

# **CONTROLLER 48x96mm**

# **RE82**



**USER'S MANUAL** 

CE

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(program version 2.14)

#### 1. APPLICATION

The RE82 controller is destined for the temperature control in plastics, food, dehydration industries and everywhere when the temperature change stabilization is necessary.

The measuring input is universal for resistance thermometers (RTD), thermocouple sensors (TC), or for linear standard signals.

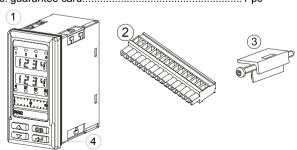
The controller has four outputs enabling the two-step control, step-by-step three-step control, three-step control of heating-cooling type and alarm signaling. The two-step control is acc. to the PID or ON-OFF algorithm.

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

## 2. CONTROLLER SET

The delivered controller set is composed of

1. RE82 controller	1 pc
2. plug with 16 screw terminals	. 2 pcs
3. screw clamp to fix the controller in the panel	. 4 pcs
4. seal	1 pc
5. user's manual	1 pcs
6 quarantee card	1 nc



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

5

# BASIC REQUIREMENTS, OPERATIONAL SAFETY

In the safety service scope, the controller meets to requirements of the EN 61010-1 standard.

#### **Observations Concerning the Operational Safety:**

- All operations concerning transport, installation, and commissioning as well as maintenance, must be carried out by qualified, skilled personnel, and national regulations for the prevention of accidents must be observed.
- Before switching the controller on, one must check the correctness of connections to the network.
- Do not connect the controller to the network through an autotransformer.
- The removal of the controller casing during the guarantee contract period may cause its cancellation.
- The controller fulfills requirements related to electromagnetic compatibility in the industrial environment
- When connecting the supply, one must remember that a switch or a circuit-breaker should be installed in the room. This switch should be located near the device, easy accessible by the operator, and suitably marked as an element switching the controller off.
- Non-authorized removal of the casing, inappropriate use, incorrect installation or operation, create the risk of injury to personnel or controller damage.

For more detailed information, please study the User's Manual.

#### 4 INSTALLATION

#### 4.1. Controller Installation

Fix the controller in the panel, which the thickness should

not exceed 15 mm, by means of four screw clamps acc. to the fig. 1. The panel cut-out should have  $45^{+0.6}$  x  $92^{+0.6}$  mm.

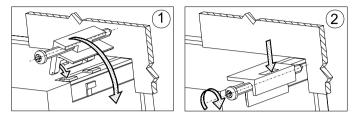


Fig.1 Controller fixing in the panel

RE82 controller overall dimensions are presented on the fig. 2.

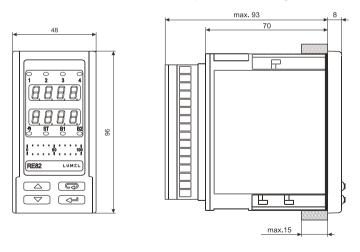


Fig. 2. Controller dimensions.

#### 4.2. Electrical Connections

The controller has two separable terminal strips with screw terminals. Strips enable to connect all signals by a wire of 2.5 mm<sup>2</sup> cross-section.

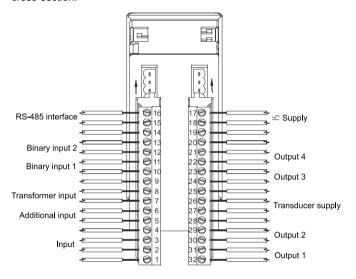
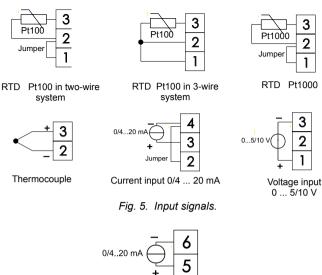


Fig. 3. View of controller connecting strips.



Fig. 4. Supply.



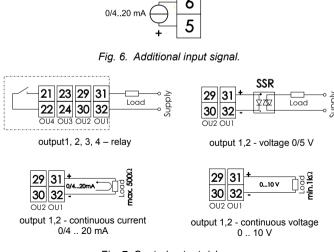


Fig. 7. Control outputs/alarm.



Fig. 8. Binary input 1 and 2



Fig. 9. Current transformer input.



Fig. 10. RS-485 Interface

Fig. 11. Transducer supply 24V

#### 4.3. Installation Recommendations

In order to obtain a full fastness against electromagnetic noise, it is recommended to observe following principles:

- 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 as above.
- all shields should be one-side earthed or connected to the protection wire, the nearest possible to the controller.
- apply the general principle, that wires leading different signals should be led at the maximal distance between them (no less than 30 cm), and the crossing of these groups of wires made at right angle (90°).

#### 5 STARTING TO WORK

After turning the supply on, the controller carries out the display test, displays the rE82, inscription, the program version and next, displays the measured and set value.

A character message informing about abnormalities may appear on the display (table 18).

The PID control algorithm with the proportional range 30°C, a 300 seconds' integration time constant, a 60 seconds' differentiation time constant and a 20 seconds' pulse period are set by the manufacturer.

# Changing the Set Point Value

One can change the set point value by pressing the 
or
(push-button (fig. 12). The beginning of change is signaled by the
flickering dot of the lower display. One must accept the new set point
value by holding down the 
push-button during 30 seconds since
the last pressure of the 
or
push-button. In the contrary, the
old value will be restored. The change limitation is set by parameters
581.1 and 581.8

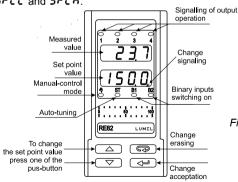
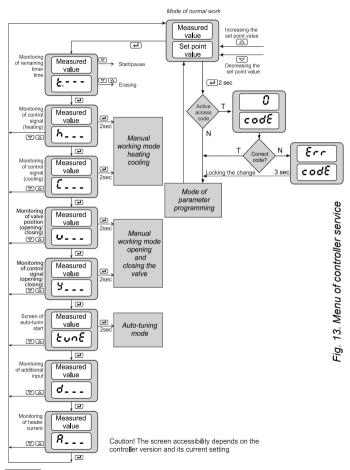


Fig. 12. Fast change of set point value

### 6. SERVICE

#### The controller service is presented on the fig. 13



## 6.1. Programming Controller Parameters

The pressure and holding down the push-button during ca 2 sec. causes the entry in 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 the possibility of changes.

The fig 14. presents the transition matrix in the programming mode. The transition between levels is carrying out by means of of or on, push-buttons and the level selection by means of the push-button. After selecting the level, the transition between parameters is carried out by means of or or push-buttons. In order to change the parameter setting, one must proceed acc. to the section 6.3. In order to exit from the selected level, one must transit between parameters until the symbol [. . .] appears and press the push-button.

In order to exit from the programming matrix to the normal working mode, one must transit between levels until the symbol [. . .] appears and press the push-button.

 $\label{eq:Some controller parameters can be invisible -- it depends on the current configuration.$ 

The table 1 includes the description of parameters. The return to the normal working mode follows automatically after 30 seconds since the last push-button pressure.

# 6.2. Programming matrix

	_		-						
inP		10.68	d۶	10.60	i n.Hi	SH: F	15.53	885	, 5.Lo
Input para- meters	Unit	Kind of main input	Pos. of decimal point	Indic. of lower thre- eshold	Indic. of higher thre- eshold	Shift of mea- sured value	Kind of auxil- liary input	Pos. of decimal point	Indic. of lower thre- eshold
٥٥٤٩	00E 1	0 16 9	0062	o254	out 3	0084	FR IL Ctr	4FL	Y∴H Upper
Output para- meters	Function of output 1	Type of output 1	Fun- ction of output 2	Type of output 2	Fun- ction of output 3	Fun- ction of output 4	signal type when defec- ted	State signal when- FR IL= YFL	limit of the mean value
ctri	8LG	EYPE	ну	Ho.	ε.άυο	Ł.ńuc	ñnt.u	4-10	y-H.
Control para- meters	Control algo- -rithm	Kind of control	Hyste- resis	Deed zone	Valve open- ning time	Valve closing time	Valve min, operation time	Min. control signal	Max. control signal
Pi d		Submen	u: Pr & I		Submen P. d3,	u: Pr d2, Pr d4	Sı	ıbmenu: 🔑	<b>β</b> ξ
PID Para-	Рь	٤٠	೬ರ	40			PbC	ی، ع	٤٥٤
meters	Propor- tional band	Integra- tion time constant	Different time constant	Correc- tion of control signal		eters as PID1	Propor- tional band	Inte- gration time con- stant	Diffrent time con- stant
8L8r	R ISP	R Idu	ล เหร	RILE	RESP .	821.6	8352	. 831.6	RYSP RYLE
Alarm para- meters	Set value for alarm 1	Devia- tion for alarm 1	Hyste- resis for alarm 1	Memory of alarm 1	alaı	eters of m 2 alarm 1)	alar	eters of m 3 alarm 1)	Param. of alarm 4 (as for alarm 1)
SPP Parame-	SPAd	E.Pr.G	SP	SP2	523	SPY	SPL	SPH	SP.c.c
ters of set-point value	Kind of set-point value	Program No to carry out	Set value SP	Set value SP2	Set value SP3	Set value SP4	Lower limita- tion SP	Upper limita- tion SP	Accre- tion rate of set value
Pr L Pro- gramm control parame- ters	Descrip- tion in program- ming control chapter								
r Etr Re-	RaFn	Rolo Lower	RoH.	٠٠.					
trans- mis- sion param.	Retrans- mis. function	retrans- mis. thre- eshold	Lower retrans- mis. thre- eshold	Transit to higher level					
intE	Rddr	ხჩაძ	Prot						
Inter- face param.	Contro- ller address	Baud rate	Trans- mis. protocol	Transit to higher level					
SEru	SECU	SEFn	t inc	٤٠٨٤	ح، ۵	dC E	tout	68r I	68r2
Ser- vice param.	Access code	Auto- tuning function	Timer function	Count down of timer time	View of auxil- liary output	View of the heater current	Exit time from view	Fun- ction of upper bar- graph	Function of lower bargraph

Fig. 14. Programming matrix

Indic. of higer thre- eshold	File Time constant of filter	ხი / Binary input 1 function	ಕಿಎ ಕ Binary input 2 function	⇒ Transit of higher level						
L.Yn Max sys. deviation when calc. mean value	εο / Pulse time out1	₽ulse time out2	Eo3 Pulse time out3	Eo Y Pulse time out4	or Transit of higher level					
GŁ Y Gain Schedul" function	Number of PID for GS	EL 12 Switching level PID1-2	EL 23 Switching level PID2-3	E.L 34 Switching level PID3-4	Con- stant PID set	St.L o Lower thres- -hold ST	St.H , Upper thres- -hold ST	Fdb Re- ver- sible signal	Vale position when auxiliary input error	Transit to higher level

∵... Transit to higher level

845P 84LE	አ <u>ል</u> SP	<i></i>	o55P	o S.H.Y	
Parameters of alarm 4 (as for alarm 1)	Set value of current alarm	Hyste- resis of current alarm	Set value of current alarm	Hyste- resis of current alarm	Transit to higher level

bart	barh	
Lower threeshold for bar- graph	Upper thre- eshold for bargraph	

# 6.3. Setting Change

The change of the parameter setting begins after pressing the push-button during the display of the parameter name. The setting selection is carried out through and push-buttons, and accepted by the push-button. The change cancellation follows after pressing of push-button or automatically after 30 sec since the last push-button pressure.

The way to change the setting is shown on the fig. 15.

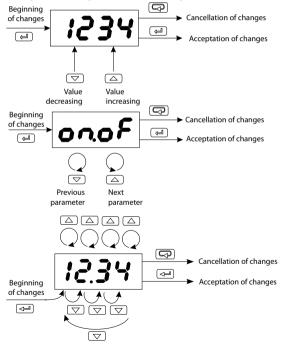


Fig. 15. Change of number, text and time parameter settings.

