

# RESISTRON

TEMPERATURE CONTROLLER  
FOR HEATSEAL BANDS  
TO SEAL PLASTIC FILMS



## RES-241

without Alarm

## RES-242

with Alarm



### FEATURES

- ★ Designed for Easy Mounting on the Control Panel
- ★ Analog Temperature Meter
- ★ Integrated Heat Sealing and Cooling Programs
- ★ Numerous Programming Functions
- ★ Easy Installation and Operation
- ★ Built in Timers
- ★ Preferred for General Applications

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## 1. APPLICATION AND SHORT DESCRIPTION

As all other **RES controllers**, this unit is used to control the temperature of heating elements (heatseal bands, beaded bands, cutting wires, etc.) by monitoring the resistivity of the heating elements. Precision measurement together with high response produces perfect temperature control during the film sealing processes. With a correctly installed system, the temperature is controlled with an accuracy of  $\pm 3\%$ .

By changing settings, this controller can be used to control heating elements with a range of resistances from a few milliohms to several ohms. Therefore, this universal controller may be used in a variety of general applications for controlling the heatseal elements in:

- vertical and horizontal f/f/s machines
- pouch filling and sealing machines
- film wrapping machines
- pouch making machines
- group packaging machines, etc.

The controller, **RES-241 / 242**, have all the known functions of the RES-200 series, plus two digital timers, sealing time and cooling time. This eliminates additional external usage of timers to control heat impulse timing and jaw action.

This additional feature makes the controller very suitable for use in:

- hand operated and table top machines
- heatsealing sealing presses
- L-sealers

As shown in Section 5, a complete sealing station can be controlled with this controller without using additional electrical components.

All parameters related to the sealing phase, like time and temperature, can easily be selected by use of the digital switches on the front panel of the unit.

The desired values are entered according to the appropriate units, i.e. **°C** and/or **sec**.

Numerous functional sequences can be programmed with the dip switches mounted on side of the controller. This allows the user to select the best program for any specific heatsealing process.

Processes that are primarily temperature dependent can be programmed, e.g. closing of the jaw only after full sealing temperature has been reached; or opening of the jaws only after the cooling to a pre-determined temperature has been reached.

(see Section 4: Timing Functions Programming).

The cycle sequence can be observed during operation by means of the analog temperature meter and the LED's for heating and cooling.

Both the **RES-241** and **RES-242** controllers are identical with the exception of the "alarm function" that is contained only in the Model RES-242.

## 2. FUNCTIONS OF THE RES-241 / 242

### 2.1

### CONTROL FUNCTIONS

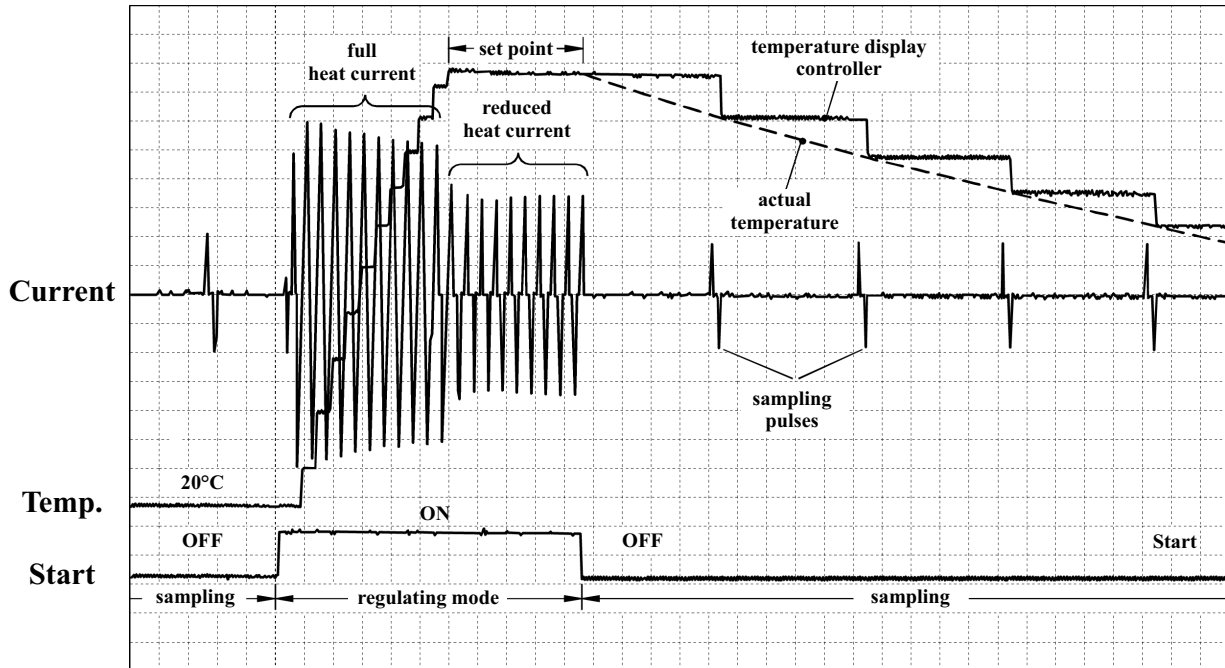
The controller operates in two different modes: monitoring or controlling.

