LUMEL

# CONTROLLER with ONE OUTPUT and PROGRAMMING CONTROL

# RE23 TYPE


CE

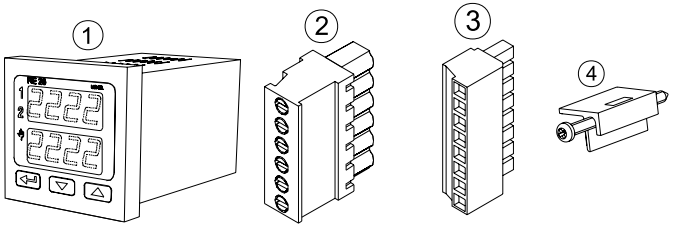
**USER'S MANUAL**

*Contents:*

# 1. APPLICATION

The RE23 controller is destined to a programming control of temperature and other physical quantities e.g. pressure, humidity, level, flow.
The measured value, the set value parameters of the realized program or the output signal are displayed on two displays. The measuring input is universal for RTD, TC or for linear standard signals. The controller has one output enabling the heating or cooling type control. The manual control is also possible.
The controller possess additionally a security function against the change of parameters, by means of a password.

# 2. CONTROLLER SET




The controller set is composed of:
1. controller ..... 1 pc
2. plug with 6 screw terminals ..... 1 pc
3. plug with 8 screw terminals ..... 1 pc
4. holder to fix in the panel ..... 2 pcs
5. seal ..... 1 pc
6. user's manual ..... 1 pc
7. guarantee card ..... 1 pc

When unpacking the controller, please check whether the type and option code on the data plate correspond to the order.

# 3. PREPARING THE CONTROLLER TO WORK

## 3.1. SAFETY

The RE23 controller fulfils requirements related to the safety of electrical measuring instruments for automatics acc. to the EN 61010-1 standard, requirements related to the resistance against electromagnetic interference acc. to the EN 61000-6-2 standard, and electromagnetic interference emission occurring in industrial environment acc. to the EN 61000-6-4 standard.

## 3.2. INSTALLING THE CONTROLLER IN THE PANEL

Fix the controller in the panel by means of two screw holders acc. to the fig.1.
The hole in the panel should have $45^{+0,6}$ x $45^{+0,6}$ mm dimensions.
The tickness of the material for panel execution cannot exceed 15 mm.

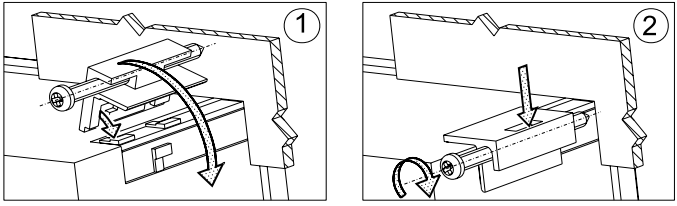



*Fig.1. Controller fixing in the panel.*

Controller dimensions are presented on the Fig. 2.

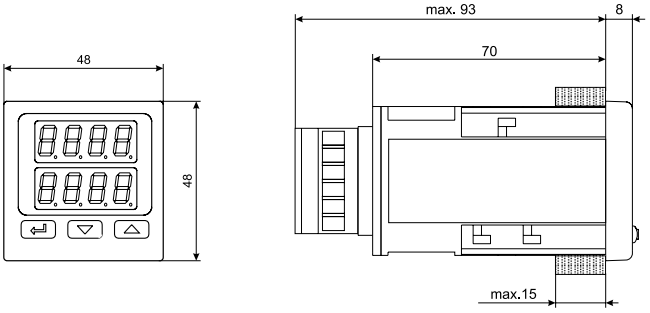



*Fig.2 Controller dimensions.*

## 3.2. ELECTRICAL CONNECTIONS

Carry out electrical connections to terminal strips and next, insert strips into controller sockets.

