RESISTRON

RES-445 ^{GB}

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 configuration of the secondary voltage and current ranges
  (AUTORANGE, as of software revision 100)

- Automatic phase angle compensation (AUTOCOMP, as of software revision 100)

- 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 input for set point selection, electrically isolated

- 0…10VDC analog output for ACTUAL temperature, electrically isolated

- 24VDC control inputs for AUTOCAL, PREHEAT and RESET, electrically isolated

- Alarm function with fault diagnosis

Identical design to and compatible with RES-225

Contents

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:

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

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 a too low temperature coefficient and incorrect coding of the RESISTRON temperature controller lead to uncontrolled heating and ultimately to burn-out of the heatsealing band!**

The heatsealing bands that were originally supplied must be identified by detail specification, part number or some other means that will assure that 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/-W3

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

⚠ **Only the original ROPEX PEX-W2 or PEX-W3 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 5. 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:

• Repeatable quality 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 60 Hz) 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.**
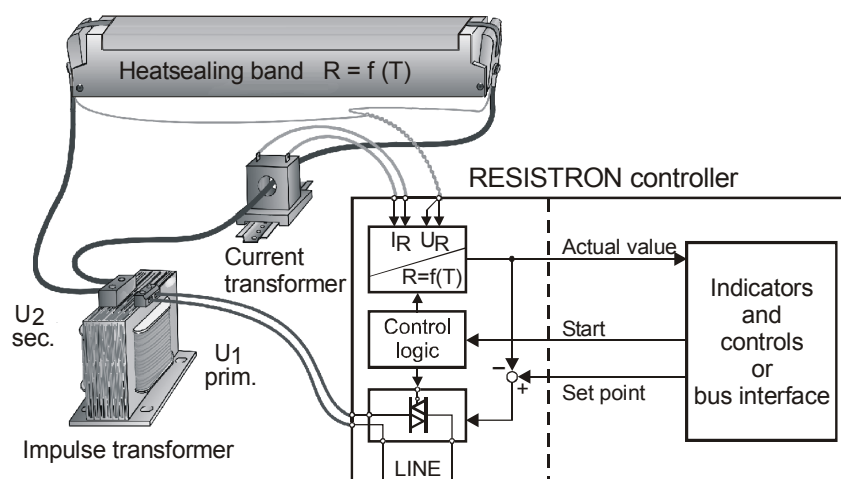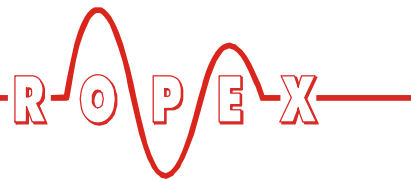
4 Description of the controller

The microprocessor technology endows the RESISTRON temperature controller RES-445 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 AUTORANGE function (as of software revision 100) covers a secondary voltage range from 0.4V to 120V and a current range from 30A to 500A.

- 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 electrically isolated, 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-445 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.).
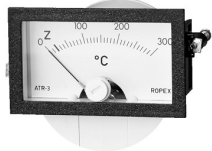
The RESISTRON temperature controller RES-445 is designed for installation in a front panel cutout. The compact design and the plug-in connections make this controller easy to install.

5 Accessories and modifications
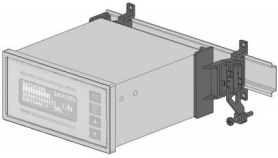
A wide range of compatible accessories and peripheral devices are available for the RESISTRON temperature controller RES-445. They allow it to be optimally adapted to your specific heatsealing application and to your plant's design and operating philosophy.

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.

Line filter LF-xx480
Essential in order to ensure CE conformity.
Optimized for the RESISTRON temperature controller.

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).

Communication interface CI-USB-1
Interface for connecting a RESISTRON temperature controller with diagnostic inter-face (DIAG) to the PC (USB port). Associated PC visualization software for dis-playing setting and configuration data, and for recording SET and ACTUAL tempe-ratures in real time.

Booster B-xxx400
External switching amplifier, necessary for high primary currents
(continuous current > 5A, pulsed current > 25A).

Monitoringcurrent transformer
For detecting frame short-circuits on the heatsealing band.
Used as an alternative to the standard PEX-W2/-W3 current transformer.

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).

Adapter for top hat rail mounting, HS-Adapter-01
For mounting the RESISTRON temperature controller RES-445 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.

	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.
	Measurement cable UML-1 Twisted measurement cable for the U_R voltage measurement. Trailing cable, halogen and silicone-free.

5.2　Modifications (MODs)

Owing to its universal design, the RESISTRON temperature controller RES-445 is suitable for a very wide range of heatsealing applications.
Modifications (MOD) are available for the RESISTRON temperature controller RES-445 for implementing special applications.

MOD 01

Amplifier for low secondary voltages (U_R = 0.25…16VAC). 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).

⚠ **This modification is only recommended for existing applications. The PC visualization software (⮑ section 10.22 "Diagnostic interface/ visualization software (as of software revision 100)" on page 52) should be used for all new applications.**

6 Technical data

Type of construction	Housing for front panel mounting Dimensions (W x H): 144 x 72 mm; depth: 161 mm (incl. terminals)
Line voltage	<u>All controller manufactured as of January 2006</u> <u>(as of software revision 100):</u> 115 VAC version: 110 VAC -15%…120 VAC +10% (equivalent to 94…132 VAC) 230 VAC version: 220 VAC -15%…240 VAC +10% (equivalent to 187…264 VAC) 400 VAC version: 380 VAC -15%…415 VAC +10% (equivalent to 323…456 VAC) <u>All controllers manufactured as of January 2004 up to December 2005</u> <u>(up to software revision 027):</u> 115 VAC version: 115 VAC -15%…120 VAC +10% (equivalent to 98…132 VAC) 230 VAC version: 230 VAC -15%…240 VAC +10% (equivalent to 196…264 VAC) 400 VAC version: 400 VAC -15%…415 VAC +10% (equivalent to 340…456 VAC) <u>All controllers manufactured up to December 2003:</u> 115 VAC, 230 VAC or 400 VAC, tolerance: +10% / -15% depending on device version (✎ Kap. 13 „How to order" auf Seite 68)
Line frequency	47…63 Hz, automatic adjustment to frequencies in this range

Heatsealing band type and temperature range	<u>As of software revision 100:</u>
	The temperature range and temperature coefficient can be set independently of one another in the Configuration menu:
	    Temperature range: 200 °C, 300 °C, 400 °C or 500 °C
	    Temperature coefficient: 400…4000 ppm (variable setting range)
	
	<u>Up to software revision 027:</u>
	Several different ranges can be selected on the controller in the Configuration menu:
	    Temperature coefficient 410 ppm, 0…300 °C (SW revision 021 or higher)
	    Temperature coefficient 460 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 510 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 570 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 630 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 700 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 780 ppm (e.g. Alloy L)
	        0…200 °C, 0…300 °C, 0…400 °C, 0…500 °C
	                                 (SW revision 011 or higher)
	    Temperature coefficient 870 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 980 ppm, 0…300 °C (SW revision 019 or higher)
	    Temperature coefficient 1100 ppm (e.g. Alloy 20):
	        0…200 °C, 0…300 °C, 0…400 °C, 0…500 °C
	    Temperature coefficient 3500 ppm (e.g. NOREX):
	        0…200 °C, 0…300 °C

Set point selection/ analog input Terminals 20+23	Via the Settings menu in the controller or the electrically isolated analog input: Input resistance: 40 kohms, reverse polarity-protected 0…10 VDC, equivalent to 0…300 °C or 0…500 °C

Analog output (actual value) Terminals 20+24	0…10VDC, Imax = 5mA Equivalent to 0…300°C or 0…500°C Electrically isolated Accuracy: ±1% add. 50mV
Digital logic levels Terminals 3, 4, 22, 25, 26	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} = 5VDC, I_{max} = 5mA
Switching output for „"Output 1"/ Temp. OK" signal Terminals 20+21	U_{max} = 30VDC, I_{max} = 50mA U_{ON} < 2V (saturation voltage) Transistor conductive if the temperature is inside the tolerance band.
Alarm relay Terminals 5+6	Contact, potential-free, U_{max} = 50V (DC/AC), I_{max} = 0.2A
Relay K1 Terminals 16, 17, 18	Changeover contact, potential-free, U_{max} = 240VAC/100VDC, I_{max} = 1.5A Interference suppression with 47nF / 560ohms for each terminal
Maximum load (primary current of impulse transformer)	I_{max} = 5A (duty cycle = 100%) I_{max} = 25A (duty cycle = 20%)
Power dissipation	max. 25W
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$^{(+-0.2)}$ x 68$^{(+-0.2)}$ 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…2.5mm² (AWG 24…12) Plug-in connectors ⚠ **If ferrules are used, they must be crimped in accordance with DIN 46228 and IEC/EN 60947-1.** **This is essential for proper electrical contact in the terminals.**

7   Dimensions/front panel cutout

panel cutout

138 $^{\pm0.2}$ **x 68** $^{\pm0.2}$

144

72

outline dimensions
front frame

rubber seal

mounting clamp

terminal wires

terminal blocks

terminal blocks

72

66

front frame

front panel

terminal wires

9

132

29

144

136

DIP-switch
to select
U_2, I_2

RES-445
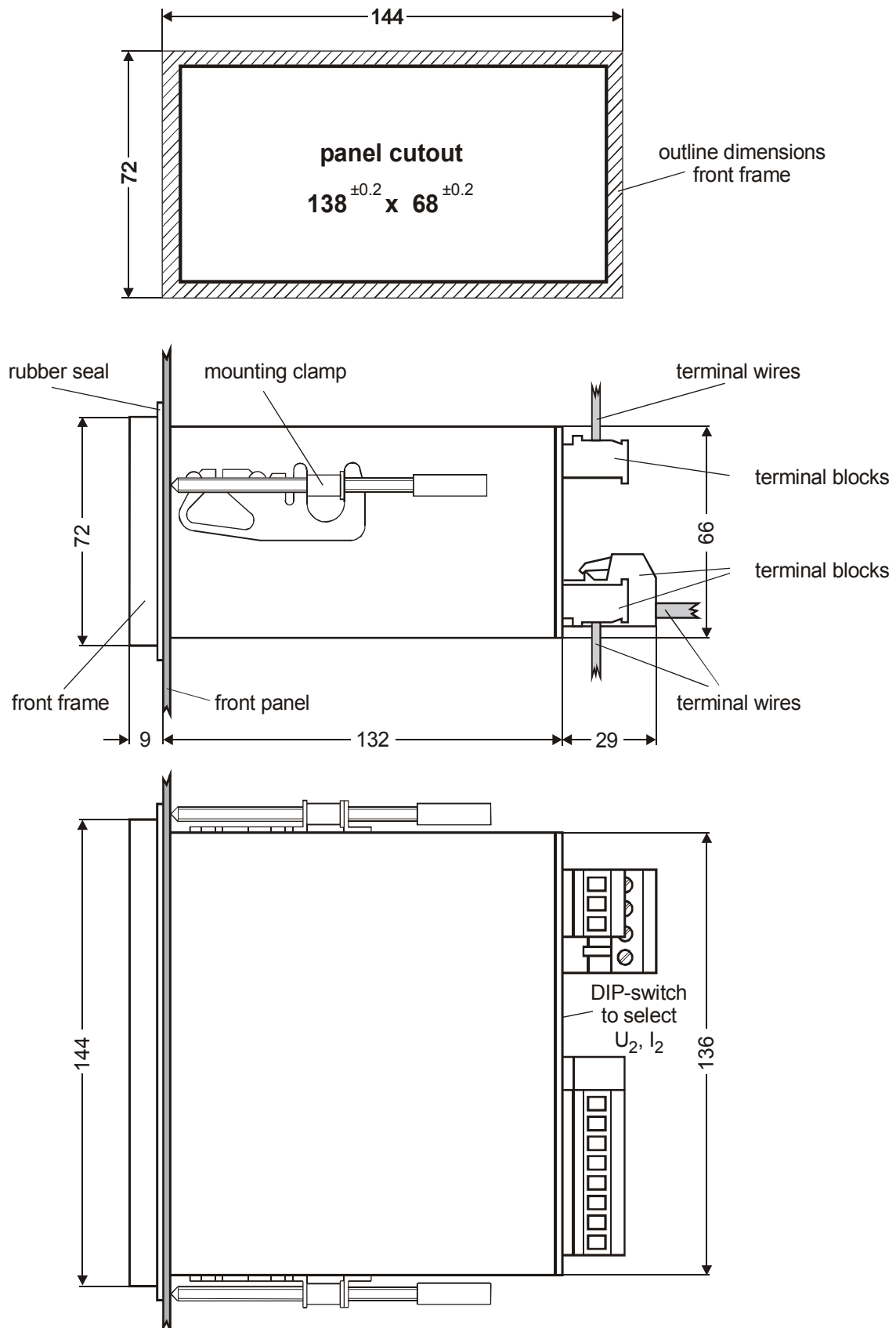
8 Installation

↳ See also Kap. 1 „Safety and warning notes" 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.**

8.1 Installation procedure

Proceed as follows to install the RESISTRON temperature controller RES-445:

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 47 Hz to 63 Hz.

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 15, Kap. 8.6 „Wiring diagram (standard)" auf Seite 17 and the ROPEX Application Report. The information provided in Kap. 8.2 „Installation steps" auf Seite 14 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

Use heatseal bands with suitable temperature coefficient

Heatseal element with coppered ends

No push-on connectors

Heatsealing band R= f (T)

No additional resistance in secondary circuit

F

Sufficient wire cross-section

A

Note number of turns

Connect U_R measuring wires directly to heatsealing band ends

Current transformer PEX-W2/-W3

Twisted

U_2 (sec.)

U_1 (prim.)

Current measuring wires I_R

Avoid long cables

Line

Line filter LF-xx480

OPTION: Temperature meter ATR-x

Impulse transformer

RESISTRON   RES-445

Set=175°c   Act=174°c
Sealing time: 1.0s
Cooling temp.: 50°c

ROPEX

Controller

Note polarity

Dimension transformer correctly
- Secondary voltage
- Power
- Duty cycle

Configure DIP switches correctly (up to SW-Rev. 027)

RES-445

8.3   Power supply

Line
115VAC, 230VAC, 400VAC
50/60Hz

Circuit breaker
Double-pole, C characteristic
(↳ ROPEX Application Report)

⚠️ Short-circuit protection only.
RESISTRON temperature controller not protected.

Relay Ka
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 run the filter supply wires (line side) parallel to the filter output wires (load side).

RESISTRON temperature controller belonging to the 4xx Series.

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

⚠️ When using a series resistor RV-....-1 the relay Kb shall be installed.

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.**

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

The wiring instructions contained in section 8.3 "Power supply" on page 15 must be observed.
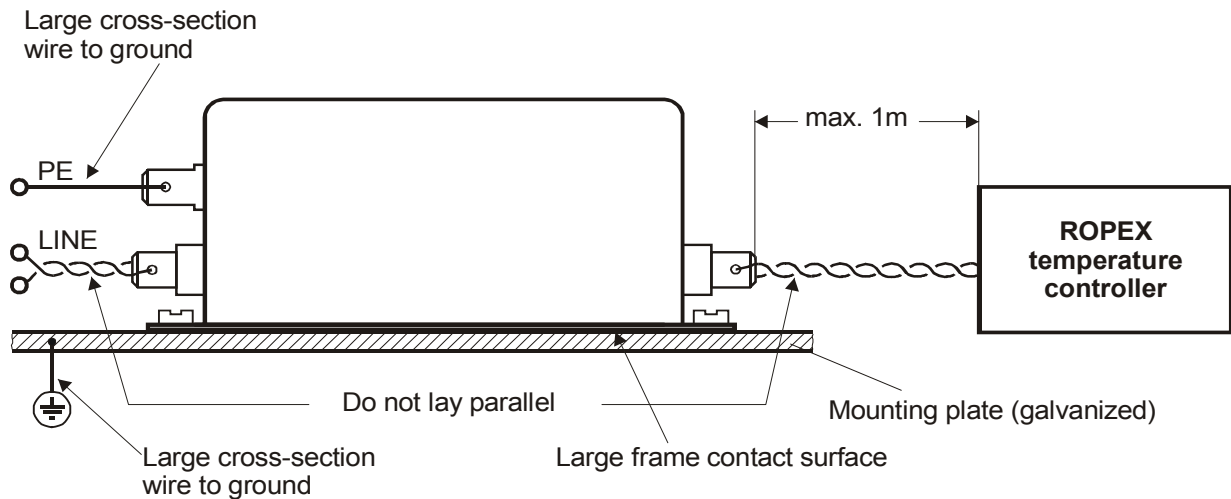
8.5 Current transformer PEX-W3

The PEX-W3 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 15).

Snap-on for DIN-rail 35 x 7,5mm or 35 x 15mm (DIN EN 50022)

8.6 Wiring diagram (standard)

RES-445
(also with MOD 01)

Line filter LF-xx480

LINE

14
15

1 +   BOOSTER
2 0V   OUTPUT

RELAY K1
100VDC/1.5A
240VAC/1.5A

17
16
18

K1

2x 47nF/560R

ALARM OUTPUT
max. 50V/0.2A

6
5

Contact closed or
opened by ALARM
(see configuration)

"OUTPUT 1"

21

GND 20

PREHEAT (CH1)
with 24VDC signal

22

START (HEAT)
with 24VDC signal

3

GND 4

**Ground
for 24VDC signals.
Must be grounded
externally to prevent
electrostatic
charging!**

AUTOCAL
with 24VDC signal

25

RESET
with 24VDC signal

26

TEMP. IN
0 - 10VDC

23

TEMP. OUT
0 - 10VDC

24

13
12

U_1 prim.

Impulse
transformer

U_2 sec.

