

RES-415

®

Operating Instructions



Important features

- Microprocessor technology
- LC display (green), 4 lines, 20 characters
Alternatively:
VF display (blue), 4 lines, 20 characters
- Automatic zero calibration (AUTOCAL)
- Automatic optimization (AUTOTUNE)
- Automatic frequency adjustment
- Large current and voltage range
- Booster connection as standard
- Reduced menu structure
- Alarm for „Temperature not OK“
- Alarm function with fault diagnosis

Contents

1	Safety and warning notes	3	9	Startup and operation	16
1.1	Use	3	9.1	Front view of the controller	16
1.2	Heatsealing band	3	9.2	Rear view of the controller	16
1.3	Impulse transformer	3	9.3	Controller configuration	16
1.4	Current transformer PEX-W2	3	9.4	Heatsealing band	17
1.5	Line filter	4	9.5	Startup procedure	18
1.6	Warranty provisions	4	10	Controller functions	19
1.7	Standards / CE marking	4	10.1	Indicators and controls	19
2	Application	4	10.2	Display	20
3	Principle of operation	5	10.3	Temperature setting (set point selection)	21
4	Description of the controller	6	10.4	Temperature indication	21
5	Accessories and modifications	6	10.5	Automatic zero calibration (AUTOCAL)	21
5.1	Accessories	6	10.6	"START" signal (HEAT)	21
5.2	Modifications (MODs)	7	10.7	Temperature monitoring	22
6	Technical data	8	10.8	Undervoltage detection	22
7	Dimensions/front panel cutout	9	10.9	Booster connection	23
8	Installation	10	10.10	System monitoring/alarm output	23
8.1	Installation procedure	10	10.11	Error messages	24
8.2	Installation steps	11	10.12	Fault areas and causes	25
8.3	Power supply	12	11	Factory settings	26
8.4	Line filter	13	12	Maintenance	26
8.5	Current transformer PEX-W2	13	13	How to order	27
8.6	Wiring diagram (standard)	14	14	Index	28
8.7	Wiring diagram with booster connection	15			

1 Safety and warning notes

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

It left the factory in perfect condition.

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

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

1.1 Use

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

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

1.2 Heatsealing band

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

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

The temperature coefficient must be specified as follows:

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

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

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

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

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

1.3 Impulse transformer

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

⚠ Incorrect installation of the impulse transformer impairs electrical safety.

1.4 Current transformer PEX-W2

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

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

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

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

1.5 Line filter

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

1.6 Warranty provisions

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

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

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

1.7 Standards / CE marking

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

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

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

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

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

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

2 Application

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

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

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

- etc.

The use of RESISTRON temperature controllers results in:

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

3 Principle of operation

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

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

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

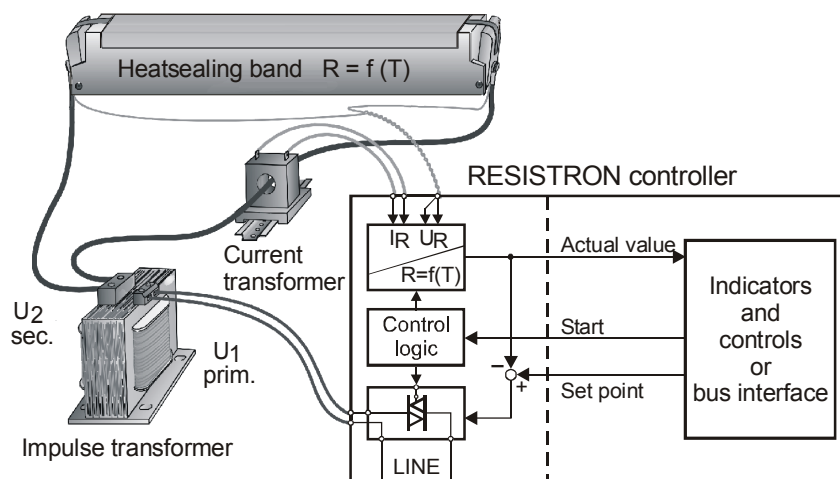
The thermoelectric control loop which is formed has a highly dynamic response because purely electrical variables are measured at a high sampling rate. A high secondary current can be controlled with only minimal power loss because power is controlled on the primary

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

PLEASE NOTE!

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

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



4 Description of the controller

The microprocessor technology endows the RESISTRON temperature controller RES-415 with previously unattainable capabilities:

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

- Increased protection against dangerous conditions, such as overheating of the heatsealing band.

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.

The real heatsealing band temperature is visualized on the display both as a digital number in °C and in the form of a dynamic bar.

The RESISTRON temperature controller RES-415 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 RESISTRON temperature controller RES-415 is designed for installation in a front panel cutout. The compact design and the plug-in connections make this controller easy to install.



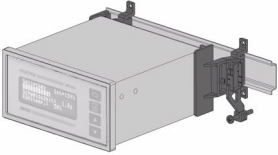


5 Accessories and modifications

A wide range of compatible accessories and peripheral devices are available for the RESISTRON temperature controller RES-415. 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).

	<p>Line filter LF-xx480 Essential in order to ensure CE conformity. Optimized for the RESISTRON temperature controller.</p>
	<p>Impulse transformer ITR-x Designed according to VDE 0570/EN 61558 with a one-section bobbin. Optimized for impulse operation with RESISTRON temperature controllers. Specified according to the heatsealing application (↪ ROPEX Application Report).</p>

	<p>Monitoring current transformer MSW-1 For detecting frame short-circuits on the heatsealing band. Used as an alternative to the standard PEX-W2 current transformer.</p>
	<p>Transparent front cover TFA-1 For increasing the degree of protection on the front of the controller to IP65. Also facilitates applications in the food technology sector (GMP).</p>
	<p>Adapter for top hat rail mounting, HS-Adapter-01 For mounting the RESISTRON temperature controller RES-415 on a top hat rail (DIN TS35). Allows the controller to be installed in the electrical cabinet, for instance, where it is only accessible to authorized persons.</p>
	<p>Lockable door TUER-S/K-1 Transparent door (with lock) for mounting on the bezel of the controller. The display is clearly legible at all times. The keyboard can only be operated, however, by authorized persons in possession of a key.</p>
	<p>Measurement cable UML-1 Twisted measurement cable for the U_R voltage measurement. Trailing cable, halogen and silicone-free.</p>