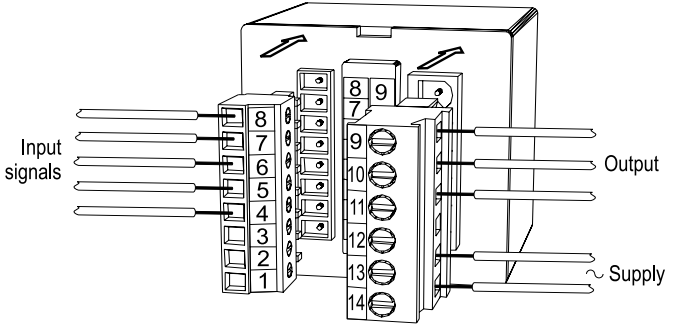



*Fig.3 View of controller connection strips.*

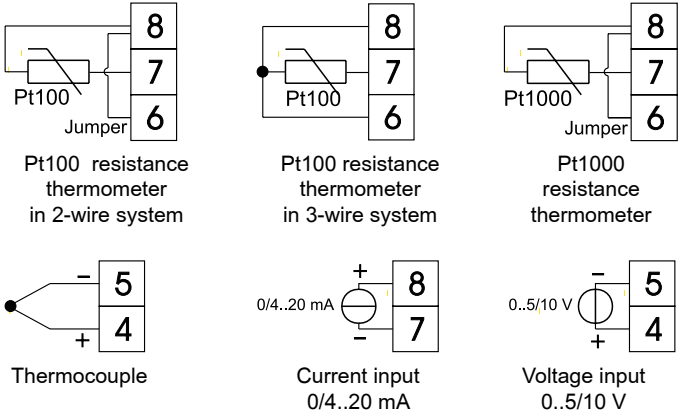



*Fig.4. Connection of input signals .*

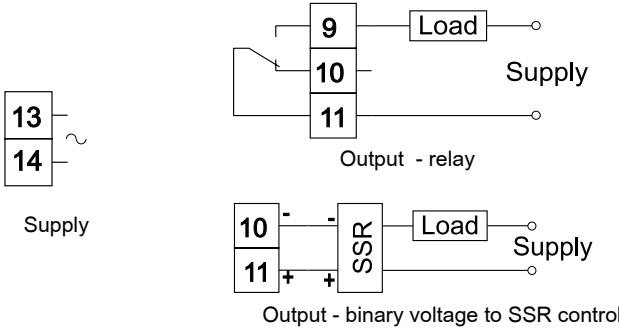



*Fig.5. Connection of the supply and load circuit*

When connecting the supply, one must remember that an automatic cut-off or a switch should be installed near the device, easily accessible for the operator and suitably marked.

## 3.4. INSTALLATION RECOMMENDATIONS

The RE23 controller fulfils requirements concerning the fastness against electromagnetic interference occurring in the industrial environment acc. to obligatory standards.

**In order to obtain a full immunity of the controller against electromagnetic interference in an unknown environment interference level it is recommended to observe following principles:**

- do not supply the controller from the network near devices generating high impulse interference and do not use common earthing circuits with them.
- apply network filters,
- apply metallic shields in the shape of tubes or braided screens to conduct supplying wires,
- wires supplying the measuring signal should be twisted in pairs, and for resistance thermometers in a 3-wire connection, twisted from wires of the same length, cross-section and resistance, and led in a shield as above,
- all screens should be one side earthed, and led the nearest possible to the controller,
- apply the general principle that wires leading different signals should be led the farthest possible between them (not less than 30 cm), and their crossing executed at a right angle.

## 4. STARTING TO WORK

After the correct installation and connecting to the power, the controller carries out the display test, displays the controller type on the upper display and the program version on the lower display.
Next, the measured value is displayed on the upper display or a message informing about abnormalities (table 6), and the set point of the controlled quantity on the lower display.

The index **1** informs about the controller output state:

- when lighting - output is switched on,
- when blanking - output is switched off

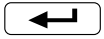
The index **P** informs about the programmed working mode of the controller:

- when lighting, that the control is switched on acc. the program,
- when flickering, that means the control has been disabled by the operator, but the program is not finished,
- when blanking, that means the control is disabled because of the program.
  Termination or the controller has been programmed in the constant valued control mode.

The index  informs about the manual working mode of the control:

- when lighting - the manual control is switched on,
- when blanking - the automatic control is switched on

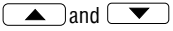
**Push-button functions:**



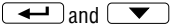
- (during 2 sec. ) entry in the mode of working parameter change
- display of the control signal and entry in the manual working mode
- entry in the mode of displayed parameter change
- accept of introduced changes

- display of the next parameter
- increase of the parameter value

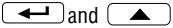
- display of the previous parameter
- decrease of the parameter value
- (during 2 sec. ) entry in the mode of program definition



- return to the previous level
- resignation of introduced changes



- program start from the beginnin



- stoppage/restart of the program

# 5. PROGRAMMING OF CONTROLLER PARAMETERS

## 5.1. DIAGRAM OF THE CONTROLLER SERVICE

The diagram of the control service depends on the type of chosen control (see **t SP** parameter).

## 5.1.1. Service diagram for programming control

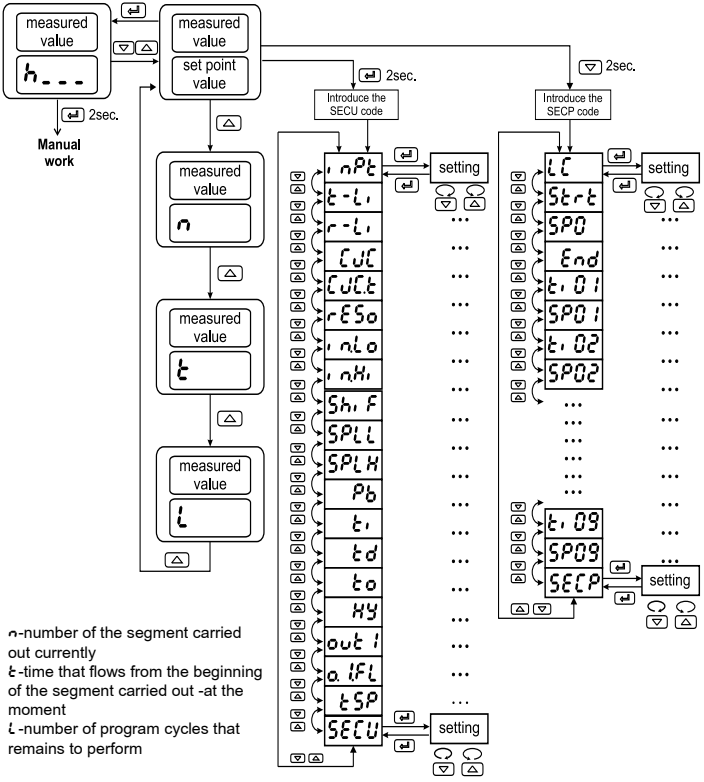



*Fig.6. Service diagram for programming control*

The way to define parameters of the set point program and the operation of the programming control is described in the section 5.5.

