INSTALLATION AND MAINTENANCE INSTRUCTIONS

UC-820
UNIVERSAL PROCESS CONTROLLER

CONTENTS

1. GENERAL

- These instructions must be carefully read before any work involving products supplied by VALSTEAM ADCA ENGINEERING S.A. is undertaken.

Note:

- Current regional safety regulations should be taken in to account and followed, while doing the installation and maintenance work.
- Handling, installation and maintenance work must be carried out by trained personnel. A supervisor must follow and check all activities.
- For the problems that cannot be solve with the help of this instructions, please contact the supplier or the manufacturer.
- The manufacturer reserves the right to change the design and material of this product without notice.

2. APPLICATION

The UC-820 is a digital universal controller used in the automation of industrial processes. It is ideally suited for use with our range of instrumentation, electric and pneumatic control valves and other electrical equipments.

The controller includes a set of universal type inputs for RTD, thermocouple (TC), logic (binary) and analog inputs. The controller has options for relay, open-collector (OC) and analog outputs using the innovative SMART PID algorithm.

3. TRANSPORT AND STORAGE

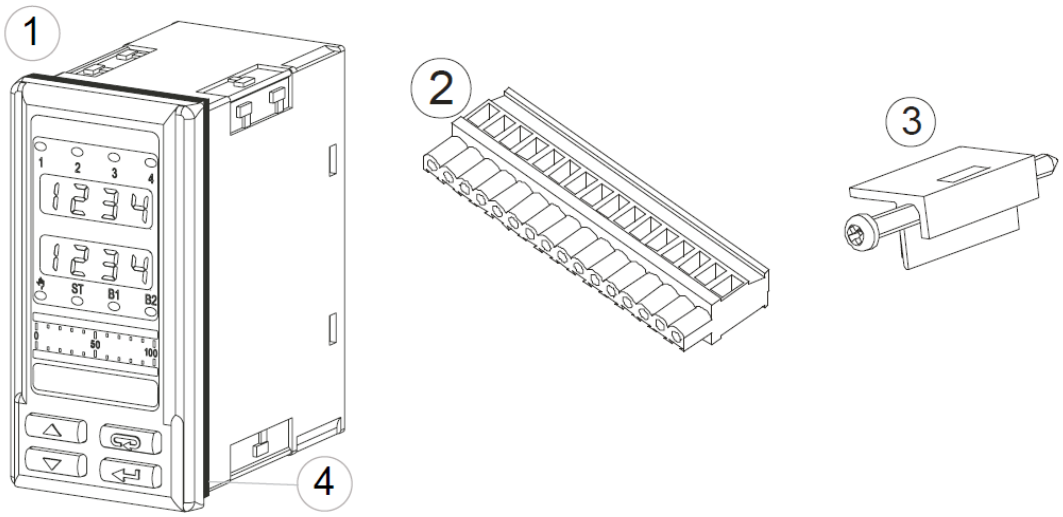
- Handling of materials should be made with adequate equipments.
- The equipments should be protected from impacts and forces during transportation and storage.
- The equipment should be stored in a dry environment.
- The manufacturer does not assume the responsibility of damaged equipments due to inappropriate handling during the transportation and storage.

4. DELIVERED SET

- When unpacking the equipment, please check whether the type and version code on the data sticker corresponds to the ordered one.

The delivered set is composed of:

1. UC-820 universal process controller..... 1 piece
2. Plug with 16 screw terminals..... 2 pieces
3. Screw clamp to fix the controller in the panel..... 4 pieces
4. Rubber seal..... 1 piece
5. User's manual..... 1 piece



5. BASIC REQUIREMENTS AND OPERATIONAL SAFETY

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

ATTENTION

- All operations concerning transportation, 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 device on, check the correctness of all the connections to the network.
- Do not connect the device to the network through an autotransformer.
- The removal of the devices' casing during the guarantee contract period may cause its avoidance.
- The device fulfils all requirements related to electromagnetic compatibility in the industrial environment.
- When connecting the supply, remember that a switch or a circuit-breaker should be installed in the room. This switch should be located near the device, with easy accessibility for the operator, and suitably marked as an element able of switching the devices' power off.
- Non-authorized removal of the casing, inappropriate use, incorrect installation or operation, create the risk of injury to personnel or damage to the device.

6. INSTALLATION

6.1. DEVICE INSTALLATION

Insert the display in the panel and fix it with the four screw clamps, according to Figure 1. The panel cut-out should have 45 x 92 mm.