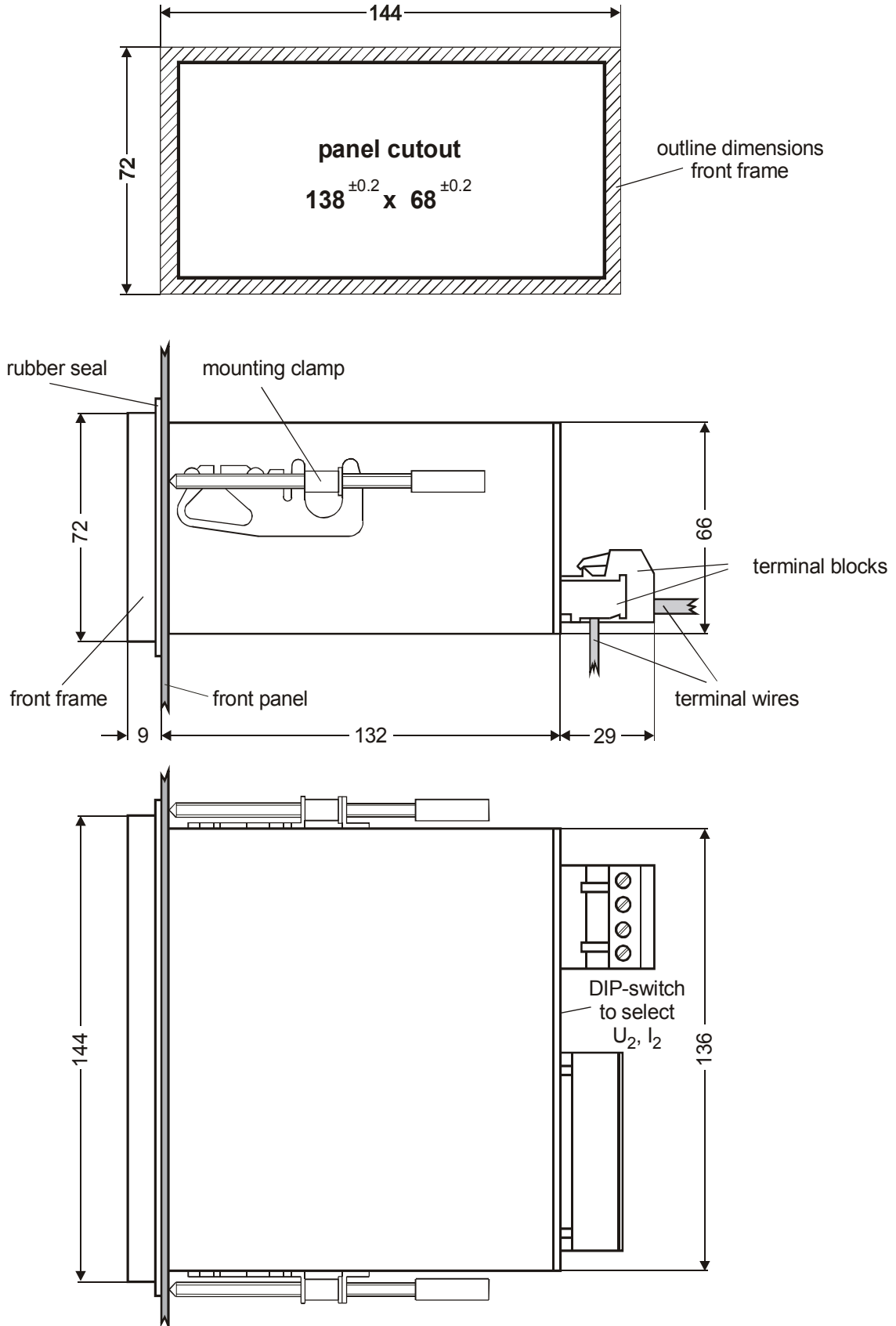
5.2 Modifications (MODs)

Modifications are not available for the RESISTRON temperature controller RES-415.

6 Technical data

Type of construction	Housing for front panel mounting Dimensions (W x H): 144 x 72mm; depth: 161 mm (incl. terminals)
Line voltage	<u>All controllers manufactured as of January 2004:</u> 115VAC version: 115VAC -15%...120VAC +10% (equivalent to 98...132VAC) 230VAC version: 230VAC -15%...240VAC +10% (equivalent to 196...264VAC) 400VAC version: 400VAC -15%...415VAC +10% (equivalent to 340...456VAC) <u>All controllers manufactured up to December 2003:</u> 115VAC, 230VAC or 400VAC, tolerance: +10% / -15% depending on device version (↪ Kap. 13 „How to order“ auf Seite 27)
Line frequency	47...63Hz, automatic adjustment to frequencies in this range
Heatsealing band type and temperature range	Temperature coefficient 1100ppm (e.g. Alloy 20) Temperature range 0...300°C
Set point selection	Via the "UP / "DOWN" keys on the front of the controller
Digital logic levels Terminals 3, 4	LOW (0V): 0...2VDC HIGH (24VDC): 12...30VDC (max. current input 6mA) Electrically isolated, reverse polarity-protected
START with contact Terminals 2+7	Switching threshold: 3.5VDC, $U_{\max} = 5\text{VDC}$, $I_{\max} = 5\text{mA}$
Alarm relay Terminals 5+6	Contact, potential-free, $U_{\max} = 50\text{VDC}$, $I_{\max} = 0.2\text{A}$
Maximum load (primary current of impulse transformer)	$I_{\max} = 5\text{A}$ (duty cycle = 100%) $I_{\max} = 25\text{A}$ (duty cycle = 20%)
Display	LC display (green), 4 lines, 20 characters, alternatively: VF display (blue), 4 lines, 20 characters
Ambient temperature	+5...+45°C
Degree of protection	Front: IP42 (IP65 with transparent front cover, Art. No. 887000) Back: IP20
Installation	Installed in front panel cutout with (W x H) $138^{(+0.2)} \times 68^{(+0.2)}$ 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...2.5mm ² (AWG 24...12) Plug-in connectors

7 Dimensions/front panel cutout



8 Installation

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

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

8.1 Installation procedure

Proceed as follows to install the RESISTRON temperature controller RES-415:

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

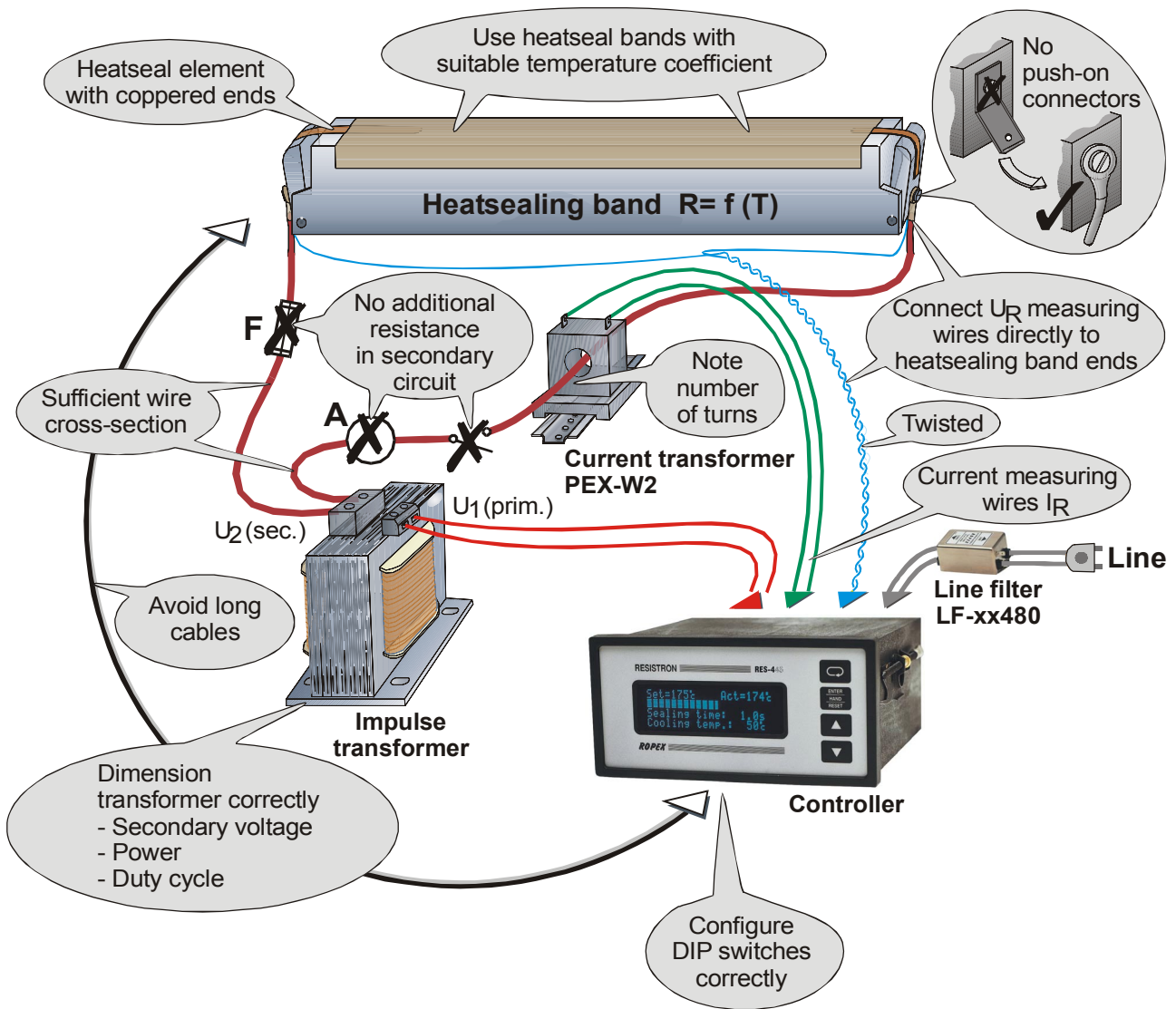
automatically detected by the temperature controller in the range from 47Hz to 63Hz.

