LUMEL

# TEMPERATURE CONTROLLER
# 48 x 48 mm
# RE70 TYPE




# USER'S MANUAL

CE

*Contents:*

**1. Application ..... 3**
**2. Controller set ..... 3**
**3. Basic requirements, operational safety ..... 3**
**4. Installation ..... 4**
4.1. Controller installation ..... 4
4.2. Electrical connections ..... 4
4.3. Recommendations for installation ..... 5
**5. Starting work ..... 6**
**6. Service ..... 7**
6.1. Programming Controller Parameters ..... 7
6.2. Programming matrix ..... 8
6.3. Setting Change ..... 8
6.4. Parameters description ..... 8
**7. Inputs and outputs of the controller ..... 10**
7.1. Inputs ..... 10
7.1. Output ..... 11
**8. Control ..... 11**
7.1. ON-OFF algorithm ..... 11
7.2. Innovative SMART PID algorithm ..... 12
**9. Alarms ..... 14**
**10. Additional functions ..... 14**
10.1. Displaying the control signal ..... 14
10.2. Manual mode ..... 14
10.3. Defaults Settings ..... 15
**11. RS-485 interface with MODBUS protocol ..... 15**
11.1. Introduction ..... 15
11.2. Error codes ..... 15
11.3. Register map ..... 15
**12. Error signaling ..... 17**
**13. Technical data ..... 18**
**14. Controller ordering code ..... 19**

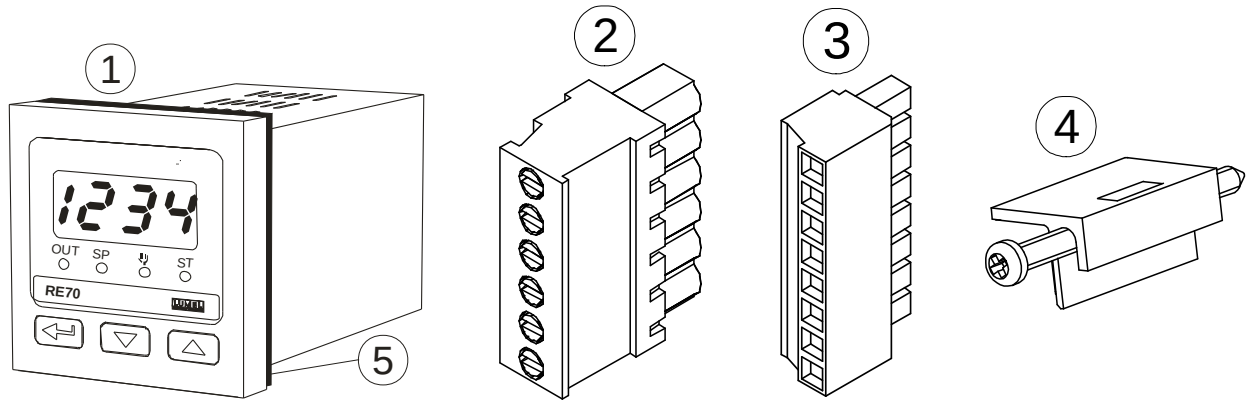
## 1. Application

The RE70 controller is destined for the temperature control. Controller works directly with the resistance sensors or thermoelectric sensors.

The controller is equipped with one output that allows for dual-point control and alert signalization. Dual-point control is based on the PID or ON/OFF algorithm. Relay output is equipped with a switchable contact and allows for indirect control of the low-power objects.

The innovative SMART PID algorithm has been implemented in the controller.

## 2. Controller set




Complete set of the controller includes:

1. controller ..... 1 pc
2. plug with 6 screw terminals ..... 1 pc
3. plug with 8 screw terminals ..... 1 pc
4. holders to fix the meter in the panel ..... 4 pcs
5. seal ..... 1 pc
6. user's manual ..... 1 pc
7. guarantee card ..... 1 pc

## 3. Basic requirements, operational safety

In terms of operational safety the controller meets the requirements of the EN 61010-1 standard.

**Comments concerning safety:**

- Assembly and installation of the electrical connections should conducted only by people authorised to perform assembly of electric devices.
- Always check the state of connections before turning the controller on.
- Prior to taking the controller housing off, always turn the supply off and disconnect measuring circuits.
- Removal of the controller housing during the warranty period voids the warranty.
- The device is designed to installation and usage in the industrial electromagnetic environment.
- The installation should have a switch or a circuit-breaker installed. This switch should be located near the device, easy accessible by the operator and suitably marked.

# 4. Installation

## *4.1. Controller installation*

Fix the controller to the board with four screw brackets as shown in the fig. 1. A slot in the panel must have the dimensions $45^{+0,6}$ x $45^{+0,6}$ mm. The thickness of the panel material cannot exceed 15 mm.

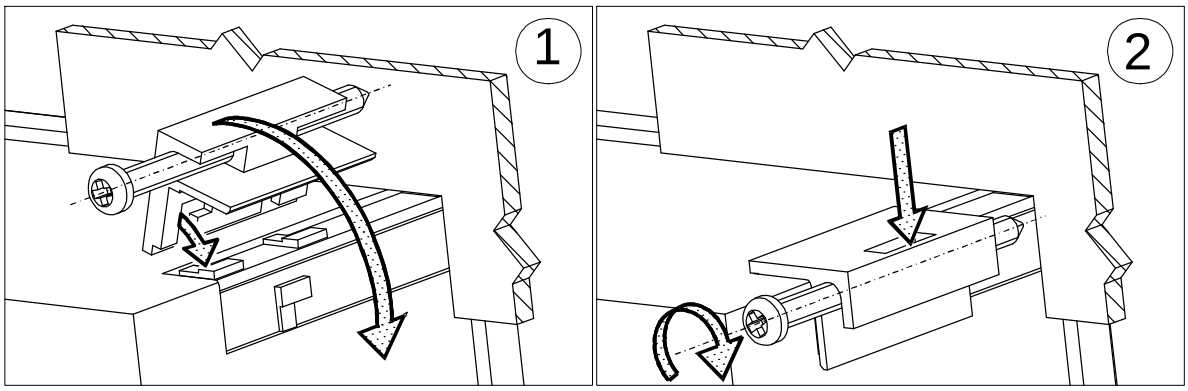



Fig. 1. Controller installation.

Dimensions of the controller are presented on the fig. 2.