# 6.4. Parameter Description

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

List of configuration parameters

Table 1

Para-	meter Parameter turer		Range of para	meter changes			
symbol			Sensors	Linear input			
• <b>၈</b> – Inpu	n nP – Input parameters						
טחי ל	Unit	٥٤	°C: Celsius deg °F: Fahrenheit °PU: Physical un	degrees			
, 4F3	Kind of main input	PE !	Pt I: Pt100 Pt I0: Pt1000 t - J: thermocol t - E: thermocol - C:	uple T uple K uple S uple R uple B uple E uple E uple L rrent  age 0-5 V			
ਰ <b>ਿ</b>	Position of the main input deci- mal point	I- dP	O.dP: without decimal point  I.dP: 1 decimal place	O-dP:without decimal point I-dP: 1 decimal point point C-dP: 2 decimal point			

into	Indication for the lower threshold of the linear main input	0.0	-	-19999999 1)
, v.H.	Indication for the upper threshold of the linear main input	100.0	-	-19999999 1)
SH: F	Measured value shift of the main input	0.0 °C	-100.0100.0 °C (-180.0180.0 °F)	-999999 1)
· 5:5 3	Kind of the auxiliary input	4-20	<b>0-20</b> : linear cu <b>4-20</b> : linear cu	
dP2	Position of the decimal point	I-dP	-	C. dP: without decimal point i.dP: 1 decimal point 2.dP: 2 decimal point
, 2Lo	Indication for the lower threshold of the auxiliary linear input	0.0	-	-19999999 1)
, 2H,	Indication for the upper threshold of the auxiliary linear input	100.0	-	-19999999 1)
۶. ۱. ٤	Time constant of the filter	0.5	of F: filter disa 0.2: time const 0.5: time constan 2: time constan 5: time constan 10: time constant 10: time 10: time constant 1	eant 0.2 s ant 0.5 s t 1 s t 2 s t 5 s int 10 s int 20 s int 50 s

b~ 1	Function of the binary input 1	nonE	none: none StoP: control stop MRnd: switching into manual working SP2: switching SP1 into SP2 SRb: erasing of timer alarm PSbR: program start PnSb: jump to the next segment PMLd: stopping to count the set point in the program SP-d: decreasing of the set point value SP-u: increasing of the set point value set point increasing of the set point value
b~ €	Function of the binary input 2	nonE	none: none StoP: control stop WRad: switching into manual working SP2: switching SP1 into SP2 r SR2: erasing of timer alarm PS54: program start Pa52: jump to the next segment PKL d: stopping to count the set point in the program SP-d: decreasing of the set point value SP-u: increasing of the set point value switching SP into additional input value
006P - Ot	utput parameters		
out i	Function of output 1	у	of F: without function S: control signal heating or control signal, "open" for analog valve SOP: control signal for the stepper control - opening5) SCL: control signal for the stepper control - closing5) CooL: control signal - cooling or control signal, "close" for analog valve RH: upper absolute alarm RLo: lower absolute alarm

			dult: upper relative alarm dul o: lower relative alarm dul o: lower relative alarm dul o: inner relative alarm dul o: inner relative alarm RLL-: timer alarm rEL-: tetransmission6) Eul: auxiliary output for the program-following control Eul: auxiliary output for the program-following control Eul: auxiliary output for the program-following control RLFL: alarm in case of sensor failure or exceeding the measuring range
o 1.89	Type of output 1	<b>4-∂0</b> 2)	r & L 9: relay output 55r: voltage output 0/5 V Y - 20: continuous current output 4 – 20 mA 0 - 20: continuous current output 0 – 20 mA 0 - 10: continuous voltage output 0 – 10 V
out?	Function of output 2	off	off: without function  3: control signal heating or control signal "open" for analog valve  \$CP: control signal for the stepper control – opening5)  \$CL: control signal for the stepper control - closing5)  CooL: control signal - cooling or control signal "close" for analog valve  RM: upper absolute alarm  RLo: lower absolute alarm  duM: upper relative alarm  duM: upper relative alarm  duM: inner relative alarm  duM: o: lower relative alarm  duM: controlling elarm  RLbc: timer alarm  RLbc: controlling element  damage alarm (short circuit)  CEL: auxiliary output for the program-following control

			Eu2: auxiliary output for the program-following control Eu3: auxiliary output for the program-following control RLFL: alarm in case of sensor failure or exceeding the measuring range
o2£3	Type of output 2	4-20 <sup>2)</sup>	r & L Y: relay output 55r: voltage output 0/5 V Y - 20: current continuous output 4 - 20 mA 0 - 20: current continuous output 0 - 20 mA 0 - 10: voltage continuous output 0 - 10 V
out3	Function of output 3	oFF	off: without function 3: control signal heating or control signal nopen" for analog valve 306: control signal for the stepper control - opening5) \$\foat{L}: control signal for the stepper control - closing5) \$\foat{L}: control signal - cooling or control signal - cooling or control signal golary  8th: upper absolute alarm 8th: upper absolute alarm  8th: upper relative alarm  9th: upper relative alarm  9th: inner relative alarm  9th: inner relative alarm  9th: beater damage alarm  8th: be heater damage alarm  8th: controlling element  9th: auxiliary output for the program-following control  \$\foat{Eu}: alarm in case of sensor failure or exceeding the measuring range

00£4	Function of output 4	off	oFF: without function S: control signal heating or control signal heating for analog valve SOP: control signal for the stepper control - opening5) SCL: control signal for the stepper control - closing5) CooL: control signal - cooling or control relative alarm sLo: lower absolute alarm dun: inper relative alarm dun: inper relative alarm sLo: lower relative alarm sLo: timer alarm sLo: controlling element damage alarm (short circuit)  Eul: auxiliary output for the program-following control Eu2: auxiliary output for the program-following control suxiliary output for the program-following control
FRIL	Selection of the control signal of the output for proportional control in case of a sensor failure or for program control in case of control stoppage 7)		measuring range  off- the output is turned off  sfl- the output takes the value set with the sfl parameter  nean - the output takes the mean value. The maximum allowable value of the control signal at the output can be de- fined with the snh parameter. The mean value is measured at 1-minute intervals and only when the system deviation is lower than the l.sn parameter

yf L	Value of the control signal in case when FR IL = 3FL	0.0	0.0	100.0
SAH	Upper mean vaule limit	5.0 %	0.0	.100.0
L.Yñ	Maximum system deviation when calculating mean value	8.0	0.0999.9	
to!	Pulse period of output 1	20.0 s	0.599.9 s	
٤٥٤	Pulse period of output 2	20.0 s	0.599.9 s	
603	Pulse period of output 3	20.0 s	0.599.9 s	
६०४	Pulse period of output 4	20.0 s	0.599.9 s	
ctrl - Co	ontrol parameters			
AL G	Control algorithm	P. d	P. d: control a	algorithm on-off Igorithm PID
<i>೬ ሄዮ६</i>	Kind of control	, 20	d. c: direct co	ntrol (cooling) control (heating)
ну	Hysteresis	1.1 °C	0.2100.0 °C (0.2180.0 °F)	
Ho	Displacement zone for heating- cooling control for dead zone for stepper control.	0.4 °C	0.0100.0 °C (0.0180.0 °F)	0999 1)
Łńuo	Valve open time	60.0 s	3.0600.0 s	
tinuc	Valve close time	60.0 s	3.0600.0 s	
ñnt.u	Minimum valve work time	0.2 s	0.1	.99.9 s
¥-10	Minimum control signal	0,0 %	0.0	100.0 %

y-H,	Maximum control signal	100.0 %	0.0100.0 %
CFA	"Gain Schedu- ling" function	off	oFF: disabled SP: from the set point value SEE: constant PID set
G.Snb	Number of PID sets for "Gain Scheduling" from the set point value	2	∂: 2 PID sets       ∂: 3 PID sets       ∀: 4 PID sets
CT 15	Switching levels for PID1 and PID 2 sets	0.0	MINMAX 3)
CL 23	Switching levels for PID2 and PID 3 sets	0.0	MINMAX 3)
GL 34	Switching levels for PID3 and PID 4 sets	0.0	MINMAX 3)
üsee	Selection of the constant PID set	የ. ሪ !	P. d 1: PID1 sets P. d2: PID2 sets P. d3: PID3 sets P. d4: PID4 sets
Stio	Lower threshold for auto-tuning	0.0 °C	MINMAX 3)
SŁ.H.	Upper threshold for auto-tuning	800.0 °C	MINMAX 3)
Fdb	Stepper control algorithm type	no	se: algorithm without feedback \$\mathbf{y}\mathbf{E}\mathbf{S}: algorithm with feedback
, EFL	Valve position, when auxiliary input error	o_CL	υ_CL: valve closing υ_αP: valve opening υ_αο: valve position unchanged

P. d - PID parameters				
	РЬ	Proportional band	30.0 °C	0.1550.0 °C (0.1990.0 °F)
	٠	Integration time constant	300 s	09999 s
P. d !	۶۵	Differentia- tion time constant	60.0 s	0.02500 s
	40	Correction of the command signal, for P or control type PD	0.0 %	0100.0 %
P. 62	205 F 95 F 1 5 5 9 5	Second set of PID para- meters	as PB, TI, TD, Y0	
P. d3	203 543 543 543	Third set of PID para- meters	as PB, TI, TD, Y0	
P. 84	204 594 594 594	Fourth set of PID para- meters	as PB, TI, TD, Y0	
P, d[	<i>የ</i> ቴር	Proportional range for cooling loop (in relation to PB)	100.0 % 0.1200 %	
,,,,,	٤٠٤	Integration time constant	300 s	09999 s
	<b>৮</b> ሪር	Differentia- tion time constant	60.0 s	0.02500 s

RLAr - Al	Re – Alarm parameters		
R 1.5P	Set point value for absolute alarm1	100.0	MINMAX 3)
R 1.du	Deviation from the set point va- lue for relative alarm 1	2.0 °C	-200.0 200.0 °C (-360.0 360.0 °F)
R 1.HY	Hysteresis for alarm 1	1.0 °C	0.2100.0 °C (0.2180.0 °F)
R I.LE	Memory of alarm 1	off	off: disabled
RESP	Set point value for absolute alarm 2	100.0	MINMAX 3)
R2.du	Deviation from the set point value for relative alarm 2	2.0 °C	-200.0 200.0 °C (-360.0 360.0 °F)
ลรหร	Hysteresis for alarm 2	1.0 °C	0.2100.0 °C (0.2180.0 °F)
85LE	Memory of alarm 2	off	off: disabled
R35P	Set point value for absolute alarm 3	100.0 °C	MINMAX 3)
83.60	Deviation from the set point va- lue for relative alarm 3	2.0 °C	-200.0 200.0 °C (-360.0 360.0 °F)
язну	Hysteresis for alarm 3	1.0 °C	0.2100.0 °C (0.2180.0 °F)
A3L E	Memory of alarm 3	off	off: disabled
ลนรค	Set point value for absolute alarm 4	100.0 °C	MINMAX 3)

84du	Deviation from the set point value for relative alarm 4	2.0 ℃	-200.0 200.0 °C (-360.0 360.0 °F)
ลฯหร	Hysteresis for alarm 4	1.0 °C	0.2100.0 °C (0.2180.0 °F)
RYLE	Memory of alarm 4	off	off: disabled
<i>አ</i> ል5ዖ	Set point for the heater damage alarm	0.0 A	0.050.0 A
<i></i>	Hysteresis for the heater damage alarm	0.1 A	0.150.0 A
o5.5 <i>P</i>	Set point for the controlling element damage alarm (short-circuit)	0.0 A	0,050.0 A
oS#Y	Hysteresis for the controlling element dama- ge alarm (short- -circuit)	0.1 A	0.150.0 A
<b>5PP</b> – Set	point value paramet	ers	
SP.nd	Kind of set point value	SP 1.∂	5P 1.2: set point value SP1 or SP2 c.n. a: set point value with soft start in units per minute c.Hc: set point value with soft start in units per hour color set point value from the additional input Pc 5: set point value from programming control 5P. a: set point value SP or from the additional input
CPrG	Program No to carry out	1	115
SP	Set point value SP	0.0 °C	MINMAX 3)