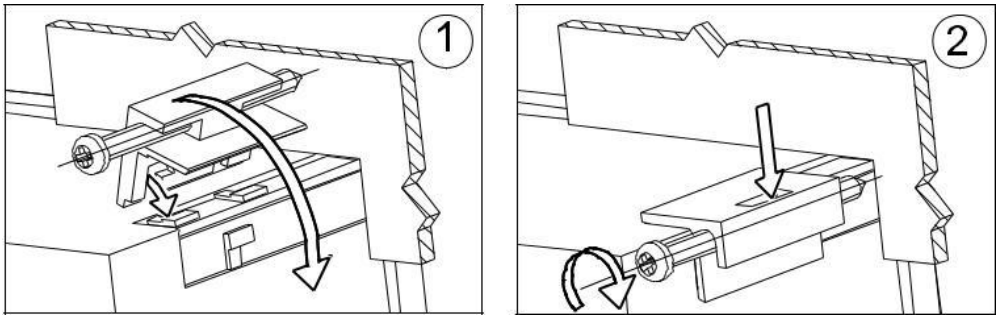


Figure 1: Controller fixation in the panel.

The overall dimensions of the UC-820 controller are presented on Figure 2 (in millimeters).

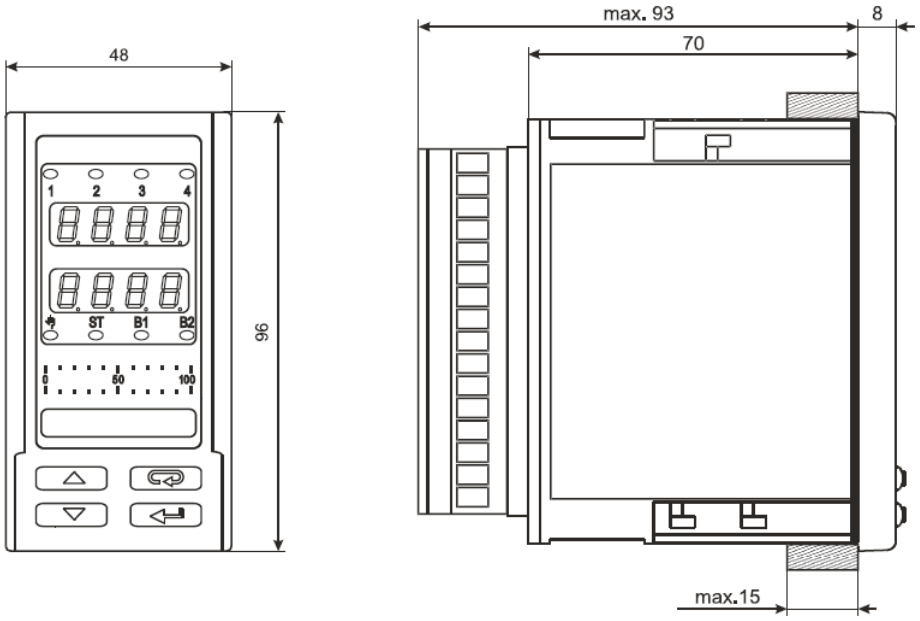


Figure 2: Controller dimensions.

6.2. ELECTRICAL CONNECTIONS

The controller has two separable terminal strips with screw terminals. The strips enable the connection of all signals by a wire with 2.5 mm^2 of cross-section.

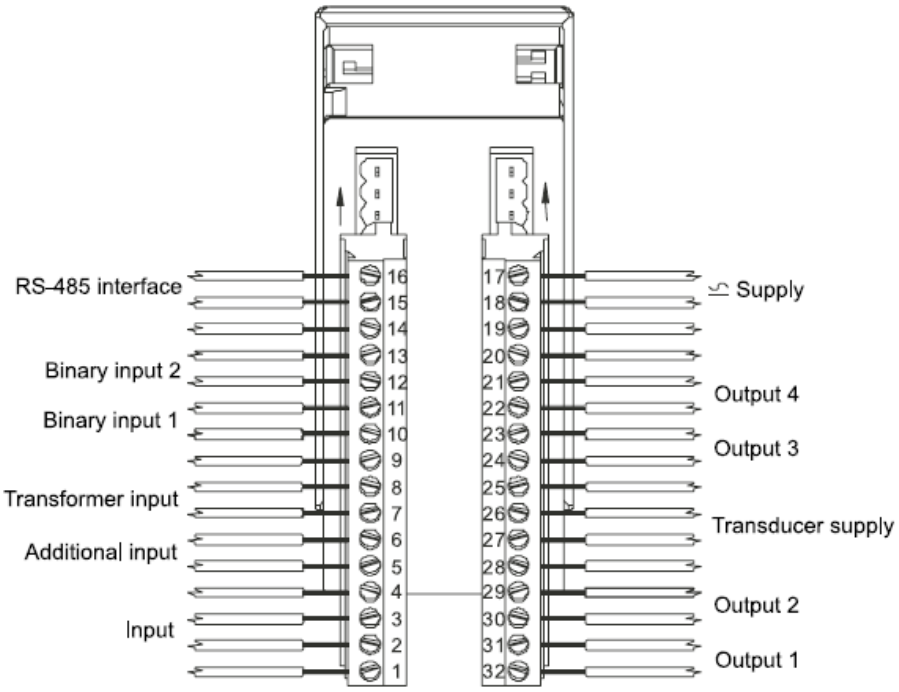
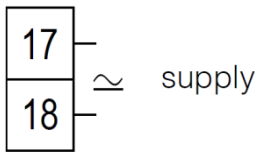
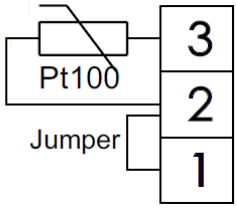