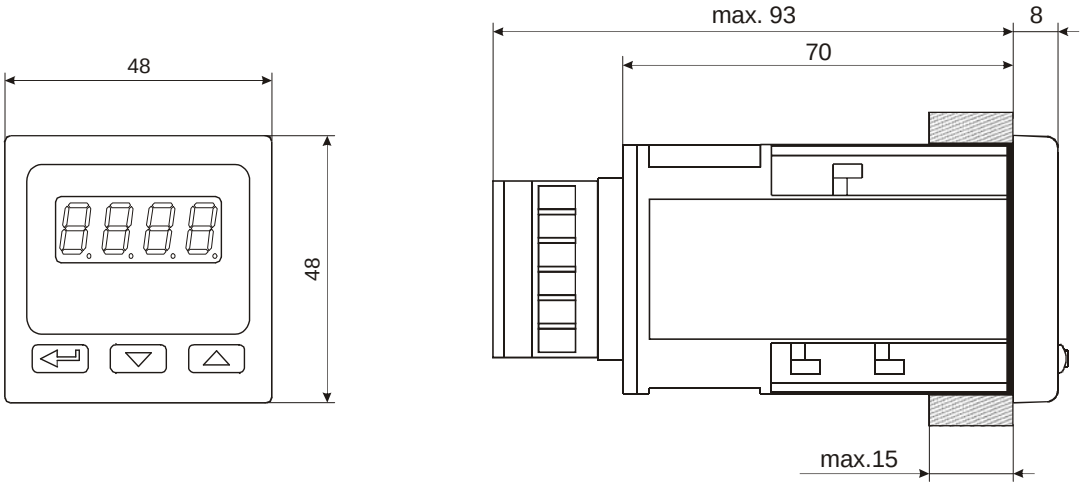



Fig. 2. Controller dimensions.

## *4.2. Electrical connections*

The controller has two separate connectors with screw terminals. One strip enables the connection of the supply and outputs by a wire of 2,5 $mm^2$, the second strip enables input signal connections by a wire of 1,5 $mm^2$.

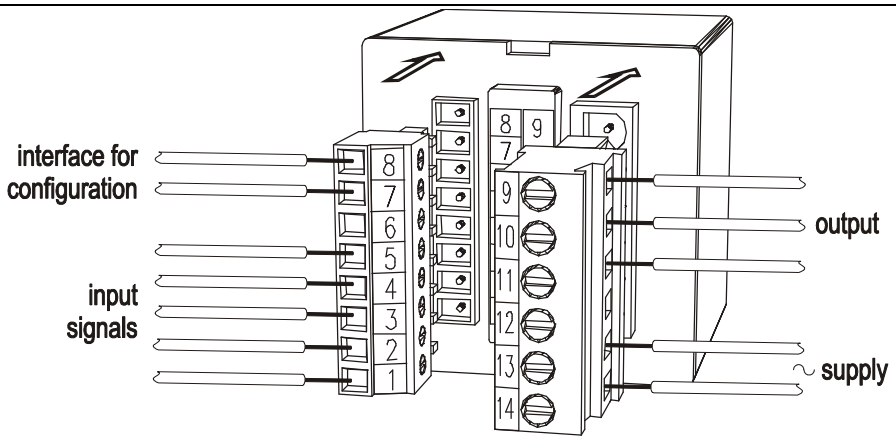
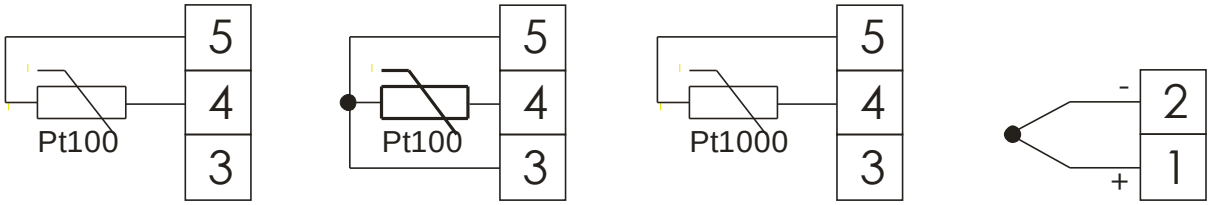



Fig. 3. View of the controller's connection strips.




thermoresistor Pt100 in 2-wire system | thermoresistor Pt100 in 3-wire system | thermoresistor Pt1000 | thermocouple

Fig. 4. Input signals

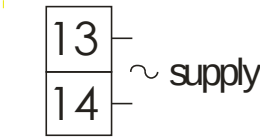



Fig. 5. Supply

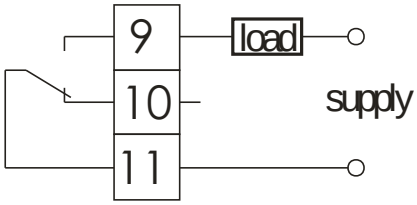



Fig. 6. Control/Alarm output

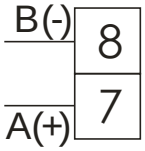



Fig. 7. RS-485 interface (only for configuration)

### *4.3. Recommendations for installation*

To achieve full electromagnetic resistance of the controller, it is necessary to follow the rules described below:

- do not supply the controller from the network in the proximity of devices generating high pulse noises and do not apply common earthing circuits,
- apply network filters,
- wires leading measuring signals should be twisted in pairs, and for resistance sensors in 3-wire connection, twisted of wires of the same length, cross-section and resistance, and led in a shield,
- all shields should be one-side earthed or connected to the protection wire, the nearest possible to the controller,

– as a rule of thumb, wires transmitting different signals should be spaced as far as it is possible (at least 30 cm) and should be crossed only at the right angle of 90°.

## 5. Starting work

### *Controller description*

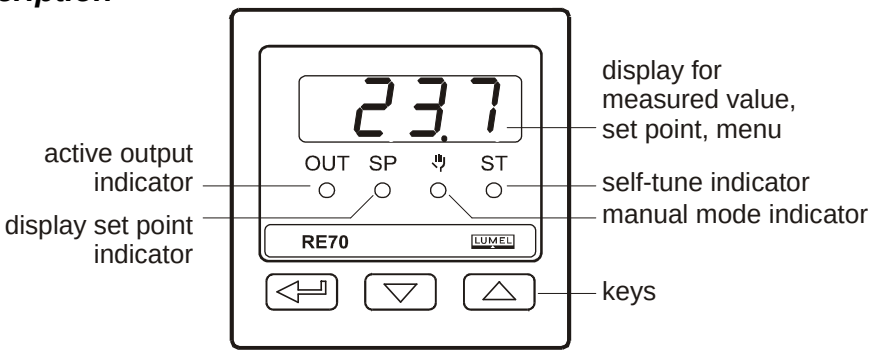



Fig. 8. Overview of the controller's front panel.