SP2	Set point value SP2	0.0 °C	MINMAX 3)	
S <i>P3</i>	Set point value SP3	0,0 °C	MINMAX 3)	
SPY	Set point value SP4	0.0 °C	MINMAX 3)	
SPL	Lower limitation of the set point value change	-200 °C	MINMAX <sup>3)</sup>	
SPH	Upper limitation of the set point value change	850 °C	MINMAX 3)	
SP.c.c	Accretion rate of the set point va- lue SP1 or SP2 during the soft start.	0.0 °C	0999.9 / time unit 4)	09999 <sup>1)</sup> / time unit <sup>4</sup> )
<b>ዖ</b> - <b>6</b> – Pro	gramming control pa	arameters	,	
The descr	iption of parameters	is in the table 5	: Programming	control
, nt E - Se	erial interface param	eters		
Rddr	Device address	1	1247	
<i>ხ</i> ჩიძ	Baud rate	9.6	<b>48</b> : 4800 bit/s <b>96</b> : 9600 bit/s <b>19.2</b> : 19200 bit <b>38.4</b> : 38400 bit <b>5 16</b> : 57600 bit	t/s t/s t/s
Prot	Protocol	r8n2	2008: none 2008: RTU 8N 2008: RTU 8E 2008: RTU 8C 2008: RTU 8N	2  1  1  1
retr – Retransmission parameters				
RoFn	Quantity re- transmitted on the continuous output	Ρυ	SP: set poir	+ D\/

Ralo	Lower threshold of the signal to retransmit	0.0	MINMAX <sup>3)</sup>
Ro.H.	Upper threshold of the signal to retransmit	100.0	MINMAX 3)
<b>58-P</b> - Se	ervice parameters		
SECU	Access code to the menu	0	09999
St.Fn	Auto-tuning function	00	off: locked on: available
t. ñr	Timer function	off	off: disabled on: enabled
£1 ñ€	Recounting time by the Timer	30.0 min	0.1999.9 min
d, 2	Monitoring of the auxiliary input	off	off: disabled on: enabled
d€Ł	Monitoring of the heater current	oFF	off: disabled on: enabled
tout	Time of the automatic exit from the monitoring mode	30 s	09999 s
68r I	Function of the upper bargraph	Ρυ	Pu: measured value on the main input PV Pu2: measured value on the additional input PV2 SP: set point value 9 t: control signal on the output 1 92: control signal on the output 2 S-t-i: segment time P-t-i: program time
<i>68r2</i>	Function of the lower bargraph	SP	Pu: measured value on the main input PV Pu2: measured value on the additional input PV2 SP: set point value 9 t: control signal on the output 1 92: control signal on the output 2 S-tn: segment time P-tn: program time

bart	Lower threshold for bargraphs (for PV, PV2 and SP)	0 °C	MINMAX 3)
ьягн	Upper threshold for bargraphs (for PV, PV2 and SP)	850 °C	MINMAX 3)

- 1) The definition at which the given parameter is shown depends on the parameter  $d^{\rho}$  position of the decimal point.
- For the output 0/4...20 mA, parameter to write, for other cases, to readout acc. to the version code.
- 3) See table 2.
- 4) Time unit defined by the parameter **5P.nd** (r.n. n, r.Hr.).
- 5) Applies to binary output
- 6) Applies to analog output
- 7) For control 815 = one F and SFL <= 50%, control signal h = 0%, SFL > 50%, control signal h = 100%.

Caution! The accessibility of parameters depends on the controller version and its current settings.

Table 2

Symbol	Input/ sensor	MIN	MAX
PE 1	Thermoresistor Pt100	-200 °C (-328 °F)	850 °C (1562 °F)
PE 10	thermoresistor Pt1000	-200 °C (-328 °F)	850 °C (1562 °F)
£-J	Thermocouple of J type	-100 °C (-148 °F)	1200 °C (2192 °F)
£ - £	Thermocouple of T type	-100 °C (-148 °F)	400 °C (752 °F)
٤-٤	Thermocouple of K type	-100 °C (-148 °F)	1372 °C (2501,6 °F)
£-5	Thermocouple of S type	0 °C (32 °F)	1767 °C (3212,6 °F)
£	Thermocouple of R type	0 °C (32 °F)	1767 °C (3212,6 °F)
£-6	Thermocouple of B type	0 °C (32 °F)	1767 °C (3212,6 °F)
ε-E	Thermocouple of E type	-100 °C (-148 °F)	1000 °C (1832 °F)
£-∩	Thermocouple of N type	-100 °C (-148 °F)	1300 °C (2372 °F)
£ - L	Thermocouple of L type	-100 °C (-148 °F)	800 °C (1472 °F)
0-20	Linear current 0-20mA	-1999 1)	9999 1)
4-20	Linear current 4-20 mA	-1999 1)	9999 1)
0-10	Linear voltage 0-10 V	-1999 1)	9999 1)

<sup>1)</sup> The definition at which the given parameter is shown depends on the parameter *dP* – position of the decimal point.

#### 7. CONTROLLER INPUTS AND OUTPUTS

# 7.1. Main Measuring Inputs

The main input is the source of measured value taking part in control and alarms.

The main input is an universal input, to which one can connect different types of sensors or standard signals. The selection of the input signal type is made by the parameter . at 9.

The position of the decimal point which defines the display format of the measured and the set point value is set by the parameter dP. For linear inputs, one must set the indication for the lower and upper analog input threshold d and d and d and d.

The correction of the measured value indication is carried out by the parameter  $\mathbf{5}\mathbf{h}$ ,  $\mathbf{F}$ .

# 7.2. Additional Measuring Inputs

The additional input is a linear input. The selection of the input signal type is possible between 0...20 mA and 4...20 mA by the parameter  $\cdot$  2.8  $\cdot$  3. The position of decimal point which defines the display format of the measured and set point value is set by the parameter  $\cdot$  2.8  $\cdot$  0.0 must also set the indication for the lower and upper analog input threshold  $\cdot$  2.8  $\cdot$  and  $\cdot$  2.8  $\cdot$  .

The signal from the additional input is displayed with the character "d" on the first position. To display the value, one must hold down

the push-button till the moment of its appearance on the lower display (acc. to the fig. 13.) The return to display the set point value is set by the manufacturer for 30 sec, but it can be changed, or disabled by the parameter <code>kout</code>.

# 7.3. Binary Inputs

Functions of binary input are set by box l and box 2 parameters. For each input must be set a different function.

Following binary input functions are available:

- without functions the binary input state does not influence the controller operation,
- control stop the control is interrupted, and control outputs are behaved as after a sensor damage, alarm and retransmission operate independently,
- switching on manual operation transition to the manual control mode'
- switching SP on SP2 change of the set point value during the control.
- erasing of the timer alarm disabling of the relay responsible for the timer alarm,
- program start the programming control process begins (after a prior set of the programming control),
- **jump to the next segment** the transition to the next segment follows, during the duration of the programming control
- stoppage to count the set point value in the program the stoppage of set point value counting follows, during the duration of the programming control

- change of the set point value after the configuration of two inputs, one for decreasing and one for decreasing the set point value, one can replace the change by upward and downward pushbuttons for changing through binary inputs,
- **switching SP on IN2** change the set point value during the control between the SP and the value of the additional input (58.5d parameter must be set to 58.5d, the other binary input cannot have set the function **switching SP on SP2**).

## 7.4. Outputs

The controller has four outputs. Each of them can be configured as a control or an alarm output.

For the proportional control (with the exception of analog outputs), the pulse period is set additionally.

The pulse period is the time which goes by between successive switches of the output during the proportional control. The length of the pulse period must be chosen depending on dynamic object properties and suitably for the output device. For fast processes, it is recommended to use SSR relays. The relay output is used to steer contactors in slow-changing processes. The application of a high pulse period to steer fast-changing processes can give unwanted effects in the shape of oscillations. In theory, lowest the pulse period, better the control, but for a relay output it can be as large as possible in order to prolong the relay life.

Recommendations concerning the pulse period:

Table 3

Output	Pulse period	Load
Electromagnetic relay	Recommended >20 s, min. 10 s	2 A/230 V a.c.
Telay	min. 5 s	1 A/230 V a.c.
Transistor output	13 s	SSR relay

#### 8.1. ON-OFF Control

When a great accuracy of temperature control is not required, especially for objects with a great time constant and small delay, one can apply the on-off control with hysteresis.

Advantages of this way of control are simplicity and liability, but disadvantage is the appearance of oscillations, even at small hysteresis values.

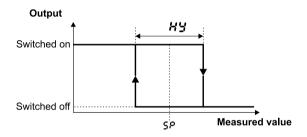


Fig. 16. Operation way of the heating output type

# 8.2. Innovative SMART PID algorithm

When a high accuracy of the temperature control is required, one must use the PID algorithm.

The applied innovative SMART PID algorithm is characterized by an increased accuracy for a widen class range of controlled objects.

The controller tuning of the object consists on the manual setting of the proportional element value, integration element, differentiation element, or automatically – by means of the auto-tuning function.

#### 8.2.1. Auto-tuning

The controller has the function to select PID settings. These settings ensure in most of case an optimal control.

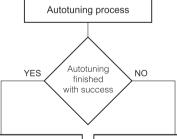
To begin the auto-tuning, one must transit to the <code>tunf</code> (acc. to the fig. 13) and hold down the push-button during at least 2 seconds. If the control algorithm is set on on-off or the auto-tuning function is locked, then the <code>tunf</code> message will be hidden.

For the correct execution of the auto-tuning function, the setting of 5£.L o and 5£.R parameters is required. One must set the 5£.L o parameter on the value corresponding to the measured value at the switched off control. For object temperature control, one can set 0°C.

One must set the 5£.H. parameter on the value corresponding to the maximum measured value when the control is switched on the full power.

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

The auto-tuning is composed of following stages:



- calculation of PID settings and stored them in the non-volatile memory,
- beginning of PID control with new settings
- the error code is on the display, one must confirm it,
- transition to the manual work mode.

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

If the auto-tuning is not achieved with success, the error code acc. to the table 4 will be displayed.

Error codes for auto-tuning

Table 4

Error code	Reason	How to proceed
€ 5.0 †	P or PD control was selected.	One must select PI, PID control, i.e. the TI element must be higher than zero.
€5.0≥	The set point value is incorrect.	One must change the temperature set-point or parameters \$\foldsymbol{\xi}\text{E}\to\text{S}\to\text{E}\to\text{N}\to\text{S}\to\text{E}\to\text{D}\text{S}\to\text{E}\to\text{D}\to\text{S}\text{E}\to\text{N}\to\text{E}\to\text{D}\to\text{S}\to\text{E}\to\text{E}\to\text{D}\to\text{S}\to\text{E}\t
E 5.03	The push-button was pressed.	
E 5.04	The maximal duration time of auto-tuning was exceeded.	Check if the temperature sensor is correctly placed and if
€ 5.0 S	The waiting time for switching was exceeded.	the set point value is not set too higher for the given object.
£5.06	The measuring input range was exceeded.	Pay attention for the sensor connection way. Do not allow that an over-regulation could cause the exceeding of the input measuring range.
€ S.20	Very non-linear object, making impossible to obtain correct PID parameter values, or noises have occurred.	Carry out the auto-tuning again. If that does not help, select manually PID parameters.

# 8.2.2. Auto-tuning and "Gain Scheduling"

In case, when "Gain Scheduling" is used, one can carry out the auto-tuning in two ways.

The first way consist on choosing a suitable set of PID parameters, in which calculated PID parameters will be stored and realizing the autotuning on the level of the currently chosen set point value for the fixed set point control. One must set the *GEY* parameter on set, and choose Gset between *Pod I* and *PodY*.

The second way enables the automatic realization of the auto-tuning for all PID sets. One must set the GEY parameter on SP, and choose the number of PID sets for setting – parameter GSnb. Set point values for individual PID sets must be give in SP, SPP, SPP, SPP parameters, from the lowest to the highest.