If there is **no START signal**, the controller will only monitor the resistance of the heating element without raising the temperature. Resistance monitoring is accomplished by means of short low power pulses every 10 cycles of the line frequency. It is in this mode that the "Z" calibration is performed. In the monitoring mode, the "ON" LED blinks red. When a START signal is applied, LED "ON" becomes steady state red.

The controller then goes into the regulating mode and increases the temperature of the heating element to the desired set point as rapidly as possible.

The maximum secondary voltage is initially supplied to the heating element and then subsequently reduced by the phase control as the preset maximum temperature is approached.

A high sampling rate together with virtually instant feedback gives the controller an instantaneous response capability.



## 2.2 ZERO CALIBRATION

ZERO calibration is the adjustment of the controller to the resistance of the cold heatseal element. This calibration must be performed with the heatseal band at room temperature. The hand of the analog temperature meter is set to "Z" by turning the "ZERO" adjustment trimmer with the heatseal element at ambient temperature and the controller in the monitoring mode. ("Z" = 20°C/68°F). After calibration the hand should rest quietly at "Z".

Proper operation depends upon the accurate calibration of the system. Because the resistance of the heatseal element may vary depending upon its precise length and cross-section, the calibration ("Z" point) must be checked and reset after each change or replacement of the heatseal element. (see Sect. 8, "Heatseal Element" and Sect. 7, "Operating Instructions")

## 2.3 START-FUNCTION

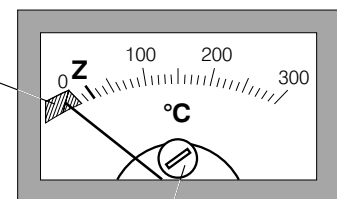
A heating cycle is initiated with the start function. The controller then switches from the monitoring mode to the regulating mode, and concurrently starts the timing cycles. The START signal can be given in three different ways:

- by pressing "HAND" on the front panel
- by closing the circuit between terminals 2 and 7, with potential free contact.
- by supplying 24VDC to Terminals 3 and 4

A "START-Lock" feature prevents the overheating of the heating element when the controller is improperly calibrated, set below the "Z" point. Should this occur, the RES-241 controller will not accept the START signal, while the RES-242 will go into "ALARM" and shut down.

**NOTE - When using new heating elements:** After a few temperature cycles the resistance of the element will be reduced, the calibration may no longer be correct. When this occurs, allow the heating element to return to ambient temperature and reset the meter to "Z" by using the Zero Trimmer.

**START ENABLE**  
when needle is below zero



Mechanical zero adjustment. **Do not move!**

**2.4**

**CYCLING TIMING**

Heating and cooling cycle time follow each other. Depending upon the program selected by use of the DIP switch, the **heating time** either starts with the "START" signal or when the heating element reaches the pre-set temperature.

(see Section 4 "Timing Functions Programming").

The **cooling cycle time** always starts at the end of the heating cycle. The maximum time duration for heating or cooling is 9.9 seconds. Depending upon the program selected, the duration of the cooling cycle may be set to

be a function of time or temperature. The cooling cycle may be set to end when a pre-set temperature is reached, that means that the relay K1 will drop out when the temperature drops below the pre-select level. The selection is done by means of the 2 position digital selector switch in °C x 10 in increments of 10 degrees.

**EXAMPLE:**

Selection 08 = 80 °C  
 Selection 12 = 120 °C

**2.5**

**ALARM FUNCTION (RES-242 only)**

**2.5.1**

**ALARM SIGNAL**

To increase the reliability of operation and to assure adequate seals, the RES-242 controller contains a comprehensive monitoring system that will send an alarm signal (LED "ALARM" will turn red) and activate the alarm relay when:

- a) the heatseal element breaks, or any discontinuity in the secondary circuit occurs.
- b) ONE of the heatseal elements breaks when two bands are mounted parallel.
- c) A short circuit occurs at the heatseal element
- d) Any discontinuity occurs in the monitoring wiring of the heatseal element or the current transformer.
- e) Any overheating of the heatseal element by 20% above the controller's operating temperature range
- f) "Z" point is incorrectly set.  
(see "START Function" and "Start Block")

To assure a trouble free "ZERO" calibration, functions e) and f) will only activate after the start signal is given.

Other reasons for an ALARM signal are:

- incorrect programming of DIP switches in the for U<sub>2</sub> voltage selection.
- improper position of the frequency jumper.
- improper power supply voltage.
- internal malfunction.

In the case of an alarm, the LED "ALARM" will turn red, the controller output will be disabled, and the ALARM relay will close between terminals 5 and 6.