### *Switching a supply on*

After powering on, the controller performs the display test, displays **rE 70** text, software version and the measured value.

Display may also show an error message (see table 11).

The ON-OFF control algorithm with hysteresis given in the table 2 is set by the defaults.

### *Change of the set point*

Set point is displayed after ▼ or ▲ buttons are pressed, this is accompanied by SP diode switching on. To change the set point, press ▼ or ▲ buttons again (fig. 9). The beginning of the change is signaled by pulsing dot symbol on the display. New set point must be accepted with a ↵ button within 30 seconds after the ▼ or ▲ button have been pressed, otherwise regulator will display set point with previously set point.

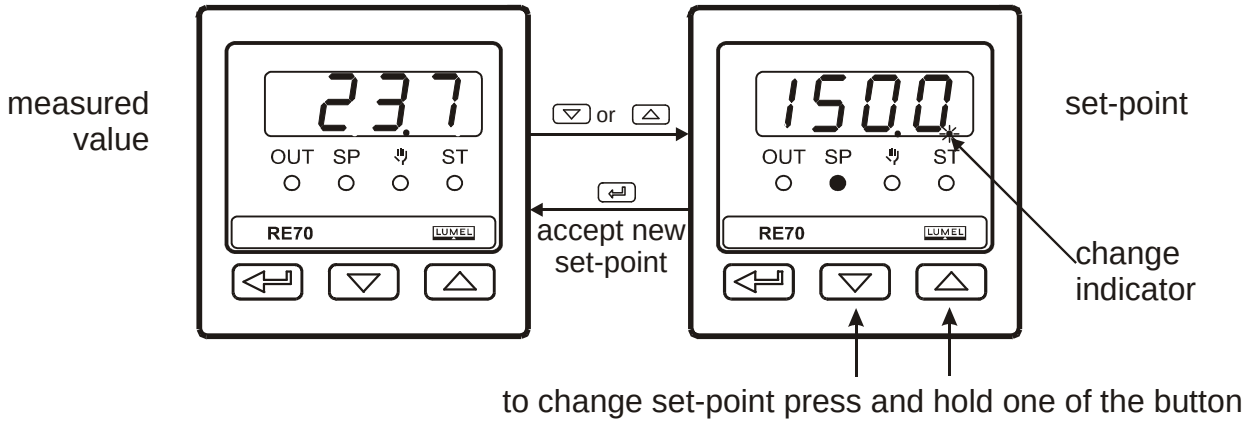



Fig. 9. Change value of the set point.

# 6. Service

The controller service is presented on the fig. 10.

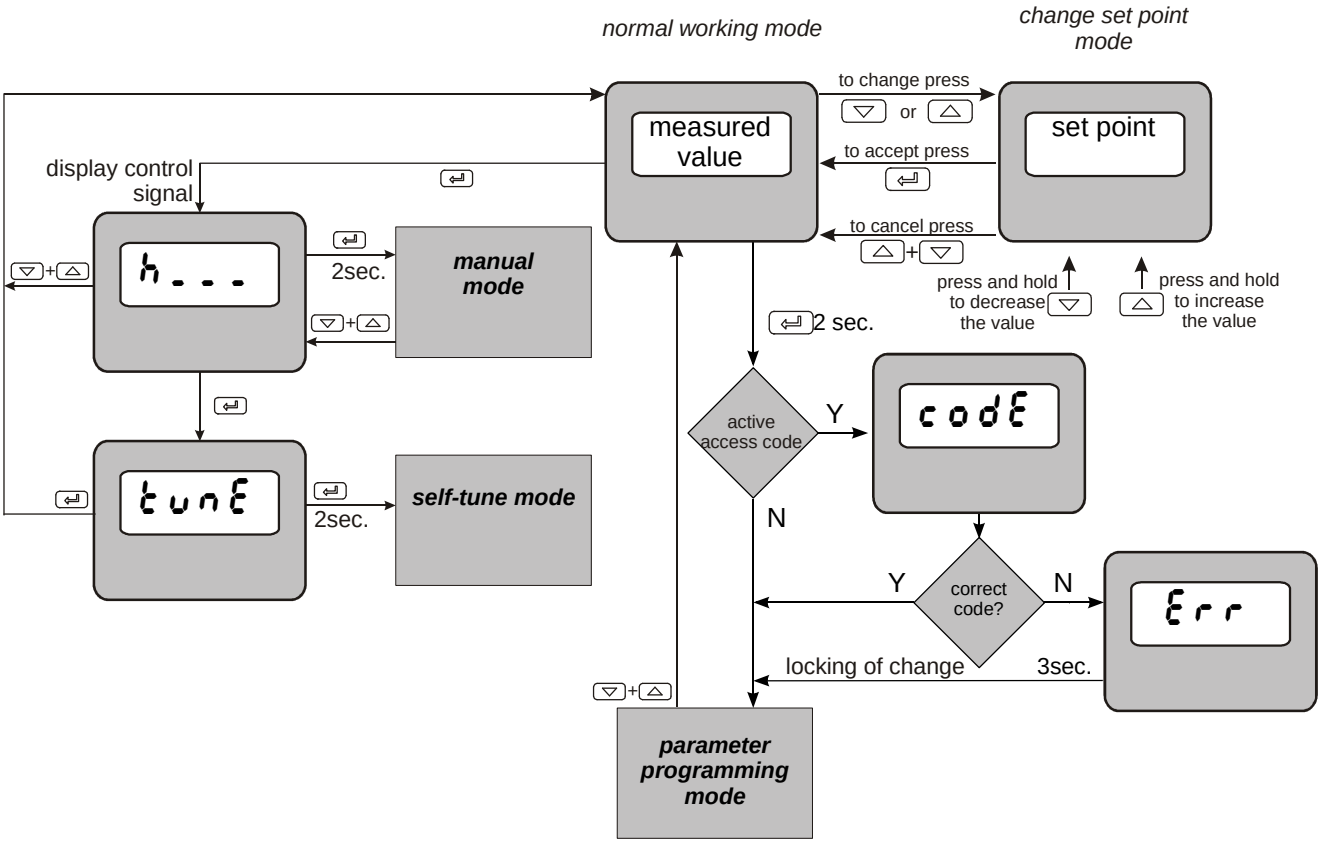



Fig. 10. Menu of controller service

## *6.1. Programming Controller Parameters*

Pressing and holding down during ca 2 seconds the button ↵ causes the entry to the programming matrix. The programming matrix can be protected by an access code. In case when giving a wrong value of the code, it is only possible to see settings through - without possibility of changes.

