ppm, 300°C
23	Maximum temperature	This menu item specifies the maximum selectable set point (step 1) and the maximum selectable preheating temperature (step 2) within the range defined by step 22.	0 to max. temperature range (step 22)
24	Set point reached (low limit)	<p>If the actual value is greater than the switching threshold specified here and less than the threshold set with step 25, the "Temperature OK" output is activated.</p> <p>The value is entered in Kelvins (K) and subtracted from the set point in order to calculate the switching threshold.</p>	-5K...-99K

No.	Name	Description	Setting range
25	Set point exceeded (high limit)	<p>If the actual value is less than the switching threshold specified here and greater than the threshold set with step 24, the "Temperature OK" output is activated.</p> <p>The value is entered in Kelvins (K) and added to the set point in order to calculate the switching threshold.</p>	+5K...+99K
26	Time control	This menu step specifies whether the controller should operate with or without time control.	ON, ON with START monitoring, OFF
27	Cooling mode	<p>The end of the cooling-down phase (end of cycle) can be configured by specifying the required cooling mode.</p> <ul style="list-style-type: none"> • Absolute: The cycle ends if the actual value falls below the cooling temperature set here. • Relative: The cycle ends if the actual value falls below the relative cooling temperature (percentage of the set point) set here. • Time: The cycle ends when the set cooling time has elapsed. <p>This function can only be selected if time control (step 26) is active.</p>	<p>Absolute (in °C)</p> <p>Relative (in %)</p> <p>Time (in s)</p>
28	Start of heatsealing time	<p>This menu step specifies whether the heatsealing time (step 4) should begin as soon as the start signal is applied or when 95% of the set point is reached.</p> <p>This function can only be selected if time control (step 26) is active.</p>	<p>Heatsealing time starts when heating starts</p> <p>Heatsealing time starts when temperature reached</p>

No.	Name	Description	Setting range
29	Relay K1 function	The energizing behavior of relay K1 can be configured as follows: Time control OFF: <ul style="list-style-type: none"> • K1 is not activated • K1 is energized if the "Temperature OK" output is active 	Relay K1 OFF Relay K1 active if Tact = Tset
		Time control ON: <ul style="list-style-type: none"> • K1 is not activated • K1 is energized if the start signal is present. The relay is deenergized at the end of the cooling phase. • K1 is energized if the actual value reaches 95% of the set point. The relay is deenergized at the end of the cooling phase. • K1 is energized at the end of the heating phase and deenergized again at the end of the cooling phase. (This setting is possible as of SW revision 010) • K1 is energized for up to 0.5 seconds at the end of the cooling phase (momentary impulse). The length of the momentary impulse can be shortened by applying the start signal (during the impulse). 	Relay K1 OFF Relay K1 active when START signal present Relay K1 active when temperature reached Relay K1 active during cooling phase Relay K1 generates end-of-cycle impulse
30	Cycles	The number of heating impulses (not manual impulses) is counted and displayed with this menu step. The counter can be reset either by pressing the "ENTER" key or by restoring the factory settings.	Reset with "ENTER" key
31	Alarm relay	This menu step permits the switching characteristics of the alarm relay to be configured. <ul style="list-style-type: none"> • Normal: The alarm relay output (terminals 5+6) operates as an NO contact in the event of an alarm. 	Normal
		<ul style="list-style-type: none"> • Inverse: The alarm relay output (terminals 5+6) operates as an NC contact in the event of an alarm. 	Inverse
32	Measuring impulse length	The length of the measuring impulse can be changed here. This function is only available with a few special applications (MOD 1).	1.7...3.0ms
33	Analog output	This menu step determines whether the current actual value or a 10V reference voltage is output at the actual value output (terminal 24). (This setting is possible as of SW revision 017)	Real temperature, 10V reference

10.6 Temperature setting (set point selection)

The heatsealing temperature can be set on the RES-440 controller by means of the setting in menu step 1.



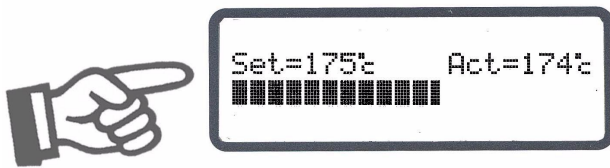
! The maximum value of the setting range is limited either by the maximum value specified with step 23 in the Configuration menu or by the heatsealing band type/temperature range set with step 22.

The set point that is selected for the heatsealing temperature must be greater than 40°C. If not, the heatsealing band will not be heated up when the "START" signal is activated or the "HAND" key is pressed.

The set heatsealing temperature is displayed in the main menu once it has been entered.

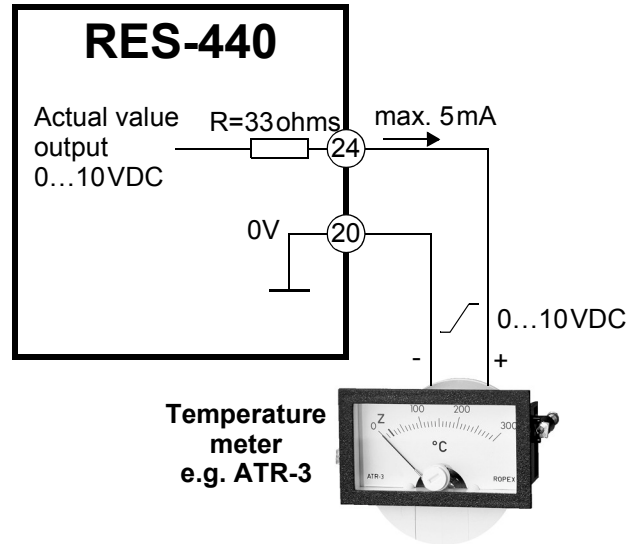
10.7 Temperature indication/actual value output

If the display is in the home position, the ACTUAL temperature is indicated there as a digital value and as a dynamic bar.



The heating and control process can thus be monitored at any time.

In addition, the RES-440 controller outputs an analog 0...10VDC signal, which is proportional to the real ACTUAL temperature, at terminals 23+24

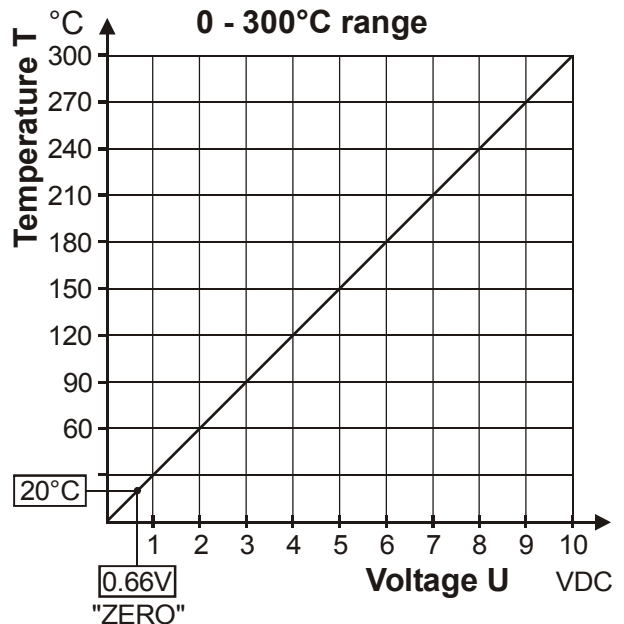


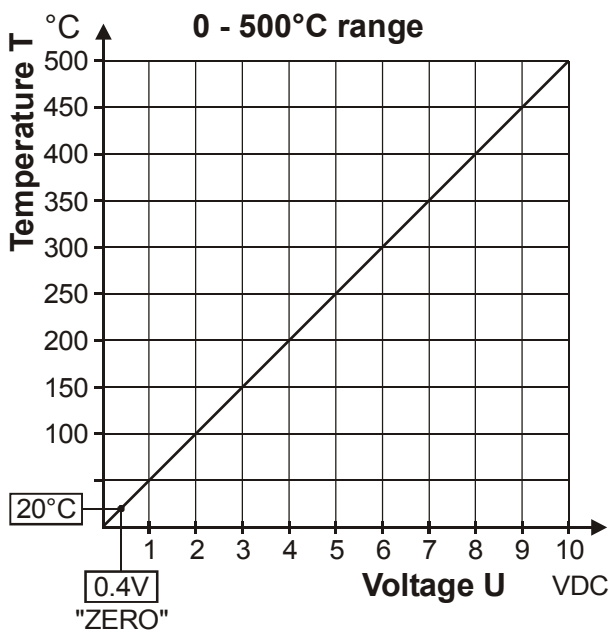
Voltage values:

0VDC → 0°C

10VDC → 300°C or 500°C (depending on the controller configuration).

The relationship between the change in the output voltage and the ACTUAL temperature is linear.





Only the two temperature ranges 300°C and 500°C appear at this actual value output. If a temperature range of 200°C is set for the controller with step 22 in the Configuration menu, it appears at this output in the 0...300°C range. A 400°C temperature range is indicated as 0...500°C.