Heat-
sealing
band

11
10

U_R R

twisted

0V
(Intern. ground)
**No external
grounding
allowed!**

9
8   I_R

Current transformer
PEX-W2/-W3

up to
production date
December 2005

0V
(Intern. ground)
**No external
grounding
allowed!**

0V (Internal ground)
Terminal   2

7

START (HEAT)
with contact

19

PREHEAT (CH1)
with contact

8.7 Wiring diagram with booster connection

RES-445
(also with MOD 01)

RELAY K1
100VDC/1.5A
240VAC/1.5A

17
16
18

2x 47nF/560R

K1

ALARM OUTPUT
max. 50V/0.2A

6
5

Contact closed or opened by ALARM (see configuration)

"OUTPUT 1" 21

GND 20

PREHEAT (CH1)
with 24VDC signal 22

START (HEAT)
with 24VDC signal 3

GND 4

Ground for 24VDC signals. Must be grounded externally to prevent electrostatic charging!

AUTOCAL
with 24VDC signal 25

RESET
with 24VDC signal 26

TEMP. IN
0 - 10VDC 23

TEMP. OUT
0 - 10VDC 24

14 Line filter LF-xx480 **LINE**
15

Booster
1 3 1
0V 2 IN OUT
4 2

13 NC
12 NC

U_1 prim.

Impulse transformer

U_2 sec.

Heat-sealing band

11
U_R
10 twisted R

0V (Intern. ground)
No external grounding allowed!

9
I_R
8

up to production date December 2005

0V (Intern. ground)
No external grounding allowed!

Current transformer PEX-W2/-W3

0V (Internal ground)
Terminal 2

7 **START (HEAT)** with contact

19 **PREHEAT (CH1)** with contact

9 Startup and operation

9.1 Front view of the controller

Terminals
Wiring diagram
Diagnostic interface
(on rear of controller)

Operator keys

Nameplate

Display

Clips
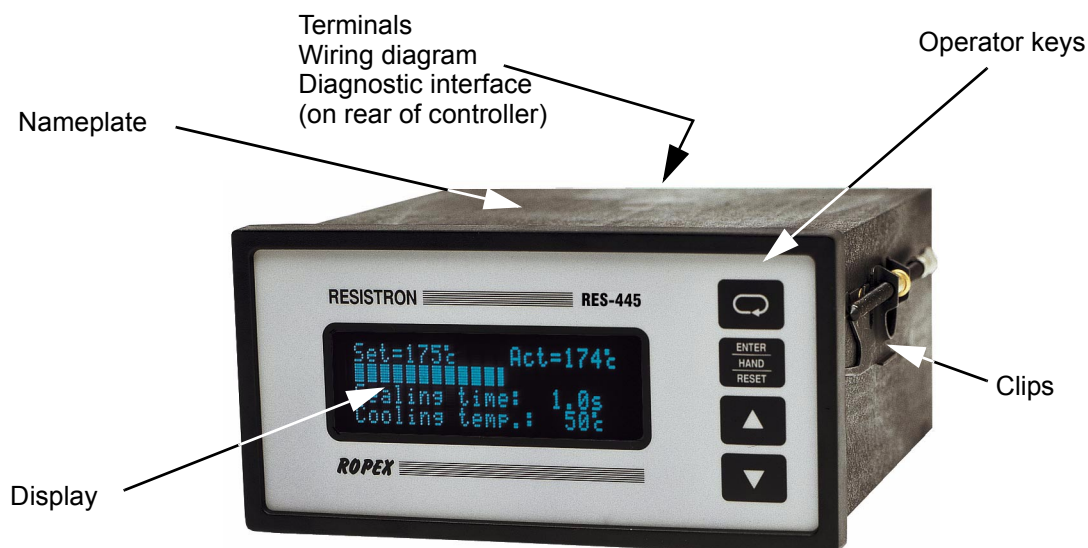
9.2 Rear view of the controller

As of software revision 100:

Printed wiring diagram

Terminals

Diagnostic interface

Terminals
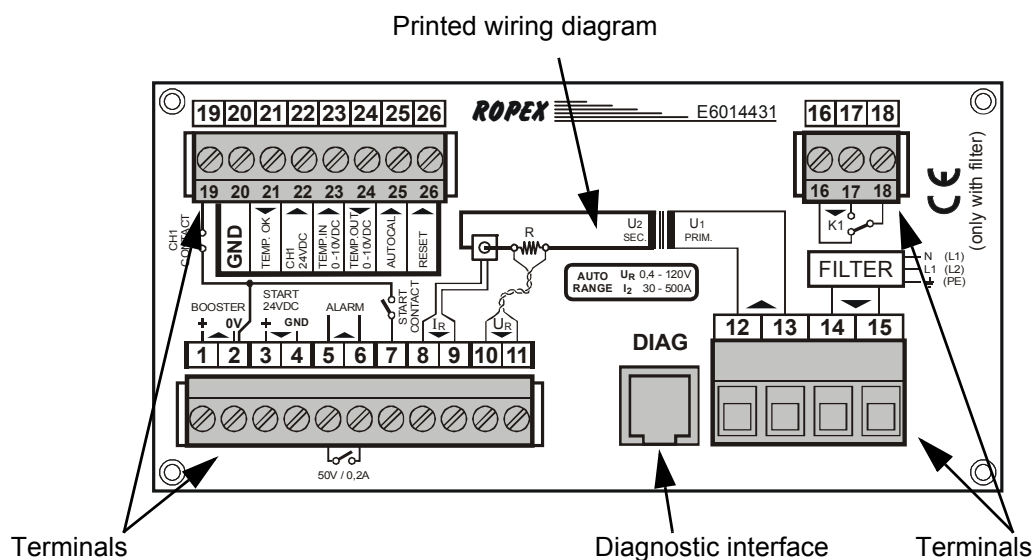
Up to software revision 027:

Printed wiring diagram

Terminals   DIP switches   Terminals
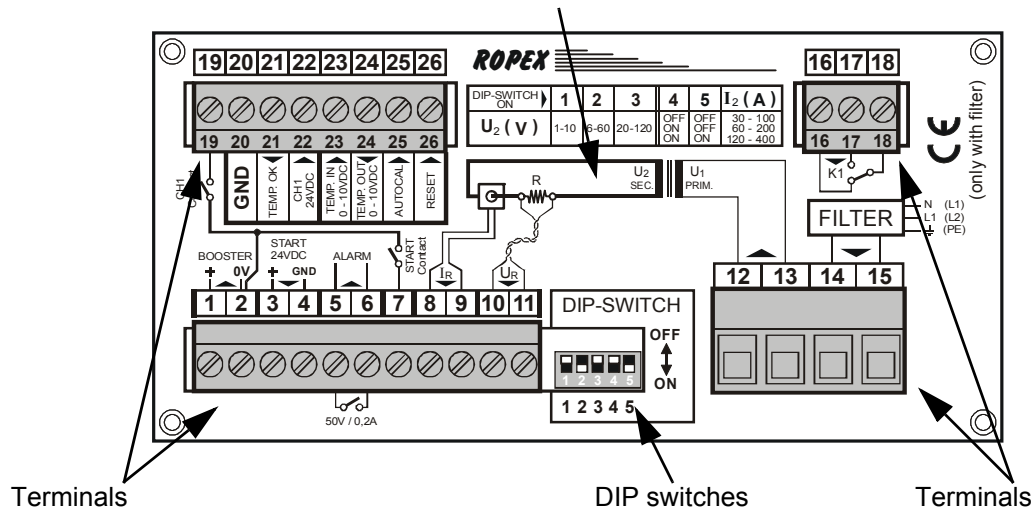
9.3 Controller configuration

The possible controller configurations are explained in the following sections. Proceed as described in Kap. 9.5.1 „Initial startup" auf Seite 26 to start up the controller for the first time.

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.**

Automatic configuration (AUTORANGE)
(as of software revision 100)

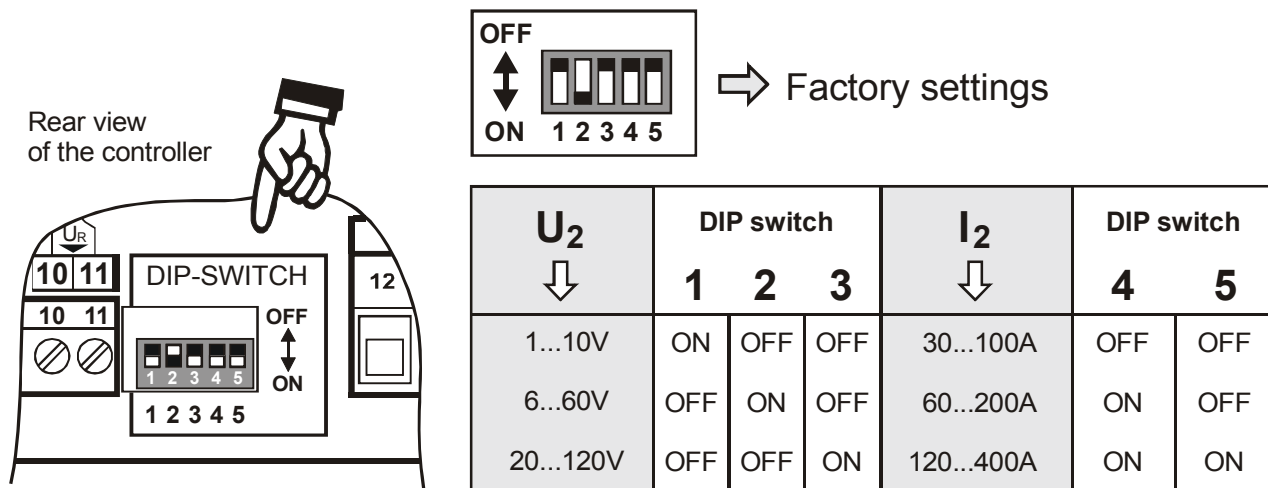The secondary voltage and current ranges are automatically configured by the automatic calibration func-tion (AUTOCAL). The voltage is configured in the range from 0.4 VAC to 120 VAC and the current in the range from 30 A to 500 A. If the voltage and/or the current is outside the permissible range, a detailed error mes-sage appears on the controller (✎ s. section 10.27 "Fault areas and causes" on page 64).

Configuration with coding switches
(up to software revision 027)

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.**

⇨ Factory settings

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/W3 current transformer must have two turns (⤷ ROPEX Application Report).

2x

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

Software revision 015 or higher also:

French, Spanish, Dutch, Danish, Finnish, Swedish, Greek, Turkish.

Software revision 024 or higher also: Portuguese.

⚠ **The language which is selected in this menu remains set even if the factory settings are restored (step 202 [21] in the Configuration menu).**

⚠ **As of software revision 103, the language setting with step 202 can still be changed even if the Configuration menu is disabled (⤷ section 10.19 "Disabling the Configuration menu" on page 51).**

9.3.3 Restoring the factory settings

The internal controller settings can be reset to the factory settings with step 202 [21] in the Configuration menu. Only the language setting (step 201 [20] in the Configuration menu) remains unchanged.

Please refer to section 11 "Factory settings" on page 65 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 (up to software revision 027)

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

Several different ranges can be selected:

1. **Temperature coefficient 410 ppm, 0…300°C** (software revision 021 or higher)

2. **Temperature coefficient 460 ppm, 0…300°C** (software revision 019 or higher)

3. **Temperature coefficient 510 ppm, 0…300°C** (software revision 019 or higher)

4. **Temperature coefficient 570 ppm, 0…300°C** (software revision 019 or higher)

5. **Temperature coefficient 630 ppm, 0…300°C** (software revision 019 or higher)

6. **Temperature coefficient 700 ppm, 0…300°C** (software revision 019 or higher)

7. **Temperature coefficient 780 ppm, 0…200°C** (e.g. Alloy L, software revision 011 or higher)

8. **Temperature coefficient 780 ppm, 0…300°C** (e.g. Alloy L, software revision 011 or higher)

9. **Temperature coefficient 780 ppm, 0…400°C** (e.g. Alloy L, software revision 011 or higher)

10. **Temperature coefficient 780 ppm, 0…500°C** (e.g. Alloy L, software revision 011 or higher)

11. **Temperature coefficient 870 ppm, 0…300 °C**
(software revision 019 or higher)

12. **Temperature coefficient 980 ppm, 0…300 °C**
(software revision 019 or higher)

13. **Temperature coefficient 1100 ppm, 0…200 °C**
(e.g. Alloy-20)

14. **Temperature coefficient 1100 ppm, 0…300 °C**
(Factory settings)
(e.g. Alloy-20)

15. **Temperature coefficient 1100 ppm, 0…400 °C**
(e.g. Alloy-20)

16. **Temperature coefficient 1100 ppm, 0…500 °C**
(e.g. Alloy-20)

17. **Temperature coefficient 3500 ppm, 0…200 °C**
(e.g. NOREX)

18. **Temperature coefficient 3500 ppm, 0…300 °C**
(e.g. NOREX)

9.3.5 Configuration of the alloy (Temperature coefficient) (as of software revision 100)

The heatsealing band alloy (and the temperature coefficient respectively) can be set with steps 203 and 204 in the Configuration menu.

In step 203 predefined values for the alloy (and the temperature coefficient repsecitvely) are available:

1. **Temperature coefficient 780 ppm**
(e.g. Alloy-L)

2. **Temperature coefficient 1100 ppm**
(Factory setting)
(e.g. Alloy-20)

3. **Temperature coefficient 1400 ppm**
(e.g. ROPEX CIRUS system)

4. **Temperature coefficient 1700 ppm**
(e.g. ROPEX CIRUS system)

5. **Temperature coefficient 3500 ppm**
(e.g. NOREX)

6. **Temperature coefficient „variable"**
Further settings in step 204.
In step 204 the temperature coeffecent can be set in a range of 400…4000 ppm individually for the used heatsealing band then.

⚠️ **Step 204 in the Configuration menu is available when step 203 is set to "variable" only.**

9.3.6 Configuration of the temperature range (as of software revision 100)

The temperature range can be set with steps 205 in the Configuration menu.
The setting can be 200 °C, 300 °C (Factory setting), 400 °C or 500 °C.

### 9.3.7 Configuration of the timer function

⚠️ **The necessary controller settings are explained in the detailed functional descriptions in Kap. 10.6 „Menu steps" auf Seite 34 and Kap. 10.24 „Time control (timer function)" auf Seite 53. They are only allowed to be entered by technically trained persons.**

The timer function is activated with step 26 in the Configuration menu.
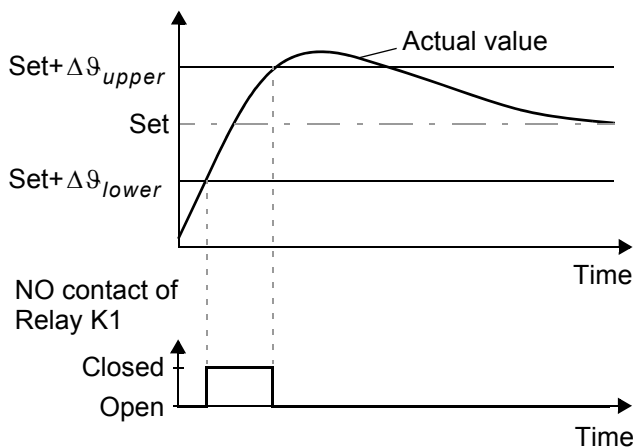
9.3.8 Relay K1 (without time control)

The function of relay K1 is specified with step 212 [29] in the Configuration menu. The following settings are possible when time control is deactivated:

1. **"Off" (Factory setting)**
Relay K1 has no function

2. **"Active if Tact = Tset"**
Relay K1 is activated if the actual value is inside the specified temperature tolerance band (steps 207 [24], 208 [25]). If the actual temperature is outside the tolerance band, relay K1 is deactivated (see graph below).
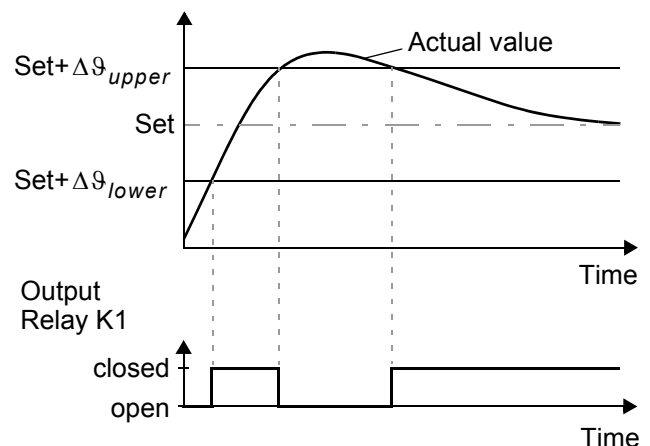
3. **"Active if Tact = Tset", with latch function (as of software revision 100)**

Relay K1 is closed if the actual value is inside the specified temperature tolerance band (steps 207, 208). If the actual temperature leaves the tolerance band <u>once</u> while the "START" signal is active, relay K1 is opened. The relay is not closed again until the next "START" signal is activated. The switching state of relay K1 can thus also be interrogated by the higher-level PLC after a heatsealing process (latch function, see graph below).


Other settings are available in this menu when time control (timer function) is active. They are described in section 10.24.7 "Relay K1 (with time control)" on page 56.