## 5.1.2. Service diagram for constant-valued control

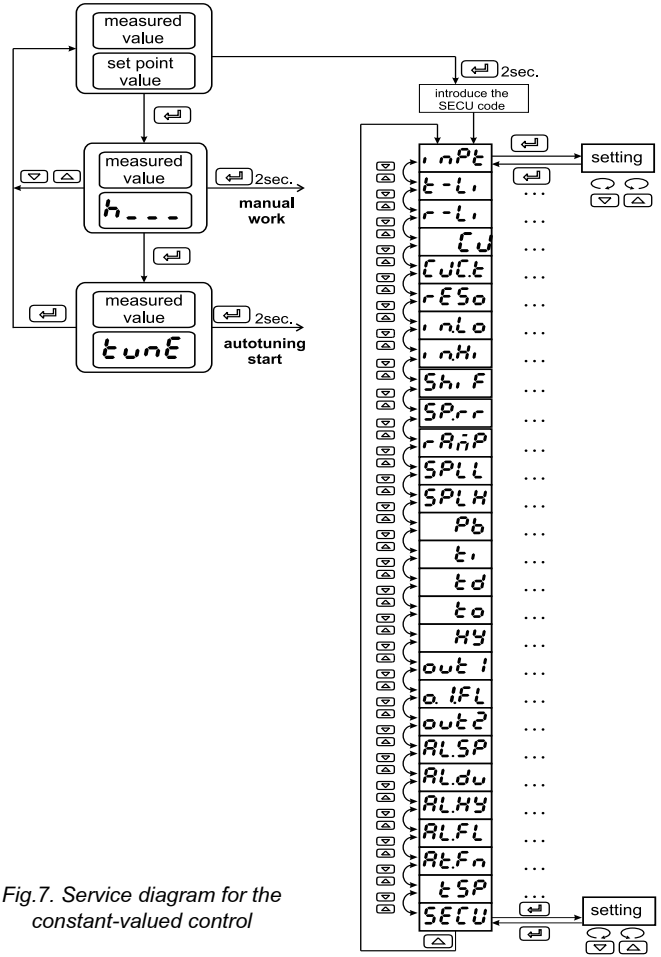



*Fig.7. Service diagram for the constant-valued control*

***Change of the set point***

The way to change the set point during the constant-valued control is presented on the Fig. 8. The change limitation is set by parameters SPLL and SPLH

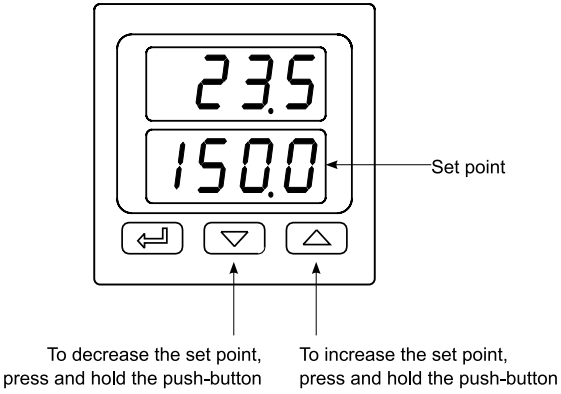



*Fig.8. Change of the set point.*

## 5.2. CONFIGURATION PARAMETERS

The description of the configuration parameters is included in the table 1. The return to the normal working mode follows after the simultaneous pressure of ▲ and ▼ push-buttons or automatically after 30 sec. since the last push-button pressure. Some parameters can be invisible - that depends on the current controller configuration.

The access to configuration parameters can be secured by a password. If the security code is set (SECU parameter is higher than zero), one must give it. During its setting, the code inscription is displayed in the lower display. If the value is not given or is erroneous, the rEAd onLy inscription appears on he displays and the user will only be able to review parameter values. The introduction of the security code is shown on the fig. 7. The programmer menu has its own SECP code. Principles of its operation are identical as for the SECU code.

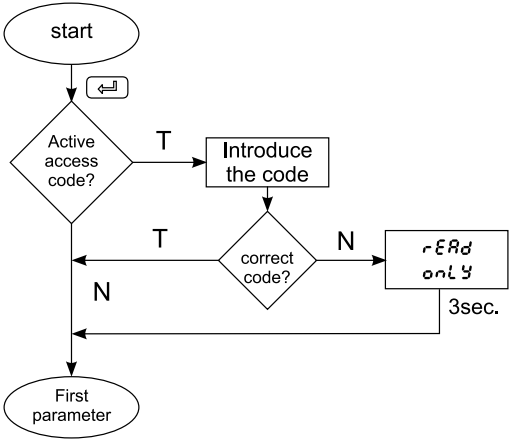



*Fig. 9. Introduction of the access code.*

## 5.3. CHANGE OF SETTINGS

The change of the parameter setting begins after pressing the ↵ push-button. One can carry out the setting choice by means of ▲ and ▼ push-buttons, and accept it by the ↵ push-button. The cancellation of change follows after the simultaneous pressure of ▲ and ▼ push-buttons or automatically after 30 seconds since the last push-button pressure.
The way to change the setting is shown in the fig.10.

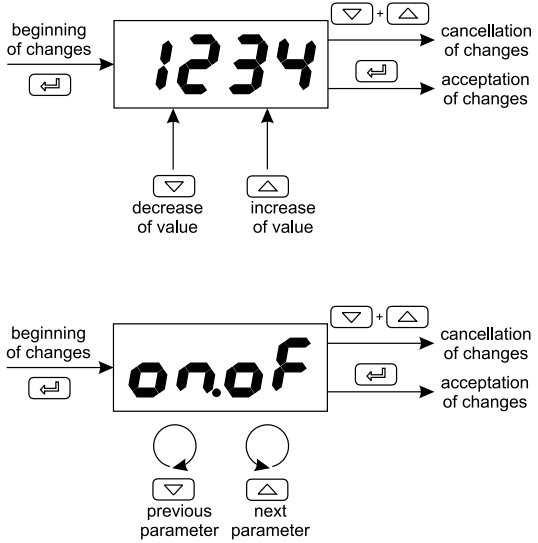



*Fig.10. Change of the numerical and textual parameter setting.*

## 5.4. LISTE OF CONFIGURATION PARAMETERS

The list of configuration parameters is presented in the table 1.