An indicating instrument can be connected to this output in order to visualize the temperature of the heatsealing band.

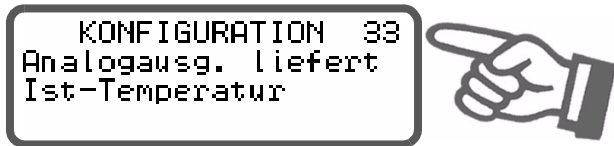
The characteristics of the ROPEX ATR-x temperature meter (size, scaling, dynamic response) are ideally suited to this application (☞ Kap. 5 „Accessories and modifications“ auf Seite 6).

It not only facilitates SET-ACTUAL comparisons, but also enables other criteria such as the heating rate, set point reached within the specified time, cooling of the heatsealing band etc. to be evaluated.

This meter moreover permits disturbances in the control loop (loose connections, contacting or wiring problems) as well as any line disturbances to be observed extremely effectively and interpreted accordingly. The same applies if mutual interference occurs between several neighboring control loops.

If an alarm is signaled, this analog output is used – in addition to the value indicated on the controller – to display a selective error message (☞ Kap. 10.20 „Error messages“ auf Seite 47).

If you want a fixed 10V reference voltage to appear at the analog output (terminal 24), you can configure this in the Configuration menu, step 33 (analog output):



- Actual temperature (•)
The actual value output indicates the current ACTUAL value as a 0...10VDC analog voltage.
- 10V reference
(This setting is possible as of software revision 017)
A fixed 10VDC reference voltage is output at the actual value output.

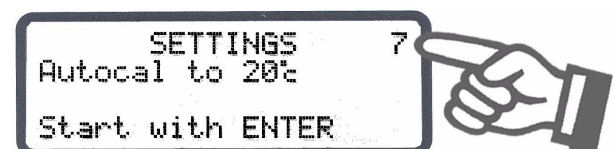
⚠ This output is not potential-free and could have the potential of the secondary voltage of the impulse transformer. External grounding is not allowed. If this warning is ignored, the controller will be damaged by frame currents. Contact voltage protection must be installed at the terminals of the external temperature meter.

10.8 Automatic zero calibration (AUTOCAL)

Owing to the automatic zero calibration (AUTOCAL) function, there is no need to adjust the zero point manually on the controller. The "AUTOCAL" function matches the controller to the current and voltage signals that are present in the system.

You can activate this function by selecting step 7 in the Settings menu and then pressing the "ENTER" key. The initial temperature (ambient temperature) of the heatsealing bar(s) which is currently valid for calibration can be set beforehand in the 0...40°C range using the "UP" and "DOWN" keys.

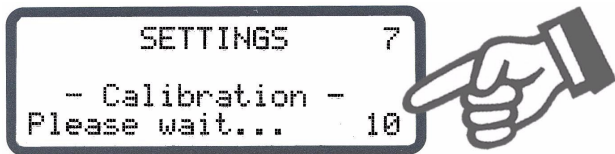
The zero point is calibrated in the factory to 20°C.



The automatic calibration process takes around 10...15 seconds. The heatsealing band is not heated until the calibration process has finished.

- (•) Factory setting

The message "- Calibration - Please wait..." appears on the display while the "AUTOCAL" function is executing and a counter counts down from 13 to 0. The actual value output (terminals 23+24) is set to 0°C (corresponds to 0VDC) for the duration of the calibration process.



! You should always wait for the heatsealing band and the bar to cool down (to ambient temperature) before activating the "AUTOCAL" function.

Reasons for disabled AUTOCAL function:

1. The "AUTOCAL" function cannot be activated if the heatsealing band cools down at a rate of more than 0.1K/second. This is additionally indicated with step 7 in the Settings menu by the message "Heatsealing band still hot! Please wait...".
2. If the "START" signal (24VDC or contact) or the "PREHEAT" signal (24VDC or contact) is activated, the AUTOCAL function is not executed. As of software revision 024 this is additionally indicated with step 7 in the Settings menu by the message „Autocal locked ! (START-Sig. active)“ or „Autocal locked ! (PREHEAT-Sig. active)“.
3. Directly after the controller is powered up, the AUTOCAL function cannot be activated if a fault with error code 101...103, 201...203, 801 or 9xx occurs (↳ Kap. 10.20 „Error messages“ auf Seite 47). If the controller has already operated correctly - a minimum of once - after powering up, the AUTOCAL function cannot be activated with error codes 201...203, 801 or 9xx.

10.9 "START" signal (HEAT)

The heating process is activated by means of the "START" signal in different ways, depending on the time control status (timer function) (↳ Configuration menu, step 26) :

1. Time control off (deactivated):

When the "START" signal is activated, the controller-internal set/actual comparison is enabled immediately and the heatsealing band is heated up to the SET temperature. It remains at this

temperature until the signal is deactivated again. This process can also be started independently of the "START" signal by pressing the "HAND" key while the display is in the home position.

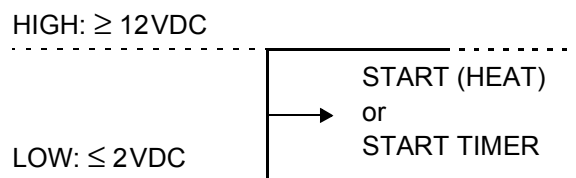
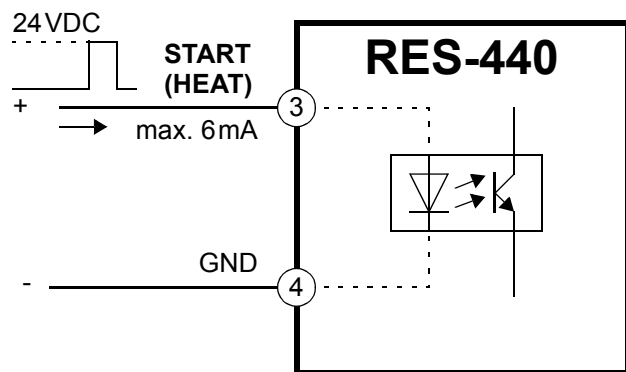
2. Time control on (activated):

If time control (timer function) is on, activating the "START" signal starts the internally parameterized timeout. The time at which the heatsealing band begins to heat up depends on the setting of this parameter. The "START" signal must be deactivated again before the next timeout is activated.

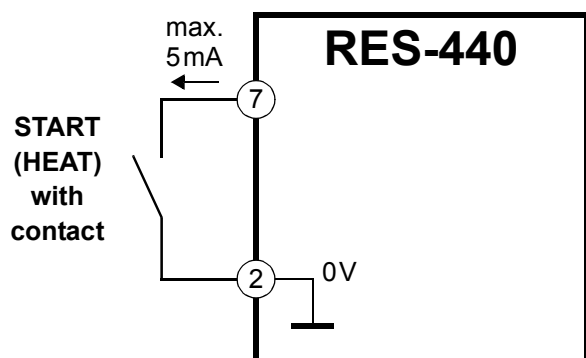
Pressing the "HAND" key while the display is in the home position causes the heatsealing band to start heating up immediately (as described in 1). The internal timeout is not started.

The "START" signal can be activated in two ways:

- By means of a 24VDC signal at terminals 3+4.



- By means of a control contact at terminals 2+7



! The "START" signal is disabled as long as the AUTOCAL function is executing in the Settings menu (with step 7).

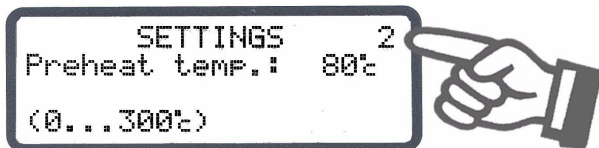
The set point that is selected for the heatsealing temperature (step 1 in the Settings menu) must be greater than 40°C. If not, the heatsealing band will not be heated up.

The alarm relay is switched if the "START" signal is activated while an alarm signal is indicating error codes 104...105, 111...113 or 211 (☞ Kap. 10.20 „Error messages“ auf Seite 47). The heatsealing band is likewise not heated.

If a "PREHEAT" signal is used, it is deactivated internally during the heating and control process. The heatsealing band is not returned to the set preheating temperature until the "PREHEAT" signal is activated again at the end of the control process for the main heat (Kap. 10.10 „PREHEAT" signal (preheating without time control)" auf Seite 36).