3. Install the RESISTRON temperature controller in the front panel cutout. It is fastened by means of two clips which snap onto the side of the controller housing.
4. Wire the system in accordance with the instructions in Kap. 8.3 „Power supply“ auf Seite 12, Kap. 8.6 „Wiring diagram (standard)“ auf Seite 14 and the ROPEX Application Report. The information provided in Kap. 8.2 „Installation steps“ auf Seite 11 must be heeded additionally.

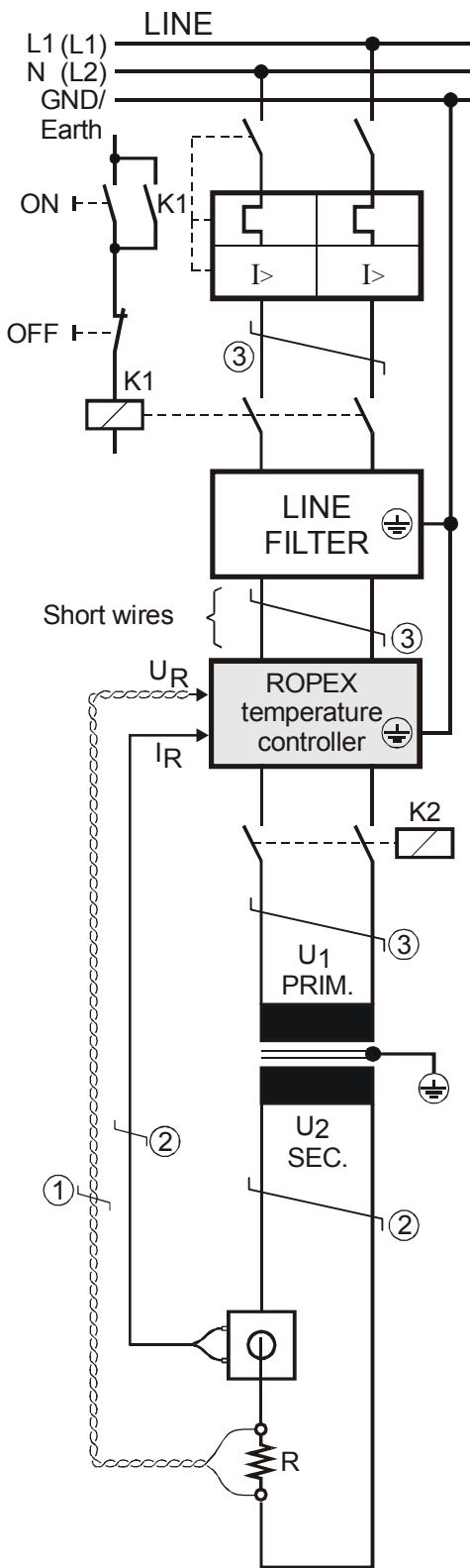
⚠ Check the tightness of all the system connections, including the terminals for the impulse transformer windings.

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

8.2 Installation steps



8.3 Power supply



Line

115VAC, 230VAC, 400VAC

Circuit breaker

Double-pole, Z characteristic

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

⚠ Short-circuit protection only.

RESISTRON temperature controller not protected.

Relay K1

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

Line filter

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

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

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

Relay K2

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

Impulse transformer

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

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

Wiring

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

Guide values:

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

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

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

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

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

8.4 Line filter

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

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

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

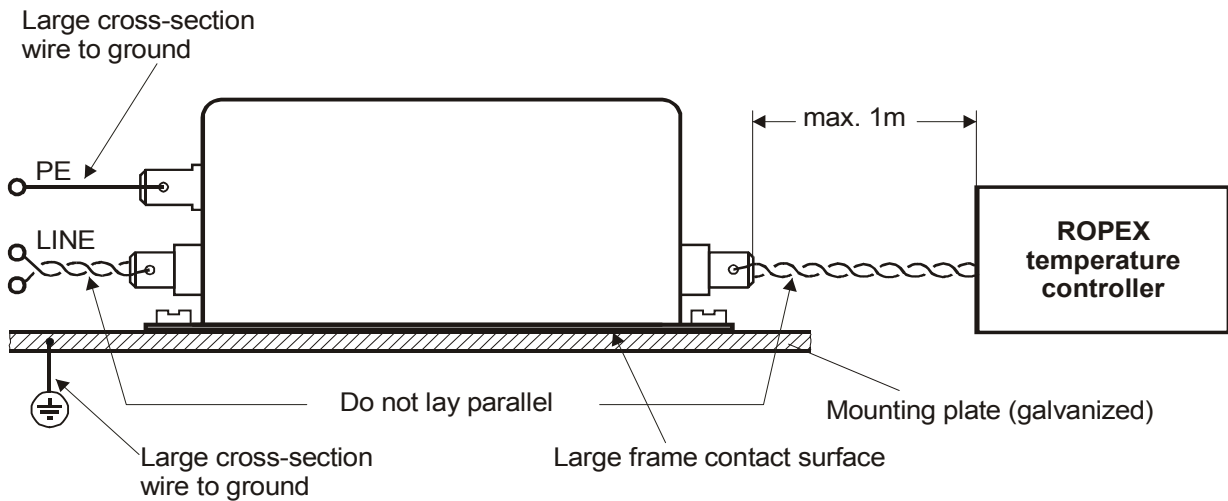
You can find the exact specification of the line filter in the ROPEX Application Report calculated for your particular heatsealing application.

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

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

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

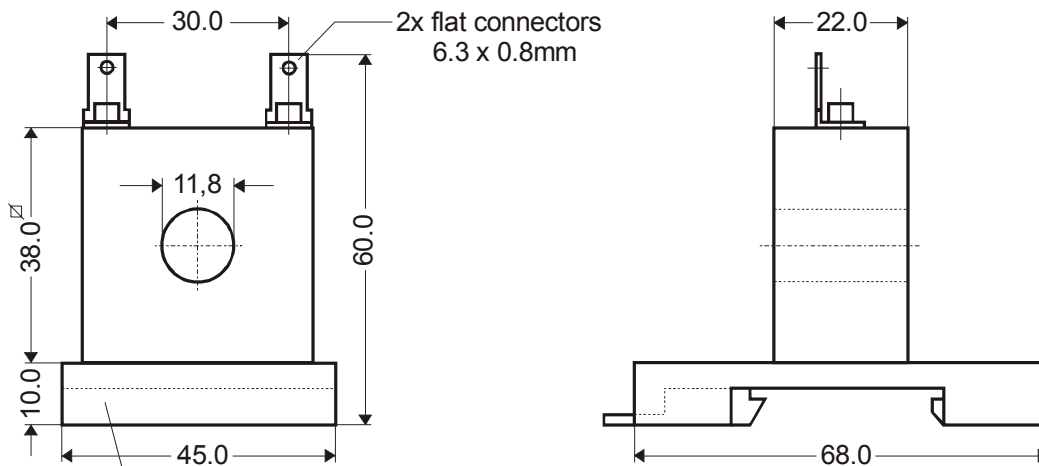
The wiring instructions contained in section 8.3 "Power supply" on page 12 must be observed.