# 8.2.3. Proceeding Way in Case of a Dissatisfying PID Control

The best way to select PID parameters is to change the value into a twice higher or into a twice lower. During changes, one must respect following principles:

## a) Oscillations:

- increase the proportional band,
- increase the integration time,
- increase the differentiation time.

### b) Over-regulations:

increase the proportional band,

- increase the differentiation time,
- increase the integration time.

## c) Instability:

- increase the proportional band,
- increase the differentiation time.

## d) Free jump response:

- decrease the proportional band,
- decrease the integration time.

Run of controlled		Algorithms of controller operations				
value	Р	PD	Р	PID		
x A CONTRACTOR OF THE PROPERTY	PbÎ	PbÎ td↓	Pb <sup>↑</sup>	Pb <sup>↑</sup> ti <sup>↑</sup> td↓		
× A The state of t	Pb↑	PbÎ tdÎ	Pb↑ ti↑	Pb↑ ti↑ td↑		
x A		Pb↓ td↓		Pb↓ td↓		
X A	Pb√	РЬ↓	ti↓	Pb√ ti√		

Fig. 17. Way to correct PID parameters.

## 8.3. Step-by-step control

The controller's step-by-step control algorithm without feedback was changed.

The description is provided below.

The controller offers two algorithms of the step-by-step control for cylinder control:

- with no feedback signal from the valve opening and closing of the valve is based on PID parameters and control deviation,
- with a feedback signal from the valve positioning device opening and closing of the valve is based on PID parameters, control deviation and valve position read from the additional input.

To select a step-by-step control, set one of the outputs out 1...out 1 to SOP and one of the outputs out 1...out 1 to SOE . For the algorithm with no feedback - the parameter FoL should be set to soE, for the algorithm with a feedback - the parameter FoL should be set to SOE. Additionally, set the insensitivity range for the set point, in which the valve does not change its position - the parameter SOE and select the set of PID parameters. Auto-tuning algorithm is not available for the step-by-step control.

For the algorithm with feedback signal the parameter  $\cdot$  2.F.L is available, that specifies the state of the valve when the feedback signal error on the secondary auxiliary input.

Step-by-step control with no feedback additionally requires the parameters settings: valve open time £āuo, valve close time £āuo, minimum valve work time āaɛu.

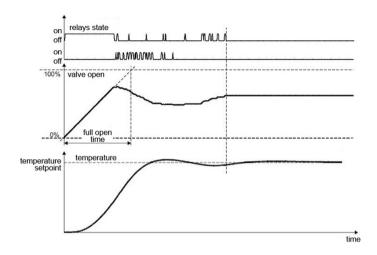


Fig. 18. Three-step step-by-step control with no feedback

The principle of the algorithm shown in Fig.18 is based on conversion of changing the control signal to the relay opening / closing time referred to the full opening / closing time.

The differences between the calculated and the actual valve position are unavoidable because of multiple changes in the direction of valve movement due to the inertia of a drive or its wear in the absence of a feedback. The controller uses the function of automatic positioning of a drive during operation to eliminate these differences. This function does not require user intervention and its function is to extend switching on time of the relay when the control signal reaches 0% or 100%.

The relay for opening / closing will remain on for a time equal to the time of a valve full open / close from a moment of a signal reaching 100% / 0%. The positioning of the valve will be stopped once the signal is different from the maximum value.

In the specific case, the positioning is performed by completely closing the valve, it is carried out each time after:

- turning the controller supply on
- changing full open / close time.

The time of full opening of the valve can have a different value than the time of closing.

Both parameters should be set to the same value when using a drive with identical times.

# 8.4. "Gain Scheduling" Function

For control systems, Where the object behaves decidedly differently in various temperatures, it is recommended to use the "Gain Scheduling" function. The controller allows to remember up to four sets of PID parameters and switch them over automatically. The switching between PID sets runs percussiveless and with hysteresis, in order to eliminate oscillations on switching limits.

The && 3 parameter settles the way of the function operation.

off	The function is disabled		
SP	a) Switching depending on the set point value. Additionally, one must also choose the number of PID sets - £5nb, parameter, and set their switching levels ££ 12, ££ 23, ££ 34. b) b) For the programmed control, one can set the PID set individually for each segment. Then for the given Prnn, program, in the PEFE group, one must set the Pid parameter on eq.		
SEŁ	Permanently setting of one PID set. The PID set is set through the £5££ parameter.		

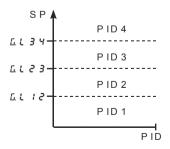


Fig 19. "Gain Scheduling" switched over from SP

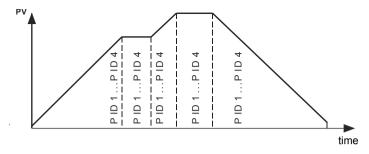


Fig. 20. "Gain Scheduling" switched over for each segment in the programmed control

# 8.5. Control of Heating-cooling Type

For the heating-cooling control, one of the outputs out !...out Y should be set to Y, one of the outputs out !...out Y should be set to Cool and the displacement zone Ho for cooling should be configured.

For the heating loop, the PID parameters should be configured: Pb, E, Ed, for the cooling loop the PID parameters: PbE, E, EdE. The parameter PbE is defined as the ratio of the Pb parameter from the range 0.1...200.0 %.

The pulse period for logic outputs (relay, SSR) is set independently for the heating and cooling loops (depending on the output, these are &o 1...&o4).

If there is the need to use the PID control in one loop and the ON-OFF control in the other loop, one output should be set to PID control and the other one upper relative alarm.

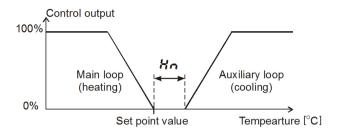
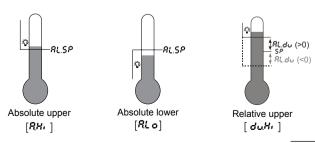


Fig.21. Control with two loops - heating-cooling type

## 9. ALARMS

Four alarms are available in the controller, which can be assigned: to each output. The alarm configuration requires the selection of the alarm kind through setting out!, out?, out? and out! parameters on the suitable type of alarm. Available types of alarms are given on the fig. 22.



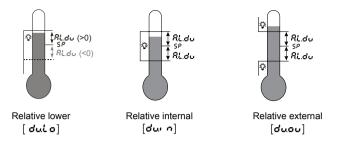


Fig. 22. Kinds of alarms

The set point value for absolute alarms is the value defined by the 8x.5P, parameter, and for relative alarms, it is the deviation from the set point value in the main loop - 8x.dv parameter. The alarm hysteresis, i.e. the zone around the set point value, in which the output state is not changed, is defined by the 8x.H9 parameter.

One can set the alarm latch, i.e. the memorizing of the alarm state after stopping alarm conditions (parameter 8x.t = on). The erasing of alarm memory can be made by the pressure of the push-button in the normal working mode or interface

## 10. TIMER FUNCTION

When reaching the set point temperature (SP) the timer begins the countdown of the time defined by the  $\xi \cdot \hat{n} \xi$  time parameter. After counting down to zero, the timer alarm is set, which remains active till the moment of the timer erasing.

To activate the timer function, one must set the parameter  $\dot{\epsilon}_{i}$ ,  $\dot{n}_{r} = o_{r}$ . To indicate the alarm state on an output, one of the outputs  $o_{i}\dot{\epsilon}_{i}$  should be set to  $RL\dot{\epsilon}_{r}$ .

The timer status/ remaining time is displayed with the mark "Ł" on the first position. To display it, one must press the push-button till the moment of it appearance on the lower display (acc. to the fig. 13).

The return to the set point value display is set by the manufacturer on 30 sec, but can be changed, or disabled using the <code>book</code> parameter.

Status	Description	Signaling
timer stopped		٤
Starting of the timer	- temperature over SP - Press the push-button	Remaining time in minutes: e.g. (£ 293)
Pause of the timer	Press the push-button	Flickering remaining time in minutes
End of the countdown	Reaching zero by the timer	£End
Timer erasing	During the countdown:  Press and pushbuttons	
Times erasing	After the countdown end: - press the  push-button - through the binary input	

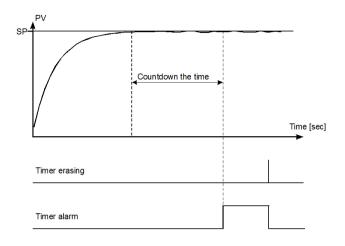


Fig.23. Principle of timer operation

# 11. CURRENT TRANSFORMER INPUT

After connecting the current transformer (CT-94-1 type), the measurement and display of the current flowing through the load steered by the output 1, is possible.

The first output must be of relay or voltage 0/5~V type. For the current counting, the minimal time of the output switching on must be at least  $200~\mathrm{ms}$ 

The transformer work range is equal 0 to 50 A. The heater current is displayed with the mark  $_{\rm N}$ 8" in the first position.

In order to display the heater current, one must press the push-button till the moment of it appearance on the lower display. The return to the set point value display in set by the manufacturer on 30 sec, but can be changed or disabled through the book parameter.

Two types of alarms concerning the heating element are available – the shorting alarm of the control element and the heater burnout alarm. The shorting alarm is realized by the current measurement when the control element is disabled, however the burnout alarm is realized when the control element is enabled.

The alarm configuration includes setting the alarm type. For the heater damage alarm out?...out 4=81.66, and for the controlling element damage alarm out? ... out 4=81.65. Remaining parameters to set are the alarm set point value 65.67, o 5.57 and the 65.85, o 5.85 hysteresis.



For a correct detection of the heater alarm burnout, the heating element cannot be connected later than the controller.

## 12. ADDITIONAL FUNCTIONS

## 12.1. Control Signal Monitoring

The control signal of heating type is displayed with the mark "b" on the first position, of cooling type is displayed with the mark "E". of valve opening or closing is displayed with the mark to the control signal depends The access on the suitabconfiguration. To display the signal. controller control one must press the push-button till the moment of its appearance on the lower display (acc. to the fig. 13). The return to the set point value display is set by the manufacturer on 30 sec. but it can be changed, or disabled through the book parameter.

### 12.2. Manual Control

The input to the manual control mode follows after holding down the -, push-button during the control signal display. The manual control is signaled by the pulsation of the LED diode. The controller interrupts the automatic control and begins the manual control of the output. The control signal value is on the lower display, preceded by the symbol  $_{n}$  $h^{n}$  – for the main loop and  $_{n}$  $h^{n}$  – for the auxiliary loop (cooling).

The push-button serves to transit between loops (if the heating – cooling control mode is selected).

The and push-buttons serve to change the control signal. The exit to the normal working mode follows after the pressure of push-button.

At set on-off control on the output 1 (parameter PB=0), one can set the control signal on 0% or 100% of the power, however when the PB parameter is higher than zero, one can set the control signal on any value from the range 0...100%.

# 12.3. Signal Retransmission

The continuous output can be used for the retransmission of selected value, e.g. in order to the temperature recording in the object or the set point value duplication in multi-zone furnaces.

The signal retransmission is possible if the output 1 or 2 is of continuous type. We begin the signal retransmission from setting the out or out parameter into retransmission from setting the upper and lower limit of the signal to be retransmitted (8 of o and 8 of ). The signal selection for retransmission is carried out through the 8 of o parameter.

The recounting method of the retransmitted parameter into a suitable analog signal is shown on the fig. 24.

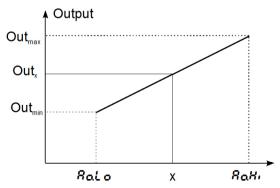


Fig. 24. Recounting of the signal for retransmission

The output signal is calculated acc. to the following formula.

$$out_x = out_{min} + (x - Ao.Lo) \frac{out_{max} - out_{min}}{Ao.Lo - Ao.Hi}$$

The **RoLo** parameter can be set as higher than **RoH**, but the output signal will be then inversed.