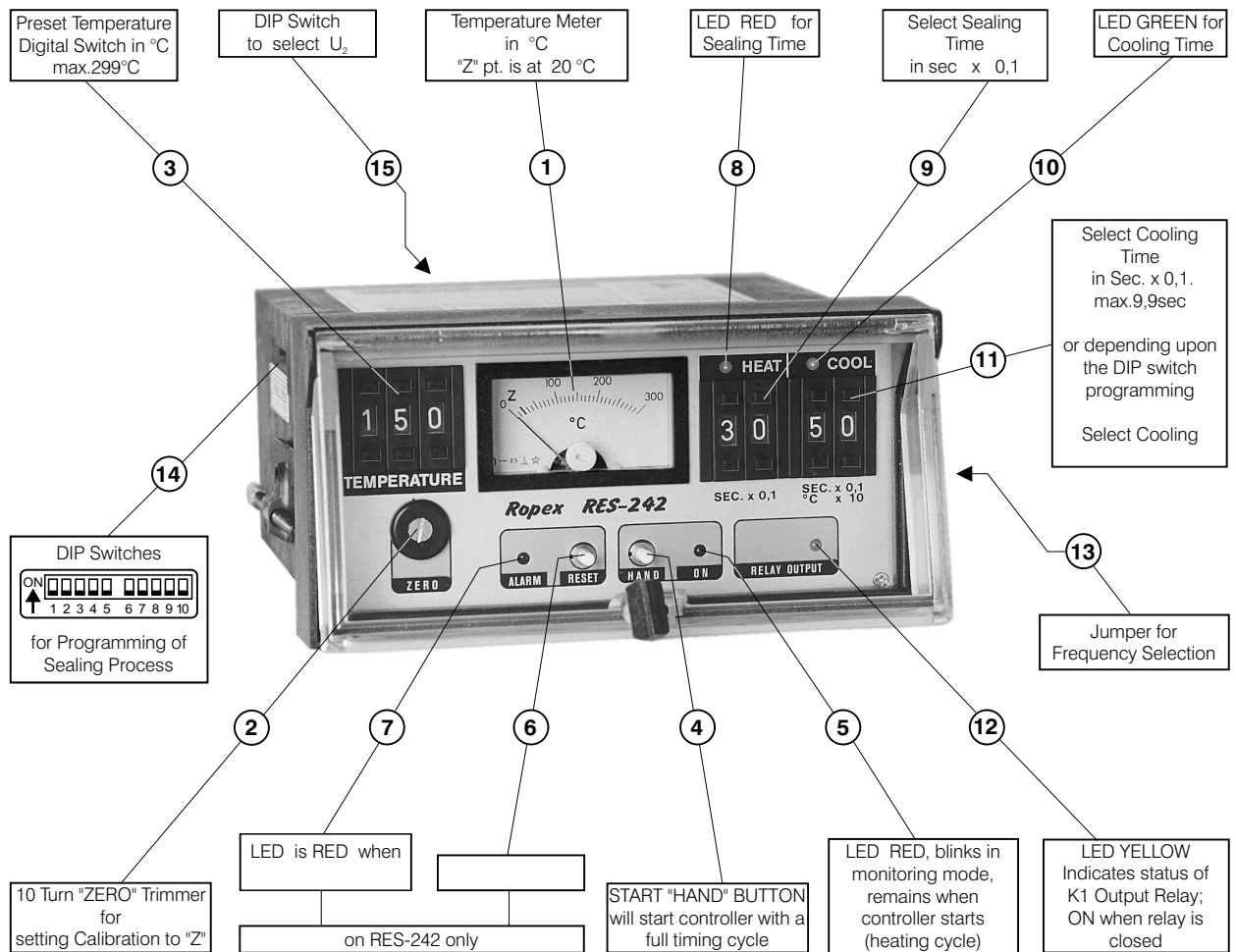
**2.5.2**

**RESET**

The controller can be reset - after the cause of the alarm has been corrected - by pushing the "RESET" button or by turning off the main power by at least 1 second.

Taste "RESET" oder Abschalten der Netzspannung für mind. 1 sec und Wiedereinschalten.

## 3. CONTROLS AND INDICATORS

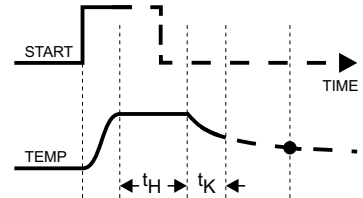


## 4. TIMING FUNCTIONS PROGRAMMING

### 4.1 PROGRAMMING THE OUTPUT RELAY

The output relay may be programmed for 5 different modes of timing sequence, for activating the seal jaws or other functions, by setting the DIP switches on the side of the controller.

**$t_K$  = Cooling Time** (LED: Green)       **$t_H$  = Heating Time** (LED: Red)      **K1 = Relay** (LED: Yellow)



A		Relay K1 will activate concurrently with the start signal to the controller, and release after	
B		Relay K1 will activate when the heatseal band reaches the pre-set temperature, and release after the cooling cycle times out.	
C		Relay K1 activates to produce a "signal pulse" (.5 sec.) after the completion of the cooling cycle.	
D		Relay K1 activates concurrently with the start signal to the controller and releases when the preset cooling temperature of the heatseal band has been reached.	
E		Relay K1 will activate when the heatseal band reaches the pre-set temperature, and release after the pre-set cooling temperature has been reached.	

### 4.2 PROGRAMMING THE HEATING TIME

The heating time can be programmed for 2 different modes by using the DIP switches on the side of the controller.