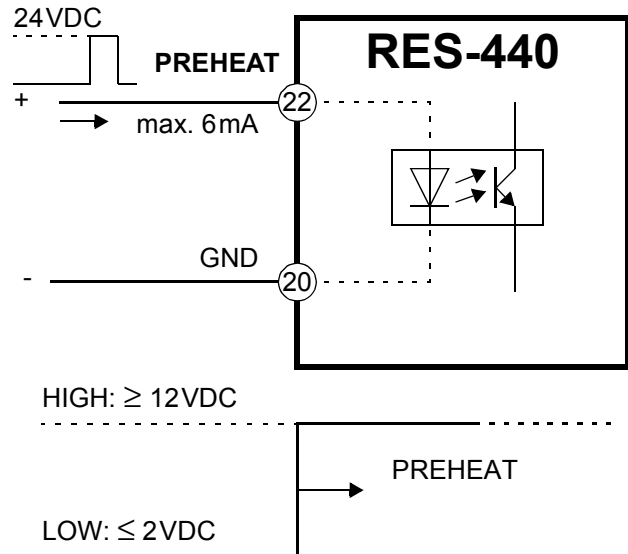
10.10 "PREHEAT" signal (preheating without time control)

The heatsealing band can be heated to a specified preheating temperature with the "PREHEAT" function, in order to shorten the temperature rise time to the selected SET temperature for time-critical applications. The preheating temperature is set with step 2 in the Settings menu:

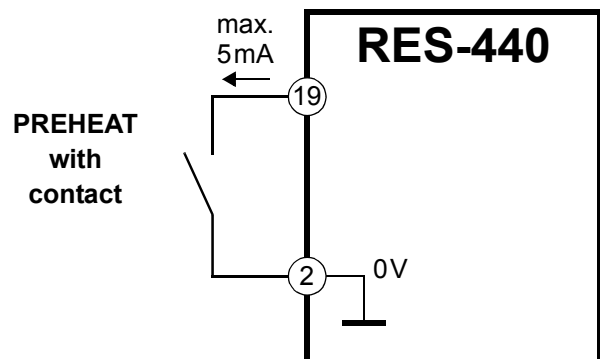


The "PREHEAT" signal can be activated in two ways:

- By means of a 24VDC signal at terminals 20+22.



- By means of a control contact at terminals 2+19 (only available in devices supplied after October 2002)

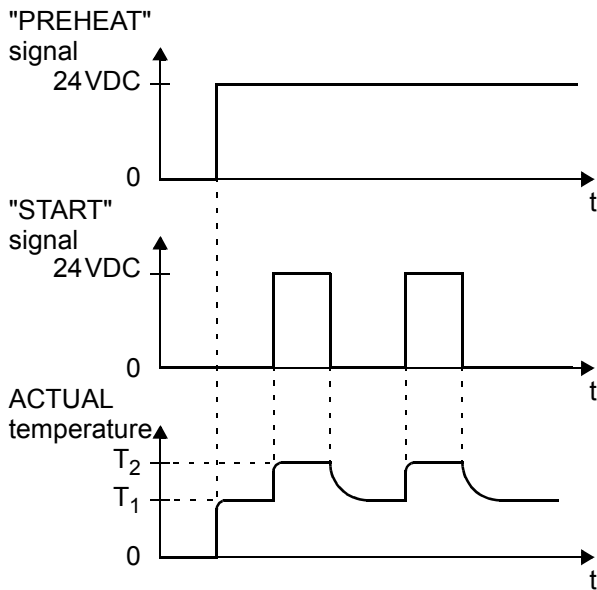


⚠ The "START" signal is disabled as long as the AUTOCAL function is executing in the Settings menu (with step 7).

The value that is selected for the preheating temperature (step 2 in the Settings menu) must be greater than 40°C. If not, the heatsealing band will not be heated up.

The alarm relay is switched if the "PREHEAT" signal is activated while an alarm signal is indicating error codes 104...105, 111...113 or 211 (☞ Kap. 10.20 „Error messages“ auf Seite 47). The heatsealing band is likewise not heated.

If a "PREHEAT" signal is active, it is deactivated internally for the duration of a heating and control process that is activated either by means of the "START" signal or by pressing the "HAND" key.

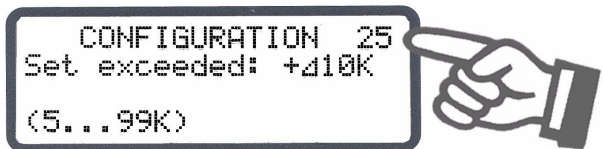
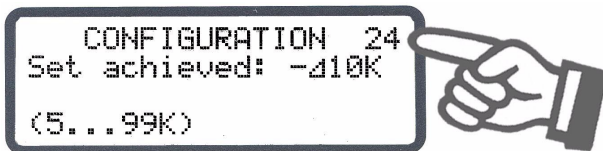


T_1 = Preheating temperature (PREHEAT)
 T_2 = Heatsealing temperature

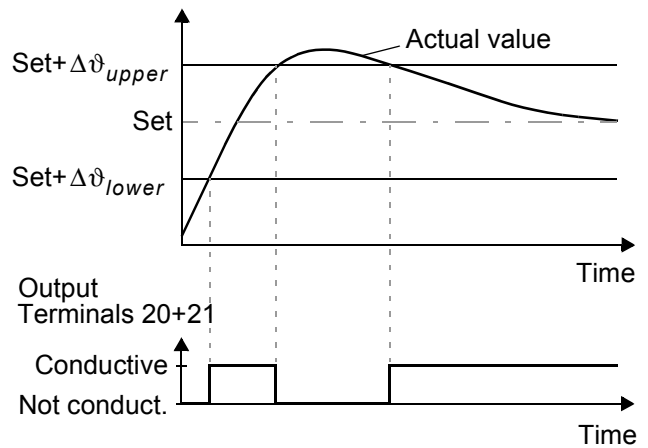
The ACTUAL temperature shows whether the heatsealing band is heated up to the preheating temperature correctly, providing the display is in the home position.

10.11 "Temperature OK" signal

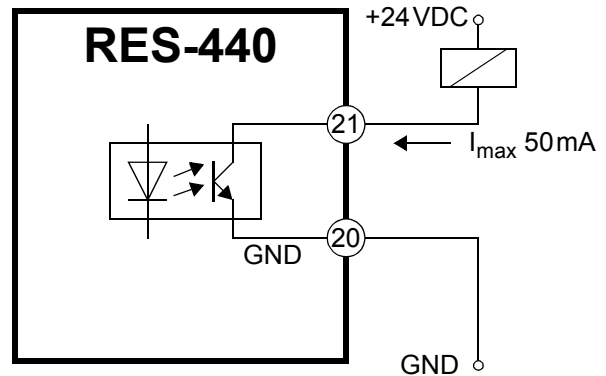
The RES-440 checks whether the ACTUAL temperature is within a settable tolerance band ("OK" window) on either side of the set temperature. The lower ($\Delta\vartheta_{lower}$) and upper ($\Delta\vartheta_{upper}$) limits of the tolerance band can be changed independently of one another by means of steps 24+25 in the Configuration menu.



If the actual temperature is inside the specified tolerance band, the output at terminals 20+21 is switched (see graph below):



The "Temperature OK" signal is available at terminals 20+21 as a digital control signal.

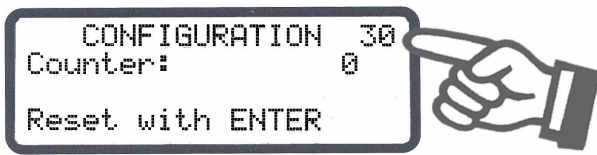


⚠ The ACTUAL temperature is evaluated, and the output signal at terminals 20+21 activated, in all operating states except when an alarm is signaled.

If time control is deactivated, relay K1 can also be switched simultaneously with this signal. This permits loads with higher currents to be controlled (☞ Kap. 9.3.6 „Relay K1 (without time control)“ auf Seite 20).

10.12 Cycle counter

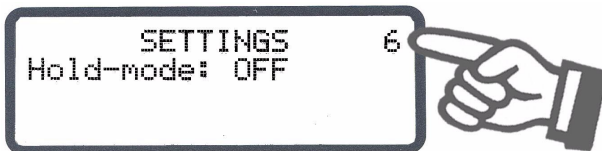
Each activation of the "START" signal during operation is detected by a cycle counter integrated in the controller. Actuations of the "HAND" key are not counted. The counter reading can be displayed with step 30 in the Configuration menu:



The cycle counter is reset to 0 if the "ENTER" key is pressed or if the maximum count of 999.999.999 cycles is exceeded.