8.5 Current transformer PEX-W2

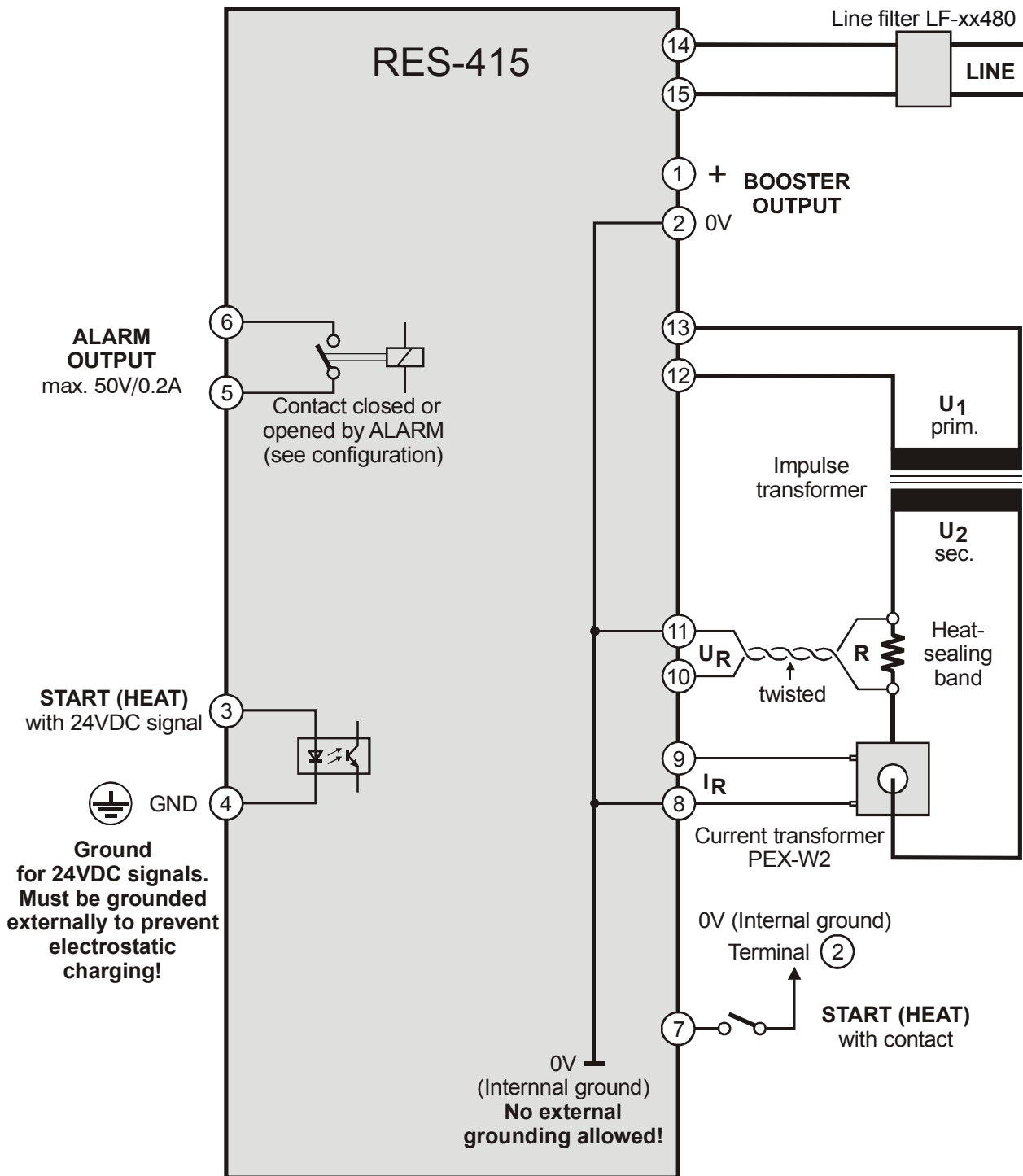
The PEX-W2 current transformer supplied with the RESISTRON temperature controller is an integral part

of the control system. The current transformer may only be operated if it is connected to the temperature controller correctly (↪ section 8.3 "Power supply" on page 12).