Fig. 11 presents the transition matrix in the programming mode. The transition between levels is carrying out by using the buttons ▼ or ▲ and the level selection by using the button ↵ . After selecting the level, the transition between parameters is carried out by using the buttons ▼ or ▲ . In order to change the parameter setting proceed acc. to the section 6.3. In order to exit from the selected level, transit between parameters until appears the symbol [. . .] and press the button ↵ . In order to exit from the programming matrix to the normal working mode, transit between levels until appears the symbol [. . .] and press the button ↵ .

Some controller parameters can be invisible – it depends on the current configuration. The description of parameters shows the table 1. The return to the normal working mode follows automatically after 30 seconds since the last button pressure.

## 6.2. Programming matrix

| | | | | | | |
|---|---|---|---|---|---|---|
| inP Input parameters | unit Unit | inty Input type | t-li Type of line | SHif Shift of measured value | dP Position of decimal point | . . . ⮌ Transition to the higher level |
| outP Output parameters | out Output configuration | . . . ⮌ Transition to the higher level | | | | |
| ctrL Control parameters | ALG Control algorithm | tYPE Type of control | HY Hysteresis | St.Lo Lower threshold for self-tuning | St.Hi Upper threshold for self-tuning | . . . ⮌ Transition to the higher level |
| Pid PID Parameters | Pb Proportional band | ti Integral time constant | td Derivative time constant | Y0 Correction of control signal, for P or PD control | to Pulse period | . . . ⮌ Transition to the higher level |
| ALAr Alarms parameters | AL.SP Set point for the absolute alarm | AL.du Deviation from the set point of the relative alarm | AL.HY Alarm hysteresis | . . . ⮌ Transition to the higher level | | |
| SPP Set point parameters | SPL lower limitation of the set point setting | SPH upper limitation of the set point setting | . . . ⮌ Transition to the higher level | | | |
| SErv Service parameters | SECU Access code | St.Fn Self-tuning function | . . . ⮌ Transition to the higher level | | | |
| . . . ⮌ Exit from the menu | | | | | | |

Fig. 11. Programming matrix

## 6.3. Setting Change

The change of parameter setting begins after pressing the button ↵ during the display of the parameter name. The setting selection is carried out through the buttons ▼ and ▲ and accepted by the button ↵ . The change cancellation follows after the simultaneous pressure of the buttons ▼ and ▲ or after 30 seconds since the last button pressure. The way to change the setting is shown on the fig. 12.

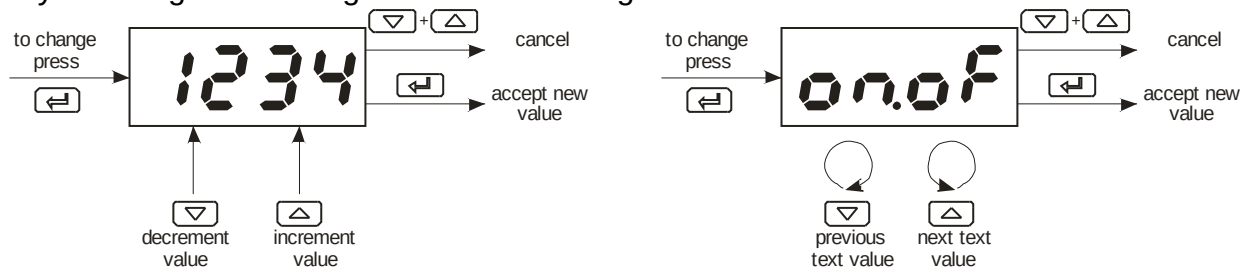



Fig. 12. Setting change of number and text parameters.

## 6.4. Parameters description

The list of parameters is presented in the table 1.

List of configuration parameters Table 1

| Symbol of parameter | Parameter description | Default setting | Range of parameter change |
|---|---|---|---|
| **inP** – Input parameters | | | |
| unit | Unit | °C | °C: degrees Celsius<br>°F: degrees Fahrenheit |
| inty | Input type | Pt1 | Pt1: Pt100<br>Pt10: Pt1000<br>t-J: J type thermocouple<br>t-t: T type thermocouple<br>t-K: K type thermocouple<br>t-S: S type thermocouple<br>t-r: R type thermocouple<br>t-b: B type thermocouple<br>t-n: N type thermocouple |
| t-Li | Line type for the sensor Pt100 | 2-P | 2-P: 2-wire<br>3-P: 3-wire |
| dP | Position of the decimal point | 1-dP | 0_dP: without a decimal place<br>1_dP: 1 decimal place |
| Shif | Shift of measured value | 0.0 °C<br>(0.0 °F) | -100.0…100.0 °C<br>(-180.0…180.0 □) |
| **outP** – Output parameters | | | |
| out | Output configuration | y | oFF: control off<br>y: control signal<br>RHi: upper absolute alarm<br>RLo: lower absolute alarm<br>duHi: upper relative alarm<br>duLo: lower relative alarm<br>duin: internal relative alarm<br>duou: external relative alarm |
| **ctrL** – Control parameters [1] | | | |
| ALG | Control algorithm | onof | onof: ON-OFF control algorithm<br>Pid: PID control algorithm |
| tYPE | Type of control | inu | dir: direct control (cooling)<br>inu: reverse control (heating) |
| HY | Hysteresis [4] | 2.0 °C<br>(3.6 °F) | 0.2…100.0 °C<br>(0.2…180.0 °F) |
| St.Lo | Lower threshold for self-tuning | 0.0 °C<br>(32.0 °F) | MIN…MAX [6] |
| St.Hi | Upper threshold for self-tuning | 800.0 °C<br>(1,472.0 °F) | MIN…MAX [6] |
| **Pid** – PID parameters [2] | | | |
| Pb | Proportional band | 30.0 °C<br>(540.0 °F) | 0.1…550.0 °C<br>(0.1…990.0 °F) |