9.3.9 "Output 1"/ „Temperature OK" signal (without time control)

⚠️ **On controllers up to software revision 027, the switching output at terminals 20+21 was called "Temperature OK". The more general name "Output 1" is used as of software revision 100 because this output now also supports other functions.**

The "Output 1" signal is available at terminals 20+21 as a digital control signal.
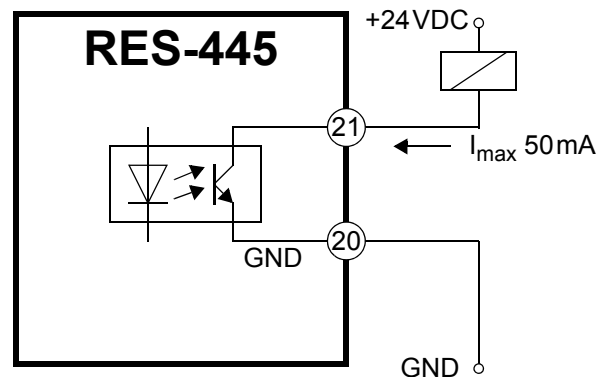
Up to software revision 027:

The RES-445 checks whether the ACTUAL temperature is inside a specifiable 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 signal at terminals 20+21 is switched (see graph below):
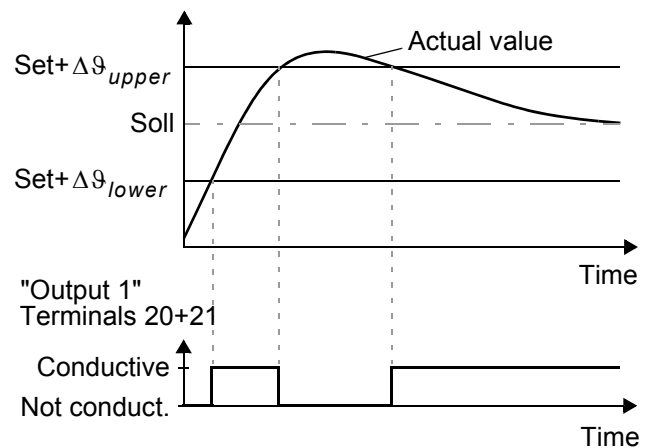
⚠️ **The ACTUAL temperature is evaluated, and the output signal at terminals 20+21 activated, in all operating states except when a fault is signaled.**

As of software revision 100:

If time control (timer function) is deactivated, the same configuration options are available for "Output 1" as for relay K1 (⮡ section 9.3.8 "Relay K1 (without time control)" on page 22). The options for "Output 1" are specified with step 222 in the Configuration menu as followed:

1. **"Off"**
   "Output 1" has no function

2. **"Active if Tact = Tset"**
   Output 1 is conductive if the actual value is inside the specified temperature tolerance band (steps 207, 208). If the actual temperature is outside the tolerance band, "Output 1" is not conductive.
   This function is the same as for the "Temperature OK" signal up to software revision 027.

3. **"Active if Tact = Tset", with latch function (factory setting)**
   "Output 1" is conductive if the actual value is inside the specified temperature tolerance band (steps 207, 208). If the actual temperature leaves the tolerance band <u>once</u> while the "START" signal is active, "Output 1 is no longer conductive. "Output 1" does not become conductive again until the next "START" signal is activated and can thus also be interrogated by the higher-level PLC after a heatsealing process.

Other settings are available in this menu when time control (timer function) is active. They are described in section 10.24.8 ""Output 1"/ „Temperature OK" signal (with time control)" on page 57.

9.3.10 Temperature diagnosis (as of software revision 100)

The temperature diagnosis function can be activated by means of step 217 in the Configuration menu. The RES-445 then checks whether the ACTUAL temperature is inside a specifiable 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 207 [24] + 208 [25] (factory setting: -10K or +10K).
If the ACTUAL temperature is inside the specified tolerance band when the "START" signal is activated, the temperature diagnosis is also activated. If the ACTUAL temperature leaves the tolerance band, the corresponding error code (307, 308) is indicated and the fault output is switched (⮡ section 10.27 "Fault areas

and causes" on page 64). If a heatsealing cycle is in progress, it is immediately interrupted.
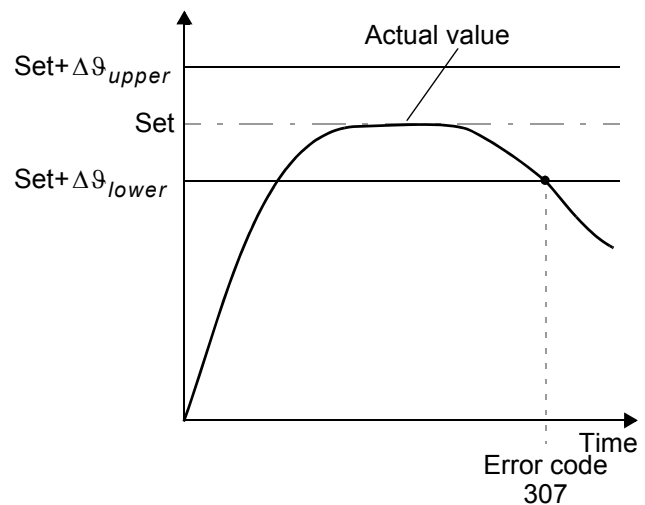
If the temperature diagnosis is not activated by the time the "START" signal is deactivated (i.e. if the ACTUAL temperature does not exceed the upper or lower tolerance band limit), the corresponding error code (309, 310) is indicated and the fault relay is switched.
If the temperature diagnosis function is activated, an additional delay time of 0 to 9.9s can be parameterized for the temperature timeout with step 218 in the Configuration menu. The first time the lower tolerance band limit is exceeded, the temperature diagnosis is not activated until the parameterized delay time has elapsed. The temperature diagnosis function can thus be explicitly deactivated, e.g. if the temperature drops temporarily owing to the closure of the sealing jaws.

9.3.11 Heatup timeout (as of software revision 100)

The heatup timeout can be parameterized with step 219 in the Configuration menu ("0" = OFF).
This timeout starts when the START signal is activated. The RES-445 then monitors the time required for the ACTUAL temperature to reach 95% of the SET temperature. If this time is longer than the parameterized time, the corresponding error code (304) is indicated and the fault relay is switched (⮡ section 10.27 "Fault areas and causes" on page 64).
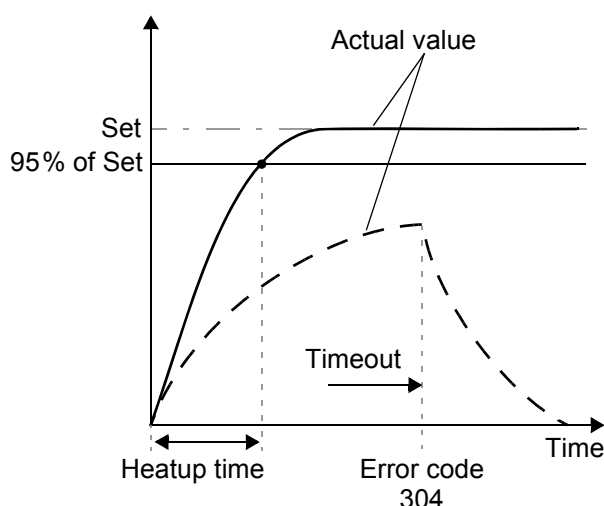
9.3.12 Configuration of the alarm relay

The alarm relay is set with step 215 [31] in the Configuration menu.

There are two possible settings:

1. **"Normal" (Factory setting)**
   Alarm relay contact closed by a fault

2. **"Inverse"**
   Alarm relay contact opened by a fault

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 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 appro-

ximately 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 (↳ chap. 9.4.2 „Burning in the heatsealing band", page 25).

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 4 and Kap. 2 „Application" auf Seite 5.

⚠ **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 13).

The possible settings are described in detail in chap. 9.3 „Controller configuration", page 20 and chap. 10 „Controller functions", page 27.

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 63 Hz.

3. In case of controllers up to software revision 027, the setting of the DIP switches on the controller are indicated in the ROPEX Application report and depend on the heatsealing band (section 9.3 "Controller configuration" on page 20).

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
Error message with error codes 104…106, 111…113, 211	Go to 8
Error message with error codes 101…103, 107, 108, 201…203, 801, 9xx	Fault diagnosis (⇨ 10.27)

8. Set the controller configuration as described in Kap. 9.3 „Controller configuration" auf Seite 20. The following settings are always required:

Setting	Step in Configuration menu
Language	201 [20]
Restore factory settings	202 [21]
Temperature range and heatsealing band alloy	203, 204, 205 [22]

9. Activate the AUTOCAL function while the heatsealing band is still cold (with step 7 in the Settings menu or by means of the "AUTOCAL" signal, terminals 20+25). The progress of the calibration process is indicated by a counter on the display (approx. 10…15 s). A voltage of app. 0 VDC appears at the same time at the actual value output (terminals 20+24). If an ATR-x is connected, it indicates 0…3 °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 0.66 VDC (for the 300 °C range) or 0.4 VDC (for the 500 °C range, equivalent to 20 °C, appears at the actual 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 erro message indicates error codes 104…106, 211. In this case the controller configuration is incorrect (⇨ Kap. 9.3 „Controller configuration" auf Seite 20 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 (or apply a 0…10 VDC voltage to the analog input, terminals 20+23) 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 section 10.27 "Fault areas and causes" on page 64.

⚠️ **If the heatsealing temperature is selected via the analog input at terminals 20+23, the specified voltage value must be checked with a voltmeter before the heatsealing process begins, in order to prevent incorrect settings or excessively high heatsealing temperatures.**

9.5.2 Restart after replacing the heatsealing band

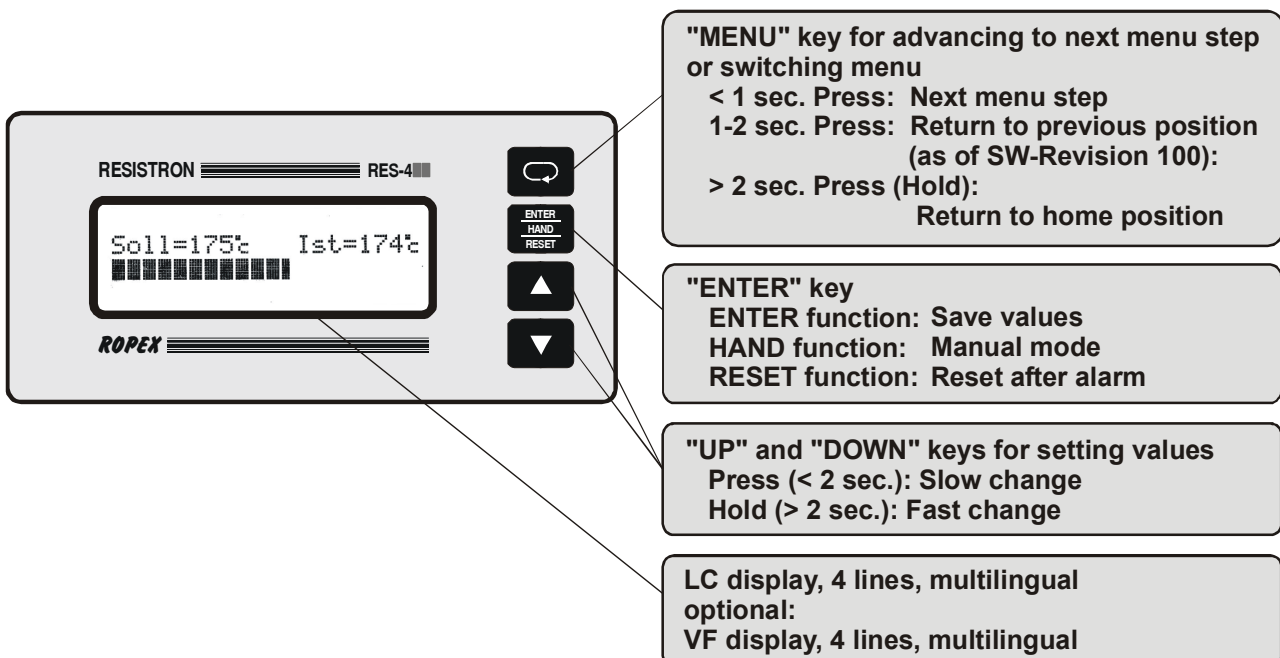To replace the heatsealing band, proceed as described in Kap. 9.4 „Heatsealing band" auf Seite 25.

11. Burn in the heatsealing band (↳ Kap. 9.4 „Heatsealing band" auf Seite 25) 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.**
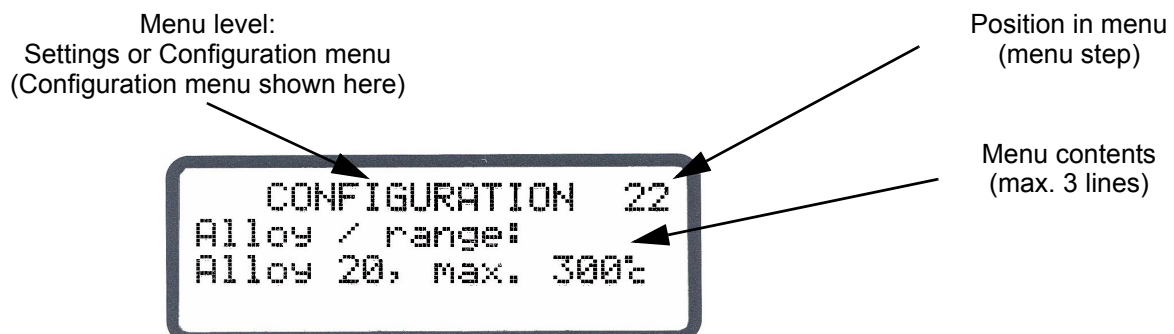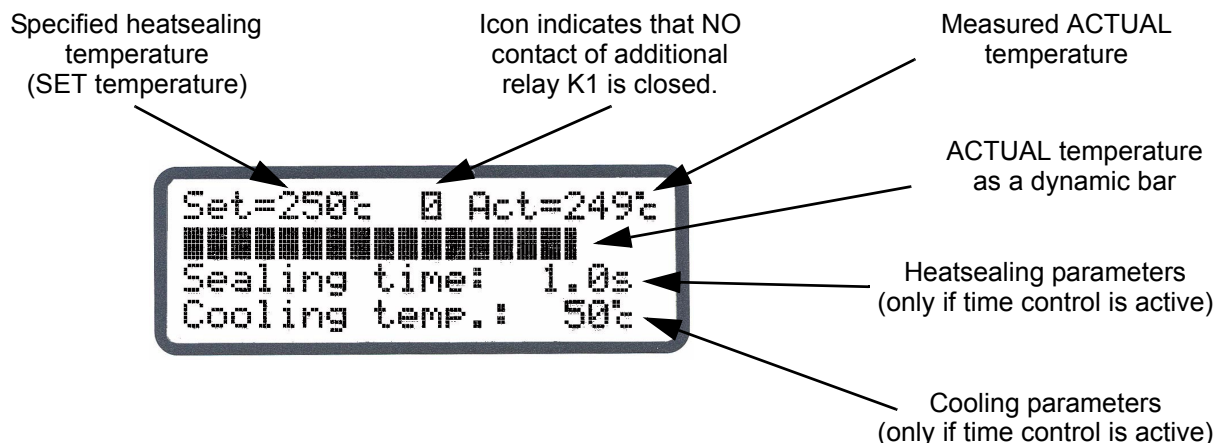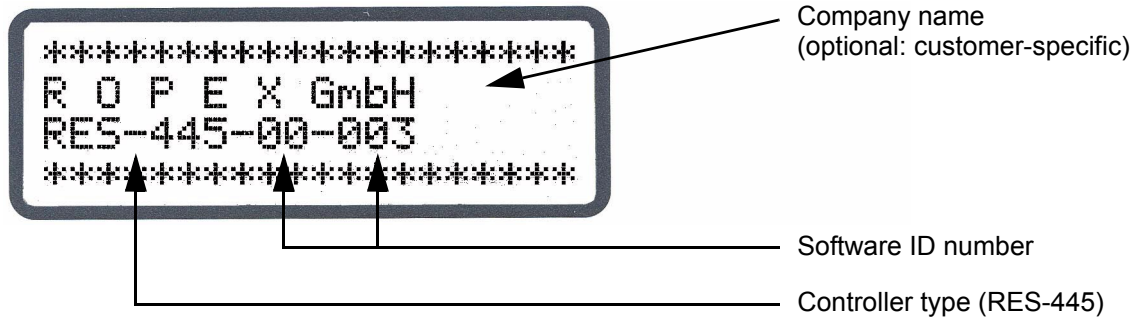
Continue with section 9.5.1, steps 9 and 10.

10 Controller functions

See also Kap. 8.6 „Wiring diagram (standard)" auf Seite 17.

10.1 Indicators and controls

RESISTRON ▬▬▬▬ RES-4▮▮

Soll=175℃   Ist=174℃
▮▮▮▮▮▮▮▮▮▮

ROPEX ▬▬▬▬▬▬

"MENU" key for advancing to next menu step or switching menu
  < 1 sec. Press: Next menu step
  1-2 sec. Press: Return to previous position
                   (as of SW-Revision 100):
  > 2 sec. Press (Hold):
                   Return to home position

"ENTER" key
  ENTER function: Save values
  HAND function: Manual mode
  RESET function: Reset after alarm

"UP" and "DOWN" keys for setting values
  Press (< 2 sec.): Slow change
  Hold (> 2 sec.):   Fast change

LC display, 4 lines, multilingual
optional:
VF display, 4 lines, multilingual

10.2 Display

10.2.1 Power-up message

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

This message also includes details of the software version.

```
********************
R O P E X GmbH
RES-445-00-003
********************
```

Company name
(optional: customer-specific)

Software ID number

Controller type (RES-445)

10.2.2 Display in home position

If no settings are entered on the controller and no error message 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.

Specified heatsealing temperature (SET temperature)

Icon indicates that NO contact of additional relay K1 is closed.

Measured ACTUAL temperature

```
Set=250°c  0 Act=249°c
████████████████████
Sealing time:   1.0s
Cooling temp.:   50°c
```

ACTUAL temperature as a dynamic bar

Heatsealing parameters (only if time control is active)

Cooling parameters (only if time control is active)

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 31).