10.13 Hold mode

The behavior of the digital indication of the ACTUAL temperature in the home position can be changed with step 6 in the Settings menu:



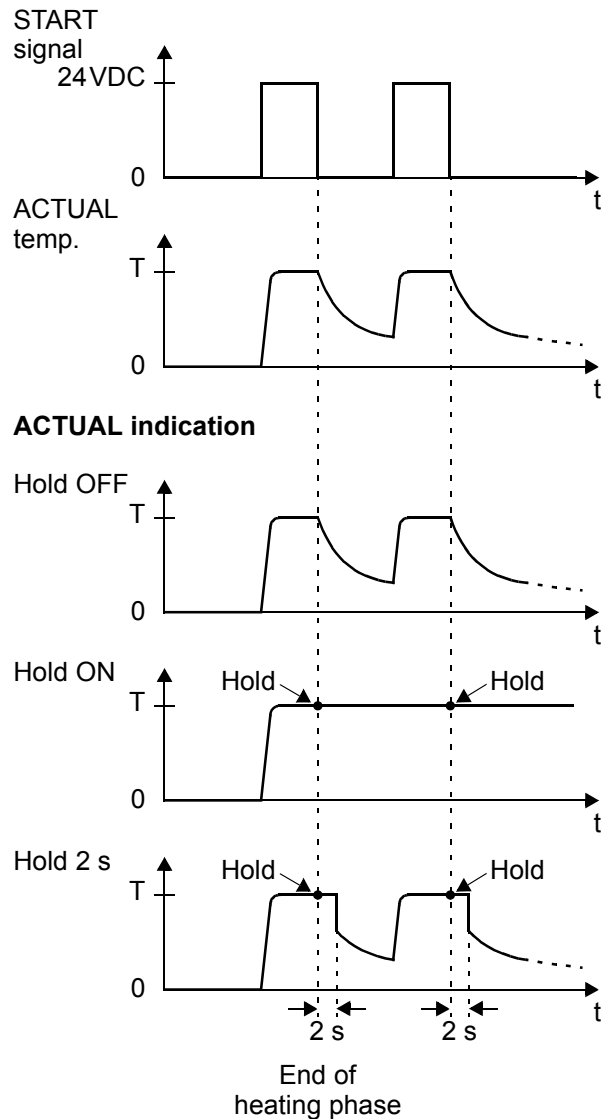
The following settings are possible:

1. **"OFF" (•)**
If the main menu is visible on the display, the real ACTUAL temperature is always indicated.
2. **"ON"**
If the display is in the home position, the ACTUAL temperature that was valid at the end of the last heatsealing phase is always indicated as a digital value. When the controller is switched on, the real ACTUAL temperature is indicated until the end of the first heating phase.
3. **"2 s"**
(Software revision 005 or higher)
It causes the current ACTUAL temperature to be displayed as a digital value for an additional 2 seconds at the end of a heatsealing phase. This temperature is then indicated again in real time until the end of the next heating phase.

! Hold mode only affects the digital value on the display. The ACTUAL temperature in real time is always indicated, regardless of the setting, by the dynamic bar and the actual value output.

(•) Factory setting

The various hold modes are shown below:



The word "Hold" appears on the display if a temperature value is indicated in hold mode. It disappears for approximately 100ms whenever the hold value is updated.



10.14 Disabling the Configuration menu

(Software revision 010 or higher)

It is possible to disable all changes to values/parameters in the Configuration menu. This prevents the controller configuration from being tampered with by unauthorized persons.

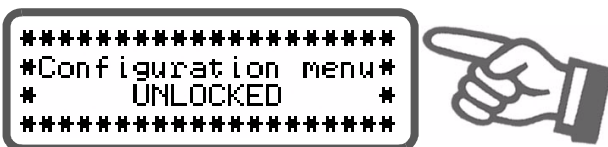
The Configuration menu can be disabled or enabled by pressing the "MENU" key for 2.0seconds while the power-up message is displayed (after switching on the controller, see section 10.2.1 "Power-up message" on page 23). The display then shows a message confirming that the disable function is active for 3.0seconds before returning to the home position.



The same message is also displayed for 5.0seconds when you open the Configuration menu to indicate that this menu is disabled.

! You can still display all steps, values and parameters even if the Configuration menu is disabled. You are no longer allowed to enter or change values, however.

The Configuration menu remains disabled until the disable function is canceled again. To do so, repeat the above procedure (press the "MENU" key for 2.0seconds while the power-up message is displayed). The display then shows a message confirming that the disable function has been canceled.



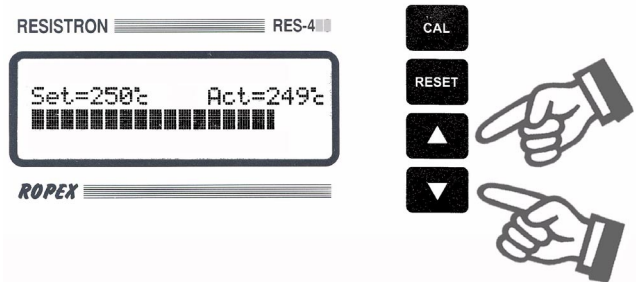
In the factory setting the Configuration menu is not disabled.

10.15 Setting the display brightness (VF display only)

(Software revision 019 or higher)

If the display is in the home position, the brightness of the VF display (blue) can be set in 4 steps (25%, 50%,

75%, 100%) with the "UP" and "DOWN" keys. The factory setting is 75%.

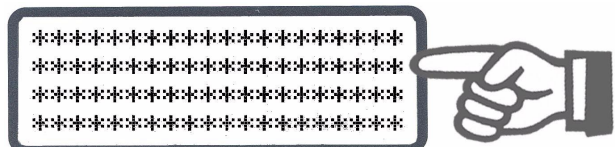


The life of the VF display can be prolonged by reducing the brightness.

10.16 Undervoltage detection

Trouble-free operation of the temperature controller is guaranteed within the line voltage tolerance range specified in Kap. 6 „Technical data“ auf Seite 9.

If a line voltage which is less than the lower limit of the permissible range occurs, the controller is switched to a standby mode. No more heatsealing processes take place and no more measuring impulses are generated. The display changes to indicate this.



The main menu is displayed again, and operation is resumed, when the input voltage returns to the specified tolerance range.

The alarm relay (terminals 5+6) is only switched by an undervoltage condition in controllers up to and including software revision 008. The last valid temperature value continues to appear at the analog output (terminals 23+24).

The alarm relay in controllers with a higher software revision number is not switched if an undervoltage condition occurs. The standby mode is indicated by 0°C (corresponds to 0V) at the analog output.

! Trouble-free operation of the controller is only guaranteed within the specified input voltage tolerance range. An external voltage monitor must be connected to prevent defective heatseals as a result of low line voltage.

10.17 Booster connection

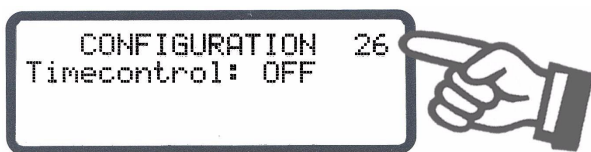
The RES-440 controller has a connection for an external switching amplifier (booster) as standard. This connection (at terminals 1+2) is necessary for high primary currents (continuous current > 5A, pulsed current > 25A). The switching amplifier should be connected as described in Kap. 8.7 „Wiring diagram with booster connection“ auf Seite 17. No settings are required in the menu.

10.18 Time control (timer function)

10.18.1 Activation and indication

! The settings described here are only allowed to be entered by technically trained persons. An incorrectly parameterized timer function may cause disruptions to operation and damage to the machine.

The timer function is activated with step 26 in the Configuration menu:



There are two possible settings in this menu:

1. **"OFF" (•)**
Time control (timer function) deactivated
2. **"ON"**
Time control (timer function) activated.
The internal timeout is started by activating the "START" signal. The timeout either ends with the parameterized cooling phase or is interrupted by activating the "RESET" signal.
3. **"ON with START monitoring"**
(software revision 021 or higher)
Time control (timer function) activated and "START" signal monitored.
Once again, the internal timeout is started by activating the "START" signal. In this setting, however, the "START" signal must remain activated until the end of the parameterized cooling phase. If the "START" signal is deactivated before the end of the cooling phase - or if the "RESET" signal is

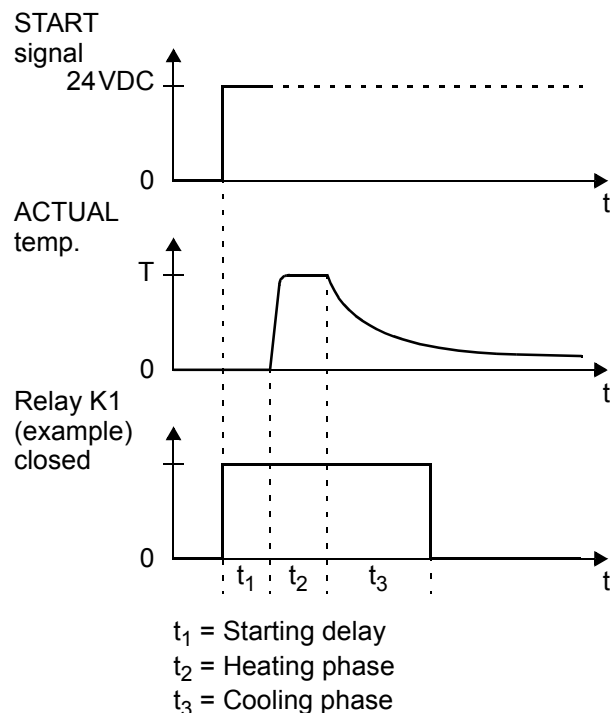
(•) Factory setting

activated - the timeout is interrupted.

