ROPEX
INDUSTRIE – ELEKTRONIK

RESISTRON

RES-203

TEMPERATURE CONTROLLER FOR HEATSEAL BANDS TO SEAL PLASTIC FILMS

FEATURES

- ★ Compact in size with easy DIN rail mounting for inside the control cabinet.
- ★ Self monitoring with "Alarm Signal" and "Alarm Signal" output.
- ★ Alternate remote start signal, 24 VDC or closed hard contact.
- ★ Analogue temperature output signal, 0-10 VDC, to indicate actual temperature.
- ★ Snap on terminal connectors for convenient hook-up.
- ★ High reliability, hybrid technology.
- ★ Jumper for easy selection of frequency 50/60 Hz.
- ★ Easy installation and operation.
- ★ Cost effective - Improved production, less scrap.

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SPECIFICATIONS FOR ALL 200 SERIES RES CONTROLLERS

POWER SUPPLY: Standard: 220 VAC, 60 Hz
Special: 110 or 380 VAC

MAX CURRENT, Continuous: 5 Amps.
Peak, 20% Duty Cycle: 20 Amps.

CONTROL TEMPERATURE RANGE: 0-300 °C (0-500 °C, Special)

ALARM SIGNAL RELAY CAPACITY: 0.2 Amps, 50 Volts

IMPORTANT PRECAUTIONS WHEN INSTALLING RES - CONTROLLERS

The satisfactory performance of the RES controller depends upon the ability of the instrumentation circuit to accurately deliver low voltage signals to the controller. Noise and induced voltages from the high current A/C circuits can send false signals to the controller thereby disrupting the controller's proper function. Please take these precautions seriously.

1. **COMPONENT MOUNTING** -All components of the heatseal circuit such as heat sealing jaws, sealing transformer and controller should be mounted as close together as possible in order to avoid long connecting wires. If this is not possible, the sealing transformer must be installed as close to the sealing jaws as possible so that the length of the high current heatseal circuit is as short as possible.

2. **WIRE SIZES** -Wiring within the high current heatseal circuit must be heavy gauge, preferably stranded. For standard applications, we recommend 10 ga wire on the heatseal circuit on the secondary side of the transformer; and 16 ga for the primary side of the transformer. In very special applications (i.e. when the sealing element is of very low resistance) wire diameters of 6 ga. or greater may be required.

3. **CONNECTIONS** -Take precaution to assure that all connections, especially in the heatseal circuit are well made to avoid possible "hot spots" or sources of power loss.

4. **INSTRUMENTATION WIRES** -To assure accurate voltage measurement across the Alloy-20 heatseal band take precaution to connect these wires at the sealing element ends. These instrumentation wires carry very low current and small diameter wire can be used. In order to counteract interference from the high current A/C conductors, and the electromagnetic field surrounding them, the low voltage instrumentation wires should be spaced away from the heatseal circuit wires and wound together for their entire length leaving only a minimum free length for connection to the sealing element and the controller. Shielding of the instrumentation wires is helpful, but not mandatory.

The instrumentation wires from the current transformer are less critical. A small diameter is adequate. The current transformer should be positioned such that the length of the secondary circuit wires going to the Alloy-20 heatseal band are as short as possible.

1. INTRODUCTION

The RES-203 Heatseal Controller is suitable for most heatseal applications. The compact control unit is mounted into the electrical cabinet, while the operating components, temperature control dial and temperature indicator are mounted on the machine's operating panel.

As with other RES controllers, this unit is used to control the temperature of heating elements (heatseal bands, beaded bands, cutting wires, etc) by measuring the change of heating element resistance. Precision measurement together with high response produces perfect temperature control during film sealing processes. With a correctly installed system, temperature is controlled with accuracy of +/-3%.

Standard controllers can be used for systems with resistance ranging from a few milli-ohms to several ohms. Easy programming through dip switches, makes this controller into a universal "building block" for temperature control in:

- vertical and horizontal plastic pouch packaging machines
- pouch form/fill/seal packaging machines
- wrapping machines
- empty pouch making machines
- fitment attachment
- other heatsealing applications

Comprehensive self monitoring of the internal and external circuits by the controller provides additional operating safety and reliability.