Menu level: Settings or Configuration menu (Configuration menu shown here)

Position in menu (menu step)

Menu contents (max. 3 lines)

```
   CONFIGURATION  22
Alloy / range:
Alloy 20, max. 300°c
```

10.2.4 Error messages

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 error message (⮫ Kap. 10.25 „System monitoring/alarm output" auf Seite 59).

Alarm indication

Fault description and error code

```
   A L A R M
ERROR: Seal wire
ERRORCODE: 103
   RESET KEY
```

Prompt to press "RESET" key

10.3 Navigation in the menus

10.3.1 Navigation in menus without a fault

A "MENU" key is provided for navigating through the various menu steps and levels. By pressing this key briefly (<1s) at any time, you can jump to the next menu step. As of software revision 100, you can also jump to the previous menu step by pressing the "MENU" key for 1-2s. 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 201 [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".

Settings

Configuration

Home position — >2s — 201 Language

<1s

101 Heatsealing temp. >2s or automatically after 30s

202 Factory settings >2s or automatically after 30s

>2s or automatically after 30s

<1s
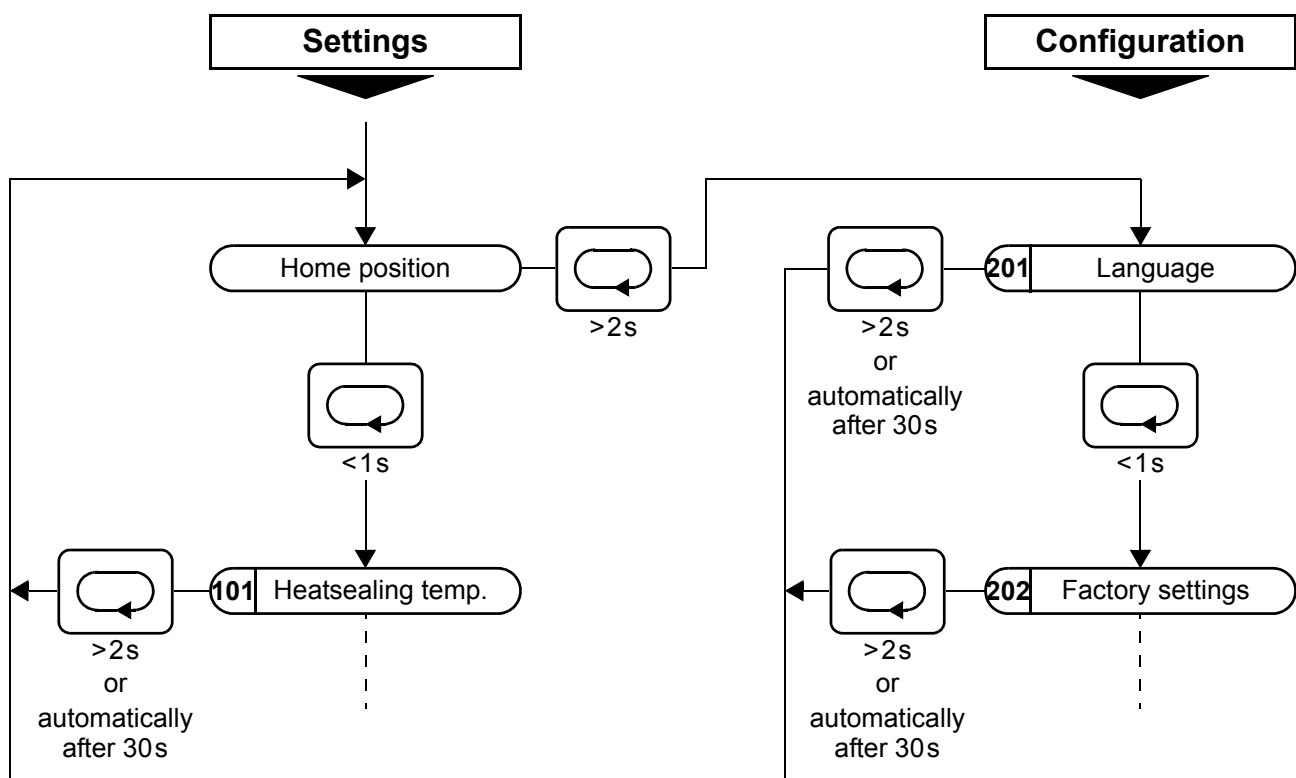
10.3.2 Navigation in menus with a fault

If an alarm is signaled, the controller switches to the Alarm menu. Some faults can be acknowledged by pressing the "RESET" key (↳ Kap. 10.25 „System monitoring/alarm output" auf Seite 59). 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 (↳ section 10.9 "Automatic zero calibration (AUTOCAL)" on page 45).

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 201 [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

Settings	**Configuration**	
▼	▼	

Power-up message

Home position → 201 Language

101 Heatsealing temp. ← 202 Factory settings

102 Preheating temp. ← 203 Alloy

103 Starting delay ← 204 Temp. coefficient

104 Sealing time ← 205 Temperature range

105 Cooling value ← 206 Max. temperature

106 Hold mode ← 207 Set point reached

107 Autocal? ← 208 Set point exceeded

Autocal ← 209 Time control

108 Autocomp? ← 210 Cooling mode

Autocomp ← 211 Start of sealing time

← 212 Relay K1 function

← 213 Lock "HAND" key

← 214 Cycles

Fault ← 215 Alarm relay

Alarm ← 216 Analog output

107 Autocal? ← 217 Temp. diagnosis

Autocal ← 218 Temp. diag. delay

1) Time control: ON
2) Time control: OFF
3) AUTOCOMP: OFF
4) AUTOCOMP: ON
5) TCR variable
6) TCR not variable

Continued on next page

Configuration

Continued from previous page

219	Heatup timeout
220	Meas. imp. length
221	Autocomp
222	"Output 1"
225	Temperature unit

Back to home position

10.5 Two-digit numbering system up to software revision 027

A system of one and two-digit numbers was used for the Settings and Configuration menus up to software revision 027. Three-digit numbers were introduced in software revision 100 to improve the clarity of the menu structure.

The table below compares the two numbering systems:

Menu	Menu steps	Numbering up to software revision 027	Numbering as of software revision 100
Settings menu	Heatsealing temperature	1	101
	Preheating temp. (PREHEAT)	2	102
	Starting delay	3	103
	Heatsealing time	4	104
	Cooling value	5	105
	Hold mode	6	106
	AUTOCAL	7	107
Configuration menu	Language	20	201
	Factory settings	21	202
	Alloy / TCR	22	203, 204
	Maximim temperature	23	206
	Set point reached	24	207
	Set point exceeded	25	208
	Time control	26	209
	Cooling mode	27	210
	Sart of heatsealing time	28	211
	Relay K1 function	29	212
	Cycles	30	214
	Alarm relay	31	215
	Measuring pulse length	32	220
	Analog output	33	216

⚠ **All number sor menu steps not listed above are only available as of software revision 100 and are described in chap. 9 „Startup and operation", page 19 (and section 10.4 "Menu structure" on page 31 respectively).**

⚠ **The new, three-digit menu step numbers are described first in all relevant sections of this document. The older, two-digit numbers are indicated afterwards in square brackets (e.g. step 201 [20]).**

10.6 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 209 [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.	
101 [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 203 [22] (alloy/range) and step 204 [23] (max. temperature). If the heatsealing temperature is to be determined by a voltage at the analog input at terminals 20+23, it must be set to 0°C with this menu step. The set point is indicated in the home position. ⚠ **If an external heatsealing temperature (analog input, terminals 20+23) and an internal heatsealing temperature (step 101 [1]) are specified simultaneously, the higher of the two temperatures is used and indicated in the main menu.**	Depends on setting of step 205 [22]: 0, 40°C…maximum temperature (step 206 [23])
102 [2]	Preheating temperature	The required preheating temperature can be set with the "UP" and "DOWN" keys. The maximum temperature (step 206 [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 205 [22]: 0, 40°C…maximum temperature (step 206 [23])
103 [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 209 [26]) is active.	0…9.9s
104 [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 209 [26]) is active.	0…99.9s, EXT

No.	Name	Description	Setting range
105 [5]	Cooling value	The cooling value can be specified here according to the cooling mode (absolute, relative, time) selected with step 210 [27].	
		• Absolute: The cycle ends if the "cooling temperature" falls below the set value (in °C).	50°C to maximum temperature (step 206 [23])
		• Relative: The cycle ends if the "cooling temperature" falls below the set percentage value, whereby 100% corresponds to the specified set point (step 101 [1]).	40%…100%
		• Time: The cycle ends when the set "cooling time" in seconds has elapsed. The current cooling value is indicated in the home position.	0…99.9 s
		This function can only be selected if time control (step 209 [26]) is active.	
106 [6]	Hold mode	If the "Hold" function is activated, the last measured value at the end of the heating phase is stored and displayed. 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 100 ms before the value is updated. 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.	ON OFF 2 s
107 [7]	Autocal	The AUTOCAL function matches the controller to the current and voltage signals that are present in the system. 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. The word "- Calibration -" appears on the display while the AUTOCAL function is executing and a counter counts down from 15 to 0. When the controller has been calibrated successfully, the display switches back directly to the home position providing the "AUTOCOMP" function is deactivated. If "AUTOCOMP" is active, the display jumps to step 108. If the controller cannot be calibrated, the AUTOCAL function is aborted and an error message is displayed instead.	0…40°C

No.	Name	Description	Setting range
108	Autocomp	Pressing the "ENTER" key starts the "AUTOCOMP" function. If the "ENTER" key is not pressed within 2s, the display returns to the home position. The home position is automatically displayed if the "AUTOCAL" function is successfully executed and "AUTOCOMP" is active.	
201 [20]	Language	The desired display language can be selected with this menu step.	English German Italian Software revision 015 or higher also: French, Spanish, Dutch, Danish, Finnish, Swedish, Greek, Turkish. Software revision 024 or higher also: Portuguese.
202 [21]	Factory settings	The controller can be reset to the factory settings by pressing the "ENTER" key (⮌ section 11 "Factory settings" on page 65). In addition, as of software revision 100: The "UP" and "DOWN" keys can be used to select whether • The controller should be reset to the ROPEX factory settings • The current configuration should be specified as the default setting • The controller should be reset to a previously specified default setting	

No.	Name	Description	Setting range
22	Alloy/range	⚠ **This step in the Configuration menu is available up to software revision 027 only.** 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. ⚠ **Please be very careful to select the heat-sealing band material with the correct alloy.** 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.	(Availability depends on software revision) TCR 410 ppm, 300 °C TCR 460 ppm, 300 °C TCR 510 ppm, 300 °C TCR 570 ppm, 300 °C TCR 630 ppm, 300 °C TCR 700 ppm, 300 °C TCR 780 ppm, 200 °C TCR 780 ppm, 300 °C TCR 780 ppm, 400 °C TCR 780 ppm, 500 °C TCR 870 ppm, 300 °C TCR 980 ppm, 300 °C TCR 1100 ppm, 200 °C TCR 1100 ppm, 300 °C TCR 1100 ppm, 400 °C TCR 1100 ppm, 500 °C TCR 3500 ppm, 200 °C TCR 3500 ppm, 300 °C
203	Alloy	Various heatsealing band alloys can be selected here. The corresponding characteristic for the controller parameters is calculated on the basis of this setting. ⚠ **Please be very careful to select the heat-sealing band material with the correct alloy.**	(Availability depends on software revision) TCR 780 ppm TCR 1100 ppm TCR 3500 ppm variable
204	Temperature coefficient	If you selected "Variable" with step 203, you can specify the temperature coefficient of the heatsealing band material here in 10 ppm increments using the "UP" and "DOWN" keys.	400…4000 ppm
205	Temperature range	Various temperature ranges can be selected here. 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.	200 °C 300 °C 400 °C 500 °C
206 [23]	Maximum temperature	This menu item specifies the maximum selectable set point (step 101 [1]) and the maximum selectable preheating temperature (step 102 [2]) within the range defined by step 205 [22].	0 to max. temperature range (step 205 [22])

No.	Name	Description	Setting range
207 [24]	Set point reached (low limit)	<u>As of software revision 100:</u> If the actual value is greater than the switching threshold specified here and less than the threshold set with step 208, "Output 1" and/or relay K1 can be activated depending on the configuration (step 212 or 222). <u>Up to software revision 027:</u> 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. The value is entered in Kelvins (K) and subtracted from the set point in order to calculate the switching threshold.	-5K…-99K
208 [25]	Set point exceeded (upper limit)	<u>As of software revision 100:</u> If the actual value is less than the switching threshold specified here and greater than the threshold set with step 207, "Output 1" and/or relay K1 can be activated depending on the configuration (step 212 or 222). <u>Up to software revision 027:</u> 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. The value is entered in Kelvins (K) and added to the set point in order to calculate the switching threshold.	+5K…+99K
209 [26]	Time control	This menu step specifies whether the controller should operate with or without time control.	ON, ON with START monitoring, OFF

No.	Name	Description	Setting range
210 [27]	Cooling mode	The end of the cooling-down phase (end of cycle) can be configured by specifying the required cooling mode.	
		• Absolute: The cycle ends if the actual value falls below the cooling temperature set here.	Absolute (in °C)
		• Relative: The cycle ends if the actual value falls below the relative cooling temperature (percentage of the set point) set here.	Relative (in %)
		• Time: The cycle ends when the set cooling time has elapsed.	Time (in s)
		This function can only be selected if time control (step 209 [26]) is active.	
211 [28]	Start of heatsealing time	This menu step specifies whether the heatsealing time (step 104 [4]) should begin as soon as the start signal is applied or when 95 % of the set point is reached. This function can only be selected if time control (step 209 [26]) is active.	Heatsealing time starts when heating starts Heatsealing time starts when temperature reached
212 [29]	Relay K1 function	The energizing behavior of relay K1 can be configured as follows: Time control OFF:	
		• K1 is not activated	Relay K1 OFF
		• Relay K1 is energized if the actual value is inside the specified temperature tolerance band (steps 207 [24], 208 [25]).	Relay K1 active if Tact = Tset

No.	Name	Description	Setting range
		• In addition, as of software revision 100: K1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208). The relay remains energized at the end of the heatsealing cycle and is not deenergized again until the next "START" signal is activated.	Relay K1 active if Tact = Tset, with latch function
		Time control ON:	
		• K1 is not activated	Relay K1 OFF
		• K1 is energized if the start signal is present. The relay is deenergized at the end of the cooling phase.	Relay K1 active when START signal present
		• K1 is energized if the actual value reaches 95% of the set point. The relay is deenergized at the end of the cooling phase.	Relay K1 active when temperature reached
		• 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 software revision 010)	Relay K1 active during cooling phase
		• 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 generates end-of-cycle impulse
		• In addition, as of software revision 100: K1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208).	Relay K1 active if Tact = Tset
		• In addition, as of software revision 100: K1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208). The relay remains energized at the end of the heatsealing cycle and is not deenergized again until the next "START" signal is activated.	Relay K1 active if Tact = Tset, with latch function
213	Lock of "HAND" key	You can specify here whether or not the heatsealing band can be heated in the home position by pressing the "HAND" key.	ON, OFF
214 [30]	Cycle counter	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

No.	Name	Description	Setting range
215 [31]	Alarm relay	This menu step permits the switching characteristics of the alarm relay to be configured.	
		• Normal: The alarm relay output (terminals 5+6) operates as an NO contact in the event of a fault.	Normal
		• Inverse: The alarm relay output (terminals 5+6) operates as an NC contact in the event of a fault.	Inverse
216 [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 software revision 017). The 10V reference can be used for the connection of an external potentiometer as temperature preset.	Real temperature, 10V reference
217	Temperature diagnosis	If this value is set to "ON" and the actual temperature leaves the tolerance band (steps 207, 208), a fault signal indicating error code 307/308 is output.	OFF ON
218	Temperature diagnosis delay time	This delay time starts when the actual temperature enters the tolerance band. The temperature timeout and fault output are not activated until after the delay time has elapsed. This step can only be selected if the temperature diagnosis function (step 217) is active.	0…99.9s
219	Heatup timeout	If the actual temperature is outside the tolerance band when the specified time elapses (after the "START" signal has been activated), a fault signal indicating error code 304 is output.	OFF, 0…99.9s
220 [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
221	Autocomp	Activates the „AUTOCOMP" function	OFF, ON
222	"Output 1"	The energizing behavior of output 1 can be configured as follows:	
		Time control OFF:	
		• Output 1 is not activated	"Output 1" OFF
		• Output 1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208).	"Output 1" active if Tact = Tset

No.	Name	Description	Setting range
		• Output 1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208). The relay remains energized at the end of the heatsealing cycle and is not deenergized again until the next "START" signal is activated.	"Output 1" active if Tact = Tset, with latch function
		Time control ON:	
		• Output 1 is not activated	"Output 1" OFF
		• Output 1 is energized if the start signal is present. The relay is deenergized at the end of the cooling phase.	"Output 1" active with START signal
		• Output 1 is energized when the actual value reaches 95 % of the set point. The relay is deenergized at the end of the cooling phase.	"Output 1" active when temperature reached
		• Output 1 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 software revision 010)	"Output 1" active during cooling phase
		• Output 1 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).	"Output 1" generates end-of-cycle impulse
		• Output 1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208).	"Output 1" active if Tact = Tset
		• Output 1 is energized if the actual value is inside the specified temperature tolerance band (steps 207, 208). The relay remains energized at the end of the heatsealing cycle and is not deenergized again until the next "START" signal is activated.	"Output 1" active if Tact = Tset, with latch function
225	Temperature unit	Unit for temperature display and input values	Celsius Fahrenheit

10.7 Temperature setting (set point selection)

The heatsealing temperature can be set on the RES-445 controller in three ways:

• By means of the setting in menu step 101 [1].

• By applying a 0…10VDC voltage to the analog input at terminals 20+23.