List of parameters in the configuration menu Table 1

| Parameter symbol | Parameter description | Range of parameter change [manufacturer's settings] | |
|---|---|---|---|
| | | sensors | linear signals |
| inPt | kind of input (description in table 2) | [Pt 1]: Pt100<br>Pt 10: Pt1000<br>t-J: thermocouple J<br>t-t: thermocouple T<br>t-K: thermocouple K<br>t-S: thermocouple S<br>t-r: thermocouple R<br>t-b: thermocouple B<br>t-E: thermocouple E<br>t-n: thermocouple N<br>t-L: thermocouple L | [0-20]: lin. cur. 0-20 mA<br>4-20: lin. cur. 4-20 mA<br>0-5: lin. volt. 0-5 V<br>0-10: lin. volt. 0-10 V |
| t-Li | type of line ( 2-wire or 3-wire line)[1] | [2-P]: 2-wire line<br>3-P: 3-wire line | — |
| r-Li | 2-wire resistance line, for Pt100 sensor | [0.0]...20.0 Ω | — |
| CJC | way of cold junction compensation for thermocouples [2] | [Auto]: automatic compensation<br>Hand: manual compensation | — |
| CJCt | temperature of cold junctions at manual compensation [°C x10] [2] | [0.0]...50.0 °C | — |
| rESo | position of the decimal point | 0.dP: without decimal place<br>[1.dP]: 1 decimal place | 0.dP: without decimal place<br>[1.dP]: 1 decimal place<br>2.dP: 2 decimal place |

| | | | |
|---|---|---|---|
| inLo | indication for the lower threshold of the analog output | — | -1999...[0.0] ...9999 [3] |
| inH i | indication for the upper threshold of the analog output | — | -1999...[100.0] ...9999 [3] |
| Sh i F | shift of the measured value | -99.9...[0.0] ...99.9 °C | -999...[0.0] ...999 [3] |
| SP.rr | accretion rate of the set point [7] | 0...[0.0] ...99.9 / time unit | 0...[0.0] ...99.9 / time unit |
| rAnP | time unit for the accretion rate of the set point [7] | [mn]: minute<br>Hour: hour | [mn]: minute<br>Hour: hour |
| SPLL | lower setting limitation of the set point | acc. table 2 [3]<br>[-199.0] | inLo...[0,0] ... inH i [3]<br>[0.0] |
| SPLH | upper setting limitation of the set point | acc. table 2 [3]<br>[850.0] | inLo...[100.0] ... inH i [3] |
| Pb | proportional band | 0...[30.0] ...999.9 °C | 0...[30.0]...9999 [3] |
| t i | integration time-constant [4] | 0...[300] ...9999 s | 0...[300] ...9999 s |
| td | differentiation time-constant [4] | 0...[60.0] ...999.9 s | 0...[60.0] ...999.9 s |
| to | pulse repetition period [4] | 0.5...[20.0] ...99.9 s | 0.5...[20.0] ...99.9 s |
| HY | hysteresis [5] | 0.2...[2.0] ...99.9 | 0.2...[2.0] ...999 [3] |
| out 1 | configuration of the main output | [cr]: cooling signal<br>inv: heating signal | |
| o1.Fn | control signal In case of sensor damage [4] | 0...[0.0] ...100,0 % | 0...[0.0] ...100,0 % |

| | | | |
|---|---|---|---|
| AtFn | autotuning fonction [7] | off: locked<br>[ on]: unlocked | |
| tSP | kind of set point | [con]: constant-valued control<br>Prg: programming control | |
| SECU | safety code [6] | [0]...9999 | [0]...9999 |

[1] Parameter only visible for the Pt100 sensor.
[2] Parameter only visible for TC.
[3] Resolution which the given parameter is shown with depends on the rESo parameter - position of the decimal point.
[4] Parameter only visible at proportional control (Pb > 0).
[5] Parameter visible only at on-off control (Pb=0).
[6] Parameter hidden in parameter reviewing mode only for readout (read only).
[7] Parameter visible for the constant valued control.

Measuring ranges for inputs Table 2

| Symbol | Input/sensor | Minimum | Maximum |
|---|---|---|---|
| Pt 1 | Resistance thermometer Pt100 | -199 °C | 850 °C |
| Pt 10 | Resistance thermometer Pt1000 | -199 °C | 850 °C |
| t-J | Thermocouple of J type | -100 °C | 1200 °C |
| t-t | Thermocouple of T type | -100 °C | 400 °C |
| t-K | Thermocouple of K type | -100 °C | 1372 °C |
| t-S | Thermocouple of S type | 0 °C | 1767 °C |
| t-r | Thermocouple of R type | 0 °C | 1767 °C |
| t-b | Thermocouple of B type | 0 °C | 1820 °C |
| t-E | Thermocouple of E type | -100 °C | 999 °C |
| t-n | Thermocouple of N type | -100 °C | 1300 °C |
| t-L | Thermocouple of L type | -199 °C | 800 °C |
| 0-20 | Linear current 0-20 mA | -1999 | 9999 |
| 4-20 | Linear current 4-20 mA | -1999 | 9999 |
| 0-5 | Linear voltage 0-5 V | -1999 | 9999 |
| 0-10 | Linear voltage 0-10 V | -1999 | 9999 |

## 5.5. CONTROLLER PROGRAMMING IN THE PROGRAMMED WORKING MODE

The controller controls the object acc. to the set point changing in time in accordance with the assigned function, named the program.
The program is composed maximally of 9 segments. For each segment, one must give the duration time and the 4 set point on the segment end. The segment time and the set point equals 0 mean the end of the program.
Moreover, one must define:

- the number of cycles, that is how many times the cycle is to be repeated,
- the way of the program beginning: from the measured value or from the value defined in the next parameter,
- the set point on the program beginning,
- the controller behaviour after the program termination: switch the output off or continue acc. to the last set point.