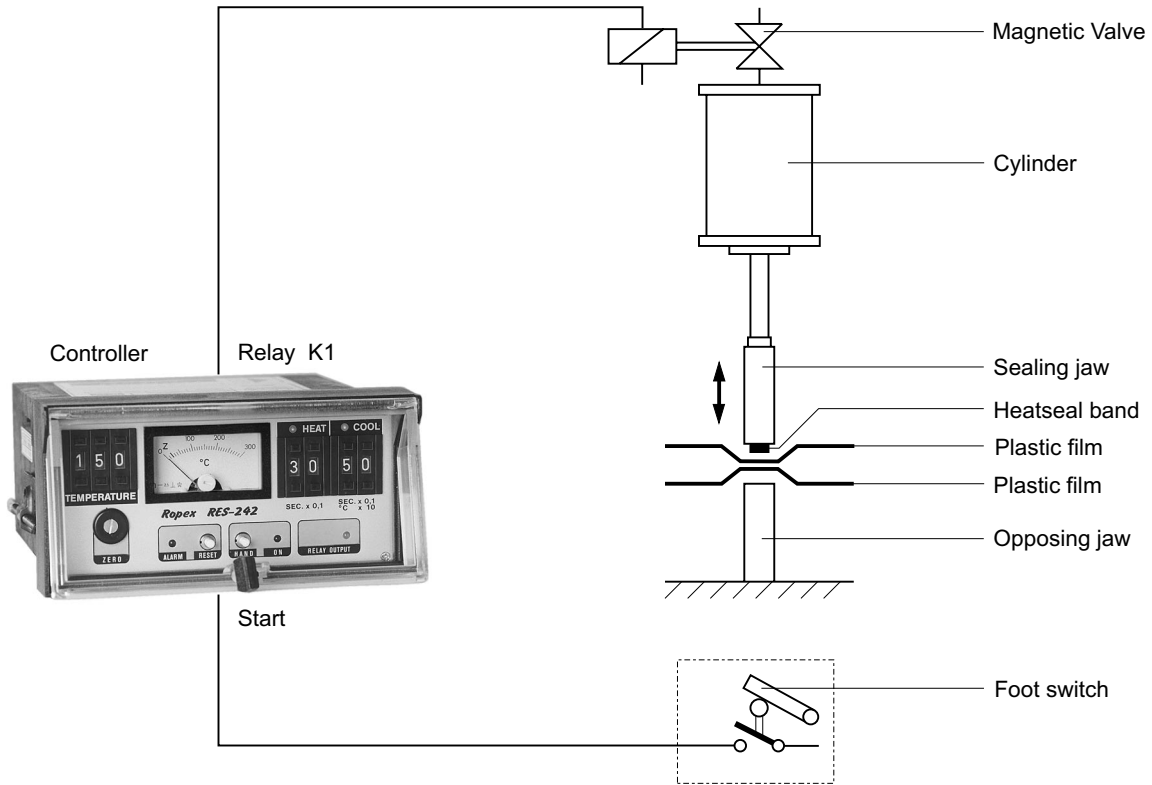
F		The heating cycle time begins with the start	
G		The heating cycle starting time begins when the heatseal band reaches the pre-set temperature.	

### 4.3 PROGRAMMING FOR CONSTANT HEAT

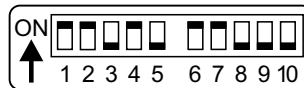
H		At the initial start signal the controller will be activated to heat and control the heatseal band temperature until the power supply to the controller is disabled. The K1 timer sequence is independent of this and can be	
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## 5. EXAMPLE

### PNEUMATICALLY OPERATED PLASTIC FILM HEATSEALING DEVICE WITH RES-242 CONTROLLER, MAGNETIC VALVE AND IMPULSE START BY FOOT PEDAL.

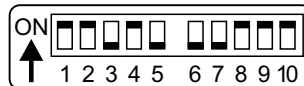


#### EXAMPLE 1: Controller Program B



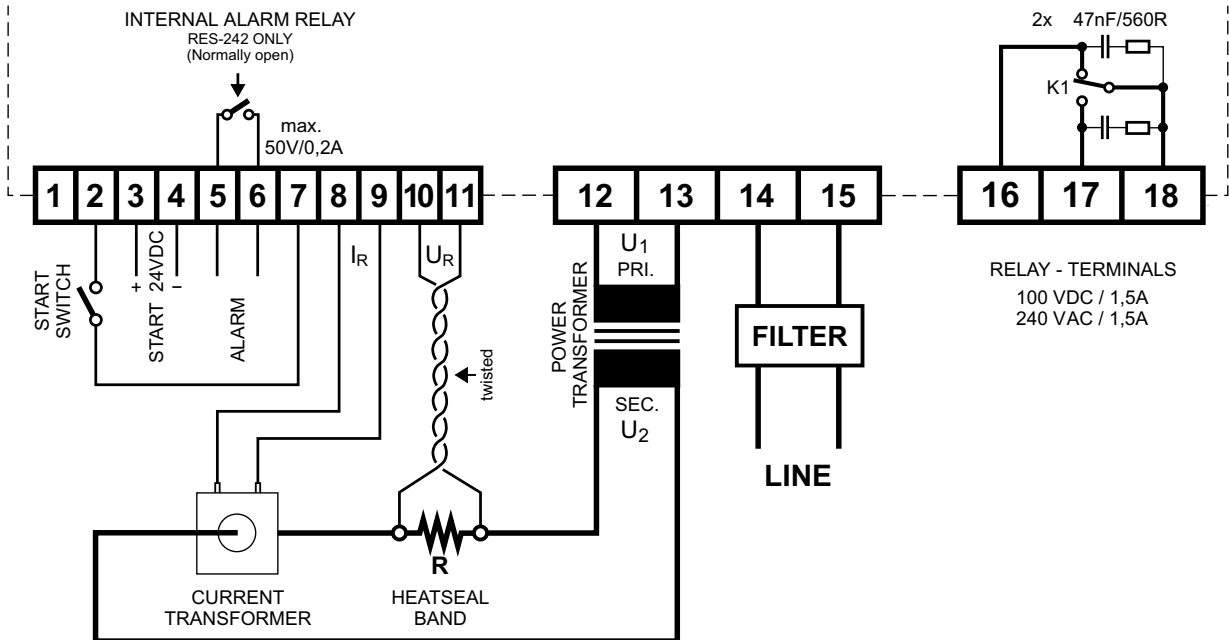
**Sequence:** The foot pedal provides the start signal to the controller, the heating cycle of the element starts. After reaching the pre-set temperature relay K1 closes, the magnetic valve is activated and the sealing jaw closes. Simultaneously, the heating cycle time is started. When the heating cycle ends, power to the heating element is disabled, and the **cooling cycle** begins (jaws remain closed). At the end of the **cooling cycle time**, relay K1 opens, the valve is deactivated and the jaws open. The sealing cycle is complete.