# 12.4. Set Point Change Rate - Soft Start

The limitation of the temperature accretion rate is carried out through the gradually change of the set point value. This function is activated after the controller supply connection and during the change of the set point value. This function allows to reach softly from the actual temperature to the set point value. One must write the accretion value in the 58cc, parameter and the time unit in the c8dc parameter. The accretion rate equals zero means that the soft start is disabled.

## 12.5. Digital Filter

In case when the measured value is instable, one can connect a programmed low-pass filter.

One must set the lowest time constant of the filter at which the measured value is stable. A high time constant can cause a control instability.

One can set the filter time constant F, LE from 0.2 up to 100 seconds.

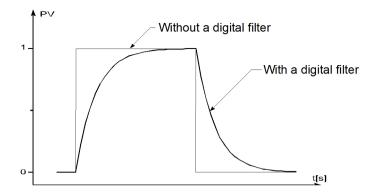


Fig. 25. Time characteristic of the filter

# 12.6. Manufacturer's Settings

Manufacturer's settings can be restored during the supply connection by holding down and push-buttons, till the moment when the F86c inscription appears on the higher display.

# 13. PROGRAMMING CONTROL

# 13.1. Description of Programming Control Parameters

List of configuration parameters

Table 5

Pr5 – Programming control						
Pr0 1	Sub-menu of the program no 1					
:						
Pr 15		Sub-men	u of the program	no 15		
	P.C.F.G	Sub-men	u of program par	ameters		
		Parameter symbol	Parameter	Manufac- turer's settings		parameter ange
		Parar	description	Manı ture setti	Sensors	Linear input
		Strt Way to begin the program		ಿ From t	ed by SP0	
		SP0	Initial set point value	0.0 °C	MINMAX	<b>(</b> 1)
		tion	Unit for the segment duration time	ñáSS	##.nn: ho	conds
		CC.U0	Unit for the accretion rate of the set point value	ñi n.	ຄົງ ຄ: minu Hour : hou	
		hold	Locking of the control deviation	d. 5	ರ 5: in: Lo: low H: : up ರಿಗಿಂದ: rev	/er per
		C 4C10	Number of program repetition	1	1999	

	FR. L	Control after the supply decay	Eont	Cont: program continuation  StoP: control stoppage and setting the steering signal on control output with the value from parameter F8 !L
	End	Control on the program end	Stop	StoP: Control stoppage and setting the steering signal on control output with the value from parameter FR !!  L.SP: fixed set point control with set point from the last segment.  E.SP: fixed set point control with set point from £ . 5P  SP !2: fixed set point control with set point from \$ . 5P  or SP ?
	E_SP	Set point value for the control after the program is completed	0,0 °C	MINMAX <sup>1)</sup>
	P. d	"Gain Scheduling" function for the program	off	oFF: disabled on: enabled
S & .0 1	Submenu of program parameters			
:	Submenu of program parameters			
S&. 15	Submenu of program parameters			

Parameter symbol	Parameter		Range of parameter change	
Para	description	Man -tu sel	sensors	linear input
<i>ዩ</i> ሄዎዩ	Kind of seg- ment			nent defined he time hent defined he accretion oint withstand am end
Ł.S <i>P</i>	Set point on the segment end	0.0 °C	MINMAX 1)	
£∙ ñ€	Segment duration	00.01	00.0199.5	9 <sup>2)</sup>
cc	Accretion rate of the set point	0.1	0.1550.0 °C / time unit <sup>4)</sup> (0.1990.0 °F / time unit <sup>4)</sup>	15500 °C <sup>3)</sup> / time unit <sup>4)</sup> (19900 °F <sup>3</sup> )/ time unit <sup>4)</sup>
HLdu	Value of the control devia- tion for which the counting of set point is interrupted	0.0	0.0 200.0 °C (0.0 360.0 °F)	02000 °C <sup>3)</sup> (03600°F <sup>3)</sup> )
Eu 1	State of the auxiliary output no 1	off	oFF: disabled	
€∪2	State of the auxiliary Output no 2	off	off: disabled	
€∪3	State of the auxiliary Output no 3	off	off: disabled	
P1 d	PID set for the segment	Pi d I	P. d 1: PID1 P. d2: PID2 P. d3: PID3 P. d4: PID4	

<sup>1)</sup> See table 2.

<sup>2)</sup> The time unit is defined by the parameter Enun

<sup>3)</sup> The resolution to show the given parameter depends on the parameter dP – position of decimal point.

<sup>4)</sup> The time unit is defined by the parameter ccoode

## 13.2. Definition of Set Point Value Programs

One can define 15 programs. The maximal number of segments in the program is equal to 15.

To render visible parameters related to the programming control in the menu, the parameter 5P.nd must be set on PrG. For each program, one must set parameters given in the submenu of program parameters. For each segment, one must select the kind of segment and next, parameters depending on the kind of segment acc. to the table 6. One must also set the output state (only when out 1...out 4 are set to 5t 1...out 1...ou

#### List of segment configuration parameters

Table 6

EUPE = E. AE	となわを = これとを	となやを = ぴぃをし	type = End
£.5 <i>P</i>	£.5 <i>P</i>	E: ñE	
Er ñE	cc		•
hldu	hldu		

The fig. 26 and the table 7 represent an example of set point value program. It is assumed in the program that the temperature in the object has to increase from the initial temperature in the object up to 800°C, with the rate of 20°C per minute, at the active locking from the deviation.

Next, during 120 minutes, the temperature is maintained (locking disabled), after that, the temperature has to decrease to  $50^{\circ}$ C during 100 minutes (locking disabled). During the object cooling, one must turn on the fan connected to the auxiliary output no 2 (parameter  $\circ \iota \iota \iota \iota$ ).

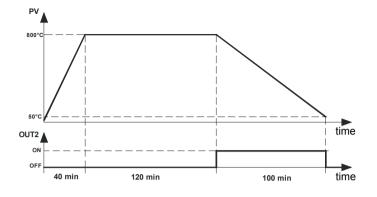


Fig. 26. Example of program

Parameter values for the example as above.

Table 7

	Parameter	Value	Meaning
	Strt	ρυ	Start to count the set point value from the current temperature
	دشوم	HH.ññ	Time unit: hour, minute
	רר.טח	ñi n	Unit for the accretion rate: minute
P.C.F.G	hold	bRnd	Locking for the program: active – two-sided
	CBCn	1	Number of program repetitions
	FR. L	cont	Program continuation after a supply decay
	End	Stop	Control stoppage after the program end

	£ 48£	-85E	Kind of segment: accretion rate
	£.5 <i>₽</i>	800.0	Target set point value: 800.0 °C
l	cc	20.0	Accretion rate 20.0 °C / minute
SE.0 1	hidu	50.0	Active locking, when the deviation exceeds 50.0 °C
	۱ ۵۵	off	Output 2 as the auxiliary output Ev1: disabled
	<i>٤ ሄ</i> ዖ ٤	duEL	Kind of segment: withstand of set point value
S£.02	4، بع	02.00	Segment time 2h00 = 120 minutes
	۱ ۵۵	off	Output 2 as the auxiliary output Ev1  – disabled
	FRE	٤، ۵٤	Kind of segment: accretion time
	£.5 <i>₽</i>	50.0	Target set point value: 50.0 °C
SŁ.03	8، بع	01.40	Segment time 1h40 = 100 minutes
	hidu	0.0	Inactive locking
	۱ ۵۶	on	Output 2 as the auxiliary output Ev1: enabled
	<i>೬ ሄ ዮ ୧</i>	End	Kind of segment: program end
SŁ.04	۱ ۵	off	Output 2 as the auxiliary output Ev1: disabled

# 13.3. Control of the Set Point Value Program

When the  $5P.\hat{n}d$  parameter is set on PrS, the controller controls the object in compliance with the set point value changing in time acc. to the given program. Before starting the control with the changeable set point value, one must select the required program (parameter E.PrS).

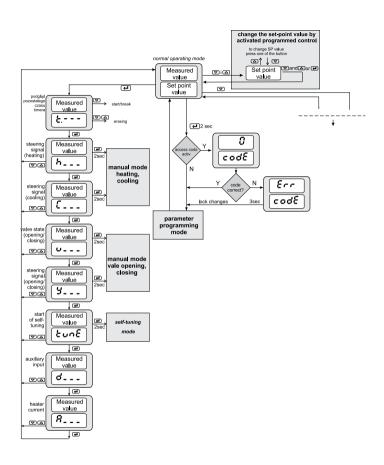
To start the program, one must press  $\bigcirc$  and  $\bigcirc$  , push-buttons when the **5** $\varepsilon$  or  $\varepsilon$  or  $\varepsilon$  inscription appears on the lower display (fig. 27).

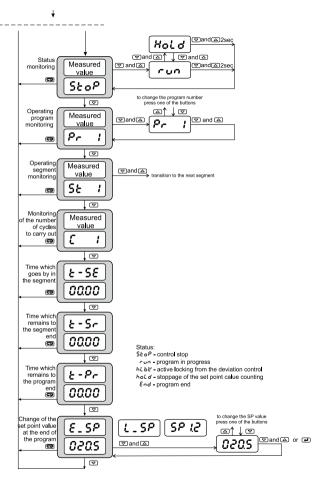
The lighted dot in the right corner of the lower display, means that the programming control is lasting. During the program duration, one can display parameters of the realized program, i.e. program status, program number, number of the operating segment, the number of cycles which still remains to carry out, time which goes by in the segment, time which remained to the end of the segment, time which remained to the program end.

After finishing the program the dot is gone out, or the program is renewed, if the number of the program repetition  $\mathcal{E}\mathcal{GL}_{\alpha}$  is higher than 1.

After finishing the control, auxiliary outputs are in the state defined by parameters – output state for the segment set as the program end.

When the parameter hold (locking in the program) is set on lo, lo, or blod and the locking value lold in the operating segment is higher than zero then, the size of the control deviation is controlled (set point value minus measured value). For lold to the locking is active, when the measured value is below the set point value diminished by the locking value. For lold the locking is active, when the measured value exceeds the set point value by the locking value. For lold lold the locking is active, as for the upper and lower locking. If the locking is active then, the counting of the set point value is interrupted, and the dot in the right corner is flickering. The controller controls acc. to the last calculated set point value.





# 14. RS-485 INTERFACE WITH MODBUS PROTOCOL

#### 14.1 Introduction

The RE82 controller is equipped with a serial interface in RS-485 standard, with implemented asynchronous communication protocol MODBUS.

The list of serial interface parameters for the RE82 controller:

- device address: 1..247,

- baud rate: 4800, 9600, 19200, 38400, 57600 bit/s,

- operating mode: RTU,

- information unit: 8N2, 8E1, 8O1, 8N1,

- data format: integer (16 bit), float (32 bit),

float (2x16 bit),

- maximal response time: 500 ms,

 maximal number of registers read out/ written by a single

Modbus frame: 116.

The RE82 controller realizes following protocol functions:

Table 8

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

#### 14.2. Error Codes

If the controller receives a request with a transmission or checksum error, the request will be ignored. For a request synthetically correct but with incorrect values, the controller will send an answer including the error code.

Possible error codes and their meanings are presented in the table 9.

#### Error codes

Table 9

Code	Meaning	Reason
01	forbidden function	The function is not serviced by the controller.
02	forbidden data address	The register address is beyond the range.
03	forbidden data value	The register value is beyond the range or the register is only to readout.

# 14.3. Register Map

#### Map of register groups

Table 10

Range of addresses	Type of values	Description	
4000 – 4149	Integer (16 bits)	The value is situated in a 16-bit register	
4150 – 5899	Integer (16 bits)	The value is situated in a 16-bit register	
7000 – 7099	float (2x16 bits)	The value is situated in two successive 16-bit registers; Registers only for readout	
7500 – 7599	float (32 bits)	The value is situated in two successive 32-bit registers; Registers only for readout	

In the controller, data are situated in 16-bit registers. The list of registers for write and readout is presented in the table 11.

Operation "R-" — means the possibility of readout, and the operation "RW" means the possibility for readout and write.