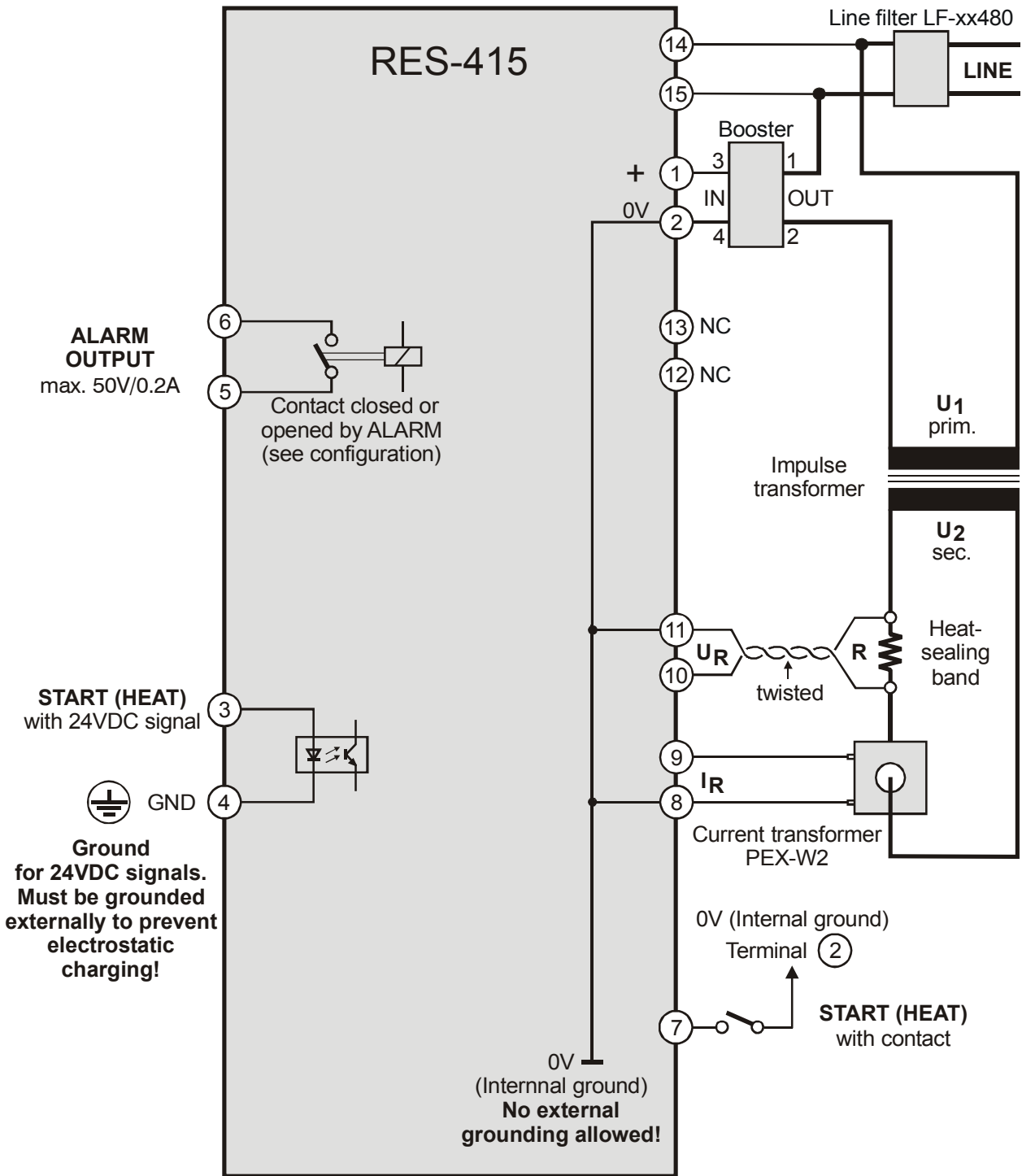


Snap-on plate for top hat rail (DIN TS35 rail), 35 x 7.5mm or 35 x 15mm, acc. DIN EN 50022

8.6 Wiring diagram (standard)

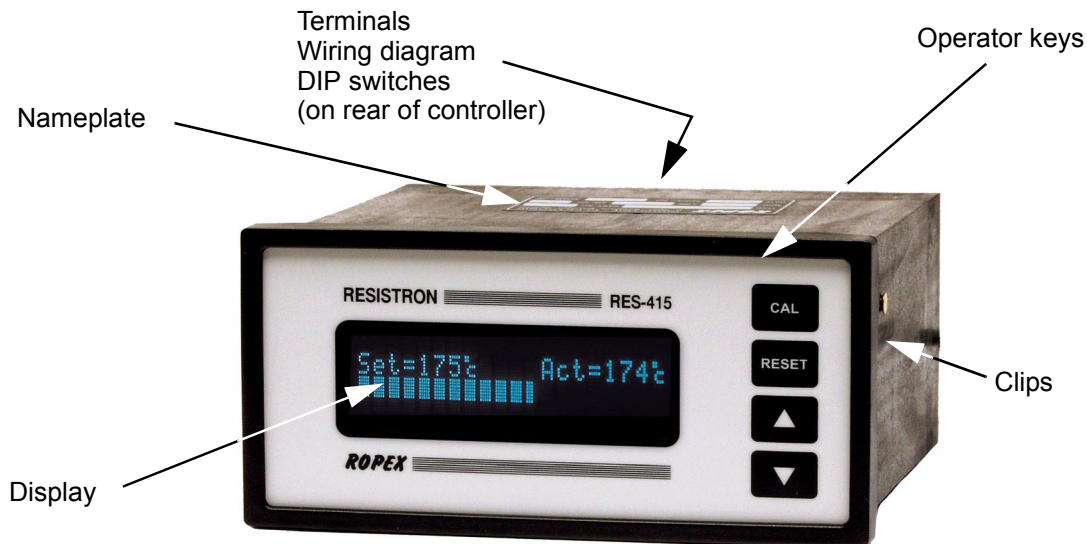


8.7 Wiring diagram with booster connection

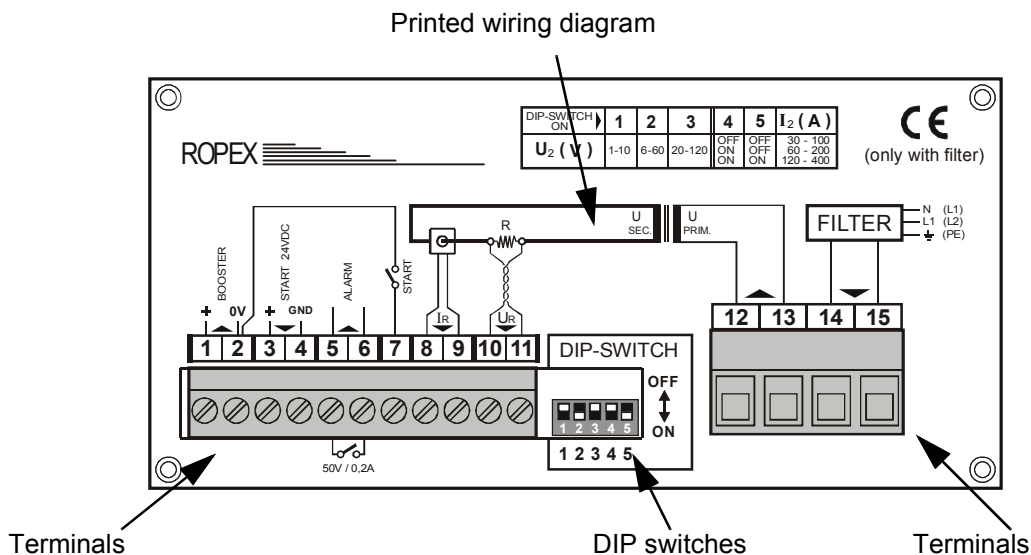


9 Startup and operation

9.1 Front view of the controller



9.2 Rear view of the controller



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 18 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.

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.

Rear view of the controller

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 current transformer must have two turns (↪ ROPEX Application Report).



effect). The cold resistance of the heatsealing band is reduced by approximately 2...3%. However, this at first glance slight resistance change results in a zero point error of 20...30°C. The zero point must therefore be corrected after a few heating cycles (↪ Kap. 9.4.2 „Burning in the heatsealing band“ auf Seite 17).

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.

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

! 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 20°C. Adjust the set point to approximately 250°C and activate the "START" signal to heat for approximately 1 second. After recooling, the controller usually indicates a value less than 20°C. Repeat the "AUTOCAL" function. The heatsealing band has now been burned in and the change in the alloy properties stabilized.

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

9.4.3 Replacing the heatsealing band

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

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

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

9.5 Startup procedure

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

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

9.5.1 Initial startup

Prerequisites: The controller must be correctly installed and connected (↪ Kap. 8 „Installation“ auf Seite 10).

The possible settings are described in detail in Kap. 9.3 „Controller configuration“ auf Seite 16 and Kap. 10 „Controller functions“ auf Seite 19.

The essential controller configurations are described below:

1. Switch off the line voltage and verify that all circuits are deenergized.
2. The supply voltage specified on the nameplate of the controller must be identical to the line voltage that is present in the plant or machine. The line frequency is automatically detected by the temperature controller in the range from 47 to 63Hz.
3. The settings of the DIP switches on the controller depend on the ROPEX Application Report and the heatsealing band that is used (Kap. 9.3 „Controller configuration“ auf Seite 16).
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
No alarm indication	Go to 8
Alarm signal with error codes 104...106, 111...113, 211	Go to 8
Alarm signal with error codes 101...103, 107, 108, 201...203, 801, 9xx	Fault diagnosis (↪ 10.11)

8. Activate the AUTOCAL function while the heatsealing band is still cold. The progress of the calibration process is indicated by a counter on the display (approx. 10...15s).

When the zero point has been calibrated, 20°C is indicated as the actual value.

If the zero has not been calibrated successfully, an alarm signal indicates error codes 104...106, 211.

In this case the controller configuration is incorrect (↪ Kap. 9.3 „Controller configuration“ auf Seite 16 and ROPEX Application Report). Repeat the zero point calibration after the controller has been configured correctly.