#### EXAMPLE 2: Controller Program E



**Sequence:** This program is the same as example 1 until the end of the heating cycle. At the end of the heating cycle, the cooling cycle starts and ends only when the **cooling temperature** has dropped below the temperature pre-selected on the "COOL" digital selector switch (digits x 10 in °C). Only then, the relay K1 opens and allows the jaw to open. This means, the complete sealing cycle does not end at a preset **cooling time** but with a pre-selected **cooling temperature**. This program is advantageous when the jaws heat and cool slowly. The cooling time is automatically prolonged and the seal is consistently good.

## 6. WIRING DIAGRAM

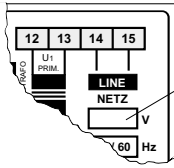




## 7. OPERATING INSTRUCTIONS

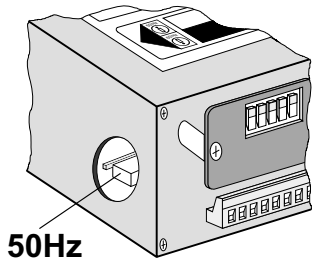
(see Section 3)

### 7.1

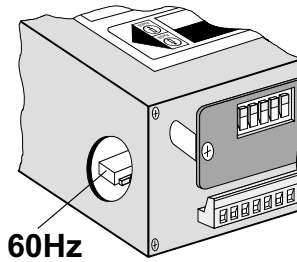


Examine the controller and determine that the power to be supplied to the controller is in agreement with the controller specification.

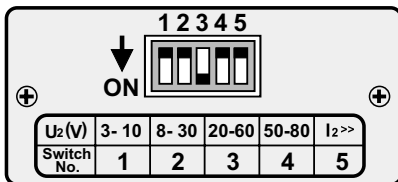
### 7.2



Jumper (13) for the frequency option (50/60Hz) must be set into its proper position.

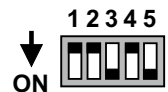


### 7.3



Set the DIP switch (15) to select the secondary voltage range that will be used. With extreme low resistance heatseal elements (less than 100mOhm) or with extremely high secondary currents (larger than 80A) switch No. 5 **must also be ON**.

**Example:** for 42V secondary voltage and an expected initial current of 120A ( $I_{2MAX} = U_2 / R_{SEALBAND}$ ), DIP SWITCH 3 **and** 5 must be ON.



### 7.4

Programming switch (14) must be set to achieve the desired program sequence. (see Section 4)



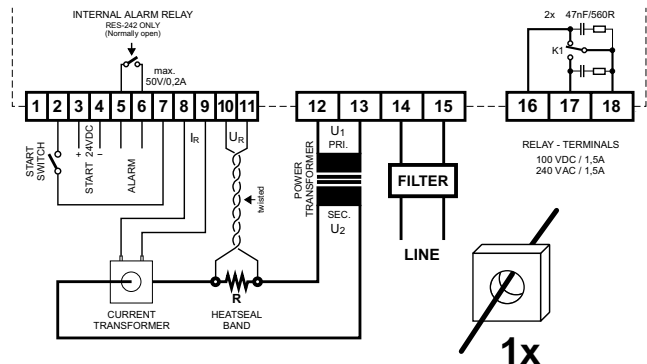
### 7.5

Connect the controller as shown in the wiring diagram. No special attention must be given to the polarity of the measuring wires for current and voltage as well as the transformer's primary or secondary.

**See General Installation Instructions** (Section 12).

**VERY IMPORTANT**

Make sure that there is **NO** "START" signal at



### 7.6

Connect power. LED "ON" (5) will blink and LED "ALARM" (7) must be off (only on the RES-242).

**NOTE:** If the controller goes immediately into

"ALARM" and LED "ALARM" is red, all wiring system must be rechecked for correct and tight connections. If ALARM continues also refer to Section 2.5 "ALARMFUNCTION".

## 7.7

Turn the "ZERO" Trimmer 2 (so) that the meter hand rests on "Z" **-only with the heatseal element at ambient temperature.**

Which way to turn?

If the hand is on the left side, turn the trimmer clockwise; if the hand is on the right side, turn the trimmer counter clockwise. If the "ZERO" calibration is not possible, the meter hand remains on the right side, pass the wire

through the current transformer a second time; in extreme cases a third pass might be necessary. This situation might occur when the heatseal element is very long and thin (high resistance).