An external jumper facilitates the selection of 50 or 60 Hz. to conform to the power supplied. See "Operating Instructions".

2. PRINCIPLES OF OPERATION

RES controllers are electrical resistance-measuring, temperature regulating units. They use the characteristics of a certain heating element alloy that change its resistance in a fixed ratio to the change in temperature.

The advantage of this control method is the instant feed-back of the heatseal element temperature (resistance).

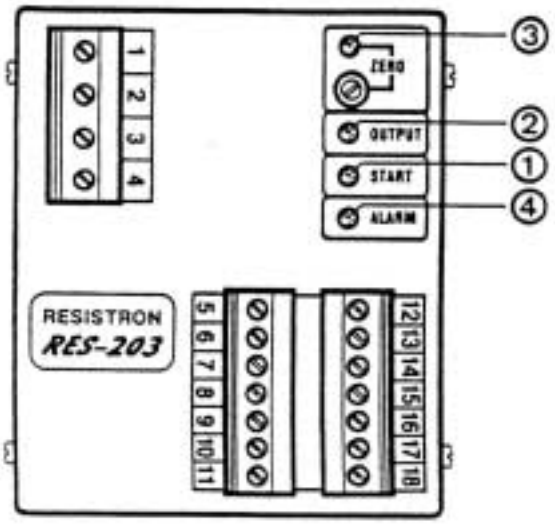
The resistance is constantly monitored at the heating element by measuring the current through the element and the applied voltage; this information is fed back to the controller as the "actual value". it is also supplied at the analog output, for display on the external temperature meter or other instrument.

After comparing this information with the "preset value" the controller adjusts the voltage output to the heating element so that it will always maintain the desired temperature. Voltage control is accomplished by phase "chopping" of the primary current going to the transformer. The high response feed back facilitates extremely fast changes in the "actual value", as well as nullifies "spikes" and other interferences.

A wide range of secondary voltages can be selected for the system because control is exercised on the primary side of the transformer. This allows optimum "fitting" of the transformer secondary voltage to the application.

3. FUNCTIONS OF THE RES-203

3.1 Control Function



The controller performs two different functions - measuring or controlling. If there is no START signal, LED (1) "START" is out. The controller only measures the resistance of the heating element without heating it up. It is in this measuring mode that the "Z" calibration is performed. In the measuring mode LED (2) "OUTPUT" blinks with a frequency of 5 or 6Hz in synchronism with the calibration impulses. If there is a START signal, LED (1) "START" is ON, the controller starts the controlling cycle by increasing the temperature of the heating element to the desired preset value as rapidly as possible. The maximum secondary voltage is supplied to the heating element and then subsequently reduced by the phase "chopping" action of the controller as soon as the preset temperature is reached. The high frequency of sampling together with virtually instant feedback gives the controller the high response control capability. The controlling action is indicated by LED (2)"OUTPUT", which changes its intensity with the change in voltage output. When more heat is needed, as in heating up or sealing, the LED is brighter.(also see Sect. 5.3)

3.2 ALARM FUNCTION

3.2.1 Alarm Signal

To increase reliability of operation and to assure adequate seals, the RES-203 controller contains a comprehensive monitoring system that will send an alarm signal (LED (4)"ALARM" will turn red) and activate the alarm relay when:

a - heatseal element breaks, or any discontinuity in the secondary circuit occurs.
b - ONE of the heatseal elements breaks if two bands are mounted parallel.
c - a full short circuit occurs at the heatseal element.
d - any discontinuity occurs in the voltage or monitoring wiring.
e - any discontinuity occurs in the wiring to the potentiometer.
f - heatseal element overheats by 20% over the selected temperature.
g - calibration was performed incorrectly (below the "Z" point).

NOTE - In order to achieve a proper calibration, functions b, f and g, only operate when there is an active start signal.