RES-445

+

+ ──────── (23) ──▷

0…10VDC

- ──────── (20)

GND
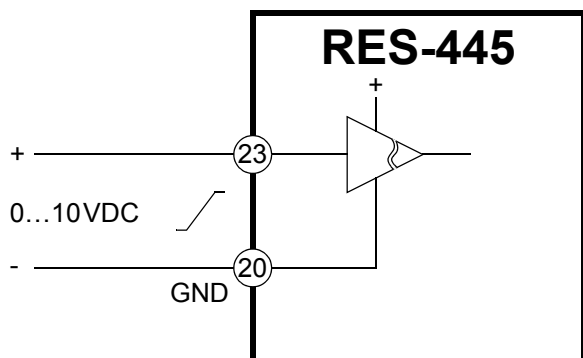
The relationship between the applied voltage and the SET temperature is linear.
Voltage values:
0VDC   → 0°C
10VDC   → 300°C or 500°C (depending on the controller configuration).

Please refer to Kap. 10.8 „Temperature indication/actual value output" auf Seite 44 for a circuit diagram.

If the heatsealing temperature is to be determined by a voltage at the analog input at terminals 20+23, it must be set to 0°C with menu step 101 [1].

⚠ **If an external heatsealing temperature (analog input, terminals 20+23) and an internal heatsealing temperature (step 101 [1]) are specified simultaneously, the higher of the two temperatures is used and indicated in the home position.**

⚠ **The maximum value of the setting range is limited either by the maximum value specified with step 206 [23] in the Configuration menu or by the heatsealing band type/temperature range set with step 205 [22].**

The set point that is selected for the heatsealing temperature must be greater than 40°C. If not, the heatse-

aling 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.

⚠ **If the heatsealing temperature is specified via the analog input at terminals 20+23, the external voltage must be activated at least 100 ms before the heatsealing process starts. If not, the heatsealing temperature will not reach the required value.**

• By connecting a 2 kohm potentiometer (e.g. PD-3 or PD-5) to terminals 20, 23 and 24:
(This setting is possible as of software revision 017)

RES-445

+

(24) U_{Ref} = 10VDC

CW

(23) ──▷ PD-x (2k)

(20) GND

Analog input 0…10VDC
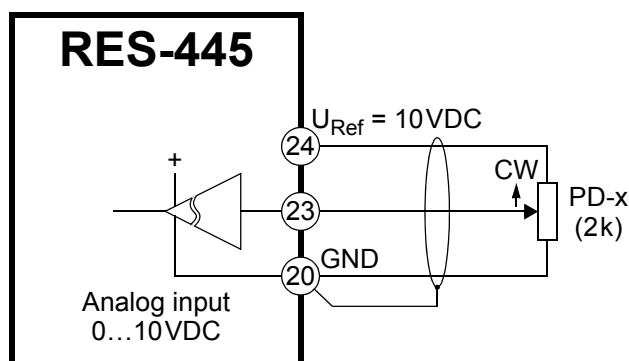
Potentiometer with digital dial PD-x

(24) ← 3
(20) ← 1
(23) ← 2
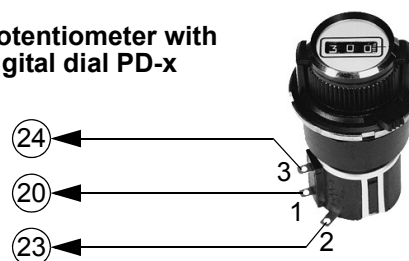
The controller is configured for this purpose so that a fixed 10VDC reference voltage is available at the analog output at terminal 24 (↳ menu step 216 [33], section 10.8 "Temperature indication/actual value output" on page 44).
This voltage is divided by the PD-x set point potentiometer and supplied to the analog input at terminal 23. You can then specify the set temperature in °C in the digital window of the potentiometer.
Once again, the set temperature must be set to zero in step 101 [1].

10.8 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.

Set=175℃   Act=174℃
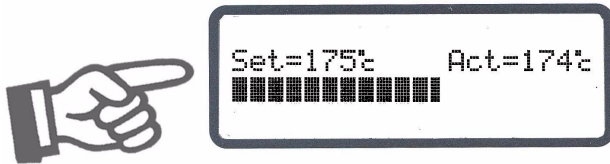
The heating and control process can thus be monitored at any time.

In addition, the RES-445 controller outputs an electrically isolated, analog 0…10VDC signal, which is proportional to the real ACTUAL temperature, at terminals 20+24.

RES-445

Act. value output 0…10VDC

33 ohms

max. 5mA

24

GND

20

0…10VDC

Temperature meter e.g. ATR-3
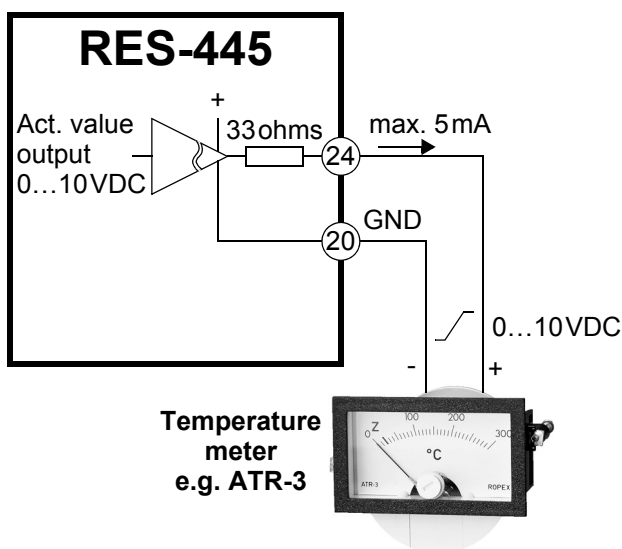
Voltage values:
0VDC → 0°C
10VDC → 300°C or 500°C (depending on the controller configuration).

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

0 - 300°C range
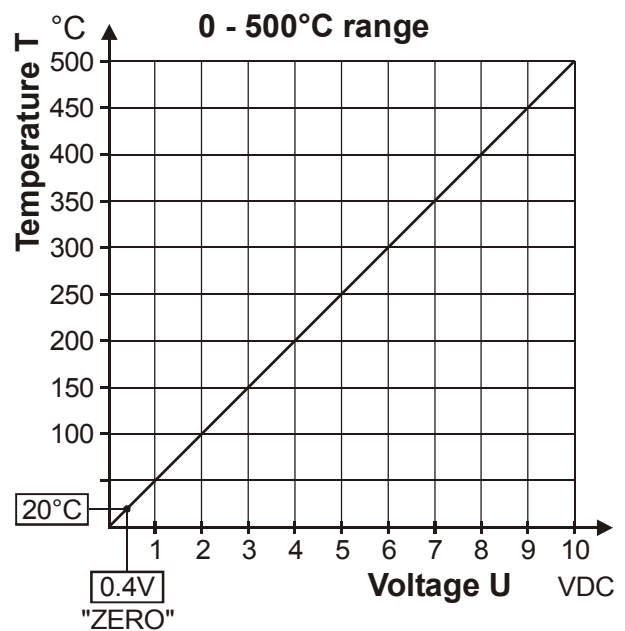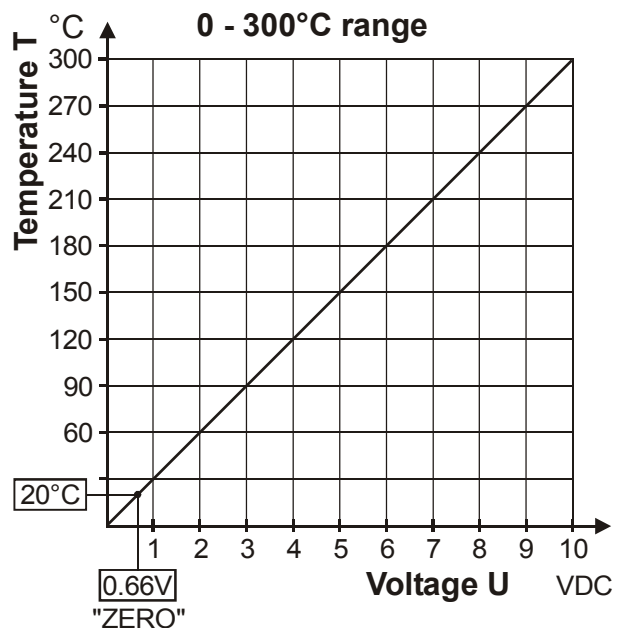
0 - 500°C range

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 205 [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 heat-sealing band.

The characteristics of the ROPEX ATR-x temperature meter (size, scaling, dynamic response) are ideally suited to this application (↘ section 5 "Accessories and modifications" on page 7).

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 a fault is signaled, this analog output is used – in addition to the value indicated on the controller – to display a selective error message ($\Rightarrow$ section 10.27 "Fault areas and causes" on page 64).

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 216 [33] (analog output):

- **Actual temperature (Factory setting)**
  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.

10.9 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. This function can be activated in two ways:

- By means of a 24VDC signal at terminals 20+25.
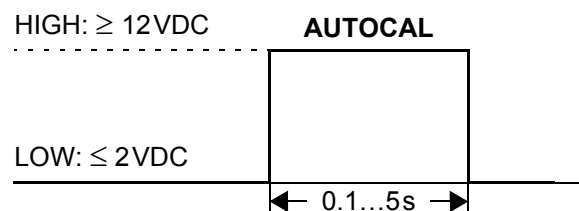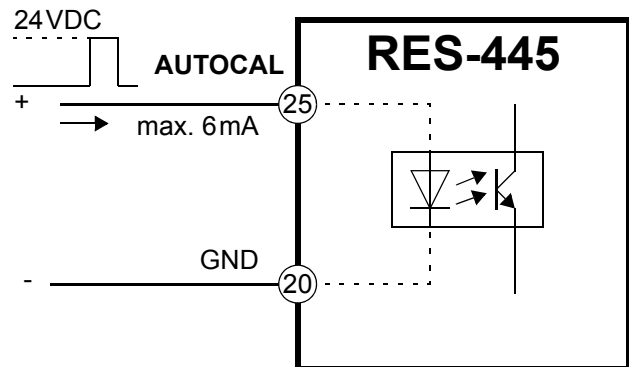
- By selecting step 107 [7] in the Settings menu and pressing the "ENTER" key

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.

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 20+24) is set to 0…3°C (corresponds to app. 0VDC) for the duration of the calibration process.
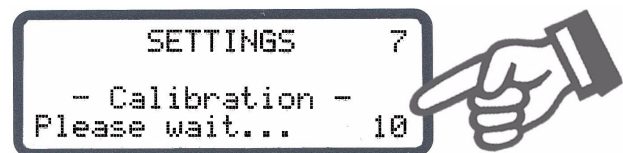
If the temperature of the heatsealing band varies on controllers as of software revision 100, the "AUTOCAL" function is executed a maximum of three times. If the function still cannot be terminated successfully, an error message appears ($\Rightarrow$ section 10.27 "Fault areas and causes" on page 64).

⚠️ **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 107 [7] in the Settings menu by the message "Heatsealing band still hot! Please wait...".
   As of software revision 012, this message is also displayed if the controller cannot be calibrated when the external "AUTOCAL" signal is activated (cooling rate too fast).

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 107 [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 (⮡ section 10.27 "Fault areas and causes" on page 64). 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.

10.10 "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 209 [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.
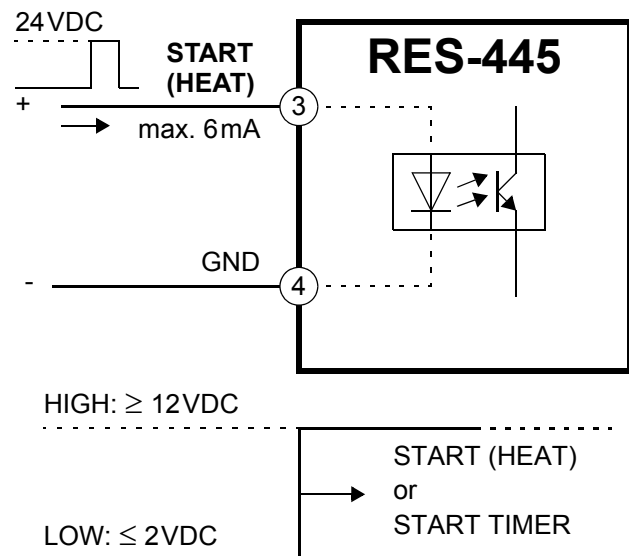

• By means of a control contact at terminals 2+7
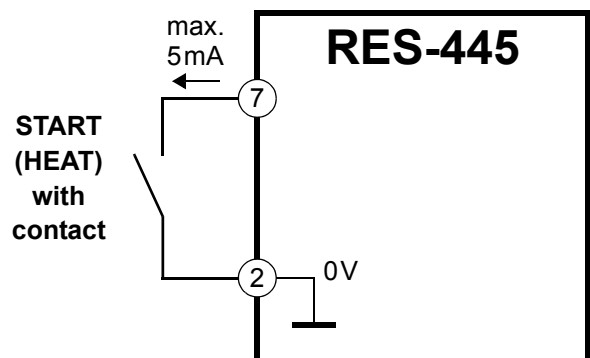
⚠️ **The "START" signal is disabled as long as the AUTOCAL function is executing in the Settings menu (with step 107 [7]) or the "RESET" signal is active.**

The set point that is selected for the heatsealing temperature (step 101 [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 error message is indicating error codes 104…105, 111…113 or 211 (⮡ section 10.27

"Fault areas and causes" on page 64). 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. 10.11 „"PREHEAT" signal (preheating)" auf Seite 47).

10.11 "PREHEAT" signal (preheating)

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 102 [2] in the Settings menu. The "PREHEAT" signal can be activated in two ways:

• By means of a 24VDC signal at terminals 20+22.
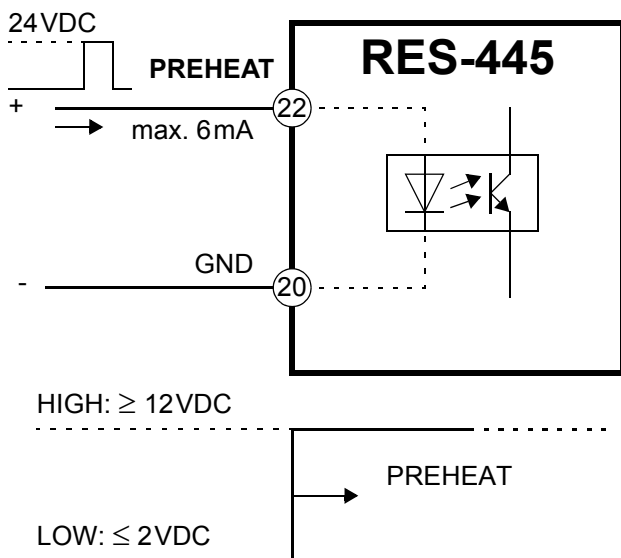
• By means of a control contact at terminals 2+19
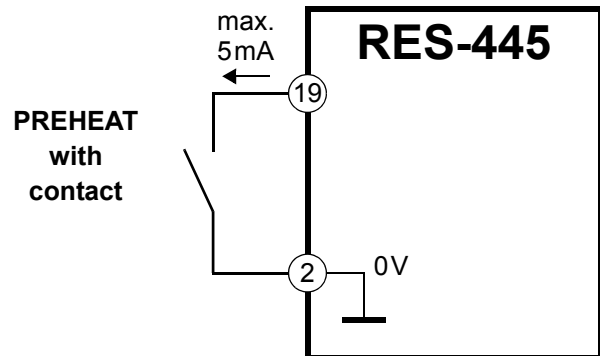
⚠ **The "START" signal is disabled as long as the AUTOCAL function is executing in the Settings menu (with step 107 [7]).**

The value that is selected for the preheating temperature (step 102 [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 error message is indicating error codes 104…105, 111…113 or 211 (↳ section 10.27 "Fault areas and causes" on page 64). 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
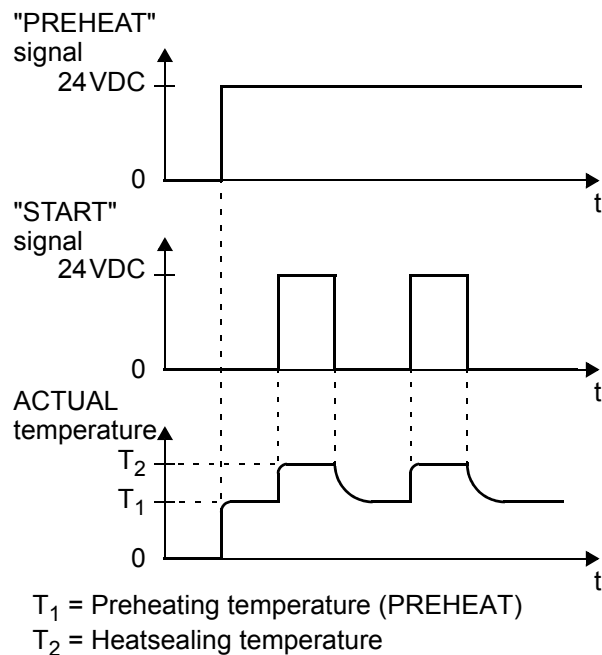
The ACTUAL temperature shows whether the heatsealing band is heated up to the preheating temperature correctly, providing the display is in the home position.