| Symbol of parameter | Parameter description | Default setting | Range of parameter change |
|---|---|---|---|
| ti | Integral time constant | 300 | 0…9999 s |
| td | Derivative time constant | 60.0 | 0.0…2500 s |
| y0 | Correction of control signal, for P or PD control | 0.0 | 0…100.0 % |
| to | Pulse period | 20.0 | 0.5…99.9 s |
| ALAr – Alarms parameters [3] | | | |
| AL.SP | Set point for the absolute alarm | 0.0 °C (32.0 °F) | MIN…MAX [6] |
| AL.du | Deviation from the set point of the relative alarm | 0.0 °C (0.0 °F) | -200,0… 200,0 °C (-360.0…360.0 °F) |
| AL.HY | Hysteresis for the alarm | 2.0 °C (3.6 °F) | 0.2…100.0 °C (0.2…180.0 °F) |
| SPP – Set point parameters | | | |
| SPL | Lower limitation of the set point setting | -200.0 °C (-3,280.0 °F) | MIN…MAX [6] |
| SPH | Upper limitation of the set point setting | 1,767.0 °C (3,212.6 °F) | MIN…MAX [6] |
| SErP – Service parameters | | | |
| SECU | Access code [5] | 0 | 0…9999 |
| St.Fn | Self-tuning function | on | oFF: locked<br>on: available |

[1] Group of parameters visible only when setting the output on the control signal.
[2] Group of parameters visible only when setting the control algorithm on PID.
[3] Group of parameters visible only when setting the output on one of the alarm.
[4] Parameter visible only when setting the control algorithm on ON-OFF.
[5] Parameter hidden in the monitoring mode of parameters only for readout.
[6] See table 2.

Range limits for inputs table 2

| Input / sensor | MIN | | MAX | |
|---|---|---|---|---|
| | °C | °F | °C | °F |
| Thermoresistor Pt100 | -200 °C | -328 °F | 850 °C | 1,562 °F |
| Thermoresistor Pt1000 | -200 °C | -328 °F | 850 °C | 1,562 °F |
| J type thermocouple | -50 °C | -58 °F | 1,200 °C | 2,192 °F |
| T type thermocouple | -50 °C | -58 °F | 400 °C | 752 °F |
| K type thermocouple | -50 °C | -58 °F | 1,372 °C | 2,501.6 °F |
| S type thermocouple | 0 °C | 32 °F | 1,767 °C | 3,212.6 °F |
| R type thermocouple | 0 °C | 32 °F | 1,767 °C | 3,212.6 °F |
| B type thermocouple | 0 °C | 32 °F | 1,767 °C | 3,212.6 °F |
| N type thermocouple | -50 °C | -58 °F | 1,300 °C | 2,372 °F |

# 7. Inputs and outputs of the controller

## *7.1. Inputs*

Input is the source of the measured value used for control or for alarms. The input is universal and the sensors Pt100, Pt1000 or thermocouples can be connected to it.

Start by using a **unit** parameter to set the temperature display unit. Unit change resets the value to the factory settings, with a different value ranges for Celsius and Fahrenheit scale.

Input signal is selected with a **inty** parameter.

For the Pt100 thermoresistor, choose the **t-2** connection type - 2-wire or 3-wire. In the 3-wire Pt100 connection, resistance compensation is automatic.

For thermocouples, a cold terminal compensation is automatic.

Position of the decimal point is a additional parameter that determines display format of measured value and set point; it is set by the **dP** parameter. Correction of the indicated measured value is determined by the **Shif** parameter.

### *7.1. Output*

The controller has one output. It is possible to choose the following output options: on-off control, proportional control (PID) or alert. It is necessary to set the pulse period for the proportional control.

Pulse period is a time between two subsequent input engagements during proportional control. Pulse period length should be adjusted for the dynamic properties of the object and characteristics of the output device. It is recommended to use SSR transmitter for quick processes. Relay output is used for a contactor control in the slow-changing processes. Long pulse periods for quick-change processes may cause unnecessary oscillation. In theory, the shorter pulse period is, the better the control, however for the relay output a period should be as large, as possible to optimize lifespan of the relay.

Pulse period setting recommendations Table 3

| Output | Pulse period is | Load |
|---|---|---|
| electromagnetic transmitter | recommended >20s<br>min. 10 s | 5 A/230 VAC<br>or a contactor |
| | min. 5 s | 2 A/230 VAC |

## 8. Control

### *7.1. ON-OFF algorithm*

When high accuracy of a temperature control is not required, especially for the high time constant and small delay, it is possible to use ON-OFF control with hysteresis. Disadvantage of this method is the occurrence of oscillations, even at small hysteresis values.

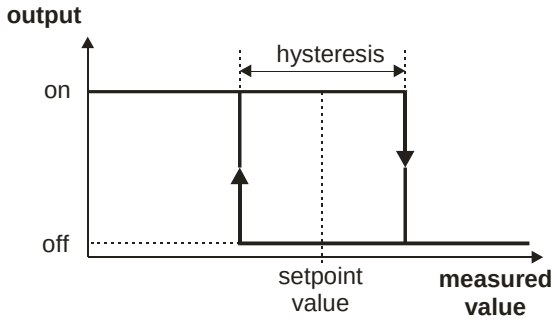



Fig. 13. Operation way of the heating type output for the ON-OFF control.

## *7.2. Innovative SMART PID algorithm*

When high precision of the temperature control is necessary, it is recommended to use PID algorithm. Innovative SMART PID algorithm ensures increased precision in the extended range of the control object classes.

Tuning of the controller to object is achieved by automatically selected PID parameters using the self-tuning function or manual setting the value of the proportional element, integral element and derivative element.