Parameters of the set point program Table 3

| Parameter symbol | Parameter description | Range of change [manufacturer's settings] |
|---|---|---|
| LC | number of program cycles | [1]...255 (value 255 means an infinite number of repetitions) |
| Strt | way of program beginning | PUO- from the currently controlled value<br>[SPO]- from the initial set point |
| SPO | initial set point, when Strt parameter is set on sp0 | SPLL ...[0]...SPLH<br>or<br>inLo ...[0]... inH i |
| End | way of program termination | [oFF]- disabling of control output<br>cont- control acc. the last set point |
| t i01 | duration of segment 1 [min] | [0]...9999 |
| SP01 | set point on the segment 1 end | SPLL ...[0]...SPLH<br>or i nLo ...[0]... inH i |
| t i02 | duration of segment 2 [min] | [0]...9999 |
| SP02 | set point on the segment 2 | SPLL ...[0]...SPLH<br>or i nLo ...[0]... inH i |
| | ..... | |
| t i09 | duration of the segment 9 [min] | [0]...9999 |
| SP09 | set point on the segment 9 end | SPLL ...[0]...SPLH |
| SECP | safety code | [0]...9999 |

*Example of program.*
Let's define the program operating acc. the fig. 11 in which the control begins from the value measured on the object. After the process termination, switch the output off.

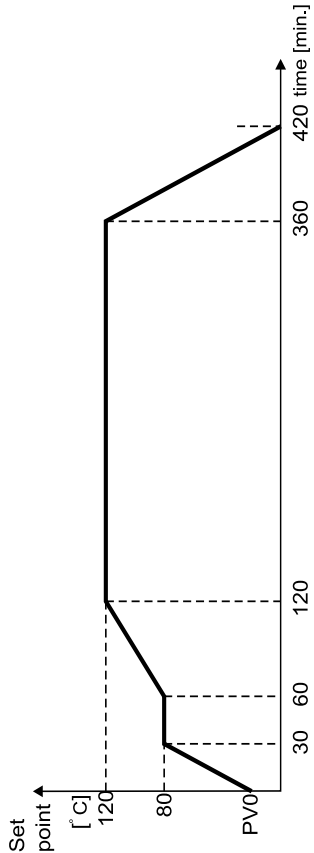



*Fig.11. Example of the set point program*

The table 4 includes parameter values in the exemplary program.
Parametr values for the exemplary program from the fig. 11

Table 4

| Parameter symbol | Parameter description | Value |
|---|---|---|
| LC | number of cycles | 1 |
| Strt | way of the program beginning | PUV - from the currently controlled value |
| End | way of the program termination | oFF - switching the control output off |
| t.01 | duration of the segment 1 [min] | 30 |
| SP01 | set point on the segment 1 end | 50.0 |
| t.02 | duration of the segment 2 [min] | 30 |
| SP02 | set point on the segment 2 end | 80.0 |
| t.03 | duration of the segment 3 [min] | 60 |
| SP03 | set point on the segment 3 end | 120.0 |
| t.04 | duration of the segment 4 [min] | 240 |
| SP04 | set point on the segment 4 end | 120.0 |
| t.05 | duration of the segment 5 [min] | 60 |
| SP05 | set point on the segment 5 end | 0.0 |
| t.06 | duration of the segment 6 [min] | 0[1)] |
| SP06 | set point on the segment 6 end | 0[1)] |

[1)] segment time and set point equals 0 means the program end.

After defining the set point program, one must start the control from the beginning, pressing simultaneously [↵] and [▼] push-buttons. The lighting index **P** means that the control is realized acc. to the set point calculated from the program.

The program will start acc. to the **Strt** parameter setting:

- the value **SP0** means, that the initial set point value is the setting of the **SP0** parameter,
- the **PU0** value means, that the initial set point value is the value measured in the moment of the program start.

The realized program can be stopped by pressing simultaneously [↵] and [▲] push-buttons. The flickering index **P** means, that the control is stopped (the control output is disabled). The continuation of the stopped program follows after the renewed pressing of [↵] and [▲] push-buttons. The stopped program can be started from the beginning by pressing simultaneously [↵] and [▼] push-buttons.

Parameters of the realized program can be displayed on the lower display by pressing the [▲] push-button.

Instead of the current set point, following parameters are displayed:

- **n** - number of the currently performed segment,
- **t** - time which elapses since the beginning of the actually performed segment [in minutes]. For times higher than 999 minutes, the oldest digit is displayed alternately with the symbol **t**
- **L** - number of program cycles which still remains to perform. The number 0 means the program termination.

After the program termination, the controller carries on in accordance with the **End** parameter setting:

- the **oFF** value means, that the control is ended, the control output is disabled, the **P** index is blank. On the lower display instead of the segment number the message **End** is displayed. The controller waits for a renewed program start since the beginning, by [↵] and [▼] push-buttons.