If time control is on, activating the "START" signal starts the internally parameterized timeout. This timeout comprises:

- Starting delay (delay at the beginning of the heating phase)
- Heating phase (heating and control process)
- Cooling phase
- Relay K1 function

! If time control (timer function) is activated, it is only possible to start a heating process with the "HAND" key on the controller. The timeout of the internal time control cannot be started with this key.



! The timeout of the internal time control (timer function) can be interrupted by switching off the controller. As of software revision 021, it can also be interrupted by deactivating the "START" signal if time control "ON with START monitoring" is configured.

If the display is in the home position, the individual timeouts can be monitored there.

The remaining heatsealing time is indicated on the display in the form of a countdown at the end of the

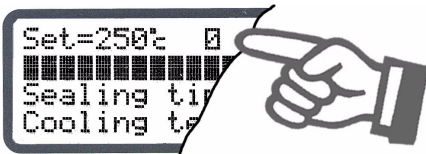
heating phase. A direction arrow indicates the active process.



The active cooling phase is subsequently marked with the direction arrow at the end of the heating phase.



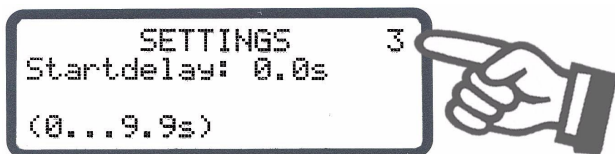
The direction arrow disappears again at the end of the cooling phase (i.e. at the end of the internal timeout). The current condition of relay K1 is indicated by means of a separate icon. If the icon is visible, the normally open contact of the relay is closed.



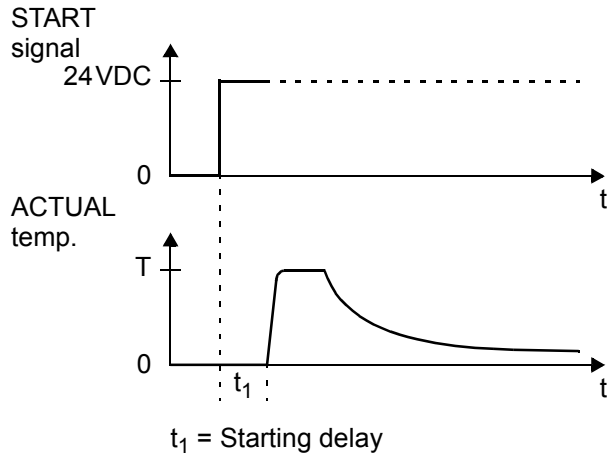
Separate settings can be entered for the individual timeouts. These settings are possible with steps 3, 4 and 5 in the Settings menu and with steps 27, 28 and 29 in the Configuration menu. The options available with these advanced settings are described below.

10.18.2 Setting the starting delay

The start of the heating process can be explicitly delayed by entering a starting delay time with step 3 in the Settings menu, e.g. in order to bridge the closing time of the heatsealing bars.



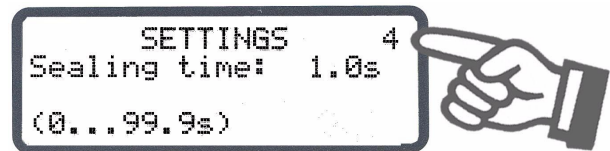
When the "START" signal is activated, the controller waits for the time specified with this menu step to elapse before commencing the heating process.



The starting delay can be set in the range from 0 to 9.9s. A delay of 0s is defined as the factory setting. In this case, the heating process begins as soon as the "START" signal is activated.

10.18.3 Setting the heatsealing time

This menu step is used to enter the heatsealing time:

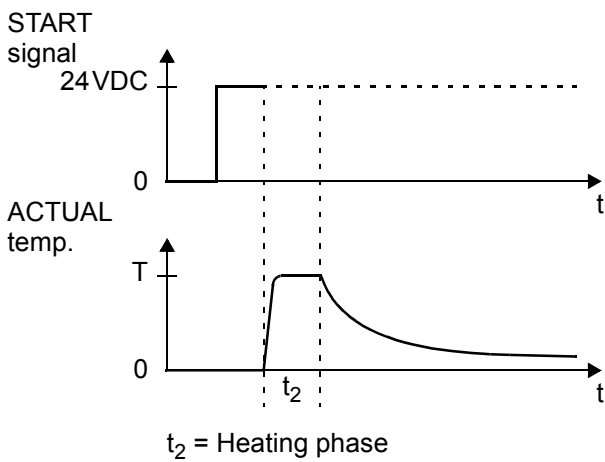


There are two possible ways to set the heatsealing time:

1. "0...99.9s"
The heatsealing time can be set in the range from 0 to 99.9s. The factory setting is 1.0s.

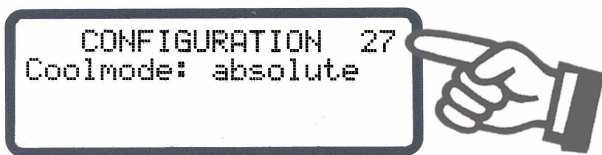
"EXT"
(This setting is possible as of software revision 013)
The heatsealing time is controlled by the "START" signal (24VDC signal applied to terminals 3+4 or contact applied to terminals 2+7). The duration of the

heatsealing time is equal to the active time of the "START" signal.



10.18.4 Setting the cooling mode

Various criteria for the end of the cooling phase can be specified with step 27 in the Configuration menu of the RES-440 controller:

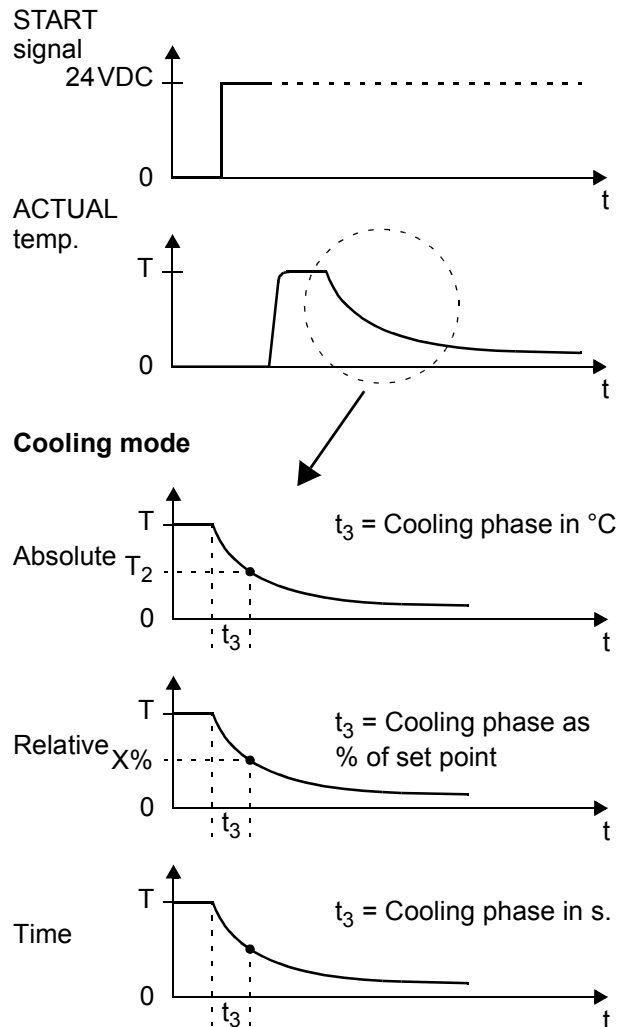


The possible settings are as follows:

1. **"Absolute" (•)**
The cooling phase ends when the ACTUAL temperature of the heatsealing band falls below a specified temperature value. This cooling temperature can be set with step 5 in the Settings menu.
2. **"Relative"**
The cooling phase ends when the ACTUAL temperature falls to a value corresponding to X% of the SET temperature. This percentage cooling value can be set with step 5 in the Settings menu.
Example:
SET temperature = 180°C, cooling value = 60%
→ Cooling phase ends when ACTUAL temperature ≤ 108°C
3. **"Time"**
The cooling phase ends after a specified time in seconds and is independent of the ACTUAL temperature. This cooling time can be set with step 5 in the Settings menu.

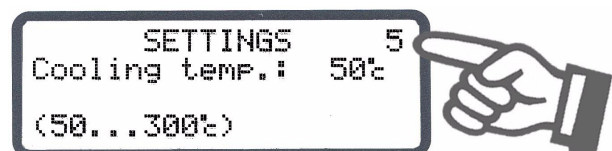
(•) Factory setting

The various cooling modes are shown below:



10.18.5 Setting the cooling value

After the cooling phase has been configured with step 27 in the Configuration menu (☞ Kap. 10.18.4 „Setting the cooling mode“ auf Seite 42), you can specify the cooling parameters with step 5 in the Settings menu.



! The options available with step 5 in the Settings menu vary according to the selection made with step 27 in the Configuration menu. All settings entered with menu step 5 are overwritten if step 27 is changed subsequently.

The possible settings are as follows:

1. "Cooling temp. in °C"

(if setting with menu step 27 = "Absolute")

The cooling phase of the internal timeout ends when the ACTUAL temperature of the heatsealing band falls below the set temperature.