### *7.2.1. Self-tuning*

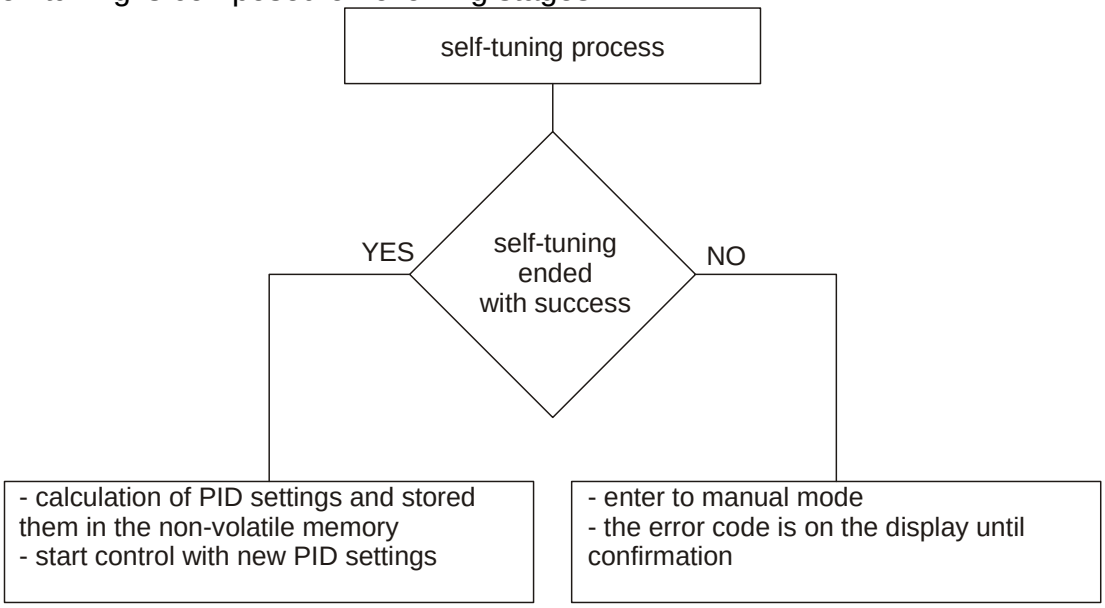
The controller has the function to select PID settings. In most cases these settings ensure an optimal control.

To begin the self-tuning, transit to the **tunE** message (acc. to the fig. 10) and hold down the button ↵ during at least 2 sec. If the control algorithm is set on ON-OFF or the self-tuning function is locked, then the tune message **tunE** is hidden.

For a correct realization of the self-tuning function, it is required to set the parameters **St.Lo** and **St.Hi** . The parameter **St.Lo** should be set on the value corresponding to the measured value at the switched off control. For object temperature control, you can set 0ºC. The parameter **St.Hi** should be set on the value corresponding to the maximum measured value when the control is switched on the full power.

The flickering AT symbol informs about the activity of the self-tuning function. The duration of self-tuning depends on dynamic object properties and can last maximally 10 hours. During self-tuning or directly after it, over-regulations can occur and because of this, one must set a smaller set point if possible.

The self-tuning is composed of following stages:




The self-tuning process will be stopped without counting PID settings, if a supply decay occurs or the button ↵ will be pressed. In this case, the control with current PID settings will be started.

If the self-tuning experiment does not end with success, then an error code will be displayed, acc. to the table 4.

Error codes for self-tuning function Table 4

| Error code | Reason | Procedure |
|---|---|---|
| E5.01 | P or PD control was selected. | One must choose PI, PID control, i.e. the TI unit must be higher than zero. |
| E5.02 | The set point is incorrect. | Change temperature set point or the parameters SE.Lo, SE.Hi. |
| E5.03 | The button ↵ was pressed. | |
| E5.04 | The maximal self-tuning duration time has been exceeded. | Check, if the temperature sensor is correctly situated, if the set point value is not set too higher for the given object. |
| E5.05 | The waiting time of switching has been exceeded. | |
| E5.06 | The input range limit has been exceeded. | Take note of the way to connect the sensor. Do not allow that the overflow results in exceeding of the input range limit. |
| E5.20 | Very non-linear object, enabling to obtain correct values of PID parameters, or an interference has occurred. | Carry out the self-tuning again. If that does not help, choose PID parameters manually. |

### *7.2.2. Proceeding in case of a unsatisfactory PID control*

It is recommended to choose PID parameters, changing the value in a twice higher or twice less. During the change, one must respect following principles.

a) Free jump response:
- decrease the proportional band,
- decrease the integral and derivative time.

b) Over-regulations
- increase the proportional band,
- increase the derivative time,

c) Oscillations
- increase the proportional band,
- increase integral time,
- decrease the derivative time,

d) Instability
- increase the integral time.

## 9. Alarms

The controller output can be configured as an alarm output. For this, set the parameter **out** as one of alarms. Available types of alarms are given on the figure 14.

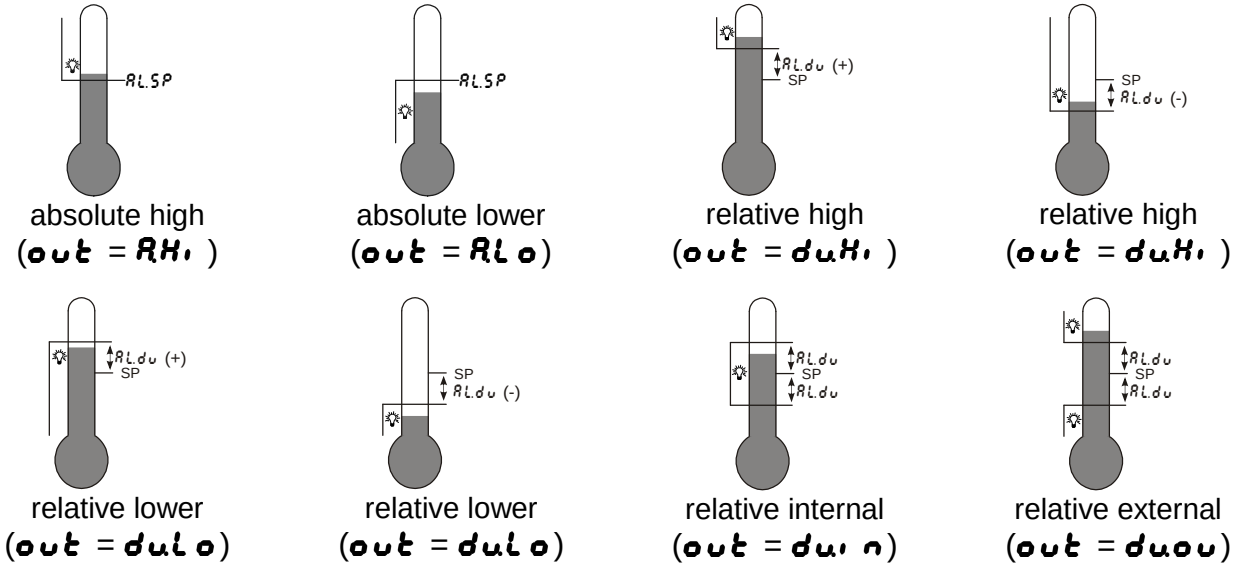



Fig.14. Types of alarms

The set point for absolute alarms is the value defined by the parameter **AL.SP**, and for relative alarms, it is the deviation from the set point - the parameter **AL.dU**. Alarm hysteresis, the zone around the set point in which the input state is not changed is defined by the **AL.HY** parameter.