9. When the zero point has been calibrated successfully, specify a defined temperature (heatsealing temperature) by means of the "UP" and "DOWN" keys and activate the "START" signal (HEAT). The indication of the ACTUAL temperature on the display (digital value and dynamic bar) permits the heating and control process to be monitored.

The controller is functioning correctly if the temperature indicated on the display has a continuous curve, in other words it must not jump abruptly, fluctuate or deviate temporarily in the wrong direction. This kind of behavior would indicate that the U_R measuring wire has been laid incorrectly. If an error code is displayed, please proceed as described in Kap. 10.11 „Error messages“ auf Seite 24.

10. Burn in the heatsealing band (↪ Kap. 9.4 „Heatsealing band“ auf Seite 17) and repeat the AUTOCAL function.

The controller is now ready

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 17.

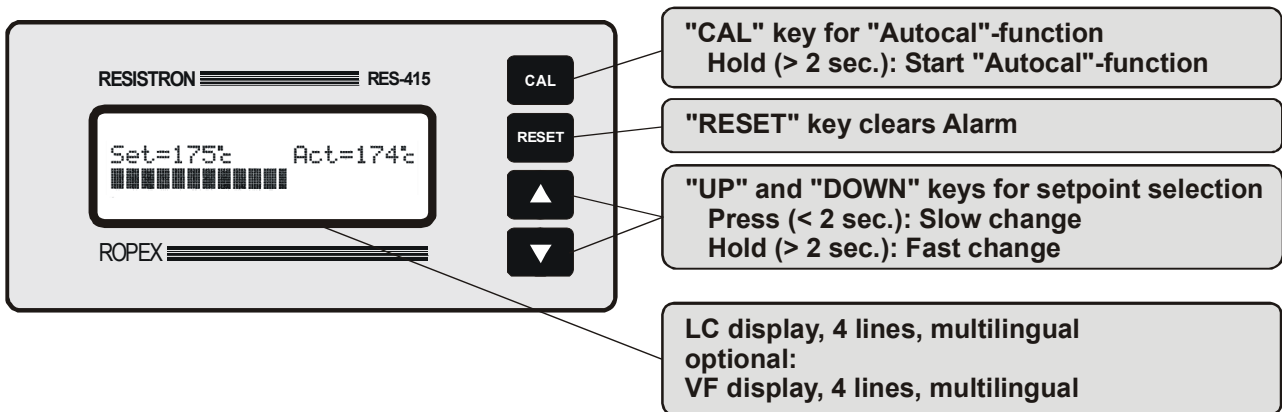
⚠ Always use a heatsealing band with the correct alloy, dimensions and copper-plating in order to avoid malfunctions and overheating.

Continue with section 9.5.1, steps 8 and 9.

10 Controller functions

See also Kap. 8.6 „Wiring diagram (standard)“ auf Seite 14.

10.1 Indicators and controls

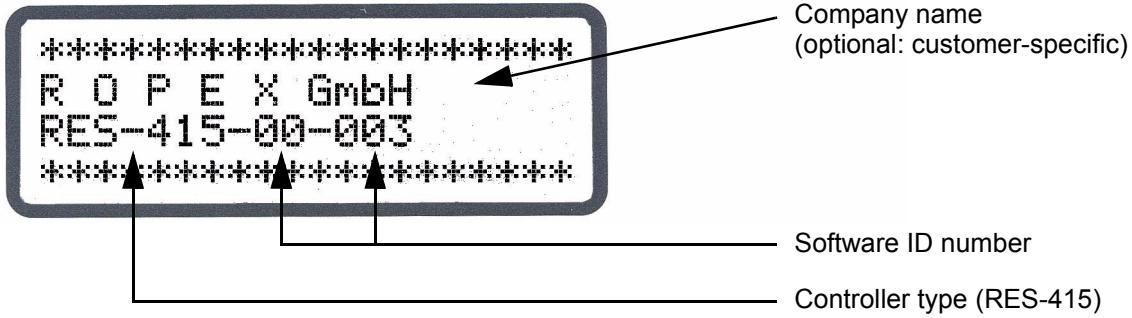


10.2 Display

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

10.2.1 Power-up message

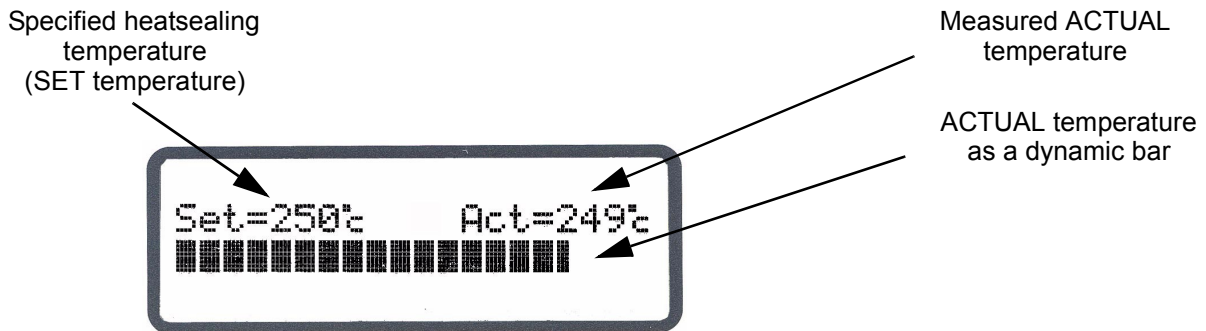
A power-up message appears on the display for approximately 2 seconds when the controller is



10.2.2 Display in home position

If no settings are entered on the controller and no alarm signals are present, the display is in the home position,

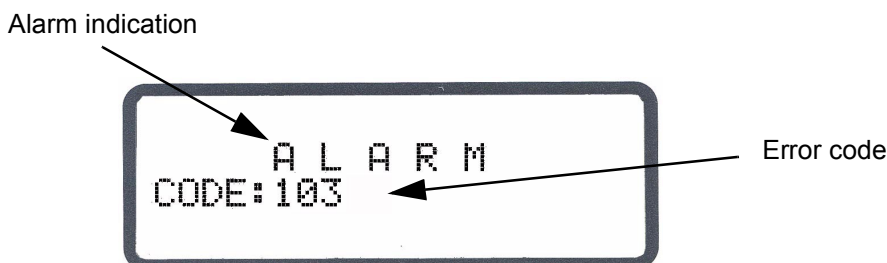
in other words it indicates the SET temperature as a digital value and the ACTUAL temperature as a digital value and a dynamic bar.



10.2.3 Alarm signals

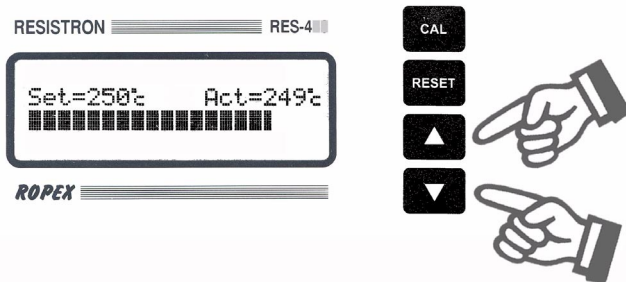
The fault diagnosis function of the controller is always active. If a fault is detected, it is indicated on the display

immediately in the form of an alarm signal (↪ Kap. 10.10 „System monitoring/alarm output“ auf Seite 23).



10.3 Temperature setting (set point selection)

The heatsealing temperature can be set on the RES-415 controller by means of the "UP" and "DOWN" keys. Changes are accepted immediately even when a heating process is active.