**RECALIBRATE** after trying each pass through the current transformer.



## 7.8

- Select any temperature (example 150°C) on the digital selector switch (3)
- Select the sealing time (example 3.0sec) on the digital selector switch (9)
- Select the cooling time (example 5.0sec) on the digital selector switch (11)
- Press "HAND" button (4), and the following cycle begins:

- LED (5) "ON" changes from blinking to constantly on; heating cycle starts.
- depending upon the programming, the LED "HEAT" (8) can be on simultaneously with LED (5), or only after the preset temperature has been reached.
- starting with the heating process the hand should show a steady temperature rise to the preset level where it should stop until the sealing time is lapsed.
- at the end of the sealing time the LED (8) will turn off and the green LED "COOL" (10) is illuminated (beginning of the cooling time). At the same time the LED (5) "ON" will return to blinking. The hand on the meter will decline indicating the cooling of the heatseal element.
- after the cooling time, or when the preset cooling temperature (digital selector switch (11) has been reached, LED (10) turns off.

Within this cycle the yellow LED (12) is on depending upon the program setting of the DIP switches (14) and indicates the switching action of the relay K1. Also refer to Section 4.1 "Programming of the Output Relay".

The Analog Meter hand movements must be steady and rhythmical, indicating the temperature increase and decrease of the heatseal element temperature during the heating the cooling cycles.

After several heating cycles, let the heatseal element cool down completely and check the "Z" calibration; some adjustment might be needed.

Now the controller is ready for full operation.

Once started, a timing sequence cannot be interrupted nor delayed. A new sequence can only be started with a new signal after completion of the previous sequence

**NOTE:** When turning on the controller, follow the correct sequence. **FIRST** - power, **THEN** the **START** signal. **NEVER** both together or in reverse sequence. However, the temperature may be pre-set before turning on the

## 8. HEATSEAL ELEMENT

The heatseal element is an important component of the control system since it is simultaneously the sealing element and the temperature sensor. There are so many different shapes and size of heatseal elements that we cannot discuss them all here, however, some very important physical and electrical characteristics are emphasized here.

- The controlling principle of the system demands that only Alloy-20 heatseal elements be used.
- During the first heat up to 200 - 250°C the heatseal element will experience a one time change in resistance (burn in effect). The resistance of the cold element

is reduced by approx. 2 or 3%. This rather small change in resistance however results in a zero point discrepancy of 20 - 30°. Therefore, it is necessary to re-adjust the zero point after a few heating cycles.

- An overheated (burned out) heatseal element cannot be used and must be replaced because of an irreversible change in metallurgy at high temperatures. A very important option is to copper plate or c/a coat the ends of the heatseal elements.
- This will result in better temperature control and extended "life" of the heatseal element as well as of the Teflon cover or coating

### 8.1

## HEATSEAL BAND REPLACEMENT

**NOTE:** When heatseal bands are replaced the system must be recalibrated as described in 7.7

## 9. IMPULSE SEALING

When the impulse sealing method is employed the start signal is synchronized with the operating cycles of the machine. Every heating cycle is followed by a cooling cycle **with jaws closed**. It is important that the cooling is effected with jaws closed so that the seal can set and gain strength and good appearance before the jaws are opened. This method is preferred if adequate sealing time is available because the strength and appearance of the seal are optimized.

Since the heat sealing is a thermodynamically reversible procedure and is often influenced by time constraints, it is very important that the relevant parameters; temperature, time and pressure are very carefully synchronized. The following diagram shows an example of the timely setting of each parameter.

Basic rules for Impulse Heatsealing:

- A. The pre-set temperature should always be attained before the sealing jaws make contact. This allows the sealing element to expand without constraint and eliminates stressing of the heatseal element ends (phase ②).
- B. The system should be designed to drive the heatseal element to the preset temperature in minimum time. The total system, principally the secondary voltage,

must be optimized to achieve the best result.

**Our application service will give you the necessary data for your special application.**

- C. The cool down of the heatseal element while still under the force of the jaws is the main advantage of impulse sealing (phase ⑤). At the completion of the heatseal cycle, most of the excess heat will be absorbed by the jaws. Cooling of the jaws is sometimes recommended so that they can absorb enough heat from the heatseal element quickly. Contrary to the constant heat mode, good thermal conductivity between the sealing element and the jaws must be assured by using a thin backup material behind the heatseal element.