The minimum settable temperature is 50°C. This is also the factory setting.

The maximum value of the setting range is limited either by the maximum value specified with step 23 in the Configuration menu or by the heatsealing band type/temperature range set with step 22.

2. "Cooling temp. in %"

(if setting with menu step 27 = "Relative")

The cooling phase of the internal timeout ends when the ACTUAL temperature falls to the specified percentage of the SET temperature. This value can be set between 40 and 100%.

The factory setting is 40%.

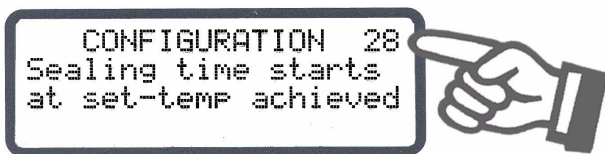
3. "Cooling time in s"

(if setting with menu step 27 = "Time")

The cooling phase ends when the specified time elapses. This time can be set between 0 and 99.9s. The factory setting is 10.0s.

10.18.6 Setting the start of the heatsealing time

The condition for the start of the set heatsealing time (step 4 in the Settings menu) can be specified with step 28 in the Configuration menu.



The following settings are possible:

1. "When heating starts"

The parameterized heatsealing time starts as soon as the set starting delay elapses (↳ Settings menu, step 3).

If the starting delay = 0s, the heatsealing time begins as soon as the "START" signal is activated.

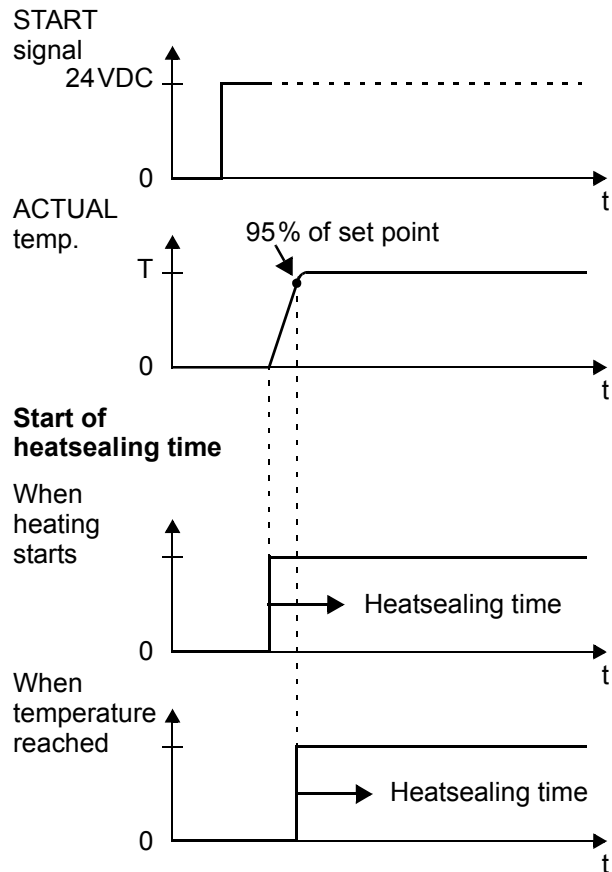
2. "When temperature reached" (•)

Once again, the heating process starts as soon as the set starting delay elapses (↳ Settings menu,

(•) Factory setting

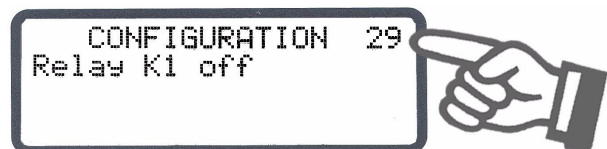
step 3). The specified heatsealing time does not start, however, until the ACTUAL temperature of the heatsealing band reaches 95% of the SET temperature.

These two alternatives are shown below:



10.18.7 Relay K1 (with time control)

The function of relay K1 when time control is active is also specified with step 29 in the Configuration menu (↳ Kap. 9.3.6 „Relay K1 (without time control)“ auf Seite 20):



The settings described here are only possible if time control is active. These settings can be selected as follows:

1. "When start signal present"

The normally open contact of relay K1 closes as soon as the "START" signal is activated and remains closed until the end of the parameterized timeout (i.e. until the end of the cooling phase).

2. **"When temperature reached"(*)**

The normally open contact of relay K1 closes when the ACTUAL temperature reaches 95% of the SET temperature and remains closed until the end of the parameterized timeout (i.e. until the end of the cooling phase).

3. **"While cooling" (Software revision 010 or higher)**

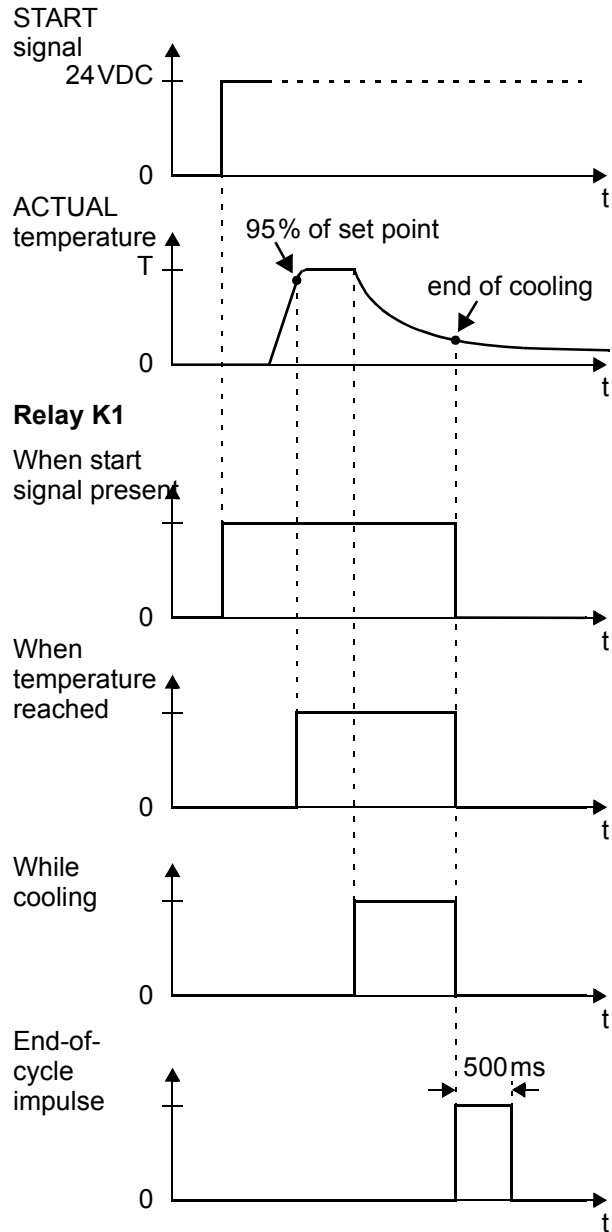
The normally open contact of relay K1 closes at the end of the heating phase and opens again at the end of the cooling phase.

This configuration permits air cooling to be activated with relay K1 during the cooling phase, for instance.

4. **"End-of-cycle impulse"**

The normally open contact of relay K1 closes at the end of the parameterized timeout (i.e. at the end of the cooling phase) and opens again after approximately 500ms. If a "START" signal is activated while relay K1 is still closed, the relay opens again immediately.

The possible settings are shown below:



(*) Factory setting

10.18.8 Preheating (with time control)

If time control is active, the preheating temperature (☞ Kap. 10.10 „PREHEAT" signal (preheating without time control)" auf Seite 36 is only deactivated during the heating phase. Preheating is active during the starting delay and the cooling phase.

The ACTUAL temperature consequently cannot fall below the set preheating temperature during the cooling phase.