Other reasons for an alarm signal could be:

- incorrect voltage range chosen (dip switch)
- incorrect frequency rating selected (jumper)
- incorrect voltage supply (e.g. 220V vs 110V)
- internal malfunction

If the alarm signal activates the LED (4) "ALARM", the controller output is disabled, and the internal relay contact between terminals 5 & 6 is closed. This feature can be used to close an external circuit for a remote alarm system.

3.2.2 Reset

The controller can be reset, after the cause of the malfunction has been corrected, by turning off the main power for at least 1 second.

3.3 ZERO Calibration (See also Section 4)

The "zero calibration" is the adjustment of the controller to the resistance of the cold heatseal band. This calibration must be performed with the heatseal band at room temperature (20°C./68°F.) using the "ZERO" potentiometer. Proper calibration is indicated by the use of the two color (red-green) LED (3) that is set to change colors exactly at 20°C. When the controller is properly calibrated, LED (3) will be "OFF" and the analog output will be .66 volts which equals 20°C. If the temperature goes below 20°C, the LED turns red; when the temperature reaches more than 20°C, the LED turns green.

If properly calibrated LED (3) will not be "ON" when the heatseal band is at ambient condition. When the machine is operating, LED (3) will show green because the temperature will be above 20°C. Under no circumstance should the LED show red since this would mean that the temperature is below 20°C., or not properly calibrated. If the controller is improperly calibrated and set below the "Z" mark and a "START" is attempted, the alarm function will activate and the controller will shut down.

3.4 Temperature Setting

The desired temperature is preset by the use of the external potentiometer. The digital potentiometer P3D or P5D display the preset temperature on the on the dial in °C. The potentiometer circuit, connected at terminals 16 and 17, is constantly monitored. An open circuit or defective potentiometer will cause the alarm function to activate.(See "Alarm function")

3.5 Temperature Reading (Analog output)

At terminals 14 and 15, the controller provides an analog voltage output of 0-10VDC that is proportional to the temperature of the heatseal element. With a properly designed system the heatseal band temperature, in the controlling mode, is equal to the pre-set value selected on the temperature control potentiometer.

A visual display of the heatseal band temperature is strongly recommended because rapid temperature changes, as in impulse sealing, can be monitored with a temperature meter and irregular performance can be easily recognized. The analog temperature meter "ATR" (see accessories) is ideal for this purpose. The analog output signal (max. 5mA) can also be used for other instrumentation, such as a recorder, or temperature limit monitor.

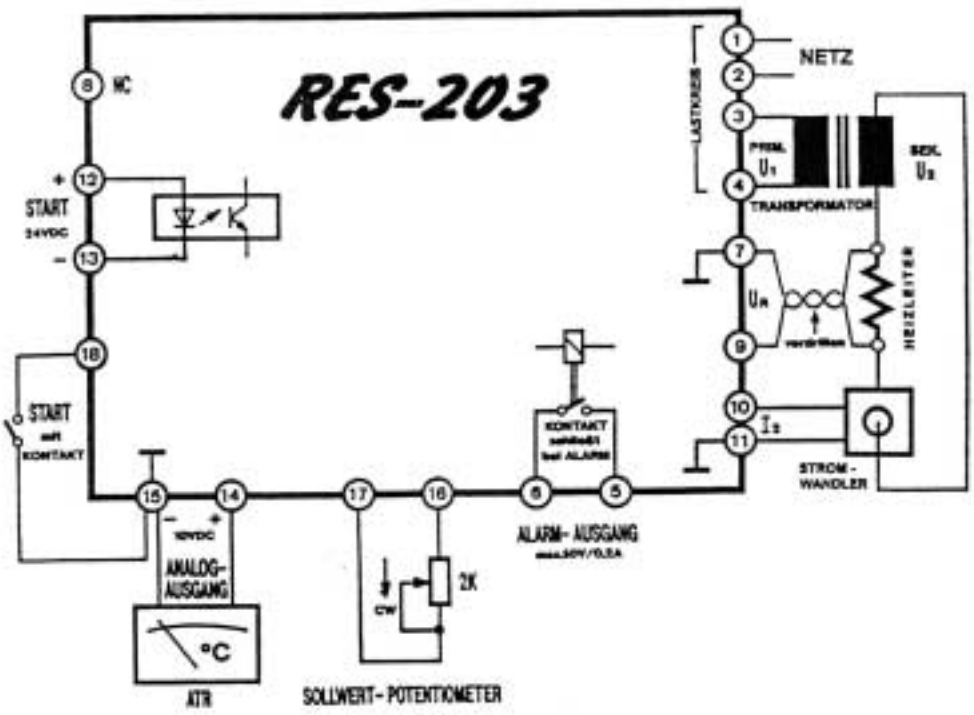
When connecting the analog output to external systems it is essential that the circuits remain ground free. Failure to do so may create a ground in the circuits connected to terminals 7 & 15 which will interfere with the proper functioning of the controller.