- the cont value means, that the control is continued acc. to the last set point in the program without the time count down.
  The **P** index is still lighting, the number of cycles to do is equal 0.
  On the lower display instead of the segment number, the message cont is displayed.
  The control can be disabled by a simultaneous pressure of [↵] and [▲], push-buttons, or restart the program from the beginning by [↵] and [▼] push-buttons.

# 6. INPUT AND OUTPUT OF THE CONTROLLER

## 6.1. MEASURING INPUT

The controller has one measuring input, which one can connect different types of sensors or standard signals to.
The choice of the input signal is carried out by the InPt parameter.
For different types of inputs, depending on the option code, one must give additional parameters.
For the Pt100 resistance thermometer, one must choose the kind of connection.
In a three-wire connection, the line resistance compensation goes on automatically.
In a two-wire connection, one can give additionally the line resistance.
For thermocouples, one must give the way of temperature compensation of cold ends - automatic or manual, and at manual compensation - the temperature of cold ends.
For linear inputs, one must give the indication for the lower and upper threshold of the analog input.
The additional parameter is the number of digits after the decimal point, the rESo parameter. For temperature sensors, it defines whether the measured temperature and the set point temperature is to be shown with a place after the decimal point.
For linear inputs, it defines the resolution which the measured value and values of some parameters are shown with.
The correction of the measured value indications is carried out by the ShiF parameter.

## 6.2. OUTPUT

The controller has one output, which it is possible to choose the on-off or PID control in. For the PIDl control, one must additionally set the pulse repetition period.The pulse repetition period is the time which expires between successive switches of the output during the proportional control.

The length of the pulse repetition period must be chosen depending on dynamic properties of the object and suitably to the output device

For quick-acting processes, it is recommended to apply SSR relays. The relay output is used to control contactors in slow-acting processes.

The use of a high pulse repetition period to control quick-acting processes can give unwanted effects in the shape of oscillations.

Theoretically, the smaller the pulse repetition period, the better the control, but for the relay output, it should be as high as possible in order to extend the relay life.

Recommendations concerning the pulse repetition period Table 5

| Output | Pulse repetition period **to** | Load |
|---|---|---|
| electromagnetic relay | recommended >20s (min. 10 s) | 2A/230 V a.c. or contactor |
| | min. 5 s | 1A/230V a.c. |
| transistor output | 1...3 s | semi-conductor relay (SSR) |

# 7. CONTROL ALGORYTHMS

## 7.1. ON-OFF CONTROL

To select the ON-OFF control, one must set the parameter Pb=0. Next, set the hysteresis value - HY. The action of the output on heating (fig.12) is set by the parameter out=1 nU, and on cooling, by the parameter out=dir.

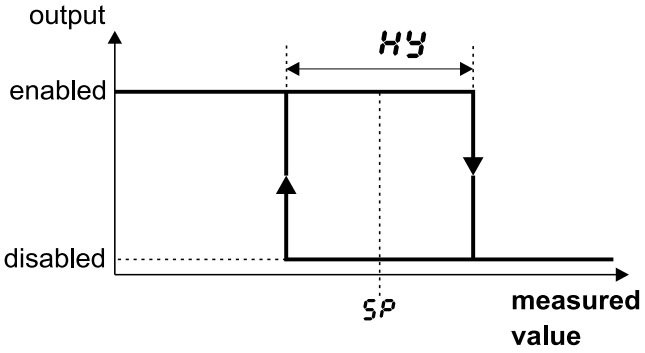



*Fig.12. Operation way of the heating type output.*

## 7.2. PID CONTROL

The choice of PID control algorithm or also PI, PD or P control algorythm consists on a suitable setting of parameter values - proportional band (Pb), integrating element (ti ) and differentiating element (td). The switching of the giving element off, consists on setting the parameter on zero. The operation way of the heating type output is chosen by setting the parameter out 1=1 nU, and the cooling type by setting the parameter out=dir. The successive parameter to set is the pulse repetition period of the output (to).

# 8. ADDITIONAL FUNCTIONS

## 8.1. DISPLAY OF THE CONTROL SIGNAL

After pressing the [↵] push-button, the value of the control signal (0...100%) appears on the display. On the first digit, the mark h is displayed. The return to the normal operation follows after the double pressure of the [↵] push-button.

## 8.2. MANUAL CONTROL

The manual control gives the possibility, among other things, to identify and test the object or control it after the sensor damage.

The entry into the manual control mode follows after holding down the [↵] push-button when displaying the control signal. The manual control is signaled by the pulsation of the measured value.

The controller breaks the automatic control and begins the manual control of the output.

The value of the control signal is displayed on the lower display, preceded by the symbol h.

[▲] and [▼] push-buttons serve to change the control signal. The exit to the normal working mode follows after the simultaneous pressure of [▲] and [▼] push-buttons.

After setting the ON-OFF control on the output (parameter Pb = 0), one can set the control signal on 0% or 100% of power, however when the Pb parameter is greater than zero, the control signal can be set on any value from the 0...100% range.

## 8.3. CONTROLLER BEHAVIOUR AFTER THE SENSOR DAMAGE

It is possible to configure the output state after the sensor damage:

- at output configuration for proportional control (Pb>0) the control signal value is defined by the oFL parameter,
- at output configuration for the ON-OFF control (Pb=0), the output will be disabled, at output operation as heating, or enabled - at output operation as cooling.

## 8.4. MANUFACTURER'S SETTINGS

One can restore manufacturer's settings, during the supply switching on, holding ▲ and ▼ push-buttons till the moment when the inscription FAbr appears in the upper display.