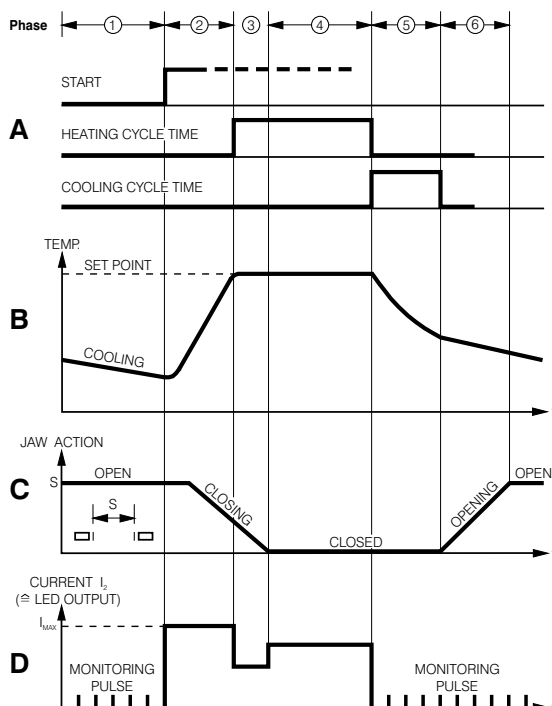
Under certain conditions, sealing is also possible with the so-called **rest-heat** procedure. In this mode, the remaining heat in a sealing element is calculated to be just enough for the sealing process. This means that in the timing process, the temperature drops in phase ④. The current is cut off when the jaws touch. The heat flows into the film and "unloads" the heat stored in the heatseal element, which results in a faster cooling. For this method to be effective the thickness, therefore the mass, of the heatseal element must be great enough to hold the required total heat.

### 9.1 PRECISION TIMING FOR PERFECT HEATSEALS

High performance productivity with perfection requires coordinated timing between the heatseal impulse and the jaw action.

Notice that it is possible to energize the heatseal band prior to jaw closing because the temperature controller eliminates the risk of overheating.

The timing chart below describes the relationship of (A) Heating and cooling cycles. (B) Heatseal Band temperature. (C) Heatseal Jaw action. (D) Power Output.



Phase :

- ① **START is "OFF"**. Jaws are **open** and the heatseal band is cooling from the previous cycle. (Monitoring Mode)
- ② While jaws are closing, the heatseal band temperature rises to the set point so that full temperature is reached before the jaws closed.
- ③ Power output is **controlled**. Temperature remains at set point.
- ④ **Heatseal process**: Start of sealing time. Time must be allowed for the heat to full penetrate the material to be sealed.
- ⑤ **Cooling phase**: Start of cooling time. Time must be allowed for the seal to **set-up** before jaws are opened.
- ⑥ Jaws are opening.

**Diagram D** shows the rate of current flow during a sealing phase. This can also be measured with an amp-meter.

Phase ① : Stand by mode. Monitoring pulses.

Phase ② : Controller "ON" heating up with full secondary voltage, maximum power.

Phase ③ : Controller "ON" and regulating to maintain the preset

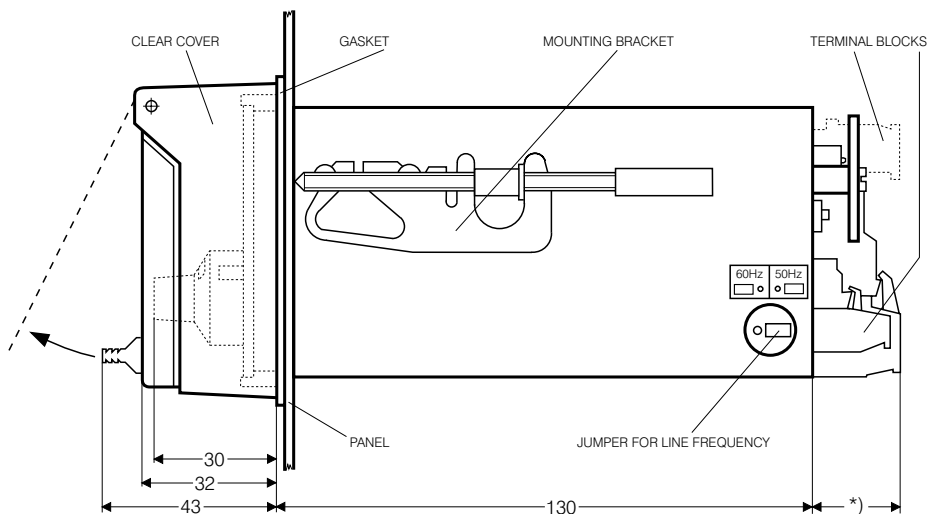
temperature while the jaws are still open.

Phase ④ : Controller "ON" and regulating. Increased power is being supplied to maintain the preset temperature

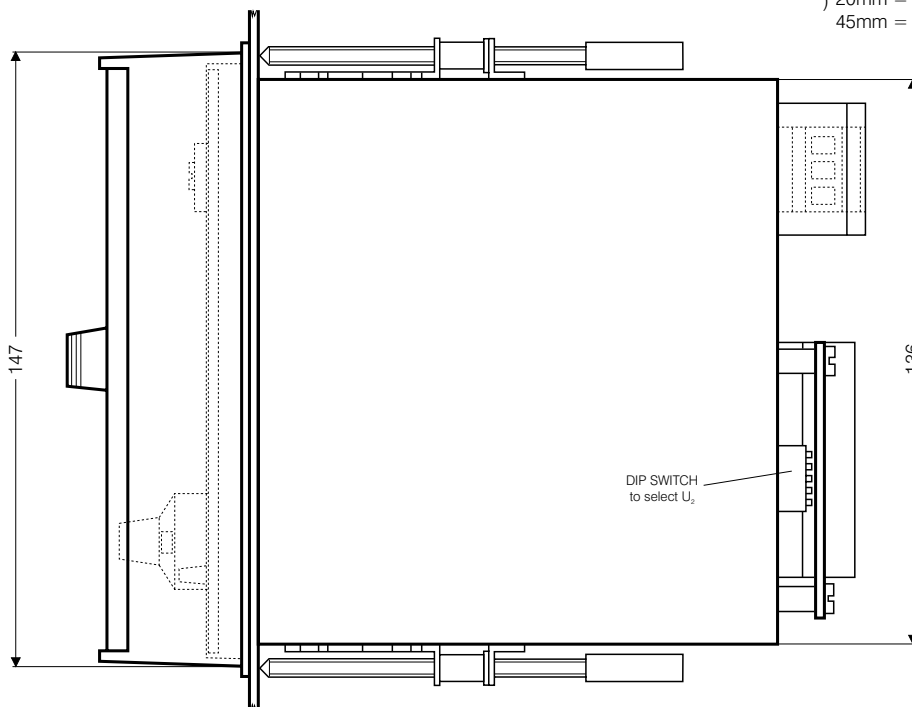
Phase ⑤ : during the sealing process.