### Map of register from address 4000

Table 11

Register address	Marking	Ope¬ration	Parameter range	Description
4000		-W	16	Register of commands:  1 – input into the automatic control mode  2 – input into the manual control mode  3 – beginning of the auto-tuning  4 – erasing of alarm memory  5 – restoration of manufacturer's settings (apart interface settings and defined programs)  6 – restoration of manufacturer's settings of defined programs.
4001		R-	100999	Number of program version [x100]
4002		R-		Version code of the controller bit 2 1 0 – OUTPUT 1:  0 0 1 – output 1 – relay 0 1 0 – output 1 – 0/5 V 0 1 1 – output 1 – continuous current: 0/420 mA 1 0 0 – output 1 – continuous voltage: 010 V bit 5 4 3 – OUTPUT 2: 0 0 1 – output 2 – relay 0 1 0 – output 2 – relay 0 1 0 – output 2 – continuous current: 0/420 mA 1 0 0 – output 2 – continuous voltage: 010 V

4003		R-	00xFFFF	Controller status – description in table 12
4004		R-	00xFFFF	Alarm state - description in table 13
4005		R-	00xFFFF	Error status – Description in table 14
4006		R-	acc. to table 171)	Measured value PV
4007		R-	-19999999	Measured value on additional input
4008		R-	acc. to table 171)	Current set point value SP
4009		RW	01000	Control signal of loop 1 [% x10] 2)
4010		RW	01000	Control signal of loop 2 [% x10] 2)
4011		R-	059994	Timer value [s]
4012		R-	0500	Heater current when the output is turned on [A x10]
4013		R-	0500	Heater current when the output is turned off [A x10]
4014	UNIT	RW	02	Unit: 0 – Celsius degrees 1 – Fahrenheit degrees 2 – physical units
4015	INPT	RW	014	Kind of main input:  0 – resistance thermometer Pt100  1 – resistance thermometer Pt1000  2 – thermocouple of J type  3 – thermocouple of K type  4 – thermocouple of S type  6 – thermocouple of R type  7 – thermocouple of B type  8 – thermocouple of E type  9 – thermocouple of E type  10 – thermocouple of L type  11 – current input: 0-20mA  12 – current input: 4-20mA  13 – voltage input: 0-10 V

4016	DP	RW	01 <sup>3) 4)</sup> 02 <sup>5)</sup>	Position of the decimal point of the main input:  0 – without decimal place 1 – 1 decimal place 2 – 2 decimal places
4017	INLO	RW	-9999999 <sup>1)</sup>	Indication for the lower threshold of the analog main input.
4018	INHI	RW	-9999999 <sup>1)</sup>	Indication for the upper threshold of the analog main input.
4019	SHIF	RW	-999999 <sup>1)</sup>	Shift of the measured value of the main input.
4020	I2TY	RW	01	Kind of the additional input: 0 – current inpur: 0-20mA 1 – current input: 4-20mA
4021	DP2	RW	02	Position of the decimal point of the additional input:  0 – without a decimal place  1 – 1 decimal place  2 – 2 decimal places
4022	I2LO	RW	-9999999 <sup>1)</sup>	Indication for the lower threshold of the analog main input.
4023	I2HI	RW	-9999999 <sup>1)</sup>	Indication for the upper threshold of the analog main input.
4024	FILT	RW	09	Time constant of the filter: 0 – OFF 1 – 0.2 sec 2 – 0.5 sec 3 – 1 sec 4 – 2 sec 5 – 5 sec 6 – 10 sec 7 – 20 sec 8 – 50 sec 9 – 100 sec

4025	BNI1	RW	010	Function of the binary input 1 0 – none 1 – control stop 2 – switching on manual control 3 – SP1 switching into SP2 4 – erasing of the timer alarm 5 – program start 6 – jump to the next segment 7 – stoppage of set point value counting in the program 8 – decrease of the set point value 9 – increase of the set point value 10 – switching SP on the additional input value
4026	BNI2	RW	010	Function of the binary input 2 0 – none 1 – control stop 2 – switching on manual control 3 – SP1 switching into SP2 4 – erasing of the timer alarm 5 – program start 6 – jump to the next segment 7 – stoppage of set point value counting in the program 8 – decrease of the set point value 9 – increase of the set point value 10 – switching SP on the additional input value
4027	OUT1	RW	016	Function of output 1:  0 – without function  1 – control signal - heating or control signal "opening" for analog valve  2 – control signal of stepper control – opening 7)  3 – control signal of stepper control – closing 7)  4 – control signal - cooling or control signal "closing" for analog valve  5 – absolute upper alarm  6 – absolute lower alarm  7 – relative upper alarm  9 – relative lower alarm  10 – relative external alarm  11 – timer alarm  12 – retransmission 8)  13 – auxiliary output EV1 in the programming control  14 – auxiliary output EV2 in the programming control

				auxiliary output EV3 in the programming control     alarm in case of sensor failure or exceeding the measuring range
4028	O1TY	R	16	Output 1 type: 1 – relay output 2 – voltage output: 0/5 V 3 – current output : 4-20 mA
.020		RW	34 6)	4 - current output : 0-20 mA 5 - reserved 6 - voltage output:: 0-10 V
4029	YFL	RW	01000	Value of the control signal in case when FR IL = 4FL
4030	OUT2	RW	018	Function of output 2: 0 – without function 1 – control signal - heating or control signal "opening" for analog valve 2 – control signal of stepper control – opening 7) 3 – control signal of stepper control – closing 7) 4 – control signal - cooling or control signal "closing" for analog valve 5 – absolute upper alarm 6 – absolute lower alarm 7 – relative upper alarm 8 – relative lower alarm 9 – relative internal alarm 10 – relative external alarm 11 – timer alarm 12 – alarm of heater burnout 13 – controlling element damage alarm (short - circuit) 14 – retransmission 8) 15 – auxiliary output EV1 in the programming control 16 – auxiliary output EV2 in the programming control 17 – auxiliary output EV3 in the programming control 18 – alarm in case of sensor failure or exceeding the measuring range

4031 O2TY	R	06	Output 2 type: 0 – without relay 1 – relay soutput 2 – voltage output: 0/5 V 3 – current output : 4-20 mA	
4031	0211	RW	34 <sup>6)</sup>	4 - current output: 0-20 mA 5 - voltage output: 0-5 V 6 - voltage output:: 0-10 V
4032	OUT3	RW	017	Function of output 3:  0 – without function  1 – control signal - heating or control signal "opening" for analog valve  2 – control signal of stepper control – opening 7)  3 – control signal of stepper control – closing 7)  4 – control signal - cooling or control signal "closing" for analog valve  5 – absolute upper alarm  6 – absolute lower alarm  7 – relative upper alarm  8 – relative lower alarm  10 – relative external alarm  10 – relative external alarm  11 – timer alarm  12 – alarm of heater burnout  13 – controlling element damage alarm (short- circuit)  14 – auxiliary output EV1 in the programming control  15 – auxiliary output EV2 in the programming control  16 – auxiliary output EV3 in the programming control  17 – alarm in case of sensor failure or exceeding the measuring range
4033	OUT4	RW	017	Function of output 4: 0 – without function 1 – control signal - heating or control signal "opening" for analog valve 2 – control signal of stepper control – opening 7) 3 – control signal of stepper control – closing 7) 4 – control signal - cooling or control signal "closing" for analog valve 5 – absolute upper alarm 6 – absolute lower alarm

				7 – relative upper alarm 8 – relative lower alarm 9 – relative internal alarm 10 – relative external alarm 11 – timer alarm 12 – alarm of heater burnout 13 – controlling element damage alarm (short - circuit) 14 – auxiliary output EV1 in the programming control 15 – auxiliary output EV2 in the programming control 16 – auxiliary output EV3 in the programming control 17 – alarm in case of sensor failure or exceeding the measuring range
4034	ALG	RW	01	Control algorithm: 0 – on-off 1 – PID
4035	TYPE	RW	01	Kind of control: 0 – direct control – cooling 1 – reverse control – heating
4036	HY	RW	2999 <sup>1)</sup>	Hysteresis HY
4037	GTY	RW	02	"Gain Scheduling " function 0 – disabled 1 – from set point value 2 – constant PID set
4038	GSNB	RW	02	Number of PID sets for "Gain Scheduling" from the set point value.  0 – 2 PID sets 1 – 3 PID sets 2 – 4 PID sets
4039	GL12	RW	acc. to table 17 <sup>1)</sup>	Switching level for PID1 and PID2 sets
4040	GL23	RW	acc. to table 17 <sup>1)</sup>	Switching level for PID2 and PID3 sets
4041	GL34	RW	acc. to table 17 <sup>1)</sup>	Switching level for PID3 and PID4 sets

4042	GSET	RW	03	Selection of the constant PID set 0 - PID1 1 - PID2 2 - PID3 3 - PID4
4043	РВ	RW	09999 <sup>1)</sup>	Proportional band PB
4044	TI	RW	09999	Integration time constant TI [s]
4045	TD	RW	09999	Differentiation time constant TD [s x10]
4046	Y0	RW	01000	Correction of control signal (for P or PD control) [% x10]
4047	PB2	RW	09999 <sup>1)</sup>	Proportional band PB2
4048	TI2	RW	09999	Integration time constant TI2 [s]
4049	TD2	RW	09999	Differentiation time constant TD2 [s x10]
4050	Y02	RW	01000	Correction of control signal (for P or PD control) [% x10]
4051	PB3	RW	09999 <sup>1)</sup>	Proportional band PB3
4052	TI3	RW	09999	Integration time constant TI3 [s]
4053	TD3	RW	09999	Differentiation time constant TD3 [s x10]
4054	Y03	RW	01000	Correction of control signal (for P or PD control) [% x10]
4055	PB4	RW	09999 <sup>1)</sup>	Proportional band PB4
4056	TI4	RW	09999	Integration time constant TI4 [s]
4057	TD4	RW	09999	Differentiation time constant TD4 [s x10]
4058	Y04	RW	01000	Correction of control signal (for P or PD control) [% x10]
4059	TO1	RW	5999	Pulse period of output 1 [s x10]
4060	HN	RW	0999 <sup>1)</sup>	Displacement zone for heating-cooling control or dead zone for stepper control

4061	PBC	RW	12000	Proportional band PBC [% x10] (in relation to PB)
4062	TIC	RW	09999	Integration time constant TIC [s]
4063	TDC	RW	09999	Differentiation time constant TDC [s]
4064	TO2	RW	5999	Pulse period of output 2 [s x10]
4065	A1SP	RW	acc. to table	Set point value for absolute alarm 1
4066	A1DV	RW	-19991999 <sup>1)</sup>	Deviation from the set point value for relative alarm 1
4067	A1HY	RW	2999 <sup>1)</sup>	Hysteresis for alarm 1
4068	A1LT	RW	01	Memory of alarm 1 0 – disabled 1 – enabled
4069	A2SP	RW	acc. to table	Set point value for absolute alarm 2
4070	A2DV	RW	-19991999 <sup>1)</sup>	Deviation from the set point value for relative alarm 2
4071	A2HY	RW	2999 <sup>1)</sup>	Hysteresis for alarm 2
4072	A2LT	RW	01	Memory of alarm 2 0 – disabled 1 – enabled
4073	A3SP	RW	acc. to table	Set point value for absolute alarm 3
4074	A3DV	RW	-19991999 <sup>1)</sup>	Deviation from the set point value for relative alarm 3
4075	A3HY	RW	2999 1)	Hysteresis for alarm 3
4076	A3LT	RW	01	Memory of alarm 3 0 – disabled 1 – enabled
4077	A4SP	RW	acc. to table 17 1)	Set point value for absolute alarm 4