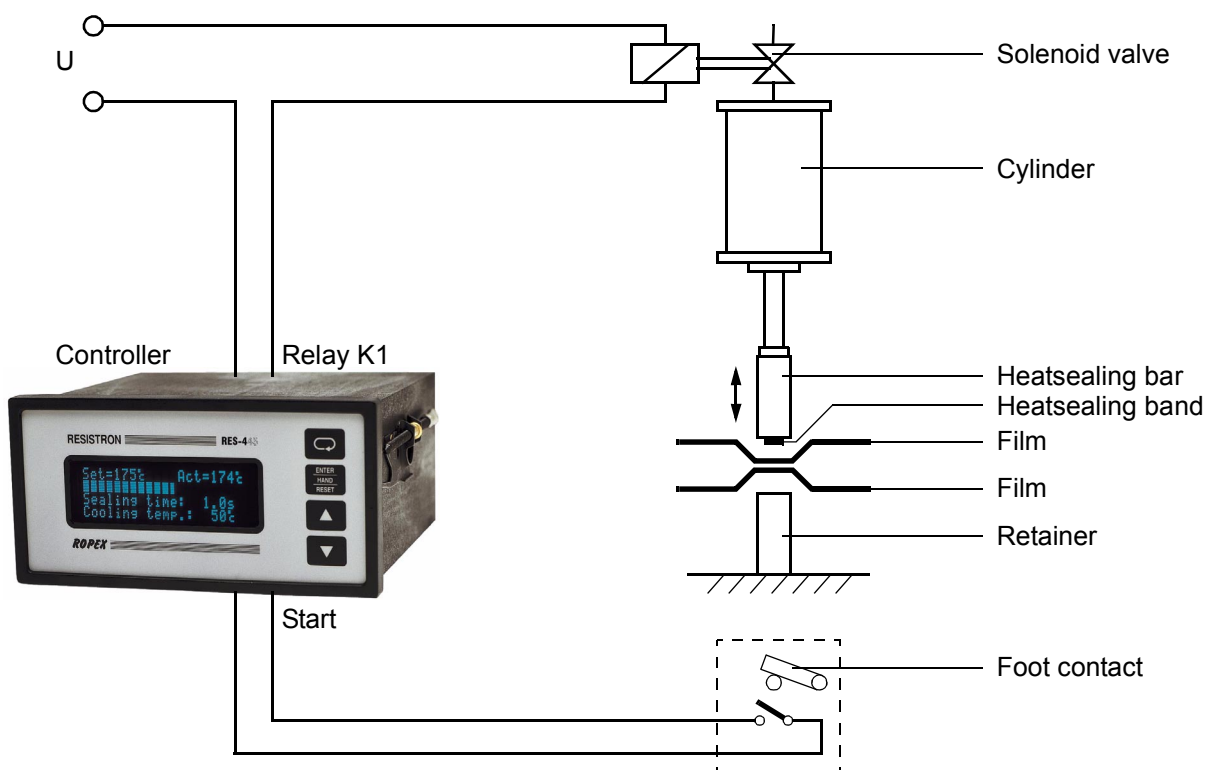
The temperature which is set for the end of the cooling phase (☞ Kap. 10.18.5 „Setting the cooling value" auf Seite 42) must always be higher than the preheating temperature. If not, the end of the cooling phase is

never reached, i.e. the internal timeout does not elapse.

If the cooling temperature is required to be lower than the preheating temperature, the "PREHEAT" signal must be deactivated until the end of the cooling phase and then activated again.

10.18.9 Example

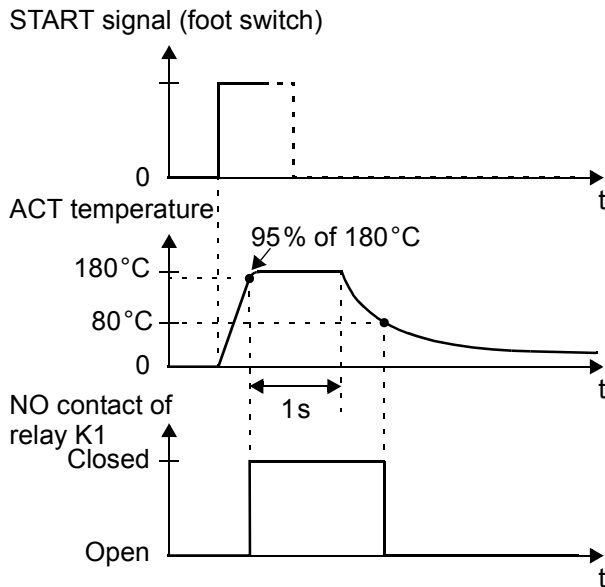
The example below illustrates the basic design of a pneumatically operated L-sealer with a solenoid valve. The heatsealing process is started by means of a foot switch.



The functional sequence is as follows:

1. The controller receives the "START" signal for internal time control via the foot switch.
2. The heating process must begin immediately – without a starting delay.
3. When the ACTUAL temperature reaches 95% of the SET temperature ($T = 180^{\circ}\text{C}$), the normally open contact of relay K1 must close. The solenoid valve is then energized and the sealing jaws are closed. The heatsealing time ($t_2 = 1\text{ s}$) begins simultaneously.
4. The heatsealing bands are not heated any further at the end of the heatsealing phase (i.e. at the end of the heatsealing time). The cooling phase begins.
5. The cooling phase must end when the ACTUAL temperature of the heatsealing bands falls to $T \leq 80^{\circ}\text{C}$. The sealing jaws are still closed (the normally open contact of relay K1 is also still closed).
6. The normally open contact of relay K1 opens again at the end of the cooling phase. The sealing jaws are also opened again.
7. End of the heatsealing process.

The timing sequence can be represented as follows:



Required controller settings:

The following controller settings are required for time control (the basic settings such as the temperature range, alloy etc. should already have been entered). The settings should be undertaken in the specified order.

Step in Configuration menu	Setting
26 (Time control)	"ON"
27 (Cooling mode)	"Absolute"
28 (Start of heatsealing time)	"When temperature reached"
29 (Relay K1 function)	"When temperature reached"

Then:

Step in Settings menu	Setting
1 (Heatsealing temperature)	180°C
3 (Starting delay)	0.0 s
4 (Heatsealing time)	1.0 s
5 (Cooling value)	Cooling temperature = 80°C

10.19 System monitoring/alarm output

To increase operating safety and to avoid faulty heatsealing, the controller incorporates special hardware and software features that facilitate selective fault detection and diagnosis. Both the external wiring and the internal system are monitored.

These features crucially support the system owner in localizing the cause of an abnormal operating state. A system fault is reported or differentiated by means of the following elements.

A.) Error message on the display:



The cause of a fault can be localized quickly and easily with the help of the error code that appears on the display. Please refer to Kap. 10.20 „Error messages“ auf Seite 47 for a list of the possible error codes.

B.) Alarm relay (relay contact, terminals 5+6):

This contact is set in the factory as follows:

- **OPEN** if error code 104...106, 111...113 or 211 is displayed. The contact closes, however, if a "START" signal is activated in this state.
- **CLOSED** if error code 101...103, 107, 108, 201...203, 801 or 9xx appears.

If the alarm relay is configured differently from the factory setting (☞ Kap. 9.3.7 „Configuration of the alarm relay“ auf Seite 20), these states are inverted.

C.) Error code output via the 0 to 10VDC actual value output (terminals 23+24):


Since a temperature indication is no longer necessary if a fault occurs, the actual value output is used to display error codes in the event of an alarm.

12 voltage levels are offered for this purpose in the 0...10VDC range, each of which is assigned an error code (☞ Kap. 10.20 „Error messages“ auf Seite 47).

If a state that requires AUTOCAL occurs – or if the controller configuration is incorrect – (error codes 104...106, 111...113 or 211), the actual value output jumps back and forth at 1Hz between the voltage value that corresponds to this error and the end of the scale (10VDC, i.e. 300°C or 500°C). If the "START" signal is

activated in one of these states, the voltage value does not change any more.

Selective fault detection and indication can thus be implemented simply and inexpensively using the analog input of a PLC with a corresponding error message (→ Kap. 10.20 „Error messages“ auf Seite 47).

 **An alarm can only be reset by pressing the "RESET" key or by switching the controller off and then on again.**

10.20 Error messages

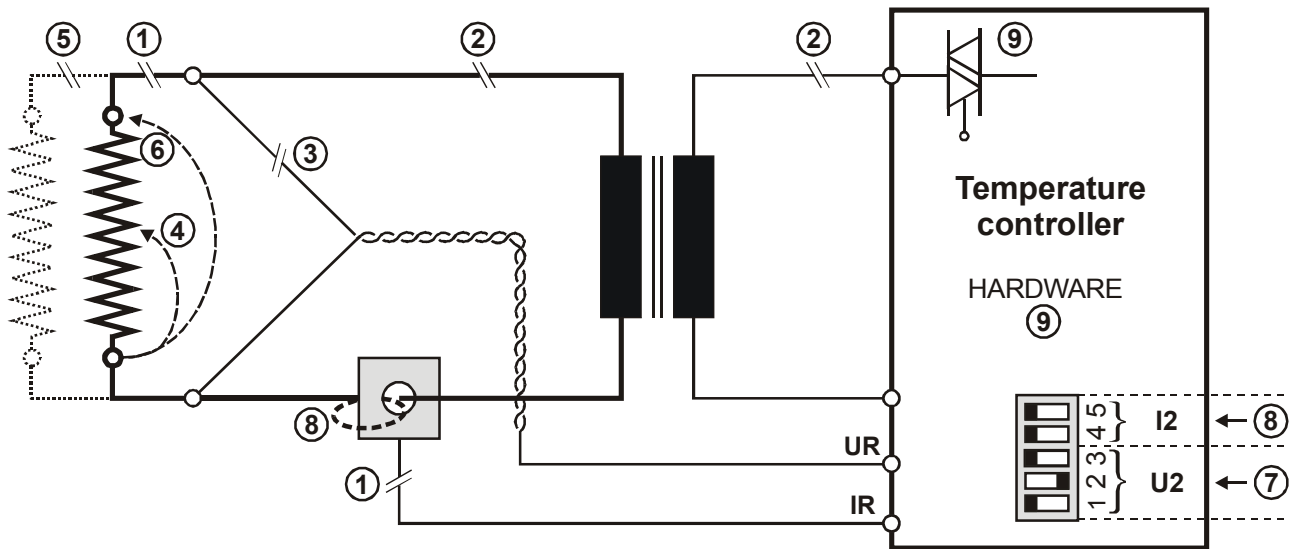
The table below shows how the analog voltage values that appear at the actual value output are assigned to the faults that have occurred. It also describes each fault and the required corrective action.