Phase ⑥ : Controller "OFF" and the heatseal band is cooling.

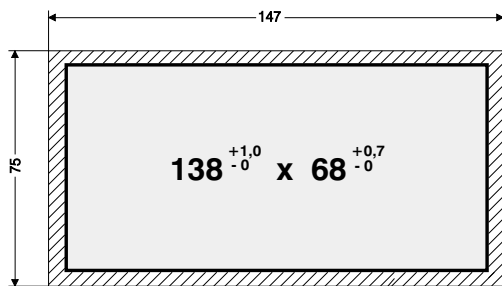
## 10. OUTLINE DIMENSIONS



\*) 20mm = TYPE RES-XXX - 0  
45mm = TYPE RES-XXX - 1

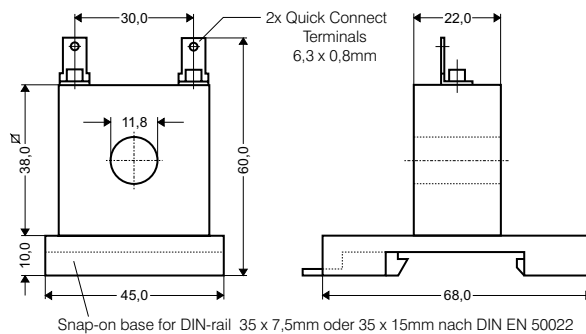


### PANEL CUTOUT



OUTLINE DIMENSIONS CLEAR COVER

### CURRENT TRANSFORMER



## 11. TECHNICAL SPECIFICATIONS

Type of Construction: Housing, with clear cover, designed for mounting into the control panel  
DIN-Format: 72 x 144 mm

**Line Voltage:** Standard 230 VAC  
Option 115 VAC or 400 VAC

Operating Range: +10% / -15%  
of Line Voltage

Line Frequency: 50Hz or 60Hz, selected with jumper

Operating Range: ±1Hz  
of Line Frequency

Sealing Temperature: Set with 3 digit selector switch, Range 0...299 °C [or 0...499 °C]  
Resolution 1K

Sealing- and Cooling Time: 2 digit selector switch, Range 0...9,9 sec  
Resolution 0,1 sec

Cooling Temperature Set Point: Set with 2 digit selector switch, Range 0...300 °C [or 0...500 °C]  
Resolution 10K

Start Signal, Terminals 3 and 4: OFF: 0... 2 VDC, ON : 5...30 VDC; typ. 8 mA at 24V  
or  
Terminals 2 and 7: OFF: Contacts open, ON: Contacts closed; typ. 0,13mA

Alarm Output: Potential free contact, max. 50V / 0,2A; Contact closed upon Alarm  
(RES-242 only)

Output Relay K1: Potential free switching contact  
with R/C safety switch, max. 100VDC / 1,5A or 240VAC / 1,5A

Sampling Rate: In monitoring mode: Every tenth cycle 200 msec at 50Hz  
or 166 msec at 60Hz  
In controlling mode: Every voltage cycle 20 msec at 50Hz  
or 16,6 msec at 60Hz

Calibration: Calibrated for heating elements with  $T_k = +10 \times 10^{-4} K^{-1}$

**Maximum Load Current:**  
=primary current of the  
heatseal transformer

Operating Mode	TYPE	
	RES-24X-0 (Standard)	RES-24X-1
Constant (average)	<b>5A</b>	<b>15A</b>
Impulse 20% duty cycle	<b>25A</b>	<b>20A</b>

 Main Application

Ambient Temperature: +5 °C bis +45 °C  
Electrical Connections: Terminal Blocks, with plug in connectors  
Protective Category: IP 20  
Controller 1,2 kg (2,64 lbs.), Current Transformer 0,15 kg (0,33 lbs.)

## 11.1 HOW TO ORDER

### EXAMPLE:

**RES-24X - X - X / 230 V - 50/60 Hz**

#### Line Voltage

Standard: 230 VAC

Option: 115 VAC oder 400VAC

#### Temperature Range

X = 3    ≙ 0 - 300°C

X = 5    ≙ 0 - 500°C

X = 0    **Maximum Load Current**

X = 1    (see Technical Specifications)

X = 1    ≙ **without** Alarm

X = 2    ≙ **with** Alarm

SERIES "RESISTRON"

- Supply :
- Controller with clear front panel, gasket and mounting brackets
  - Current transformer

## INSTALLATION - INSTRUCTIONS