# 9. SELECTION OF PID PARAMETER SETTINGS

## 9.1. AUTOMATIC CHOICE OF SETTINGS

The controller has the function of the automatic PID setting selection. These settings ensure in the most of cases the optimal control.
To begin the autotuning, one must transit to the tunE position (acc. to the fig.7) and hold the ↵ push buton during at least 2 sec. If the proportional band is equal zero or the AtFn parameter is set on oFF or the tSP parameter is set on Pr9 then it will not be possible to begin the autotuning.
The flickering upper display informs about the activity of the autotuning function. The autotuning duration depends on the dynamic properties of the object and can last maximally 10 hours. During the autoadaptation or directly after it, overshoots can appear and for this reason, one must set a lower set point, if it is possible. After the autotuning termination, calculated PID settings are stored in the non-volatile memory and the process control with new settings begins.

The autotuning process may not begin or be broken without the calculation of PID settings, if:

– the control deviation is lower than 6.5 % of the range (SPLH-SPLL)
– the time of the object preliminary stabilization or the admissible autotuning duration will be exceeded,
– a decay of the controller supply occurs,
– the ↵ push-button has been pressed,
– calculated parameter values are beyond the range.

In such cases the control with previous PID settings will begin.

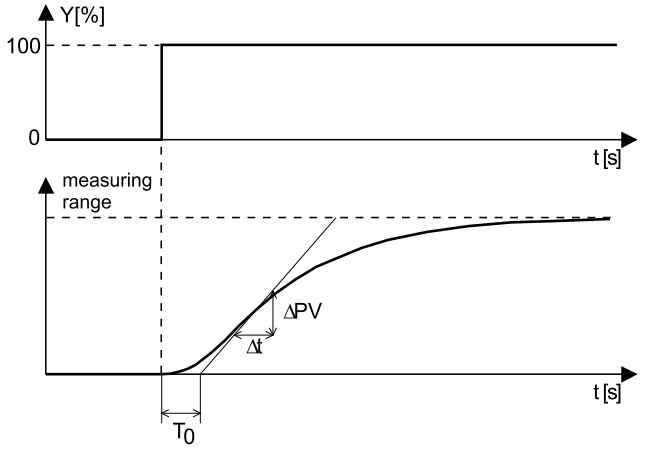



*Fig.13. Selection of settings by the method of response to a unitary jump.*

## 9.2. MANUAL SELECTION OF SETTINGS

Set the on-off control with a minimal hysteresis. Set the set point as to we can observe the run of the measured value as in the fig.13.

One must read out the delay time To and the maximal temperature accretion rate from the object characteristic presenting the controlled value in the function of time, from the dependence:

$$V_{max} = \frac{\Delta PV_{max}}{\Delta t}$$

Calculate PID settings acc. to following formulas:

$Pb = 1.1 \cdot V_{max} \cdot T_0$ - proportional band

$t_i = 2.4 \cdot T_0$ - integration time constant

$t_d = 0.4 \cdot T_0$ - differentiation time constant

## 9.3. CORRECTION OF SETTINGS

Since PID parameters interact between them, one must introduce changes only of one parameter. The best is to choose parameters changing the value into a twice greater or twice smaller one.

During changes, one should be guided by following principles:

a) Slow jump answer:
- – decrease the proportional band,
- – decrease the integration and differentiation time.

b) Overshoots:
- – increase the proportional band,
- – increase the differentiation time.

c) Oscillations:
- – increase the proportional band,
- – increase the integration time,
- – decrease the differentiation time.

d) Instability:
- – increase the integration time.

## 10. SIGNALLING OF ERRORS

Character messages Table 6

| **Error code** (upper display) | **Reason** | **Procedure** |
|---|---|---|
| LErr | Exceeding of the measuring range downwards or short-circuit occurring in the sensor circuit. | Check if the type of chosen sensor is in compliance with the connected one. Check if values of input signals are situated in the appropriate range. If so, check whether there is no short-circuit in the sensor circuit. |
| HErr | Exceeding of the measuring range upwards or break in the sensor circuit. | Check if the type of chosen sensor is in compliance with the connected one. Check if values of input signals are situated in the appropriate range. If so, check whether there is no short-circuit in the sensor circuit. |
| Er.Ad | Discalibrated input. | Connect again the controller supply and if it cannot help, contact the nearest authorized service shop. |
| Er.At | The automatic selection of PID parameters cannot be produced or was broken. | Check conditions of the autotuning function generation described in section 9.1. The message disappears after pressing any push-button. |

# 11. TECHNICAL DATA

**Input signals:**

- for sensor inputs acc. to the table 7
- for linear inputs acc. to the table 8

Input signals and sensor measuring ranges Table 7

| Sensor type | Standard | Symbol | Range | Symbol on the display |
|---|---|---|---|---|
| Pt100 | PN-EN 60751+A2:1997 | Pt100 | -199...850°C | Pt 1 |
| Pt1000 | PN-EN 60751+A2:1997 | Pt1000 | -199...850°C | Pt 10 |
| Fe-CuNi | PN-EN 60584-1:1997 | J | -100...1200°C | t-J |
| Cu-CuNi | PN-EN 60584-1:1997 | T | -100...400°C | t-t |
| NiCr-NiAl | PN-EN 60584-1:1997 | K | -100...1372°C | t-K |
| PtRh10-Pt | PN-EN 60584-1:1997 | S | 0...1767°C | t-S |
| PtRh13-Pt | PN-EN 60584-1:1997 | R | 0...1767°C | t-r |
| PtRh30-PtRh6 | PN-EN 60584-1:1997 | B | 0...1820°C<br>300...1820°C [1)] | t-b |
| NiCr-CuNi E | PN-EN 60584-1:1997 | E | -100...999°C | t-E |
| NiCrSi-NiSi | PN-EN 60584-1:1997 | N | -100...1300°C | t-n |
| NiCr-CuNi (chromel-kopel) | Gost R 8.585- 2001 | L | -100...800°C | t-L |