3.6 Start function

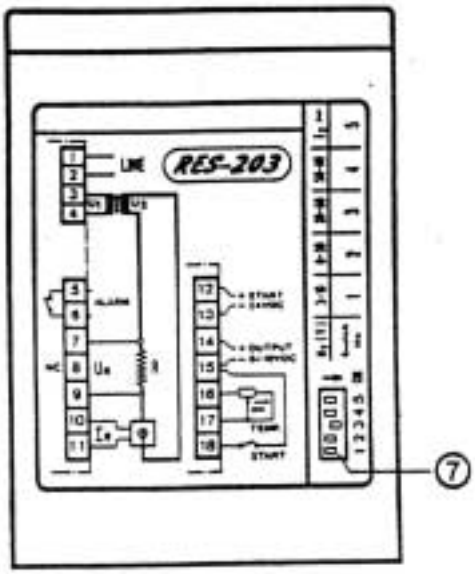
When the controller is activated, given the start signal, LED (1) "START" becomes yellow. The controller automatically switches from the calibration mode into the controlling mode (see Section 3.1 Control Function). There are two ways to start the controller.

- closing the circuit between terminals 18 and 15, or
- a 24VDC signal applied at terminals 12 and 13. This signal is isolated by an opto coupler within the controller.

4. WIRING DIAGRAM



5. OPERATING INSTRUCTIONS RES-203



5.1. Examine the controller and determine that the power to be supplied to the controller is in agreement with the controller specifications in both voltage and frequency. If the unit has frequency options (50/60Hz), the jumper on the side of the unit must be set into its proper position.

5.2. Set the DIP switch (7) 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) the No.5 switch must be ON.

5.3. Connect the controller according to 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 Important Precautions When Installing RES-Controllers (Section 11)

5.4 **IMPORTANT**- Make absolutely sure that there is no Start signal between terminals 18 and 15, they must be open. There must be NO signal at terminal 12.

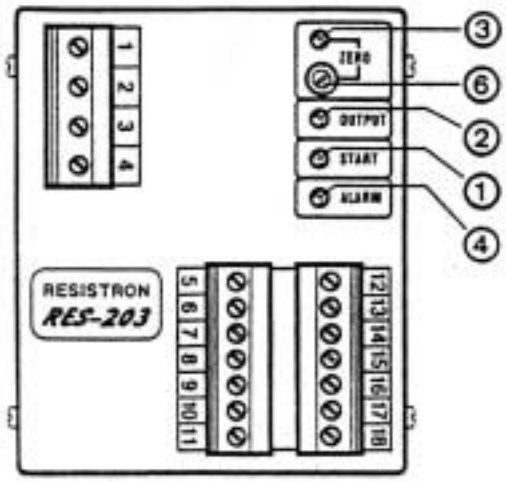
5.5. Connect power, LED (2) "OUTPUT" will blink at 5 or 6 Hz. , this is caused by the calibration impulse. LED (3) "ZERO" may be red or green. All other LED's should be out.

5.6. Turn the "Zero" trimmer (6) until LED (3) "ZERO" is OFF, (neither green nor red). Which way to turn? If the LED is red, turn the trimmer clockwise; if the LED is green, turn counter clock-wise. When properly calibrated LED (3) "ZERO" will be OFF and the analog output will be .66V (20°C). If the analog temperature meter "ATR" is connected, the needle should rest at "Z" (20°C).