The block diagram in Kap. 10.21 „Fault areas and causes“ auf Seite 49 permits each fault to be cleared quickly and efficiently.



Error code	Act. value output; Voltage [V]	Temp. 300 °C [°C]	Temp. 500 °C [°C]	STATUS of alarm relay (factory set.)	Cause	Action if machine started for first time	Action if machine already operating, HS band not chang.
101	0.66	20	33	Closed	I _R signal missing	Fault area ①	Fault area ①
102	1.33	40	66		U _R signal missing	Fault area ③	Fault area ③
103	2.00	60	100		U _R and I _R signals missing	Fault area ②	Fault areas ②③
107 108	2.66	80	133	Closed	Temperature step	Fault areas ④⑤⑥ (loose contact)	Fault areas ④⑤⑥ (loose contact)
201 202 203	3.33	100	166		Frequency fluctuation, inadmissible line frequency	Check power supply	Check power supply
801	4.00	120	200		Internal fault	Run RESET	Run RESET
9xx	4.66	140	233	Open, does not close until "START" signal (voltage value at actual value output then no longer changes)	Internal fault, controller defective	Replace controller	Replace controller
104 105 106	↺5.33 ↻ ↻ 10 ↻	↺160 ↻ ↻ 300 ↻	↺266 ↻ ↻ 500 ↻		U _R and/or I _R signal incorrect	Run AUTOCAL	Fault areas ④⑤⑥
211	↺6.00 ↻ ↻ 10 ↻	↺180 ↻ ↻ 300 ↻	↺300 ↻ ↻ 500 ↻		Data error	Run AUTOCAL	---
111	↺6.66 ↻ ↻ 10 ↻	↺200 ↻ ↻ 300 ↻	↺333 ↻ ↻ 500 ↻	Open, does not close until "START" signal (voltage value at actual value output then no longer changes)	I _R signal incorrect, calibration not possible	Fault area ⑧, check configuration	---
112	↺7.33 ↻ ↻ 10 ↻	↺220 ↻ ↻ 300 ↻	↺365 ↻ ↻ 500 ↻		U _R signal incorrect, calibration not possible	Fault area ⑦, check configuration	---
113	↺8.00 ↻ ↻ 10 ↻	↺240 ↻ ↻ 300 ↻	↺400 ↻ ↻ 500 ↻		U _R and I _R signals incorrect, calibration not possible	Fault area ⑦⑧, check configuration	---

10.21 Fault areas and causes



The table below explains the possible fault causes.

Fault area	Explanation	Possible causes
①	Load circuit interrupted after U_R pickoff point	- Wire break, heatsealing band break - Contacting to heatsealing band defective
	PEX-W2 current transformer signal interrupted	- I_R measuring wire from current transformer interrupted
②	Primary circuit interrupted	- Wire break, triac in controller defective - Primary winding of impulse transformer interrupted
	Secondary circuit interrupted before U_R pickoff point	- Wire break - Secondary winding of impulse transformer interrupted
③	U_R signal missing	- Measuring wire interrupted
④	Partial short-circuit (ΔR)	- Heatsealing band partially bypassed by conducting part (clamp, opposite heatsealing bar etc.)
⑤	Parallel circuit interrupted	- Wire break, heatsealing band break - Contacting to heatsealing band defective
⑥	Total short-circuit	- Heatsealing band installed incorrectly, insulation at heatsealing bar ends missing or incorrectly installed - Conducting part bypasses heatsealing band completely
⑦	U_R signal incorrect	- DIP switches 1 - 3 configured incorrectly (U_2 range)
⑧	I_R signal incorrect	- DIP switches 4 + 5 configured incorrectly (I_2 range)
	Turns through PEX-W2 current transformer incorrect	- Check number of turns (two or more turns required for currents < 30A)
⑨	Internal controller fault	- Hardware fault (replace controller)

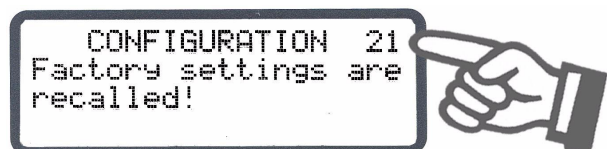
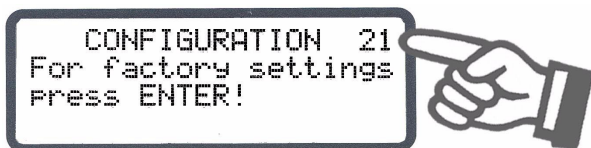
11 Factory settings


The RESISTRON temperature controller RES-440 is configured in the factory as follows:

<p><u>DIP switches</u> for secondary voltage U_2 and current I_2</p>		<p>$U_2 = 6...60VAC$ $I_2 = 30...100A$</p> <p>DIP switches: 2 ON 1, 3, 4, 5 OFF</p>
<p><u>Values in the Settings and Configuration menus</u></p>	<p>Settings menu</p> <p>Step 1 Heatsealing temperature: 0°C Step 2 Preheating temperature: 0°C Step 3 Starting delay: 0s Step 4 Heatsealing time: 1s Step 5 Cooling value: Cooling time: 10s Absolute cooling temperature: 50°C Relative cooling temperature: 40 % of temperature</p> <p>heatsealing</p> <p>Step 6 Hold mode: OFF Step 7 AUTOCAL temperature: 20°C</p> <p>Configuration menu</p> <p>Step 20 Language German This selection is NOT changed if the factory settings are restored with step 21 in the Configuration menu.</p> <p>Step 22 Alloy/range: Alloy-20/max. 300°C Step 23 Maximum temperature: 300°C Step 24 Set point reached: -10K Step 25 Set point exceeded: +10K Step 26 Time control: OFF Step 27 Cooling mode: Absolute Step 28 Start of heatsealing time: When temperature reached Step 29 Relay K1 function: Active when temperature reached Step 30 Cycle counter: 0 Step 31 Alarm relay: Normal (contact closed by alarm) Step 32 Measuring impulse length: Standard (1.7ms) Step 33 Analog output: Actual temperature</p>	

The controller can be reset with step 21 in the Configuration menu:

The factory settings are restored if the "ENTER" key is pressed. An acknowledgment message is displayed for approximately 2s.









 **The language which is selected with step 20 in the Configuration menu remains set even if the factory settings are restored.**

12 Maintenance

The controller requires no special maintenance. Regular inspection and/or tightening of the terminals – including the terminals for the winding connections on

the impulse transformer – is recommended. Dust deposits on the controller can be removed with dry compressed air.

13 How to order

	<p>Contr. RES - 440- . / . . . VAC</p> <ul style="list-style-type: none"> L / 115: LC display, line voltage 115VAC, Art. No. 744011 L / 230: LC display, line voltage 230VAC, Art. No. 744012 L / 400: LC display, line voltage 400VAC, Art. No. 744013 V / 115: VF display, line voltage 115VAC, Art. No. 744021 V / 230: VF display, line voltage 230VAC, Art. No. 744022 V / 400: VF display, line voltage 400VAC, Art. No. 744023 <p>Scope of supply: Controller includes connector plug-in parts (current transformer must be ordered separately)</p> <p>Modification MOD . . (optional, if required)</p> <ul style="list-style-type: none"> e.g. 01: MOD 01, Art. No. 800001 (amplifier for low voltage) <p>Please indicate the article numbers of the controller and the required modifications (optional) in all orders, e.g. RES-440-L/400VAC + MOD 01 (controller with LC display for 400VAC line voltage and amplifier for low voltage) Art. Nos. 744013 + 800001 must be ordered</p>
	<p>Current transformer PEX-W2 Art. No. 885104</p>
	<p>Line filter LF- . . 480</p> <ul style="list-style-type: none"> 06: Continuous current 6A, 480VAC, Art. No. 885500 35: Continuous current 35A, 480VAC, Art. No. 885506
	<p>Impulse transformer</p> <p>See ROPEX Application Report for design and ordering information</p>
	<p>Temp. meter ATR- .</p> <ul style="list-style-type: none"> 3: 300°C range, Art. No. 882130 5: 500°C range, Art. No. 882150
	<p>Booster B- . . . 400</p> <ul style="list-style-type: none"> 075: Max. pulse load 75A, 400VAC, Art. No. 885301 100: Max. pulse load 100A, 400VAC, Art. No. 885304

For more accessories: ↪ "Accessories" leaflet

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