[1)] Range which the measurement error is given to

Input signals and measuring ranges for linear inputs Table 8

| Sensor type | Notation | Range | Symbol on the display |
|---|---|---|---|
| Linear current | I | 0...20 mA | 0-20 |
| Linear current | I | 4...20 mA | 4-20 |
| Linear voltage | U | 0...5 V | 0-5 |
| Linear voltage | U | 0...10 V | 0- 10 |

**Basic error of true value measurement:**
0.2%, for RTD inputs,
0.3%, for TC inputs (0.5% - for B, R, S);
0.2% ±1 digit, for linear inputs

**Measurement time:**
- for sensor inputs 0.33 s
- for linear inputs 0.16 s

**Input resistance:**
- for voltage input 150 kΩ
- for current input 4 Ω

**Detection of error in the measuring circuit:**
- thermocouple, Pt100, PT1000 overrunning of the measuring range
- 0...10 V over 11 V
- 0...5 V over 5,25 V
- 0...20 mA over 22 mA
- 4...20 mA under 1mA nd over 22 mA

**Control algorithm:**
- P,PD, PI, PID, two-state with hysteresis

**Kind of outputs:**
- relay switch over contact maximal load-carrying capacity:
  - voltage: 250 V a.c., 150 V d.c.
  - current: 5A 250 V a.c., 5 A 30 V d.c.
  - resistance load: 1250 VA, 150 W
- binary voltage (without isolation from the sensor side) voltage: 5 V
  resistance limiting the current: 66 Ω

**Way of output action:**

| | |
|---|---|
| - reverse | for heating |
| - direct | for cooling |

**Signalling of the:**

- output switching on
- programming control
- manual control mode

**Rated service conditions:**

| | |
|---|---|
| - supply voltage | 230 V a.c. ±10%<br>110 V a.c. ±10%<br>24 V a.c. ±10% |
| - supply voltage frequency | 50...60 Hz |
| - ambient temperature | 0...23...50 °C |
| - storage temperature | -20...+70 °C |
| - relative air humidity | < 85 % (without condensation) |
| - external magnetic field | < 400 A/m |
| - preheating time | 30 min |
| - work position | any |
| - resistance of wires connecting the resistance thermometer with the controller | <20 Ω |
| **Power consumption** | < 3 VA |
| **Weight** | < 0.25 kg |

**IP protection ensured through the housing: acc. to EN 60529**

| | |
|---|---|
| - from the frontal side | IP65 |
| - from terminal side | IP20 |

**Additional errors in rated working conditionscaused by:**

| | |
|---|---|
| - compensation of the thermocouple cold junction | ≤ 2°C, |
| - ambient temperature change | ≤ 100% of the basic error value /10K. |

**Safety requirements acc. to EN 61010-1**

- installation category III,
- level of pollution 2,
- maximal working voltage in relation to ground:
  - for supply circuit, outputs - 300 V a.c.
  - for input circuits - 50 V a.c.

**Electromagnetic compatibility**
- immunity acc. to EN 61000-6-2
- emission acc. to EN 61000-6-4

## 12. ORDER CODES

Coding way is given in the table 9.

Kind of options and ordering way Table 9

| **Controller RE23 -** | **X** | **X** | **X** | **X** |
|---|---|---|---|---|

**Input:**
universal for thermocouples and RTD..... 1
universal
linear current: 0/4...20 mA,
linear voltage: 0...5/10 V ..... 2
on order .....X

**Output:**
relay ..... 1
binary 0/5V to SSR control..... 2
on order.....X

**Supply:**
230 V 50/60 Hz ..... 1
110 V 50/60 Hz..... 2
24 V 50/60 Hz ..... 3
on order.....X

**Additional requirements**
without an extra quality inspection certificate.....8
with an extra quality inspection certificate.....7
acc. to customer's agreement*..... X

* The option code is established by the manufacturer.

**Ordering example:** The code: **RE23-1-2-3-7** means
RE23 - controller with universal input + 1 output
1 - universal input for RTD and TC
2 - binary output 0/5 V to SSR control
3 - supply: 24 V a.c.
7 - with an extra quality inspection certificate

## 13. MAINTENANCE AND GUARANTEE

The RE23 controller does not require any periodical maintenance.

In case of some incorrect operations:

1. **After the dispatch date and in the period stated in the guarantee card**

One should return the instrument to the Manufacturer's Quality Inspection Dept.
If the instrument has been used in compliance with the instructions, the Manufacturer warrants to repair it free of charge.
The disassembling of the housing causes the cancellation of the granted guarantee.

2. **After the guarantee period:**

One should turn over the instrument to repair it in a certified service workshop.
Spare parts are available for the period of five years from the date of purchase.

We reserves the right to make changes in design and specifications of any products as engineering advances or necessity requires.

**SALES PROGRAMME**

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***CONTROL***
***RECORDING***

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- MEASURING TRANSDUCERS
- ANALOG PANEL METERS (DIN INSTRUMENTS)
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- PROCESS and HOUSEHOLD CONTROLLERS
- CHART AND PAPERLESS RECORDERS
- POWER CONTROL UNITS and SOLID-STATE RELAYS
- AUTOMOTIVE DASHBOARD INDICATORS
- 1-PHASE AND 3-PHASE WATT-HOUR METERS
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