4078	A4DV	RW	-19991999 <sup>1)</sup>	Deviation from the set point value for relative alarm 4
4079	A4HY	RW	2999 <sup>1)</sup>	Hysteresis for alarm 4
4080	A4LT	RW	01	Memory of alarm 4 0 – disabled 1 – enabled
4081	HBSP	RW	0500	Set point value for the heater damage alarm [Ax10]
4082	НВНҮ	RW	0500	Hysteresis for the heater damage alarm [Ax10]
4083	SPMD	RW	05	Kind of set point value:  0 – set point value SP or SP2  1 – set point value with soft start in units per minute  2 – set point value with soft start in units per hour  3 – set point value from the additional input  4 – Set point value acc. to the programming control  5 – set point value SP or from the additional input
4084	SP	RW	acc. to table 17 <sup>1)</sup>	Set point value SP
4085	SP2	RW	acc. to table 17 <sup>1)</sup>	Set point value SP2
4086	SP3	RW	acc. to table 17 <sup>1)</sup>	Set point value SP3
4087	SP4	RW	acc. to table 17 <sup>1)</sup>	Set point value SP4
4088	SPLL	RW	acc. to table 17 <sup>1)</sup>	Lower limitation of the fast set point value change
4089	SPLH	RW	acc. to table 17 <sup>1)</sup>	Upper limitation of the fast set point value change
4090	SPRR	R	09999 <sup>1)</sup>	Accretion rate of the set point value SP1 or SP2 during the soft start
4091	ADDR	RW	1247	Device address

4092	BAUD	RW	04	Baud rate: 0 – 4800 1 – 9600 2 – 19200 3 – 38400 4 – 57600
4093	PROT	RW	04	Protocol: 0 – none 1 – RTU 8N2 2 – RTU 8E1 3 – RTU 8O1 4 – RTU 8N1
4094	-	RW	065535	Reserved
4095	AOFN	RW	05	Quantity retransmitted on the main input:  0 – measured value on the main input PV  1 – measured value on the additional input PV2  2 – measured value PV – PV2  3 – measured value PV2 – PV  4 – set point value  5 – deviation (set point value – measured value PV)
4096	AOLO	RW	acc. to table 17 <sup>1)</sup>	Lower limit of signal for retransmission
4097	АОНІ	RW	acc. to table 17 <sup>1)</sup>	Upper limit of signal for retransmission
4098	SECU	RW	09999	Access code to the menu
4099	STFN	RW	01	Auto-tuning function: 0 – locked 1 – unlocked
4100	STLO	RW	acc. to table 17 <sup>1)</sup>	Lower limit of signal for retransmission
4101	STHI	RW	acc. to table 17 <sup>1)</sup>	Upper limit of signal for retransmission
4102	TOUT	RW	0250	Time of automatic output from the monitoring mode

4103	TIMR	RW	01	Timer function: 0 – disabled 1 – enabled
4104	TIME	RW	19999	Time counted down by the timer [min x 10]
4105	DI2	RW	01	Monitoring of the auxiliary input: 0 – disabled 1 – enabled
4106	DCT	RW	01	Monitoring of heater current: 0 – disabled 1 – enabled
4107	BAR1	RW	06	Function of the upper bargraph:  0 – measured value on the main input PV  1 – measured value on the additional input PV2  2 – set point value  3 – control signal on the output 1  4 – control signal on the output 2  5 – segment time  6 – program time
4108	BAR2	RW	06	Function of the upper bargraph:  0 – measured value on the main input PV  1 – measured value on the additional input PV2  2 – set point value 3 – control signal on the output 1 4 – control signal on the output 2 5 – segment time 6 – program time
4109	BARL	RW	acc. to table 17 <sup>1)</sup>	Lower threshold for bargraphs
4110	BARH	RW	acc. to table 17 <sup>1)</sup>	Upper threshold for bargraphs
4111	ТО3	RW	5999	Pulse period of output 3 [s x10]
4112	TO4	RW	5999	Pulse period of output 4 [s x10]

4113	FDB	RW	01	Algorithm for stepper control 0 – without feedback 1 – with feedback
4114	OSSP	RW	0500	Set point for the controlling element damage alarm (short- circuit) [Ax10]
4115	OSHY	RW	0500	Hysteresis for the controlling element damage alarm (short-circuit) [Ax10]
4116	TMVO	RW	306000	Valve open time [s x10]
4117	TMVC	RW	306000	Valve close time [s x10]
4118	MNTV	RW	1999	Minimum valve work time [s x10]
4119	YLO	RW	01000	Minimum control signal [% x10]
4120	YHI	RW	01000	Maximum control signal [% x10]
4121	I2FL	RW	02	State of the valve when auxiliary input error 0 – valve closing 1 – valve opening 2 – valve position unchanged
4122	FAIL	RW	02	Selection of the control signal of the output for proportional control in case of a sensor failure or for program control in case of control stoppage 9) 0 - the output is turned off 1 - the output takes the value set with the %F£ parameter 2 - the output takes the mean value. The maximum allowable value of the control signal at the output can be defined with the %AB parameter. The mean value is measured at 1-minute intervals and only when the system deviation is lower than the £.9A parameter value.
4123	Y_mH	RW	01000	Upper mean value limit
4124	L_Ym	RW	09999	Maximum system deviation when calculating mean value

- 1) Value with the decimal point position defined by bits 0 and 1 in the register 4003.
- <sup>2)</sup> Parameter to write only in the manual operating mode
- 3) Concerns resistance thermometer inputs
- 4) Concerns thermocouple inputs
- 5) Concerns linear inputs
- 6) Range to write for continuous current outputs
- 7) Concerns output 1 of binary type
- 8) Concerns output 1 of continuous type.
- 9) For control 8 $\xi S$  = one  $\xi$  and  $\xi S$  <= 50%, control signal h = 0%,  $\xi S \xi \xi$  > 50%, control signal h = 100%.

# Register 4003 - controller status

Table 12

bit	Description
0-1	Decimal point position for MODBUS registers from address 4000, depending on the input (02) <sup>1)</sup>
2-3	Decimal point position for MODBUS registers from address 4000, depending on the additional input (02) <sup>1)</sup>
4	Auto-tuning finished with failure
5	Soft start: 1 – active, 0 – inactive
6	Timer status:1 – countdown finished, 0 – remaining states
7	Automatic control/manual: 0 – auto, 1 – manual
8	Auto-tuning: 1 – active, 0 – inactive
9-10	Current set of PID parameters 0 - PID1, 1 - PID2, 3 - PID3, 4 - PID4
11-12	Reserved
13	Measured value beyond the measuring range
14	Measured value on the additional input beyond the measuring input
15	Controller error – check the error register

<sup>&</sup>lt;sup>1)</sup> For sensor inputs value equal 1, for linear inputs the value is depended on the parameter dp (register 4023)

Bit	Description
0	State of alarm 1.:1 – active, 0 – inactive
1	State of alarm 2.:1 – active, 0 – inactive
2	State of alarm 3.:1 – active, 0 − inactive
3	State of alarm 4.:1 – active, 0 – inactive
4	Alarm state of heater burnout
5	Alarm state of permanent output 1 shorting:1 – active , $0$ – inactive
6	State of the digital input 1: 1 - (terminal 10 of the controller connected with terminal 11) 1)
7	State of the digital input 2: 1 - (terminal 12 of the controller connected with terminal 13) 1)
8	State of the digital input 1: 1 - output is active, 0 - output is inactive1)
9	State of the digital input 2: 1 - output is active, 0 - output is inactive1)
10	State of the digital output 3: 1 - output is active, 0 - output is inactive
11	State of the digital output 4: 1 - output is active, 0 - output is inactive
1215	Reserved

<sup>1)</sup> in models without the digital input the value equals 0

# Register 4005 – error register

Table 14

Bit	Description
0	Discalibrated input
1	Discalibrated additional input
2	Discalibrated analog output 1
3	Discalibrated analog output 2
4-14	Reserved
15	Checksum error of controller memory

Register address	Marking	Operation	Parameter range	Description
4150		RW	014	Program number for realization (0 – means first program)
4151		RW	01	Program start/stop: 0 – program stop 1 – program start (the write causes the program start from the beginning)
4152		RW	01	Stoppage of set point value counting in the program: 0 – disabled 1 – enabled
4153		RW	014	Realized segment (0 – means the first program) The write causes the jump to the given segment.
4154		R-		Control status:  0 – control stop  1 – program in progress  2 – active locking from the control deviation  3 – Stoppage of set point value counting (by the push-button, binary input or interface)  4 – program end
4155		R-		Number of cycles which remains to the end
4156		R-		Time which goes out in the segment LSB [s]
4157		R-		Time which goes out in the segment MSB [s]
4158		R-		Time to the segment end LSB [s]

	1					
4159				R-		Time to the segment end MSB [s]
4160				R-		Time to the segment end LSB [s]
4161				R-		Time to the segment end MSB [s]
4162				RW	065535	Reserved
4163				RW	065535	Reserved
4164				RW	065535	Reserved
4165				RW	065535	Reserved
4166				RW	065535	Reserved
4167				RW	065535	Reserved
4168				RW	065535	Reserved
4169				RW	065535	Reserved
4170			STRT	RW	01	Way to begin the program: 0 – from value defined by SP0 1 – from current measured value
4171			SP0	RW	acc. to table 17 <sup>1)</sup>	Initial set point value
4172		SIS	TMUN	RW	01	Unit for the segment duration: 0 – minutes and seconds 1 – hours and minutes
4173	Program 1	Program parameters	RRUN	RW	01	Unit for the accretion rate of the set point value: 0 – minutes 1 – hours
4174		Prog	HOLD	RW	03	Lockings of control deviations 0 – inactive 1 – lower 2 – upper 3 – two-sided
4175			CYCN	RW	1999	Number of program repetitions
4176			FAIL	RW	01	Control after a supply decay: 0 – program continuation 1 – control stoppage

4177		END	RW	03	Control on the program end:  0 – control stoppage  1 – fixed set point control with the set point value of the last segment  2 – fixed set point control with the set point value from ESP  3 – fixed set point control with the set point value from SP or SP2
4178		PID	RW	01	"Gain Scheduling" function for the program: 0 – disabled 1 – enabled
4179		TYPE	RW	03	Kind of segment: 0 – segment defined by the time 1 – segment defined by the accretion 2 – withstand of the set point value 3 – program end
4180		TSP	RW	acc. to table 17 <sup>1)</sup>	Set point value on the segment end
4181		TIME	RW	15999	Segment duration
4182	t 1	RR	RW	15500 <sup>1)</sup>	Accretion rate of the set point
4183	Segment 1	HLDV	RW	02000 1)	Value of the control deviation, over which the set point value counting is interrupted
4184			RW	03	State of auxiliary outputs (sum of bits): bit 0 is set – auxiliary output EV1 is turned on bit 1 is set – auxiliary output EV2 is turned on
4185		PID	RW	03	PID set for the segment: 0 – PID1 1 – PID2 2 – PID3 3 – PID4

4277			TYPE	RW	03	Kind of segment
4278			TSP	RW	wg tablicy 17 1)	Set point value on the segment end
4279		2	TIME	RW	05999	Segment duration
4280		Segment 15	RR	RW	15500 <sup>1)</sup>	Accretion rate of the set point value
4281		Seg	HLDV	RW	02000 1)	Control deviation value, over which the set point value counting is interrupted
4282				RW	03	State of auxiliary outputs
4283			PID	RW	03	PID set for the segment
5766			STRT	RW	01	Way of program beginning
5767			SP0	RW	acc. to table 17 <sup>1)</sup>	Initial set point value
5768			TMUN	RW	01	Unit for the segment duration
5769		Program parameters	RRUN	RW	01	Unit for the accretion rate of the set point value
5770		para	HOLD	RW	03	Blockings of the control deviation
5771		an,	CYCN	RW	1999	Number of program repetitions
5772	Program 15	Prog	FAIL	RW	01	Way of the controller behaviour after a supply decay.
5773	Prog		END	RW	01	Way of the controller behaviour on the program end
5774			PID	RW	01	"Gain Scheduling " function for the program
5775			TYPE	RW	03	Kind of segment
5776		Segment 1	TSP	RW	acc. to table 17 <sup>1)</sup>	Set point value on the segment end
5777		egn	TIME	RW	05999	Segment duration
5778		S	RR	RW	15500 <sup>1)</sup>	Accretion rate of the set point value