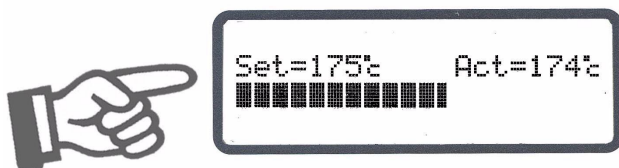


! The maximum value of the setting range is limited to 300°C.

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

10.4 Temperature indication

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

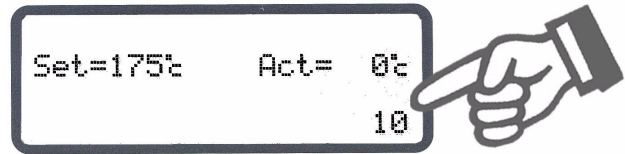


The heating and control process can thus be monitored at any time.

10.5 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 by pressing the "CAL" key for more than 2 seconds.



The automatic calibration process takes around 10...15 seconds. The heatsealing band is not heated until the calibration process has finished. A counter which counts down from 13 to 0 appears on the display while the "AUTOCAL" function is executing.

! 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:

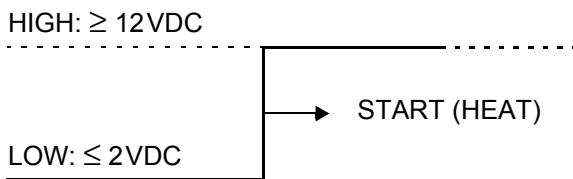
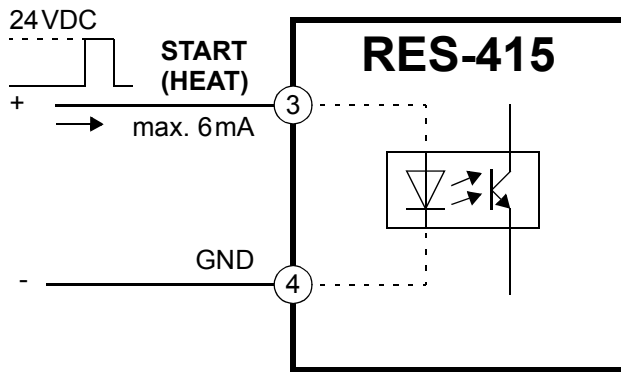
1. The "AUTOCAL" function cannot be activated if the heatsealing band cools down at a rate of more than 0.1K/second. If you try to activate the "AUTOCAL" function nevertheless by pressing the "CAL" key for more than 2 seconds, the display shows two flashing stars instead of the countdown.
2. If the "START" signal (24VDC or contact) is activated, the AUTOCAL function is not executed.
3. Directly after the controller is powered up, the AUTOCAL function cannot be activated if a fault with error code 101...103, 201...203, 801 or 9xx occurs (→ Kap. 10.11 „Error messages“ auf Seite 24). 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, 304, 308, 801 or 9xx.

10.6 "START" signal (HEAT)

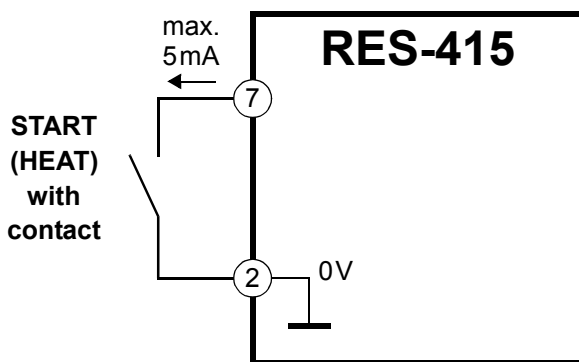
When the "START" signal is activated, the controller-internal set/actual comparison is enabled immediately and the heatsealing band is heated up to the SET temperature. It remains at this temperature until the signal is deactivated again.

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.

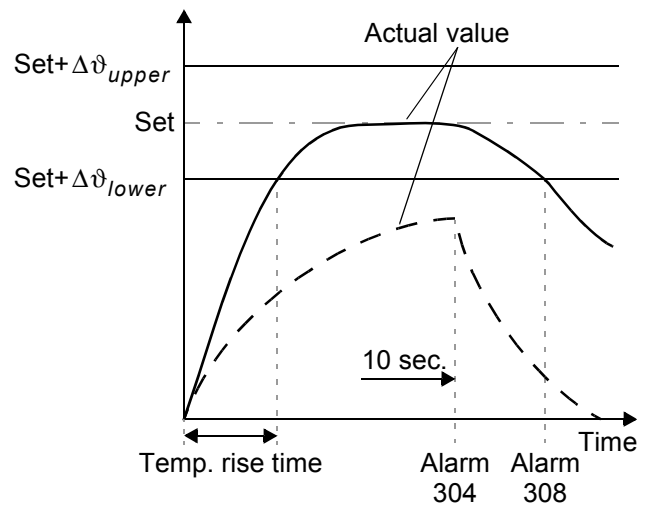
The set point that is selected for the heatsealing temperature must be greater than 40°C. If not, the heatsealing band will not be heated up. The alarm relay is switched if the "START" signal is activated while an alarm signal is indicating error codes 104...105, 111...113 or 211 (↳ Kap. 10.11 „Error messages“ auf Seite 24). The heatsealing band is likewise not heated.

10.7 Temperature monitoring

The RES-415 checks during the heatsealing phase whether the ACTUAL temperature is within a defined tolerance band ("OK" window) on either side of the SET

temperature. The lower and upper tolerance band limits are fixed at $\Delta\vartheta_{lower} = -15K$ and $\Delta\vartheta_{upper} = 10K$. As soon as the ACTUAL temperature leaves this "OK" window, the alarm relay is activated and error code 308 appears on the display.

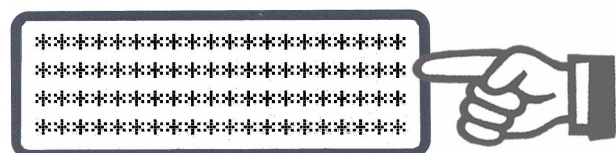
The RES-415 also monitors the temperature rise time. If this time is longer than 10 seconds, the alarm relay is likewise activated and error code 304 appears on the display. The temperature rise time begins when the START signal is activated and ends when the ACTUAL temperature exceeds the lower threshold of the monitoring window once.



10.8 Undervoltage detection

Trouble-free operation of the temperature controller is guaranteed within the line voltage tolerance range specified in Kap. 6 „Technical data“ auf Seite 8.

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.

! 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.

10.9 Booster connection

The RES-415 controller has a connection for an external switching amplifier (booster) as standard. This connection (at terminals 1+2) is necessary for high primary currents (continuous current > 5A, pulsed current > 25A). The switching amplifier should be connected as described in Kap. 8.7 „Wiring diagram with booster connection“ auf Seite 15.

10.10 System monitoring/alarm output

To increase operating safety and to avoid faulty heatsealing, the controller incorporates special hardware and software features that facilitate selective fault detection and diagnosis. Both the external wiring and the internal system are monitored. These features crucially support the system owner in localizing the cause of an abnormal operating state. A system fault is reported or differentiated by means of the following elements.

A.) Error message on the display:



The cause of a fault can be localized quickly and easily with the help of the error code that appears on the display. Please refer to Kap. 10.11 „Error messages“ auf Seite 24 for a list of the possible error codes.

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

This contact is:

- **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, 304, 308, 801 or 9xx appears.