## 10. Additional functions

### *10.1. Displaying the control signal*

After pressing the button ↵ the value of the control signal (0…100%) is displayed on the display. On the first digit the h mark is displayed. Control signal can be displayed when the **out** parameter is set on **y**.

### *10.2. Manual mode*

The manual mode gives the possibility to identify, test the object, or control it after a sensor damage.

The entry to the manual mode follows after holding down the button ↵ during the control signal is display. The manual mode is signaled by the pulsation of the diode with the symbol ☝. The controller interrupts the automatic control and begins the manual mode of the output. The control signal value is on the display, preceded by the symbol h.

For the ON-OFF control – the control signal can be set up by the buttons ▼ and ▲ at 0% or 100%.

For the PID control – the control signal can be set up by the buttons ▼ and ▲ at any optional value from the 0.0…100% range.

The exit to the normal work mode follows after pressing simultaneously the buttons ▼ and ▲ .

### *10.3. Defaults Settings*

Defaults settings can be restored during the supply connection by holding down the buttons [▼] and [▲] till the moment when the inscription FAbr appears on the display.

## 11. RS-485 interface with MODBUS protocol

### *11.1. Introduction*

RE70 controller is equipped with RS-485 serial interface with implemented MODBUS asynchronous communication protocol. The interface is designed for controller configuration prior to using it.

Summary of the RE70 controller serial interface:

- device address: 1,
- baud rate: 9600 bit/s,
- operation modes: RTU,
- information unit: 8N2,
- data format: integer (16 bits)
- maximum response time: 500 ms,
- maximum number of registers read/written in one command: 32.

RE70 controller uses following protocol functions:

Table 5

| Code | Meaning |
|---|---|
| 03 | n-registers read |
| 06 | 1 register write |
| 16 | n-registers write |
| 17 | slave device identification |

### *11.2. Error codes*

If the controller receives query with the transmission error or checksum error, then such query will be ignored. When a query with correct syntax and invalid values is found, the controller returns an error code.

Table 6 shows error codes and their meaning.

Error codes Table 6

| code | meaning | reason |
|---|---|---|
| 01 | illegal function | function is not handled by the controller |
| 02 | illegal data address | register address out of range |
| 03 | illegal data value | register value out of range or register is readout only |

### *11.3. Register map*

In the controller, data are placed in 16-bit registers. The list of registers for write and readout is presented in the table 7. Operation "R-" – means the possibility of readout, and the operation "RW" means the possibility for readout and write.

Map of the registers from address 4000 Table 7

| *register address* | *marking* | *operation* | *parameter range* | *description* |
|---|---|---|---|---|
| 4000 | | -W | 1 | Command register<br>1 – revert to defaults settings (except for interface settings and defined programs) |
| 4001 | | R- | 100…999 | Program version number [x100] |
| 4002 | | R- | 1301…9999 | Older 4 digits of the serial number |
| 4003 | | R- | 1…9999 | Younger 4 digits of the serial number |
| 4004 | | R- | 0…0xFFFF | Controller status – description in the table **8** |
| 4005 | | R- | 0…0xFFFF | Error status – description in the table **9** |
| 4006 | | R- | acc. to the table **10** | Measured value PV |
| 4007 | | R- | acc. to the table **10** | Current set point SP |
| 4008 | | R- | 0…1000 | Control signal [% x10] |
| 4009 | UNIT | RW | 0…1 | Unit<br>0 – degrees Celsius<br>1 – degrees Fahrenheit |
| 4010 | INPT | RW | 0…8 | Type of main input:<br>0 – thermoresistor Pt100<br>1 – thermoresistor Pt1000<br>2 – J type thermocouple<br>3 – T type thermocouple<br>4 – K type thermocouple<br>5 – S type thermocouple<br>6 – R type thermocouple<br>7 – B type thermocouple<br>8 – N type thermocouple |
| 4011 | T-LI | RW | 0…1 | Type of line<br>0 – 2-wire<br>1 – 3-wire |
| 4012 | DP | RW | 0…1 | Position of the decimal point of the main input<br>0 – without a decimal place<br>1 – 1 decimal place |
| 4013 | SHIF | RW | -1000…1000 [x10 °C]<br>-1800…1800 [x10 °F] | Shift of the measured value of the main input |
| 4014 | OUT | RW | 0…7 | Output function<br>0 – no function<br>1 – control signal<br>2 – upper absolute alarm<br>3 – lower absolute alarm<br>4 – upper relative alarm<br>5 – lower relative alarm<br>6 – internal relative alarm<br>7 – external relative alarm |
| 4015 | ALG | RW | 0…1 | Control algorithm<br>0 – ON-OFF<br>1 – PID |
| 4016 | TYPE | RW | 0…1 | Type of control<br>0 – direct control – cooling<br>1 – reverse control – heating |
| 4017 | HY | RW | 2…1000 [x10 °C]<br>2…1800 [x10 °F] | Hysteresis HY |
| 4018 | STLO | RW | acc. to the table **10** | Lower threshold for self-tuning |
| 4019 | STHI | RW | acc. to the table **10** | Upper threshold for self-tuning |
| 4020 | PB | RW | 1…5500 [x10 °C]<br>1…9900 [x10 °F] | Proportional band PB |
| 4021 | TI | RW | 0…9999 | Integral time constant TI [s] |
| 4022 | TD | RW | 0…25000 | Derivative time constant TD [s x10] |
| 4023 | Y0 | RW | 0…1000 | Correction of control signal Y0 (for P or PD control) [% x10] |
| 4024 | TO | RW | 5…999 | Pulse period of output [s x10] |
| 4025 | ALSP | RW | acc. to the table **10** | Set point for the absolute alarm [x10] |

| *register address* | *marking* | *operation* | *parameter range* | *description* |
|---|---|---|---|---|
| 4026 | ALDV | RW | -1800…1800 [x10 °C]<br>-3600…3600 [x10 °F] | Deviation from the set point of the relative alarm |
| 4027 | ALHY | RW | 2…1000 [x10 °C]<br>2…1800 [x10 °F] | Hysteresis for the alarm |
| 4028 | SPL | RW | acc. to the table **10** | Lower limitation of the fast set point change |
| 4029 | SPH | RW | acc. to the table **10** | Upper limitation of the fast set point change |
| 4030 | SECU | RW | 0…9999 | Access code to the menu |
| 4031 | STFN | RW | 0…1 | Self-tuning function<br>0 – locked<br>1 – unlocked |