5779			HLDV	RW	02000 1)	Control deviation value, over which the counting of the set point value is interrupted	
5780				RW	03	State of auxiliary outputs	
5781			PID	RW	03	PID set for the segment	
5873			TYPE	RW	03	Kind of segment	
5874			TSP	RW	acc. to table 17 1)	Set point value on the segment end	
5875		nt 15	TIME	RW	05999	Segment duration	
5876		Segment	RR	RW	15500 <sup>1)</sup>	Accretion rate of the set point value	
5877		0)	HLDV	RW	02000 1)	Control deviation value, over which the counting of the set point value is interrupted	
5878				RW	03	State of auxiliary outputs	
5879			PID	RW	03	PID set for the segment	
5880	Pro- gram1		ESP	RW	acc. to	Set point value after completing the program 1	
5881	Pro- gram2		ESP	RW	table 17 <sup>1)</sup>	Set point value after completing the program 2	
5894	Pro- gram15		ESP	RW		Set point value after completing the program 15	

<sup>1)</sup> Value with the decimal point position defined by bits 0 and 1 in the register 4002

Register address	Register address	Symbol	Operatione	Description
7000	7500		R-	Measured value PV
7002	7501		R-	Measured value on the additional input
7003	7502		R-	Current set point value SP
7006	7503		R-	Control signal of loop 1
7008	7504		R-	Control signal of loop 2
7010	7505	SP	R-	Set point value SP
7012	7506	SP2	R-	Set ponit value SP2
7014	7507	A1SP	R-	Set point value for the absolute alarm
7016	7508	A1DV	R-	Deviation from the set point value for the relative alarm 1
7018	7509	A2SP	R-	Set point value for the absolute alarm
7020	7510	A2DV	R-	Deviation from the set point value for the relative alarm 2
7022	7511	A3SP	R-	Set point value for the absolute alarm 3
7024	7512	A3DV	R-	Deviation from the set point value for the relative alarm 3
7026	7513	A4SP	R-	Set point value for the absolute alarm 4
7028	7514	A4DV	R-	Deviation from the set point value for the relative alarm 4

	Range				
Kind of sensors	UNIT = °C [x10]	UNIT = °F [x10]	UNIT = PU		
Pt100	-20008500	-328015620			
Pt1000	-20008500	-328015620			
Fe-CuNi (J)	-100012000	-148021920			
Cu-CuNi (T)	-10004000	-14807520			
NiCr-NiAl (K)	-100013720	-148025016			
PtRh10-Pt (S)	017670	32032126			
PtRh13-Pt (R)	017670	32032126			
PtRh30-PtRh6 (B)	017670	32032126			
NiCr-CuNi (E)	-100010000	-148018320			
NiCrSi-NiSi (N)	-100013000	-148023720			
chromel – kopel (L)	-10008000	-148014720			
Linear current (I)			-19999999		
Linear current (I)			-19999999		
Linear voltage (U)			-19999999		
Linear voltage (U)			-19999999		

# 15. SOFTWARE UPDATING

Function enabling updating of software from the computer of the PC with software eCon was implemented in controller RE82 (from version of software 2.00). Free software eCon and update files are available at www.lumel.com.pl. The connected to the computer convertor RS485 is required on USB to the updating, e.g.: the convertor PD10.

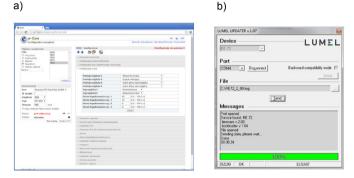


Fig.28. Program view: a) eCon, b) updating of software

**Warning!** Before doing update, currently settings of controller should be saved by program eCon, because when software is updated default settings of controller are restored.

After starting eCon's software COM port, baudrate, transmission mode and adress should be set. It can be done in *Communication* window. Then, RE82 controller should be selected in the window *Select device* and push icon *Load* in window Communication and then the icon



to read the current settings. Open window Lumel Updater (LU) -

figure 28b from *Updating firmware*. Push *Connect*. Update progress is shown in *Messages* section. Text *Port opened* appear after correctly opened port. Putting controller in update's mode can be done in two ways: remote from LU (with settings from eCon – port, baudrate, transmission mode and adress) or by turning power on while button pressed . Message boot in the upper display signal the availability to update. LU will show message "*Device found*" with name and current version of firmware. Using button ... a valid file should be selected. If the file is correct, message *File opened* will show. *Send* button should be pressed. During firmware update the leds on the upper bargraph indicate process progress. If firmware update is successful device starts normal operation and message *Done* and update duration will show. Close LU and next press icon . *Upload configuration to device* to restore previously read parameters. Current firmware version can be checked when controller is power on.

**Warning!** Power loss during firmware update could result permanent controller damage!

# 16. ERROR SIGNALING

# Character messages

Table 18

Error code (upper display)	Reason	Procedure
	Down overflow of the measuring range or shorting in the sensor circuit.	Check, if the type of chosen sensor is in compliance with the connected one; check, if input signal values are situated in the appropriate range – If yes, check if there is no break in the sensor circuit.
	Upper overflow of the measuring range or break in the sensor circuit.	Check, if the type of chosen sensor is in compliance with the connected one; check, if input signal values are situated in the appropriate range – If yes, check if there is no break in the sensor circuit.
€ c.0 1	Incorrect controller configuration.	After selecting the valve opening on one output, the valve closing should be set on another output.
Er.02	Incorrect controller configuration.	After selecting the cooling type control on one output, the reverse control (heating) and the PID algorithm (ALG=PID) should be set on another output.
€ S	Auto-tuning is ended with failure	Check the reason of the auto- -tuning process interruption in the auto-tuning point.

Er.Ad	Input discalibrated	Turn off and turn on again the controller supply, when this not help, contact the nearest service shop.
Er.dR	Continuous output discalibrated	Turn off and turn on again the controller supply, when this not help, contact the nearest service shop.
Er.EE	Error of readout verification from the non-volatile memory.	Turn off and turn on again the controller supply, when this not help, contact the nearest service shop.  The controller exploitation in his state can cause its unforeseen behavior.

# 17. TECHNICAL DATA

MAIN INPUT

Input signals and measuring ranges

Table19

Sensor type	Standard	Range		Symbol
Pt100	EN	-200850 °C	-3281562 °F	<i>የ</i>
Pt1000	60751+A2:1997	-200850 °C	-3281562 °F	PE 10
Fe-CuNi (J)		-1001200 °C	-1482192 °F	£ - J
Cu-CuNi (T)		-100400 °C	-148752 °F	٤-٤
NiCr-NiAl (K)		-1001372 °C	-1482501,6 °F	۶-۶
PtRh10-Pt (S)	EN 60584-	01767 °C	323212,6 °F	٤-5
PtRh13-Pt (R)	1:1997	01767 °C	323212,6 °F	۶
PtRh30-PtRh6 (B)		01767 °C <sup>1)</sup>	323212,6 °F <sup>1)</sup>	۶-9
NiCr-CuNi (E)		-1001000 °C	-1481832 °F	٤-٤
NiCrSi-NiSi (N)		-1001300 °C	-1482372 °F	۴-0
Chromel – Kopel (L)	GOST R 8.585- 2001	-100800 °C	-1481472 °F	£-L
Linear current (I)		020 mA	020 mA	0-50
Linear current (I)		420 mA	420 mA	4-50
Linear voltage (U)		05 V	05 V	0-5
Linear voltage(U)		010 V	010 V	0- 10

 $<sup>^{1)}</sup>$  The intrinsic error is related to measuring range 200...1767  $^{\circ}\text{C}$  (392...3212,6  $^{\circ}\text{F})$ 

#### Intrinsic error of the real value measurement

0.2%, for resistance thermometer inputs,

0.3%, for inputs for thermocouple sensors (0.5% – for B, R, S);

0.2% ± 1 digit, for linear inputs

#### Current flowing through the resistance

thermometer sensor 0.22 mA

Measurement time 0.2 s

#### Input resistance:

- for voltage input 150 kΩ - for current input 50  $\Omega$ 

#### Error detection in the measuring circuit:

- thermocouple, Pt100, Pt1000 overrun of measuring range

- 0...10 V over 11 V - 0...5 V over 5.5 V - 0...20 mA over 22 mA - 4...20 mA over 1 mA

and over 22 mA

#### **AUXILIARY INPUT**

#### Measurement basic error

of real value  $0.3\% \pm 1$  digit

Measurement time 0.5 s

Input resistance  $100 \Omega$ 

#### Setting range of controller parameters:

See table 1

 Binary input
 voltageless

 - shorting resistance
 ≤ 10 kΩ

 - opening out resistance
 ≥ 100 kΩ

# Kinds of outputs 1 and 2:

- voltageless relay NO contact, load capacity

2 A/230 V a.c.

- voltage transistor 0/5 V, maximum load capacity

40 mA

- continuous voltage  $0...10 \text{ V at R}_{load} \geq 1 \text{ k}\Omega$ 

0...20 mA, 4...20 mA

at  $R_{load} \le 500 \Omega$ 

# Kinds of outputs 3 and 4:

- continuous current

- voltageless relay NO contact, load capacity

1 A/230 V a.c.

#### Way of output operation:

reverse for heatingdirect for cooling

#### **Error of analog outputs** 0.2% of the range

Digital interface RS-485
- protocol Modbus

- baud rate 4800, 9600, 19200, 38400,

57600 bit/s

- mode RTU - 8N2, 8E1, 8O1, 8N1

- address 1...247

- maximal response time 500 ms

#### Supply of object transducers

24 V d.c. ± 5 %, max.: 30 mA

## Signaling:

- turning outputs 1, 2, 3, 4 on

- mode of manual control

- auto-tuning process

- turning binary inputs 1, 2 on

#### Rated operating conditions:

- supply voltage 85...253 V a.c./d.c.

20...40 V a.c./d.c.

- frequency of supply voltage 40...440 Hz

- ambient temperature 0...23...50 °C

- storage temperature -20...+70 °C

- relative air humidity < 85 % (condensation

inadmissible)

< 6 VA

- preheating time 30 min

- operating position any

- resistance of wires connecting

the resistance thermometer or

Power input

the thermocouple with the controller  $< 20 \Omega$  / wire

Weight < 0.2 kg

#### Protection grade ensured by the casing acc. to EN 60529

- from the frontal plate- from the terminal sideIP20

# Additional errors in rated operating conditions caused by:

- compensation of thermocouple cold

junction temperature changes ≤ 2 °C,

- ambient temperature change ≤ 100% value of basic error /10 K.

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

- installation category III, - pollution level 2,

- maximal phase-to-earth operating voltage:

for supply circuits, outputs 300 Vfor input circuits 50 V

- altitude above sea < 2000 m

#### Electromagnetic compatibility

- noise immunity acc. to EN 61000-6-2
- noise emissions acc. to EN 61000-6-4

# 18. ORDERING CODE

The way of coding is given in the table 20.

Table 20 RE82 - X Х Х X Χ Х Χ Output 1: relav voltage 0/5 V 2 continuous current 0/4 .. 20 mA 3 continuous voltage 0 .. 10 V Output 2: relay1) voltage 0/5 V 3 continuous current 0/4 .. 20 mA continuous voltage 0 .. 10 V Transducer supply: none 0 transducer supply 24 V d.c. /30mA Supply: 85 .. 253 V a.c./ d.c. 1 20 .. 40 V a.c./ d.c. Version: standard 00 custom made2) XX Language: Polish Р English F Russian3) R other2) Χ Acceptance tests: without extra quality requirements 0 with an extra quality inspection certificate 1 acc. to customer's request Χ

<sup>1) -</sup> Only, when a relay or a 0/5 V voltage is also selected on the output 1,

<sup>2) -</sup> Only after agreeing by the manufacturer

<sup>3) -</sup> Only product label in Russian language

## Ordering Example:

The code **RE82 - 1 2 1 1 00 E 0** means:

RE82 - controller of RE82 type

1 - output 1: relay

2 - output 2: voltage 0/5 V

1 - transducer supply 24 V d.c./ 30 mA

1 - supply: 85 .. 253 V a.c./ d.c.

00 - standard version

E - English version of user's manual

**0** - without extra quality requirements.



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