<u>"Zero" calibration must be done with the heatseal band at ambient temp. (20°C. or 68°F.).</u>

5.7. If the "ZERO" calibration is not possible because LED (3) "ZERO" remains green, the secondary circuit wire must be threaded through the current transformer a second time. This situation might occur when the heatseal element is very long or thin (high resistance). After creating the second pass through the current transformer re-calibrate the controller. Re-calibration is also recommended after each heatseal element replacement.

5.8. Set the desired temperature on the potentiometer, e.g. 150°C and activate the controller, LED (1) "START" will turn on yellow. The temperature will rise and can be observed at the analog temperature meter. The movement of the analog temperature meter needle must be a "calm" and rhythmical, equivalent to the gradual increase and decrease in the temperature of the heatseal element. After a few heating cycles check the "ZERO" calibration again, and adjust if necessary. The controller is now ready for operation.



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 controller.

6. OPERATING MODES

Two completely different modes of operation can be chosen, Constant heat or Impulse. The choice of mode and the correct timing of the impulse sealing will be determined by practical tests with the machine, the product and the film.

6.1 Constant Heat

The START signal is turned on for the duration of the machine use, and the heatseal element is constantly monitored and maintained at the pre-set temperature. During the sealing phases, the controller automatically compensates for the "lost" heat by adjusting the voltage supply. During pauses, only occasional controlling is necessary to maintain the preset temperature to offset the heat lost into the jaw and the environment. When the jaws are open, the controller will compensate and overheating is not possible. The constant heat feature is usually used for speeds over 50-60 cycles/minute when the interval between seals is short and cool down time is minimal.

The advantage of this method is that the heatseal element is not constantly cycled. Therefore the power demand during the initial heating phase can be less than in the impulse mode. Also there is less demand upon the heatseal element (less expansion and contraction); the band remains in its expanded condition. The disadvantage of the constant heat is the loss of controlled cool down time while the jaws hold the seal. If the jaws open before the seal cools the seals may tend to shrink, pucker or deform. When operating with constant heat, the seal is frequently cooled immediately after jaw opening by use of cooling air or a subsequent quenching jaw.

When using the "Constant Heat" feature, a fast cool down of the heatseal element is not important, therefore, there should be good thermal insulation between the heatseal element and the jaws. The heat flow into the jaws, and the heating of the jaws, will be reduced. Less total energy will be consumed placing less demand on the transformer and the controller.

6.2 Impulse Sealing

The impulse sealing method occurs when the start signal is synchronized with the machine rhythm, every heatsealing cycle is followed by a cooling phase with jaws closed. Cooling is effected with jaws closed so that the seal has already set and has good strength and appearance when the jaws are opened. This method is preferred when sealing time is not critical since seam strength and appearance are better.

Since the heat sealing is a thermodynamic reversible procedure, and often influenced by time restraints, it is very important that the relevant parameters - temperature, time and pressure - are very carefully synchronized with regards to time and temperature cycle. The following diagram shows an example of the timely setting of temperature and jaw movement.

Basic rules for impulse heatsealing:

A. The pre-set temperature should always be attained when the sealing jaws are still open. This allows the sealing element to expand without interference and avoids over-stressing of the ends (phase 2).