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



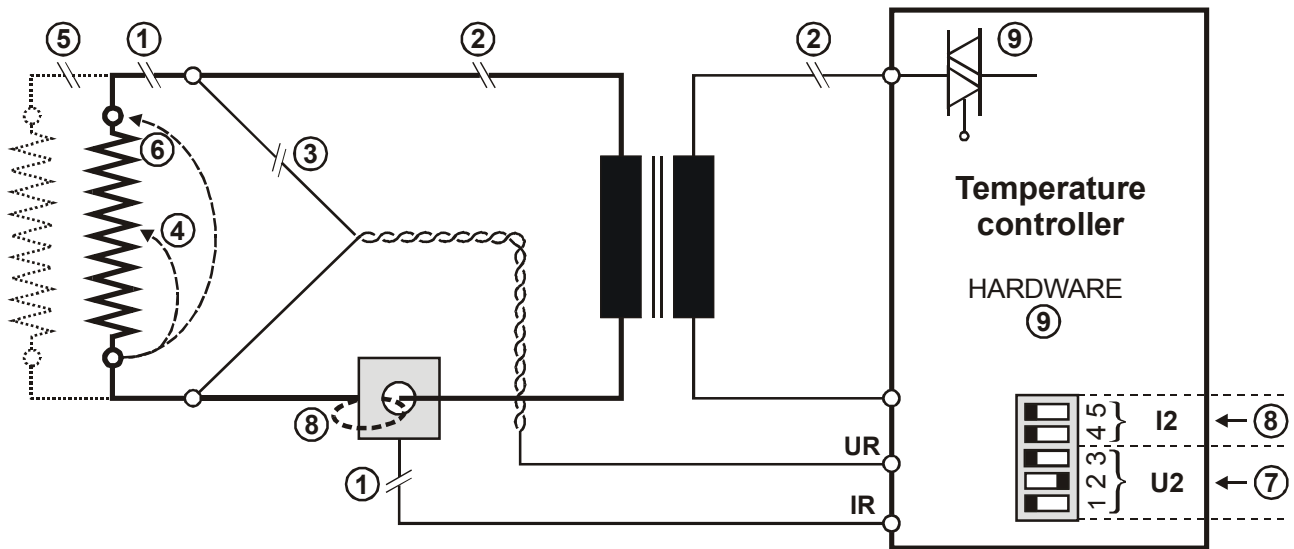
10.11 Error messages

The block diagram in Kap. 10.12 „Fault areas and causes“ auf Seite 25 permits each fault to be cleared quickly and efficiently.

The table below describes each fault and the required corrective action.

Error code	STATUS of alarm relay (factory set.)	Cause	Action if machine started for first time	Action if machine already operating, HS band not chang.
101	Closed	I _R signal missing	Fault area ①	Fault area ①
102		U _R signal missing	Fault area ③	Fault area ③
103		U _R and I _R signals missing	Fault area ②	Fault areas ②⑨
107 108		Temperature step	Fault areas ④⑤⑥ (loose contact)	Fault areas ④⑤⑥ (loose contact)
201...203		Frequency fluctuation, inadmissible line frequency	Check power supply	Check power supply
304		Temperature rise time exceeded	U _R signal too low, heatsealing band with wrong TCR	Impulse transformer defect (loose contact)
308		Temperature monitoring	U _R signal incorrect	Impulse transformer defect (loose contact)
801		Internal fault	Run RESET	Run RESET
9xx		Internal fault, controller defective	Replace controller	Replace controller
104...106		Open, does not close until "START" signal	U _R and/or I _R signal incorrect	Run AUTOCAL
211	Data error		Run AUTOCAL	---
111	I _R signal incorrect, calibration not possible		Fault area ⑧, check configuration	---
112	U _R signal incorrect, calibration not possible		Fault area ⑦, check configuration	---
113	U _R and I _R signals incorrect, calibration not possible		Fault area ⑦⑧, check configuration	---

10.12 Fault areas and causes

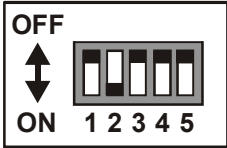


The table below explains the possible fault causes.

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

11 Factory settings

The RESISTRON temperature controller RES-415 is configured in the factory as follows:





<p><u>DIP switches</u> for secondary voltage U_2 and current I_2</p>		<p>$U_2 = 6...60VAC$ $I_2 = 30...100A$</p> <p>DIP switches: 2 ON 1, 3, 4, 5 OFF</p>
--	---	---

12 Maintenance

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

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

13 How to order

	<p>Contr. RES - 415- . / . . . VAC</p> <ul style="list-style-type: none"> L / 115: LC display, line voltage 115VAC, Art. No. 741511 L / 230: LC display, line voltage 230VAC, Art. No. 741512 L / 400: LC display, line voltage 400VAC, Art. No. 741513 V / 115: VF display, line voltage 115VAC, Art. No. 741521 V / 230: VF display, line voltage 230VAC, Art. No. 741522 V / 400: VF display, line voltage 400VAC, Art. No. 741523 <p>Scope of supply: Controller includes connector plug-in parts (current transformer must be ordered separately)</p> <p>Modification MOD . . (optional, if required)</p> <ul style="list-style-type: none"> e.g. 01: MOD 01, Art. No. 800001 (amplifier for low voltage) <p>Please indicate the article numbers of the controller and the required modifications (optional) in all orders, e.g. RES-415-L/400VAC + MOD 01 (controller with LC display for 400VAC line voltage and amplifier for low voltage) Art. Nos. 741513 + 800001 must be ordered</p>
	<p>Current transformer PEX-W2 Art. No. 885104</p>
	<p>Line filter LF- . . 480</p> <ul style="list-style-type: none"> 06: Continuous current 6A, 480VAC, Art. No. 885500 35: Continuous current 35A, 480VAC, Art. No. 885506
	<p>Impulse transformer</p> <p>See ROPEX Application Report for design and ordering information</p>

For more accessories: ↪ "Accessories" leaflet

14 Index

A

Accessories 6
 Adapter for top hat rail mounting 7
 Alarm output 23
 Alarm relay 8
 Alloy 19
 Ambient temperature 8
 Application 4
 Application Report 10, 13, 17
 AUTOCAL 6, 18, 21
 Automatic zero calibration 6, 18, 21
 AUTOTUNE 6

B

Booster 15
 Booster connection 23
 Burning in heatsealing band 17, 19

C

Circuit breaker 12
 Controller configuration 16
 Controls 19
 Current transformer 7, 13, 27

D

Degree of protection 8
 Dimensions 9
 DIP switches 17
 Display 20

E

External switching amplifier 15

F

Factory settings 26
 Fault areas 25
 Fault diagnosis 6
 Front cover 7

H

HEAT 18, 21
 Heatsealing band type 8

I

Impulse heatsealing method 4
 Impulse transformer 6, 12, 27
 Installation 8, 10
 Installation procedure 10
 Installation regulations 10

L

Line filter 6, 12, 13, 27
 Line frequency 6, 8
 Line voltage 8

M

Maintenance 26
 Measurement cable 7
 Modifications 7, 27
 MODs 7, 27
 Monitoring current transformer 7

O

Overheating of heatsealing band 6

P

PEX-W2 13, 27
 Power supply 12
 Principle of operation 5

R

Replacing heatsealing band 18, 19

S

Secondary current I_2 17
 Secondary voltage U_2 17
 Set point selection 8, 21
 Standby mode 22
 "START" signal 18, 21
 System monitoring 23

T

TCR 3, 17
 Temperature coefficient 3, 17
 Temperature control 4
 Temperature indication 21
 Temperature monitoring 22
 Temperature range 8
 Temperature setting 21
 Transformer 3, 6, 12, 27
 Type of construction 8

U

Undervoltage detection 22

V

View of controller 16

W

Wiring 10, 12
 Wiring diagram 14, 15