Register 4002 – controller status Table 8

| bit | description |
|---|---|
| 0-11 | Reserved |
| 12 | Automatic/Manual mode: 0 – automatic, 1 – manual |
| 13 | State of alarm: 0 – active, 1 – inactive |
| 14 | Measured value beyond the range limits |
| 15 | Controller error – check the error register |

Register 4003 – error register Table 9

| bit | description |
|---|---|
| 0-14 | Reserved |
| 15 | Input discalibrated |

Input range limits Table 10

| *sensor type* | *range* | |
|---|---|---|
| | *UNIT = °C [x10]* | *UNIT = °F [x10]* |
| Pt100 | -2000...8500 | -3280...15620 |
| Pt1000 | -2000...8500 | -3280...15620 |
| Fe-CuNi (J) | -500...12000 | -580...21920 |
| Cu-CuNi (T) | -500...4000 | -580...7520 |
| NiCr-NiAl (K) | -500...13720 | -580...25016 |
| PtRh10-Pt (S) | 0...17670 | 320...32126 |
| PtRh13-Pt (R) | 0...17670 | 320...32126 |
| PtRh30-PtRh6 (B) | 0...17670 | 320...32126 |
| NiCrSi-NiSi (N) | -500...13000 | -580...23720 |

## 12. Error signaling

Character messages signaling the incorrect controller operation. Table 11

| Error code | Reason | Procedure |
|---|---|---|
| - - - - | Down overflow of the range limit or lack of RTD | Check, if input signal values are situated in the appropriate range – if yes, check if check if there is no short circuit in the thermoresistor or the thermocouple is connected inversely. |
| - - - - | Upper overflow of the range limit or break in the sensor circuit | Check, if input signal values are situated in the appropriate range – if yes, check if there is no break in the sensor circuit. |
| Er.Ad | Input discalibrated | Connect the controller supply again and if that is not effective, contact the nearest service shop. |
| Er.EE | Configuration parameters checksum error | Connect the controller supply again and if that is not effective, contact the nearest service shop. |

# 13. Technical data

**Input signals** acc. to the table 12

Input signals and range limits for inputs Table 12

| Sensor type | Standard | Designation | Range | |
|---|---|---|---|---|
| Pt100 | EN 60751+A2:1997 | Pt100 | -200…850 °C | -328…1,562 °F |
| Pt1000 | EN 60751+A2:1997 | Pt1000 | -200…850 °C | -328…1,562 °F |
| Fe-CuNi | EN 60584-1:1997 | J | -50…1200 °C | -58…2,192 °F |
| Cu-CuNi | EN 60584-1:1997 | T | -50…400 °C | -58…752 °F |
| NiCr-NiAl | EN 60584-1:1997 | K | -50…1372 °C | -58…2,501.6 °F |
| PtRh10-Pt | EN 60584-1:1997 | S | 0…1767 °C | 32…3,212.6 °F |
| PtRh13-Pt | EN 60584-1:1997 | R | 0…1767 °C | 32…3,212.6 °F |
| PtRh30-PtRh6 | EN 60584-1:1997 | B | 0…1767 °C [1)] | 32…3212,6 °F [1)] |
| NiCrSi-NiSi | EN 60584-1:1997 | N | -50…1300 °C | -58…2,372 °F |

[1)] Intrinsic error is related to the range limits 200…1,767 °C (392…3,212.6 °F)

[*)] Sensor line resistance <10 Ω/wire; the connection must use wires of identical diameter and length

**Basic error of real value measurement**
0.3% for thermoresistance inputs
0.3% for thermoelectric inputs (0.5% – for B, R, S);

**Measurement time** 0.33 s

**Detection of error in the measurement circuit:**
- thermocouple, Pt100 range limit exceeded

**Types of outputs:**
- relay output type SPDT (form C), max load: 5 A/230 V AC, max. 200,000 cycles for 5 A/230 V AC (resistive)

**Way of output operation:**
- reverse for heating
- direct for cooling

**Rated operating conditions:**
- supply voltage 230 VAC ±10%
- supply voltage frequency 50/60 Hz
- ambient temperature 0…23…50 °C
- storage temperature -20…+70 °C
- relative air humidity < 85% (no condensation)
- preheating time 30 min
- operating position any

**Power input** < 4 VA

**Weight** < 0.25 kg

**Protection grade ensured by the housing** acc. to EN 60529
- from the frontal plate IP65
- from the terminal side IP20

**Additional errors in rated operating conditions caused by:**
- compensation of reference junction temperature changes ≤ 2°C
- resistance change of thermoresistance sensor line ≤ 50% intrinsic error value
- ambient temperature change ≤ 100% intrinsic error value /10 K

**Safety requirements acc. to EN 61010-1** [1)]
- circuit-to-circuit insulation basic
- installation category III
- pollution grade 2
- maximum phase-to-earth operating voltage:

- for supply circuit, output 300 V
- for input circuits 50 V
- altitude a.s.l. below 2000 m

**Electromagnetic compatibility:**

- noise immunity, acc. to standard EN 61000-6-2
- noise emission, acc. to standard EN 61000-6-4

## 14. Controller ordering code

The way of coding is given in the table 13.

Versions and ordering Table 13

| **RE70 controller –** | | ***XX*** | ***X*** | ***X*** |
|---|---|---|---|---|
| Version | standard | 00 | | |
| | custom-made * | XX | | |
| Language version | Polish | | P | |
| | English | | E | |
| | other * | | X | |
| acceptance tests | without extra quality requirements | | | 0 |
| | with quality inspection certificate | | | 1 |
| | according to buyer's specification * | | | X |

* after agreeing with the manufacturer

**LUMEL S.A.**
ul. Słubicka 1, 65-127 Zielona Góra, Poland

Tel.: (48-68) 45 75 100
Fax: (48-68) 45 75 508
e-mail:lumel@lumel.com.pl
http://www.lumel.com.pl

**Export Department**:
Tel.: (48-68) 45 75 302
Fax: (48-68) 32 54 091
e-mail: export@lumel.com.pl

RE70-09