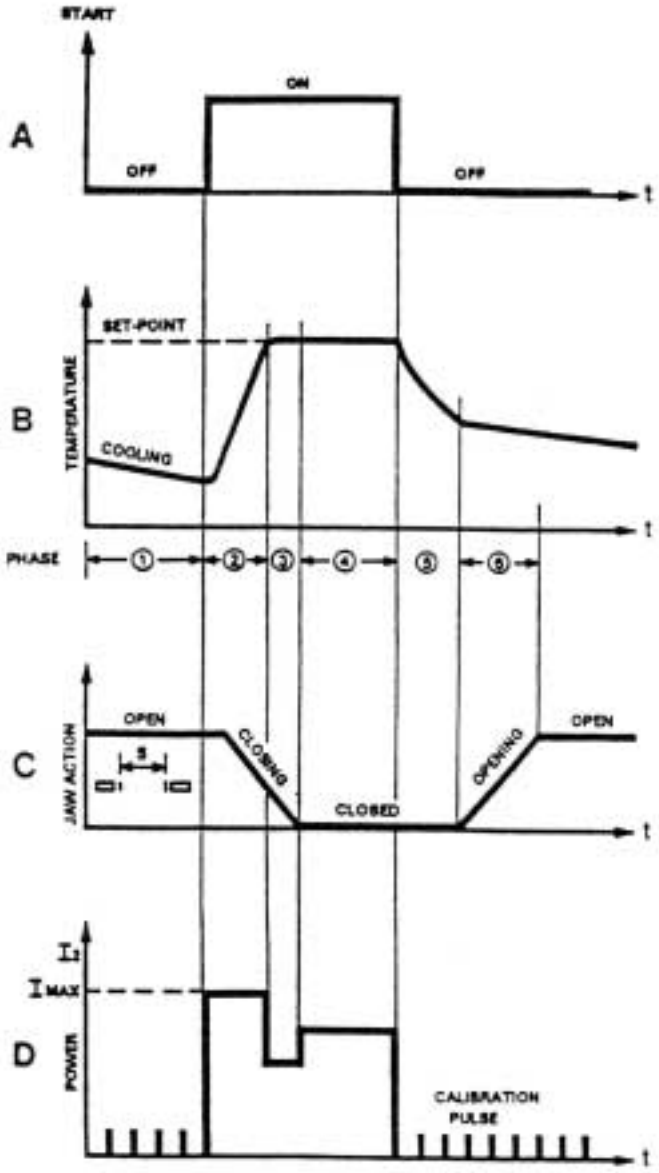
B. The system should be designed to drive the heatseal band to the pre-set temperature in minimum time. However, the maximum rate of temperature rise should not exceed 1°C./mSec. The total system, principally the secondary voltage, must be optimized to achieve the best result. (Our application service will give you the necessary data for your special application.)

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

Under certain conditions, sealing is also possible with the so-called rest-heat procedure. During such a phase the remaining heat in a sealing element is calculated just to be enough for the sealing process. This means that in the timing process, phase 4 goes to zero in favor of phase 5. The current is cut off when the jaws touch. The heat flows into the film and "unloads" the heatseal band, which results in a fast cooling phase. For this method to be effective the thickness, therefore the mass, of the heatseal band must be great enough to hold the required total heat.

PRECISION TIMING FOR PERFECT IMPULSE HEATSEALS

High performance, productivity with perfection, requires coordinated timing between the heatseal impulse and the jaw action. The timing chart below describes the relationships of (A) Impulse Start (B) Heatseal Band Temperature (C) Heatseal Jaw Action (D) Power Output. Notice that it is possible to energize the heat seal band prior to jaw closing because the temperature controller eliminates the risk of overheating.



PHASE 1 - Power is "off". Jaws are "open" and the heatseal band is cooling from the previous cycle.

PHASE 2 - Power "on". Heatseal band temperature rises to the "set-point". Jaws are closing.

PHASE 3 - Power output is controlled. Temperature remains at "set-point". Jaws become completely closed.

PHASE 4 - Power output is controlled. Jaws are closed. Heat is being transferred into the material being sealed.

PHASE 5 - Power "off". Heatseal band cools as remaining heat is draw off into the mass of the jaws. Jaws remain closed.

PHASE 6 - Jaws are opening. Heatseal band continues to cool.

6.3 Current Flow

Current flow may be observed by watching LED (2) "OUTPUT" during the impulse sealing. The LED indicates the change in current by a variation in light intensity.Diagram D shows the rate of current flow during a sealing phase. This can also be measured with an amp-meter.

Phase 1: Controller "OFF". LED (2) "OUTPUT" is blinking.

Phase 2: Controller "ON" and 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 during the sealing process.

Phase 5 + 6: Controller "OFF" and the heatseal band is cooling, LED (2) "OUTPUT" is blinking.

LED (2) "OUTPUT" is useful in detecting temperature "overshoot". After phase (2) the LED may turn OFF for a brief period. This is an indication that the controller has shut off to compensate for a temperature overshoot. In this case the secondary voltage is too high and must be reduced for proper operation.