Please note the following if the "PREHEAT" function is used and the temperature is selected via the analog input at terminals 20+23:

The voltage at the analog input is valid for the preheating temperature and the heatsealing temperature. Preheating cannot be activated with the "PREHEAT" signal in conjunction with the analog input.
If this function is used, the preheating temperature must be set by altering the voltage value at the analog input. The "START" signal is always activated for this purpose (the "PREHEAT" signal is deactivated).
The timing sequence is shown in the diagram below:

T_1 = Preheating temperature (corresponds to U_1)
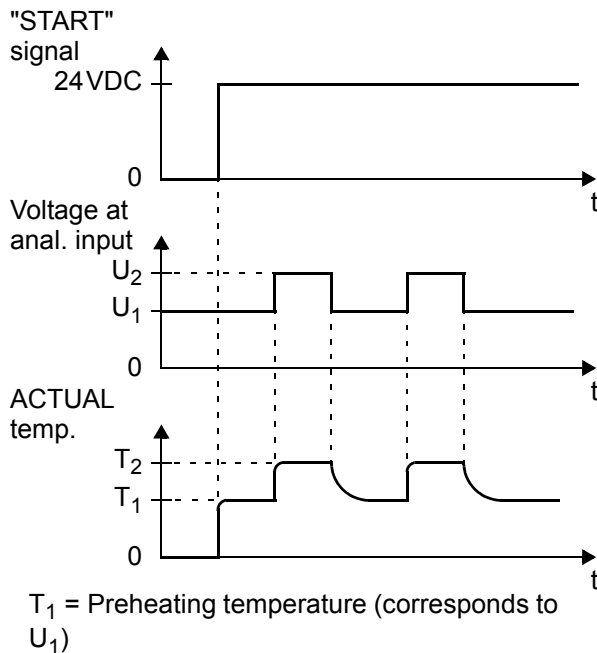
10.12 "RESET" signal

The RESISTRON temperature controller RES-445 can be reset by means of an external "RESET" signal at terminals 20+26.
As a result:

- A heatsealing cycle is aborted if one is in progress

- No more measuring impulses are generated

- An error message is reset if one is present
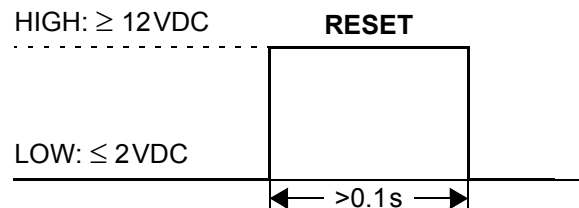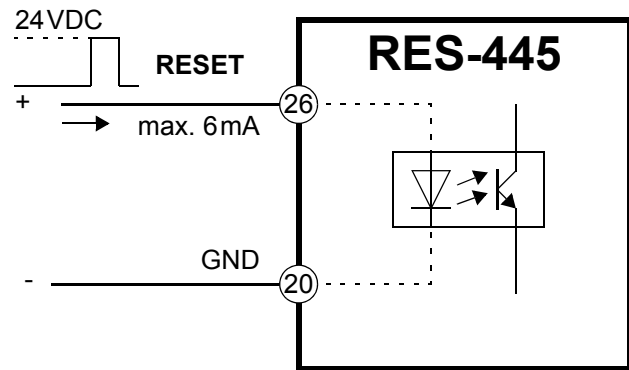
The actual value output changes to 0…3°C (i.e. approximately 0VDC) while the "RESET" signal is being activated. This may be interpreted by the higher-level controller (e.g. a PLC) as feedback.
The message "External RESET signal active" is additionally displayed on the controller as of software revision 009 when the "RESET" signal is active.
The "AUTOCAL" function is not aborted if the "RESET" signal is activated while it is still executing.

⚠ **The controller executes an internal initialization for approximately 500ms after the "RESET" signal is deactivated. The next heatsealing process cannot be started until it has finished.**

⚠ **If a contactor Kb is used to deactivate the control loop (↳ Kap. 8.3 „Power supply" auf Seite 15), it must be energized again 50ms at the latest after the "RESET" signal is deactivated. If it is energized too late, an error message will be output by the controller.**

10.13 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 214 [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.

10.14 Hold mode

The behavior of the digital indication of the ACTUAL temperature in the home position can be changed with step 106 [6] in the Settings menu. The following settings are possible:

1. **"OFF" (Factory setting)**
   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.**

The various hold modes are shown below:

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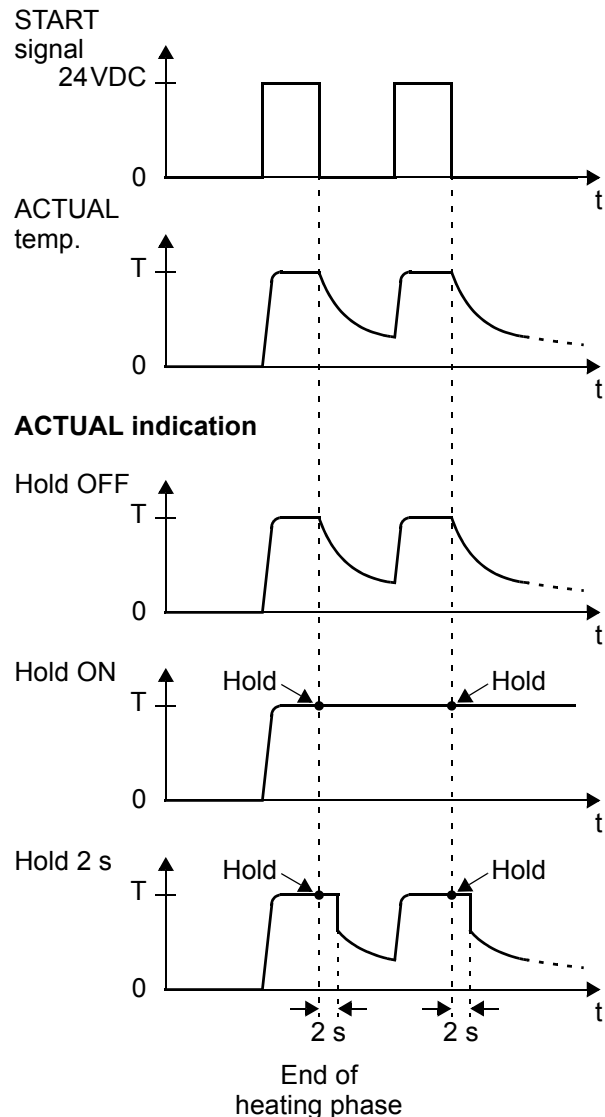
The word "Hold" appears on the display if a temperature value is indicated in hold mode. It disappears for approximately 100 ms whenever the hold value is updated.

10.15 Measuring impulse duration (as of software revision 026)

The length of the measuring impulses generated by the controller can be set with this parameter by means of step 220 [32]. It may be necessary to set a measuring impulse that is longer than the default 1.7 ms for certain applications (✎ ROPEX Application Report).

10.16 Automatic phase angle compensation (AUTOCOMP) (as of software revision 100)

It may be necessary to compensate the phase angle displacement between the U_R and I_R measuring signals in certain heatsealing applications (✎ ROPEX Application Report). The "AUTOCOMP" function is provided for this purpose. It can be parameterized with step 221 as followed:

1. **„OFF" (Factory setting)**
   The „AUTOCOMP" function is deactivated.

2. **„ON"**
   The „AUTOCOMP" function is activated by pressing the "ENTER" key after the "AUTOCAL" function has been successfully executed (✎ section 10.9 "Automatic zero calibration (AUTOCAL)" on page 45). The interval after the end of the "AUTOCAL" function must be less than 2.0 s ("Start AUTOCOMP? Start with ENTER" appears on the display during this time). The subsequent "AUTOCOMP" function is executed in approximately 2.0 s ("- AUTOCOMP - Please wait…" appears on the display during this time).
   If the interval following the successful execution of the "AUTOCAL" function is longer than 2.0 s, the display returns to the home position and the "AUTOCOMP" function is not executed.
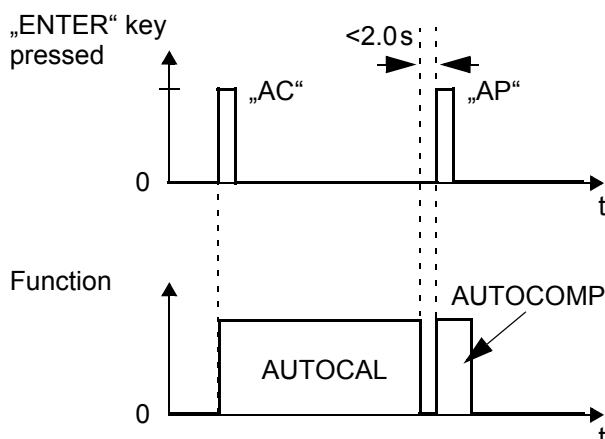
The actual value output (terminals 24+4) is set to 0…3°C (i.e. approx. 0 VDC) when the "AUTOCOMP" function is executed.

3. **„AUTO"**
   (as of software revision 105)
   With this setting the „AUTOCOMP" function is activated automatically after the "AUTOCAL" function has been successfully executed.
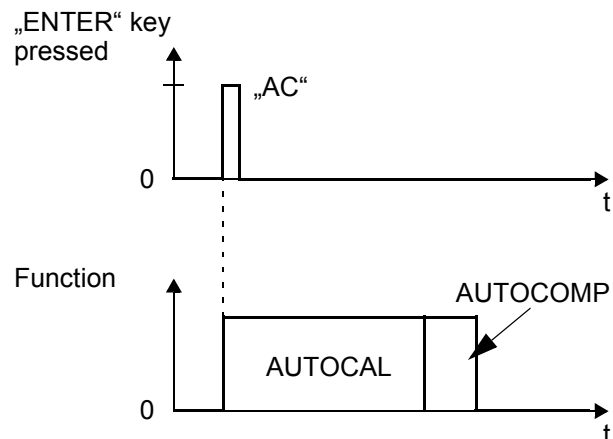
The actual value output (terminals 24+4) is set to 0…3°C (i.e. approx. 0 VDC) when the "AUTOCOMP" function is executed.

10.17 Locking the "HAND" key (as of software revision 100)

The "HAND" key function can be configured with step 213 in the Configuration meun when the display is in home position.
This prevents the heatsealing bands from beeing heated if the "HAND" key is pressed inadvertenly.
The following settings are possible:

1. Lock **„OFF" (Factory setting)**
   Pressing the "HAND" key while the display is in the home position starts amanual heating process. The heatsealing band is heated as long as the "HAND" key remains pressed.

2. Lock **„ON"**
   The "HAND" key is locked when the display is in the home position, in other words it has no function.

10.18 Temperature unit Celsius / Fahrenheit (as of software revision 106)

As of software revision 106 the unit for the temperature indication and value selection can be switched between °C (Celsius) and °F (Fahrenheit). It can be parameterized with step 225 as followed:

1. **„Celsius" (Factory setting)**
Temperature indication and value selection in Celsius (°C).

2. **„Fahrenheit"**
Temperature indication and value selection in Fahrenheit (°F)

Up to software revision 105 only Celsius (°C) can be specified on the controller as the temperature unit.

⚠ **The degree unit can be changed on the controller without interrupting operation**

⚠ **If you specify temperature indication and value selection in Fahrenheit (°F), the controller still uses Celsius (°C) internally. Value steps are therefore possible with this function owing to the conversion from Celsius to Fahrenheit.**

10.19 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 2.0 seconds while the power-up message is displayed (after switching on the controller, ↳ section 10.2.1 "Power-up message" on page 28). The display then shows a message confirming that the disable function is active for 3.0 seconds before returning to the home position.

The same message is also displayed for 5.0 seconds 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.**

⚠ **As of software revision 103 the language in menu pos. 201 can be changed while the configuration menu is locked (↳ section 9.3.2 "Setting the language" on page 21).**

The Configuration menu remains disabled until the disable function is canceled again. To do so, repeat the above procedure (press the "MENU" key for 2.0 seconds while the power-up message is displayed). The display then shows a message confirming that the disable function has been canceled.
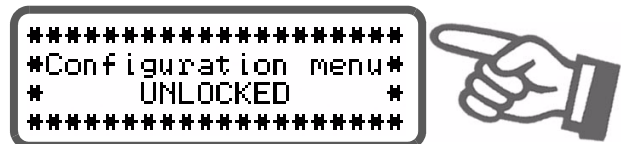
In the factory setting the Configuration menu is not disabled.

10.20 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%.
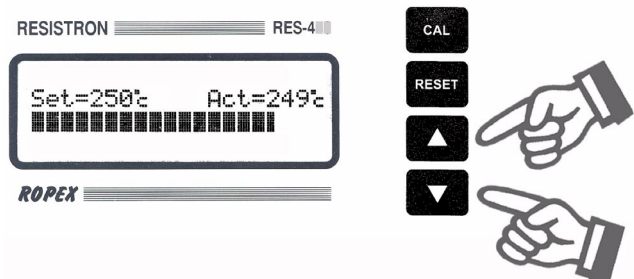
The life of the VF display can be prolonged by reducing the brightness.

10.21 Undervoltage detection

Trouble-free operation of the temperature controller is guaranteed within the line voltage tolerance range specified in section 6 "Technical data" on page 10.
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.
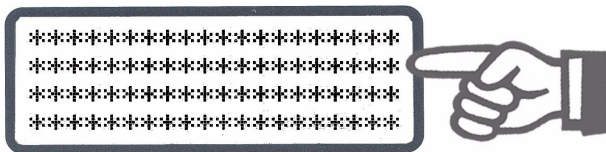
The main menu is displayed again, and operation is resumed, when the input voltage returns to the specified tolerance range.
The alarm relay (terminals 5+6) is only switched by an undervoltage condition in controllers up to and including software revision 002. The last valid temperature value continues to appear at the analog output (terminals 20+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…3 °C (corresponds to app. 0 V) 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.**

10.22 Diagnostic interface/visualization software (as of software revision 100)

An interface with a 6-pole Western socket is provided for systemdiagnostics and process visualization. This interface allows a data connection to be set up to the ROPEX visualization software using the ROPEX communication interface CI-USB-1.
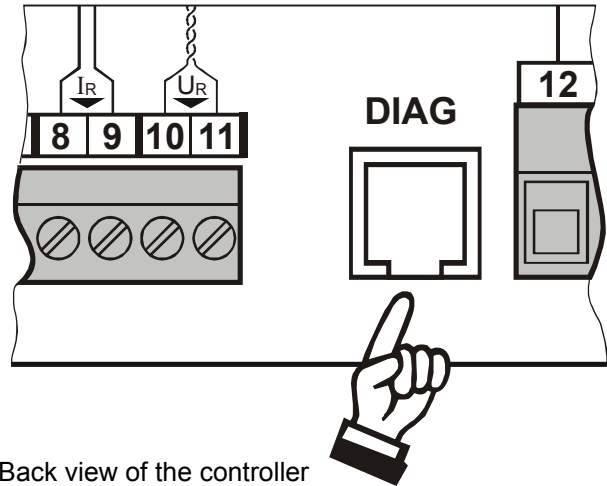
Back view of the controller

⚠ **Only a ROPEX comunication interface is allowed to be connected to the diagnostic interface. Connecting another device (e.g. a telephone cable) could result in malfunctions or damage to the controller.**

The ROPEX visualization software is described in a separate document.

10.23 Booster connection

The RES-445 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 section 8.7 "Wiring diagram with booster connection" on page 18. No settings are required in the menu.

10.24   Time control (timer function)

10.24.1 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 209 [26] in the Configuration menu. There are two possible settings in this menu:

1. **"OFF" (Factory setting)**
   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 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.

t_1 = Starting delay
t_2 = Heating phase
t_3 = Cooling phase
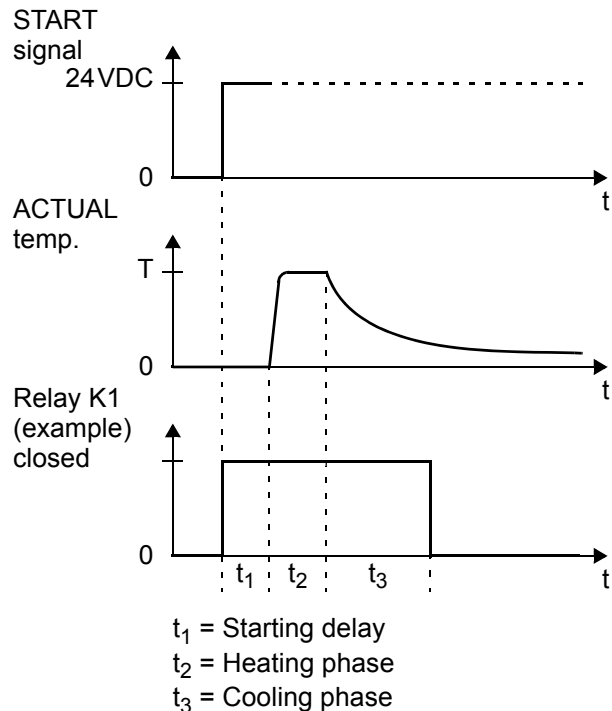
⚠️ **The timeout of the internal time control (timer function) can be interrupted by activating the external "RESET" signal (software revision 009 or higher) or by switching off the controller. As of software revision 021, it can also be interrupted by deactivating the "START" signal if time control "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.

```
Set=250°c    Act=249°c
████████████████████
Sealing time:   1.0s←
Cooling temp.:   50°c
```
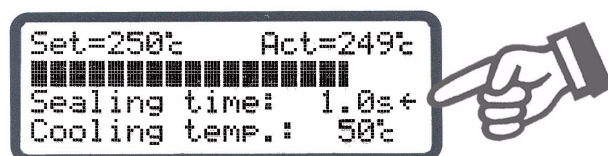
The active cooling phase is subsequently marked with the direction arrow at the end of the heating phase.


```
Set=250℃    Act=249℃
████████████████████
Sealing time:   1.0s
Cooling temp.:   50℃←
```
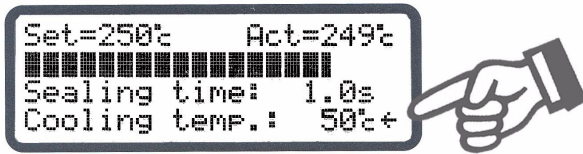
The direction arrow disappears again at the end of the cooling phase (i.e. at the end of the internal timeout). The current condition of relay K1 is indicated by means of a separate icon. If the icon is visible, the normally open contact of the relay is closed.


```
Set=250℃   0
███████████████
Sealing ti
Cooling t
```
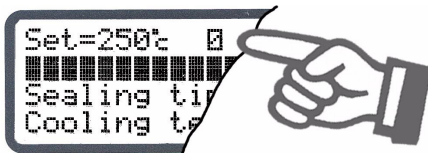
Separate settings can be entered for the individual timeouts. These settings are possible with steps 103 [3], 104 [4] and 105 [5] in the Settings menu and with steps 210 [27], 211 [28] and 212 [29] in the Configuration menu.
The options available with these advanced settings are described below.