The controller is also capable of regulating low temperatures, such as 50°C. Depending upon the cooling phase and secondary voltage, the controller may go into an on-off mode of control, because the current phase angle is too small and normal control is not possible. When this condition occurs the LED will blink more or less rhythmically.

If power cycling is observed while at sealing temperature ranges e.g. 150°C, the secondary voltage is too high and should be reduced.

7. HEATSEAL ELEMENTS

The heatsealing 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 sizes of heatsealing elements that we cannot discuss them all here, however, some very important physical and electrical characteristics are emphasized here.

- The controlling principle demands that alloy of the heatsealing element has a predetermined temperature co-efficient. Therefore only Alloy - 20 heatseal bands can be used with the RES controllers. With other alloys the controller may swing from extreme to extreme, or "run away".

- During the first heat up to 250-300°C the alloy will experience a one time change in resistance (burn in effect). The resistance of the cold element is reduced by approx. 2-3%. This rather small change in resistance however results in a zero point discrepancy of 20-30°. Therefore, it is necessary to readjust the zero point after a few heating cycles.

- A overheated (burned out) heatseal element cannot be used and must be replaced because of an irreversible change in the temperature co-efficient at high temperatures.

- A very important option is to copper plate or silver dip the ends of the heatseal elements. Protected ends will result in better temperature control and extend "life" of the heatseal element as well as of the teflon cover or coating.

8. TECHNICAL SPECIFICATIONS

Type of Construction: Housing designed for mounting into the electrical control cabinet on a 35mm DIN rail.

Line Voltage: Standard 230 VAC; 115 or 400 VAC optional (allowable deviation -10% +15%)

Frequency: 50 or 60 Hz; selected with an external jumper (allowable deviation +/- 1 Hz.)

Selection of Temperature: Potentiometer 2K (see Accessories)

Analog Output: 0-10VDC equals 0-300°C
Internal resistance - 33 ohms
max. output current, 5mA

Logic Threshold, 24VDC Start Signal: (Terminals 12 & 13, 8 ma, reverse polarity protected)
LOW: 0.....2 VDC
HIGH: 7.....30 VDC

Alarm Output: Internal relay contacts close on "alarm" (terminals 5 & 6)
Max.: 50V, 0.2 Amps

Sampling frequency: Every tenth cycle of line voltage in the calibration mode. (200 msec at 50 Hz /-166 mSecs at 60 Hz.), every voltage cycle in the controlling mode (20 mSecs at 50 Hz. / 16.6 mSecs at 60 Hz.)

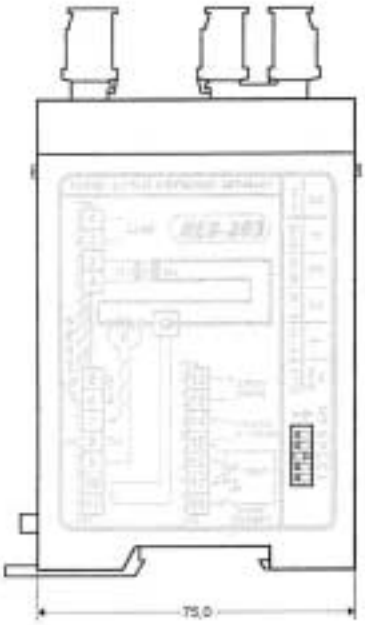
Max. Primary Current: Impulse with 20% Duty Cycle, 20A
Constant heat, 5A

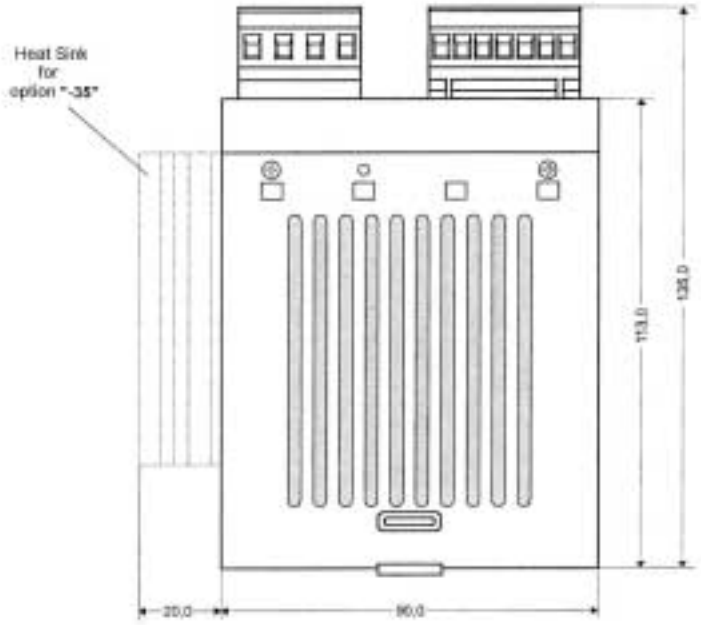
Ambient Temperature: +5.... +45°C

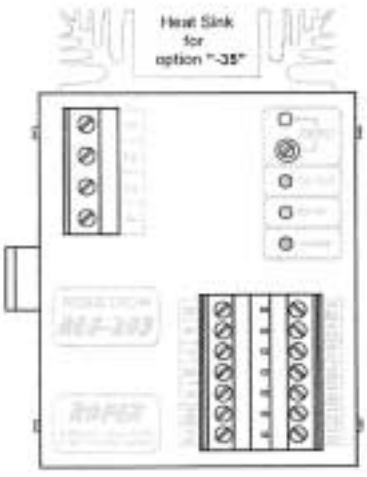
Electrical Connection: Terminal blocks with connectors

Weight: Controller .7kg(1.54lbs),
Current transformer .15kg(.33lbs)

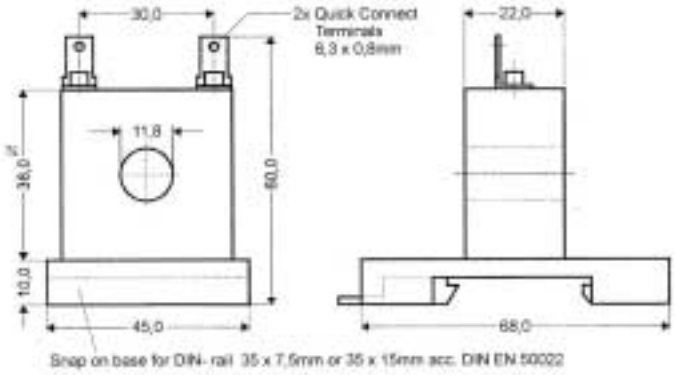
9. INSTALLATION DRAWINGS







CURRENT TRANSFORMER



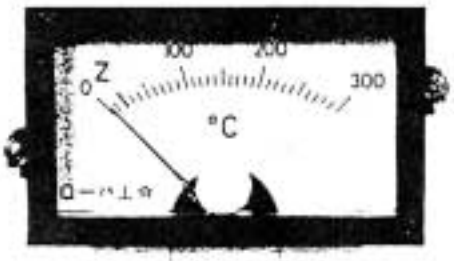
HOW TO ORDER

RES - 203 - X / 230V - 50/60Hz

- Frequency: 50Hz/60Hz selectable by moving the jumper on the side of the controller.
- Line Voltage: 230V Std. 115V or 400V available
- Temperature Range: 3 = 0-300°C, 5 = 0-500°C
- Model of controller

10. ACCESSORIES

ANALOG TEMPERATURE METER - to be mounted into control panel. Zero calibration at "Z"; available for temperature ranges of 0-300 and 0-500°C.



Size: 30 x 50mm front plate
Depth: 40mm
Panel cut-out: 28 x 48mm,

Model ATR-3 for 300°C
Model ATR-5 for 500°C

DIGITAL POTENTIOMETER - with dial for temperature setting. The value selected on the dial is the temperature in °C.

Diameter of the dial: 30mm
Mounting hole dia: 28mm
Solder lug connectors

Model P3D for 300°C
Model P5D for 500°C

INSTALLATION INSTRUCTIONS