10.24.2 Setting the starting delay

The start of the heating process can be explicitly delayed by entering a starting delay time with step 103 [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.
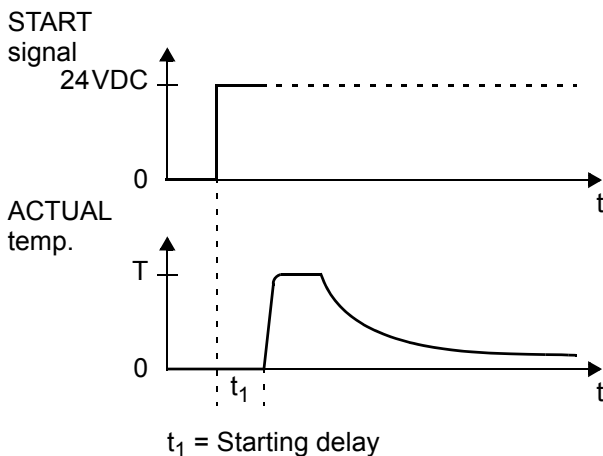
t_1 = Starting delay

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.

10.24.3 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.

2. **"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.

t_2 = Heating phase
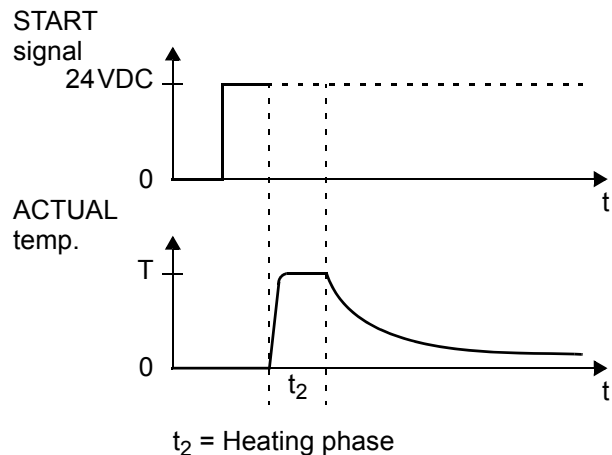
10.24.4 Setting the cooling mode

Various criteria for the end of the cooling phase can be specified with step 210 [27] in the Configuration menu of the RES-445 controller. The possible settings are as follows:

1. **"Absolute" (Factory setting)**
   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 105 [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 105 [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 105 [5] in the Settings menu.

The various cooling modes are shown below:
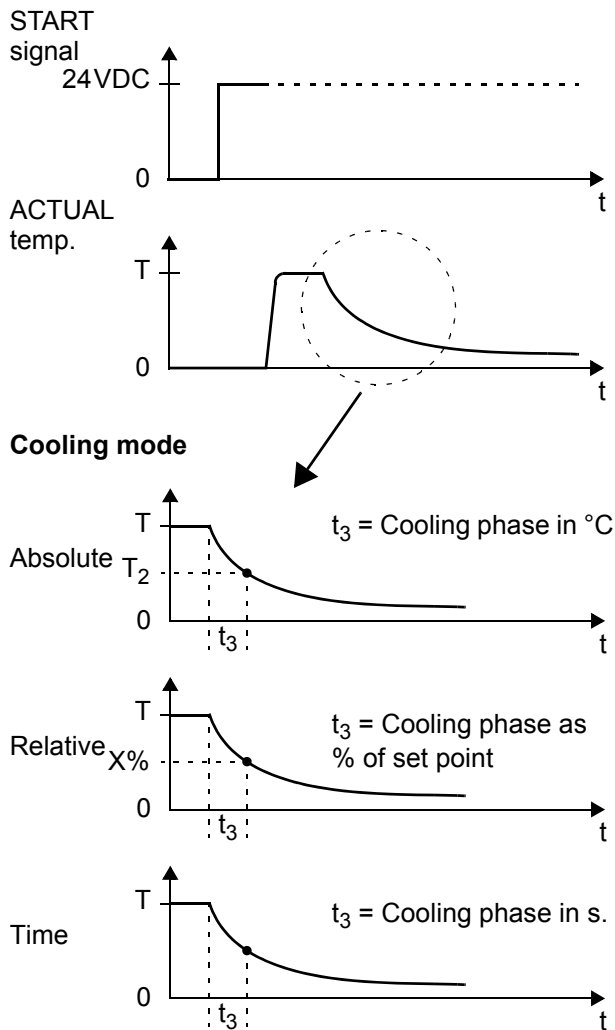
10.24.5 Setting the cooling value

After the cooling phase has been configured with step 27 in the Configuration menu (↳ section 10.24.4 "Setting the cooling mode" on page 54), you can specify the cooling parameters with step 105 [5] in the Settings menu.

⚠ **The options available with step 105 [5] in the Settings menu vary according to the selection made with step 210 [27] in the Configuration menu. All settings entered with menu step 105 [5] are overwritten if step 210 [27] is changed subsequently.**

The possible settings are as follows:

1. **"Cooling temp. in °C"**
   (if setting with menu step 210 [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 206 [23] in the Configuration menu or by the heatsealing band type/temperature range set with step 205 [22].**

2. **"Cooling temp. in %"**
   (if setting with menu step 210 [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 210 [27] = "Time")
   The cooling phase ends when the specified time elapses. This time can be set between 0 and 99.9 s.
   The factory setting is 10.0 s.

10.24.6 Setting the start of the heatsealing time

The condition for the start of the set heatsealing time (step 104 [4] in the Settings menu) can be specified with step 211 [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 103 [3]).
   If the starting delay = 0 s, the heatsealing time begins as soon as the "START" signal is activated.

2. **"When temperature reached" (Factory setting)**
   Once again, the heating process starts as soon as the set starting delay elapses (↳ Settings menu, step 103 [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:

START signal

ACTUAL temp.

95% of set point

Start of heatsealing time

When heating starts

Heatsealing time

When temperature reached

Heatsealing time
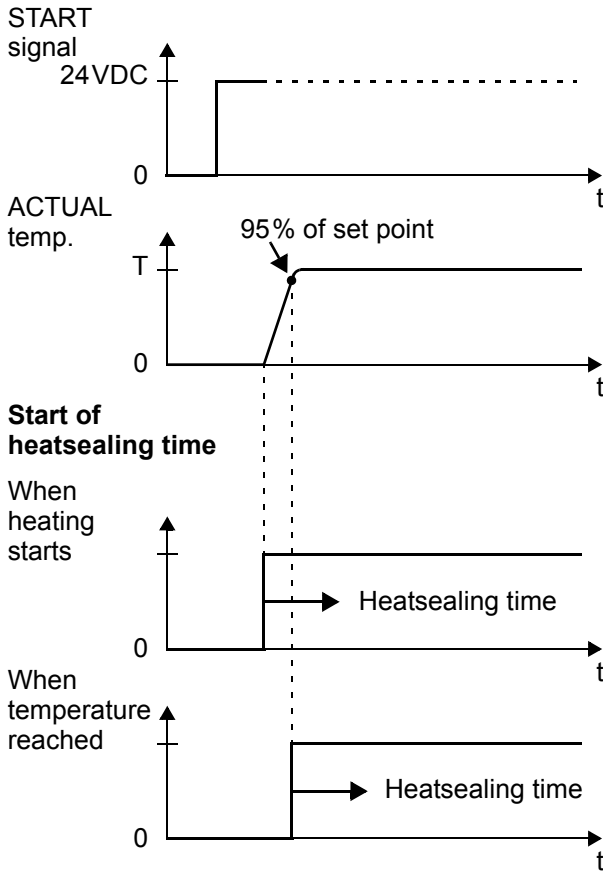
10.24.7 Relay K1 (with time control)

The function of relay K1 when time control is active is also specified with step 212 [29] in the Configuration menu (↻ section 9.3.8 "Relay K1 (without time control)" on page 22). The settings described here are only possible if time control is active. These settings can be selected as follows:

1. **„OFF"**
   Relay K1 without function

2. **"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).

3. **"When temperature reached"**
   (Factory setting)
   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).

4. **"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.

5. **"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 500 ms. If a "START" signal is activated while relay K1 is still closed, the relay opens again immediately.

The possible settings are shown below:

START signal

ACTUAL temperature

95% of set point

end of cooling

Relay K1

When start signal present

When temperature reached

While cooling

End-of-cycle impulse

500 ms
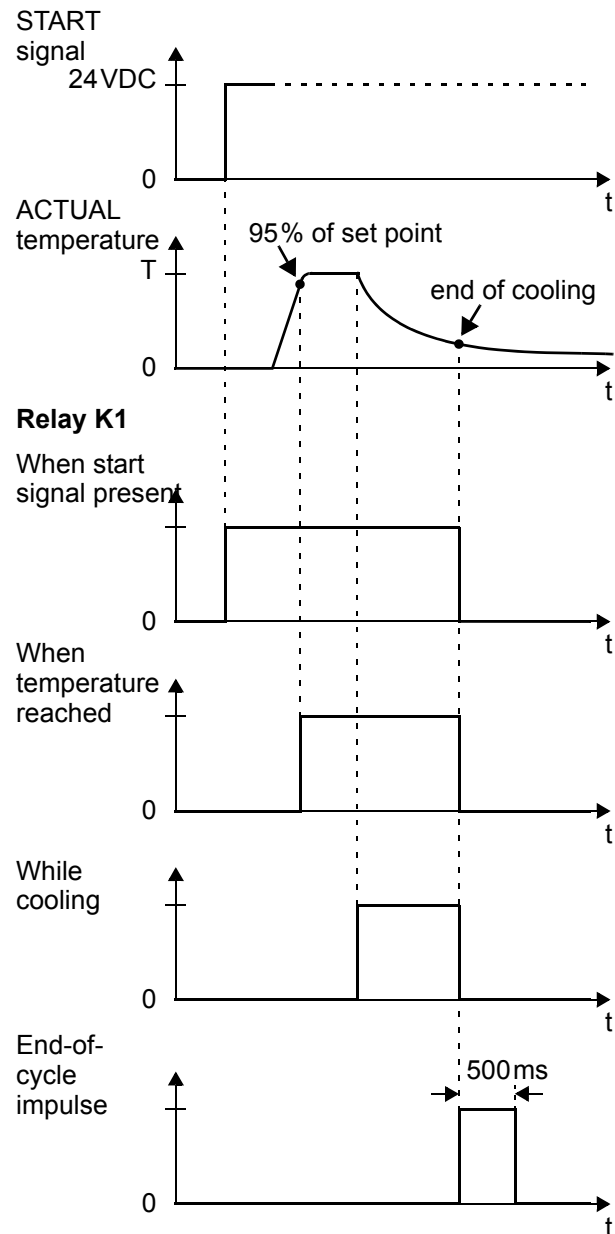
6. **"Active if Tact = Tset"**
   (This setting is possible as of software revision 100)
   Relay K1 is activated if the actual value is inside the specified temperature tolerance band (steps 207, 208). If the actual temperature is outside the tolerance band, relay K1 is deactivated (see graph below).
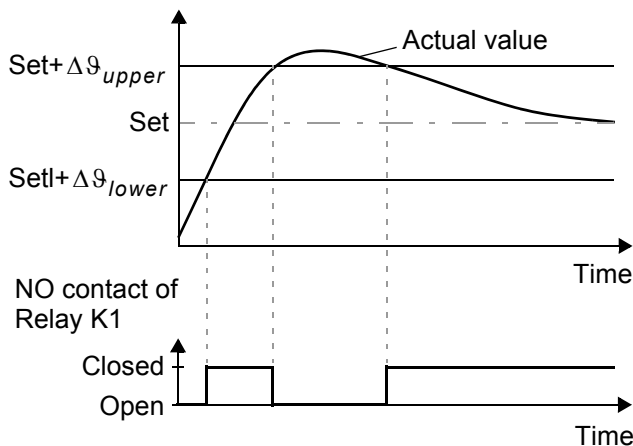
7. **"Active if Tact = Tset", with latch function**
   (This setting is possible as of software revision 100)
   Relay K1 is closed if the actual value is inside the specified temperature tolerance band (steps 207, 208). If the actual temperature leaves the tolerance band <u>once</u> during the heatsealing phase, relay K1 is opened. The relay is not closed again until the next "START" signal is activated. The switching state of relay K1 can thus also be interrogated by the higher-level PLC after a heatsealing process (latch function, see graph below).
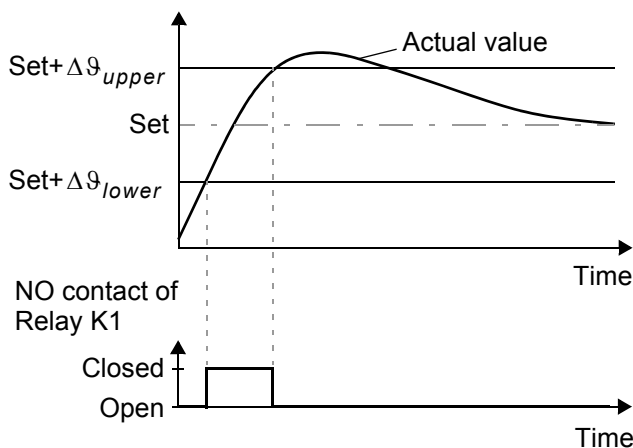
10.24.8 "Output 1"/ „Temperature OK" signal (with time control)

⚠️ **On controllers up to software revision 027, the switching output at terminals 20+21 was called "Temperature OK". The more general name "Output 1" is used as of software revision 100 because this output now also supports other functions.**

The "Output 1" signal is available at terminals 20+21 as a digital control signal.
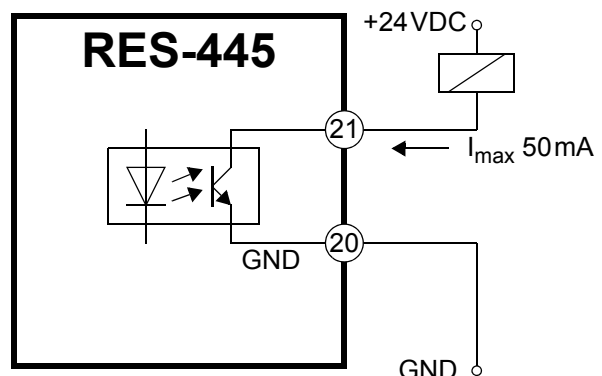
Up to software revision 027:
The switching output at terminals 20+21 ("Temperature OK" signal) always has the function "Active if Tact = Tset" (⤳ section 9.3.9 ""Output 1"/ „Temperature OK" signal (without time control)" on page 23).

As of software revision 100:
If time control (timer function) is active, the switching output at terminals 20+21 ("Output 1") can be parameterized in the same way as relay K1. The options for "Output 1" are specified with step 222 in the Configuration menu as followed:

1. **"Off"**
2. **"When start signal present"**
3. **"When temperature reached"**
4. **"While cooling"**
5. **"End-of-cycle impulse"**
6. **"Active if Tact = Tset"**
7. **"Active if Tact = Tset", with latch function (factory setting)**

For a detailed description of these functions, see section 10.24.7 "Relay K1 (with time control)" on page 56.

10.24.9 Preheating (with time control)

If time control is active, the preheating temperature (⤷ section 10.11 ""PREHEAT" signal (preheating)" on page 47 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 (⤷ section 10.24.5 "Setting the cooling value" on page 55) 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.

10.24.10 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.
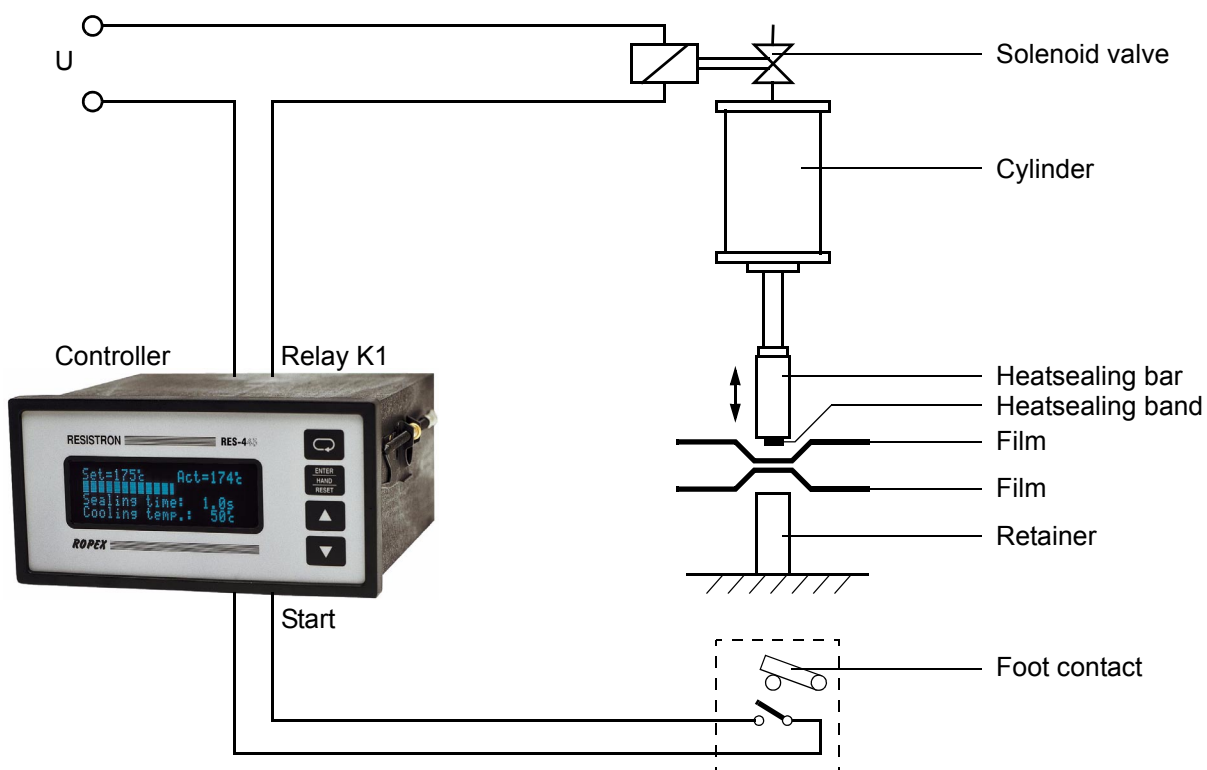
The functional sequence is as follows:

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°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 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 $T \leq 80°C$. 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:
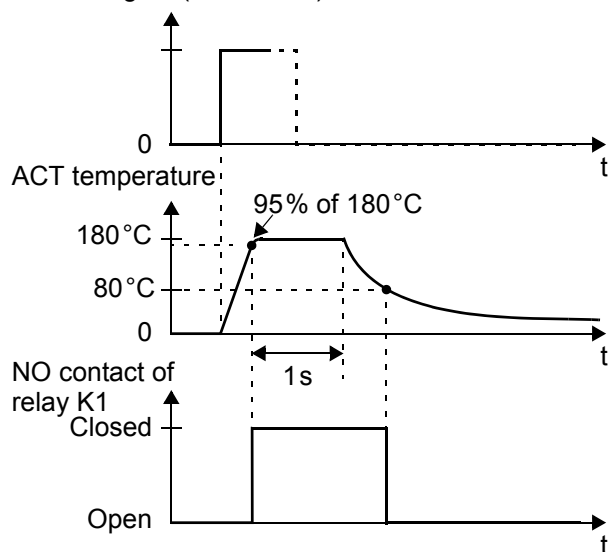
Required controller settings:

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 temp. reached"
29 (Relay K1 function)	"When temp. reached"

Then:

Step in Settings menu	Setting
101 [1] (Heatsealing temp.)	180 °C
103 [3] (Starting delay)	0.0 s
104 [4] (Heatsealing time)	1.0 s
105 [5] (Cooling value)	Cooling temp. = 80 °C

10.25 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 section 10.27 "Fault areas and causes" on page 64 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 (↳ section 9.3.12 "Configuration of the alarm relay" on page 25), these states are inverted.

C.) Error code output via the 0 to 10 VDC actual value output (terminals 20+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 a fault.

13 voltage levels (up to software revision 027: 12 voltage levels) are offered for this purpose in the 0…10 VDC range, each of which is assigned an error code (↳ section 10.27 "Fault areas and causes" on page 64).

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 1 Hz between the voltage value that corresponds to this error and the end of the scale (10 VDC, 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 (⤷ section 10.27 "Fault areas and causes" on page 64).

⚠ **An error message can be reset by pressing the "RESET" key, by activating the "RESET" signal at terminals 20+26 (⤷ section 10.12 ""RESET" signal" on page 48) or by switching the controller off and then on again.**
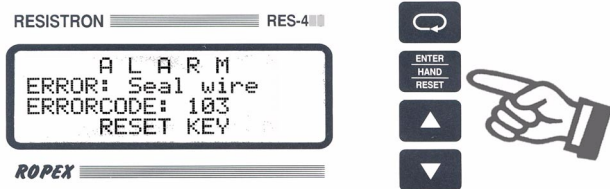
⚠ **Invalid error messages may appear when the controller is switched off owing to the undefined operating state. This must be taken into account when they are evaluated by the higher-level controller (e.g. a PLC) in order to avoid false alarms.**

10.26 Error messages

The table below shows how the analog voltage values that appear at the actual value output correspond to the faults that have occurred. It also describes each fault and the required corrective action. The block diagram in section 10.27 "Fault areas and causes" on page 64 permits each fault to be cleared quickly and efficiently The error codes described below can also be displayed in the ROPEX visualization software (⤷ section 10.22 "Diagnostic interface/visualization software (as of software revision 100)" on page 52) to facilitate troubleshooting.

⚠ **If the actual value output is evaluated in order to identify an error message - in the higher-level controller, for instance - the tolerance window must be adjusted to prevent it from being incorrectly interpreted. Please note the tolerances of the actual value output (⤷ section 6 "Technical data" on page 10).**

Part 1 of 3:

#	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.
1	101	0,66	20	33		I$_R$ signal missing	Fault area ①	Fault area ①
2	102	1,33	40	66		U$_R$ signal missing	Fault area ③	Fault area ③
3	103	2,00	60	100		U$_R$ and I$_R$ signals missing	Fault area ②	Fault area ② ⑨
4	107 108					Temperature step, down Temperature step, up	Fault area ④ ⑤ ⑥ (loose contact)	Fault area ④ ⑤ ⑥ (loose contact)
	307 308 309 310	2,66	80	133	Closed	Temperature too low/high (↳ section 9.3.10)		
5	201 202 203	3,33	100	166		Frequency fluctuation, inadmissible line frequency	Check power supply	Check power supply
6	304	4,00	120	200		Heatup time too long (↳ section 9.3.11)	Run **RESET**	Run **RESET**
7	901 913 914 915 916	4,66	140	233		Int. faut, contr. defective Triac defective Int. faut, contr. defective Int. faut, contr. defective Int. faut, contr. defective	Replace controller Replace controller Replace controller Replace controller Replace controller	Replace controller Replace controller Replace controller Replace controller Replace controller
	917 918					Plug-in jumper for alarm relay wrong	Check plug-in jumper	Check plug-in jumper

Part 2 of 3:

NOTE: The specified error messages are initially output as warnings (actual value output jumps back and forth between two values; alarm relay is open). When the "START" signal is activated, the warning changes to a fault (actual value output no longer jumps back and forth, see **bold italic values**; alarm relay is closed).

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.
104				Warning: Open	I_R signals incorrect, incorrect specification of impulse-transformer		
105					U_R signals incorrect, incorrect specification of impulse-transformer	Run **AUTOCAL**, Check specification of transformer, Fault area ⑦⑧	Fault area ④⑤⑥ (loose contact)
106	*5,33*⤒ 10⤓	*160*⤒ 300⤓	*266*⤒ 500⤓	Fault: Closed (voltage value at actual value output then no longer changes)	U_R and/or I_R signals incorrect, incorrect specification of impulse-transformer		
302 (AC)					Temperature too low, AUTOCAL wasn't performed, loose contact, ambient temp. fluctuates	Run **AUTOCAL** and/or fault area ④⑤⑥ (loose contact)	
303 (AC)					temperature too high, AUTOCAL wasn't performed, loose contact, ambient temp. fluctuates		
211	*6,00*⤒ 10⤓	*180*⤒ 300⤓	*300*⤒ 500⤓		Data error	Run **AUTOCAL**	---

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Part 3 of 3:

NOTE: The specified error messages are initially output as warnings (actual value output jumps back and forth between two values; alarm relay is open). When the "START" signal is activated, the warning changes to a fault (actual value output no longer jumps back and forth, see ***bold italic values***; alarm relay is closed).

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.
10	**111**	*6,66* ↑ 10 ↓	*200* ↑ 300 ↓	*333* ↑ 500 ↓	Warning: Open	I_R signal incorrect, calibration not possible	Fault area ⑧, check configuration	¦¦
11	**112**	*7,33* ↑ 10 ↓	*220* ↑ 300 ↓	*366* ↑ 500 ↓		U_R signal incorrect, calibration not possible	Fault area ⑦, check configuration	¦¦
12	**113**	*8,00* ↑ 10 ↓	*240* ↑ 300 ↓	*400* ↑ 500 ↓	Fault: Closed (voltage value at actual value output then no longer changes)	U_R and I_R signals incorrect, calibration not possible	Fault area ⑦⑧, check configuration	¦¦
	114					Temperature fluctuates, calibration not possible		
13	**115**	*8,66* ↑ 10 ↓	*260* ↑ 300 ↓	*433* ↑ 500 ↓		Ext. calibration temperature too high,		
	116					Ext. calibration temperature fluctuates		

10.27   Fault areas and causes
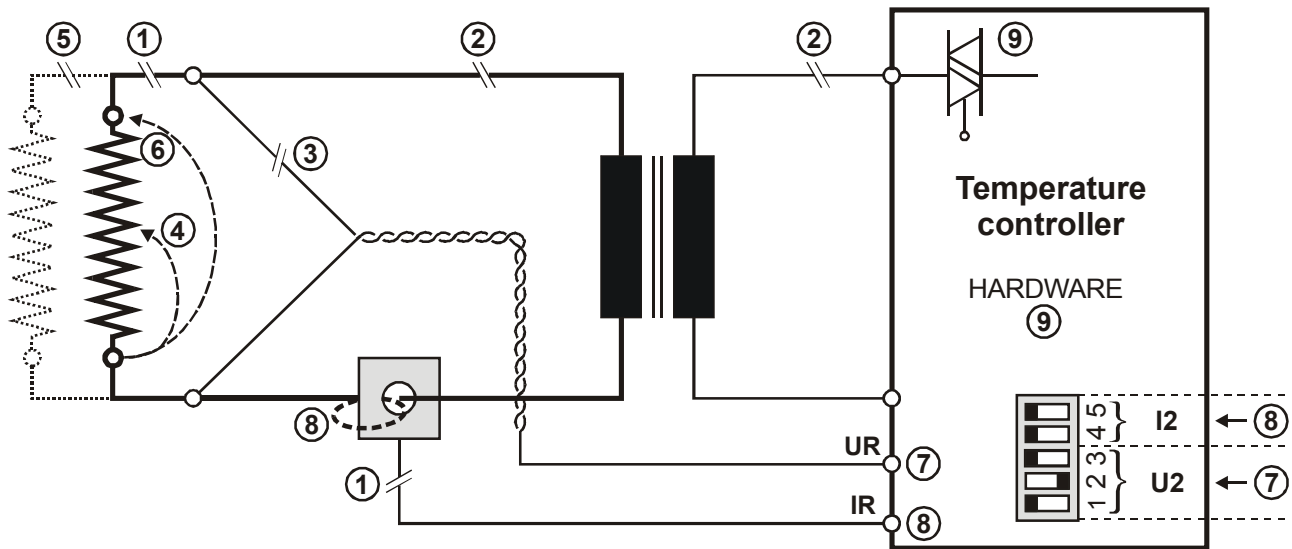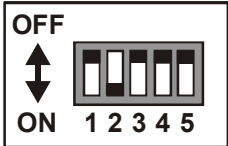
The table below explains the possible fault causes.

Fault area	Explanation	Possible causes
①	Load circuit interrupted after U_R pickoff point	- Wire break, heatsealing band break - Contacting to heatsealing band defective
①	PEX-W2/W3 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
②	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 (delta R)	- 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	- Up to software revision 027: DIP switches 1 - 3 configured incorrectly (U_2 range) - As of software revision 100: U_2 outside permissible range from 0.4…120 VAC

Fault area	Explanation	Possible causes
⑧	I_R signal incorrect	- Up to software revision 027: DIP switches 4+5 configured incorrectly (I_2 range) - As of software revision 100: I_2 outside permissible range from 30…500 A
	Turns through PEX-W2/W3 current transformer incorrect	- Check number of turns (two or more turns required for currents < 30 A)
⑨	Internal controller fault	- Hardware fault (replace controller)

11   Factory settings

The RESISTRON temperature controller RES-445 is configured in the factory as follows:

DIP switches for secondary voltage U_2 and current I_2 (Up to software revision 027)	 OFF ⇕ ☐☐☐☐☐ ON 1 2 3 4 5	U_2 = 6…60 VAC I_2 = 30…100 A DIP switches: 2 ON 1, 3, 4, 5 OFF These switches are automatically set by the AUT-ORANGE function on all controllers as of software revision 100.

Settings menu	No. 101 [1] Heatsealing temperature: 0 °C
	No. 102 [2] Preheating temperature: 0 °C
	No. 103 [3] Starting delay: 0 s
	No. 104 [4] Heatsealing time: 1 s
	No. 105 [5] Cooling value: Cooling time: 10 s
	                                        Absolute cooling temperature: 50 °C
	                                        Relative cooling temperature:
	                                                40 % of heatsealing temperature
	No. 106 [6] Hold mode: OFF
	No. 107 [7] AUTOCAL temperature: 20 °C	

Configuration menu	No. 201 [20]	Language	German
			This selection is NOT changed if the factory settings are restored with step 202 [21] in the Config. menu.
	No. 203, 204 [22]		
		Alloy/range:	Alloy-20/max. 300°C
	No. 206 [23]	Maximum temperature:	300°C
	No. 207 [24]	Set point reached:	-10K
	No. 208 [25]	Set point exceeded:	+10K
	No. 209 [26]	Time control:	OFF
	No. 210 [27]	Cooling mode:	Absolute
	No. 211 [28]	Start of heatsealing time:	When temperature reached
	No. 212 [29]	Relay K1 function:	Active when temperature reached
	No. 213	Lock of „HAND" key	OFF
	No. 214 [30]	Cycle counter:	0
	No. 215 [31]	Alarm relay:	Normal (contact closed by a fault)
	No. 216 [33]	Analog output:	Actual temperature
	No. 217	Temperature diagnosis:	OFF
	No. 218	Temp.diagnosis delay time:	0s
	No. 219	Heatup timeout:	OFF
	No. 220 [32]	Measuring impulse length:	Standard (1.7ms)
	No. 221	Autocomp:	OFF
	No. 222	"Output 1":	Active if Tact = Tset, with latch function
	No. 225	Temperature unit:	Celsius

Up to software revision 027:
The controller can be reset with step 21 in the Configuration menu:


```
    CONFIGURATION  21
For factory settings
press ENTER!
```

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


```
    CONFIGURATION  21
Factory settings are
recalled!
```
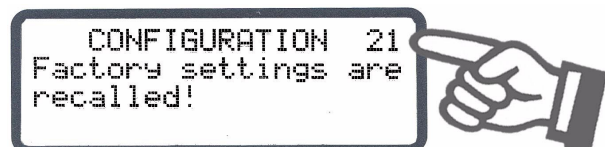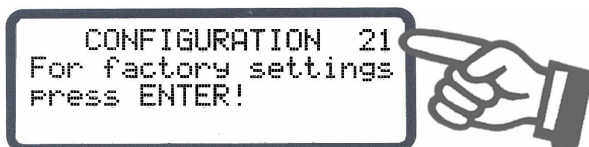
⚠ **The language which is selected with step 20 in the Configuration menu remains set even if the factory settings are restored.**

11.1 Customer settings (as of software revision 100)

The controller factory settings can be specified or restored with step 202 in the Configuration menu. You can also store customer settings in addition to the Ropex settings:

```
   CONFIGURATION   202
Factory settings:
Recall Ropex
settings
```

The following settings are possible:

1. **„Restore Ropex settings"**
   (Factory setting)
   Selecting this option restores the menu values listed in section 11 "Factory settings" on page 65. These values correspond to the factory settings with which the controller was delivered.

2. **„Define customer settings"**
   Selecting this option saves the values that are currently set in the controller Settings and Configuration menus as "customer settings". These "customer settings" are independent of the Ropex settings. Machine-specific settings can be stored in the controller in this way.

3. **„Restore customer settings**
   Selecting this option restores the "customer settings" that were saved as described in 2.

⚠ **When the controller is first delivered, the "customer settings" are identical to the Ropex settings.**

After pressing the "ENTER" key in this menu step, you are asked to confirm the new settings (safety query).

```
   CONFIGURATION   202
Are you sure?

(YES = ENTER key)
```

Another message appears if you now confirm these settings by pressing the "ENTER" key for approximately 2 seconds.

```
   CONFIGURATION   202
Ropex settings are
recalled!
```

You can also cancel the new settings by pressing the "MENU", cursor "UP" or cursor "DOWN" keys. Step 203 then appears on the display.

⚠ **The language which is selected with step 201 in the Configuration menu remains set even if the previous 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

Contr. RES - 445- . / . . . VAC

L / 115: LC display, line voltage 115 VAC, Art. No. 744511
L / 230: LC display, line voltage 230 VAC, Art. No. 744512
L / 400: LC display, line voltage 400 VAC, Art. No. 744513
V / 115: VF display, line voltage 115 VAC, Art. No. 744521
V / 230: VF display, line voltage 230 VAC, Art. No. 744522
V / 400: VF display, line voltage 400 VAC, Art. No. 744523

Scope of supply: Controller includes connector plug-in parts (current transformer must be ordered separately)

Modification MOD . . (optional, if required)

e.g.
01: MOD 01, Art. No. 800001 (amplifier for low voltage)

Please indicate the article numbers of the controller and the required modifications (optional) in all orders,

e.g.   RES-445-L/400 VAC + MOD 01
(controller with LC display for 400 VAC line voltage
and amplifier for low voltage)
Art. Nos. 744513 + 800001 must be ordered

Current transformer PEX-W3

Art. No. 885105

Line filter LF- . . 480

06: Continuous current   6A, 480 VAC, Art. No. 885500
35: Continuous current 35A, 480 VAC, Art. No. 885506

Impulse transformer

See ROPEX Application Report for design and ordering information

Communication interface CI-USB-1

Art. No. 885650

Temp. meter ATR- .

3: 300 °C range, Art. No. 882130
5: 500 °C range, Art. No. 882150

Booster B- . . . 400

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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