Figure 3: View of the controllers' connection strips.

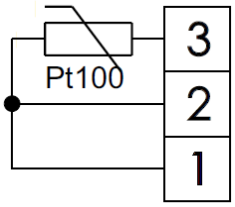
Power supply



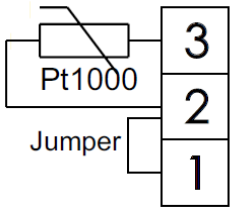
PT100 in two-wire system



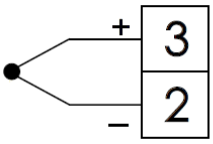
PT100 in three-wire system



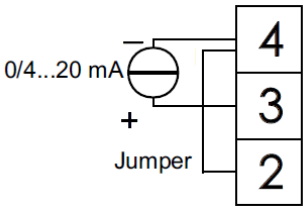
PT1000



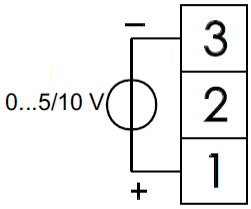
Thermocouple



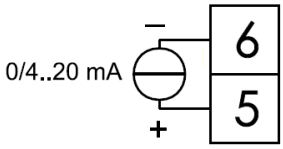
Current Input 0/4 … 20 mA



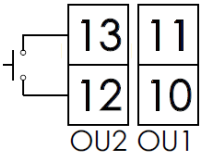
Voltage Input 0 … 5/10 V



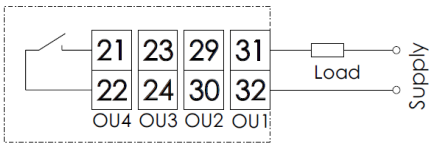
Additional input signal



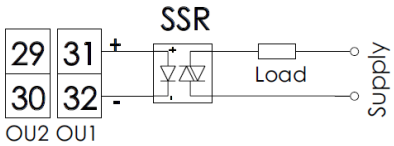
Binary input 1 and 2



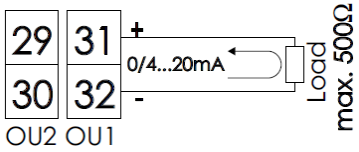
Output 1, 2, 3, 4 – Relay



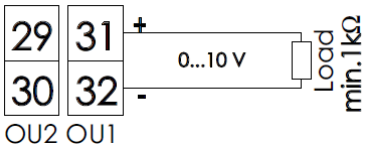
Output 1, 2 – Voltage 0/5 V



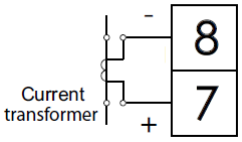
Output 1,2 – Continuous current 0/4 ... 20 mA



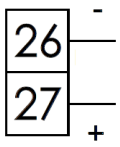
Output 1, 2 – continuous voltage 0 … 10 V



Current transformer input



Transducer supply 24 V



RS-485 Interface

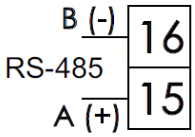


Figure 4: Inputs, outputs and other connections.

6.3. INSTALLATION RECOMMENDATIONS

In order to obtain a full protection against electromagnetic noise, it is recommended to follow the principles below:

- Do not supply energy to the device from the network in the proximity of equipments generating high pulse noises.
- 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 device.
- 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 (90º).

7. STARTING TO WORK

After turning the supply on, the controller carries out the test procedure, showing the program version followed by the measured and set value.

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

A PID control algorithm with a proportional range of 30ºC, a 300 second integration time constant, a 60 second differentiation time constant and a 20 second pulse period are set by the manufacturer as default.

7.1. CHANGING THE SET POINT VALUE

The set point value can be changed by pressing the ▼ or ▲ push-button. The beginning of the procedure is signalled by the flickering dot of the lower display. Accept the new set point value by holding down the ↵ push-button during 30 seconds since the last pressure of ▼ or ▲. If not, the old value will be restored. The change limitation is set by parameters **SPLL** and **SPLH**.

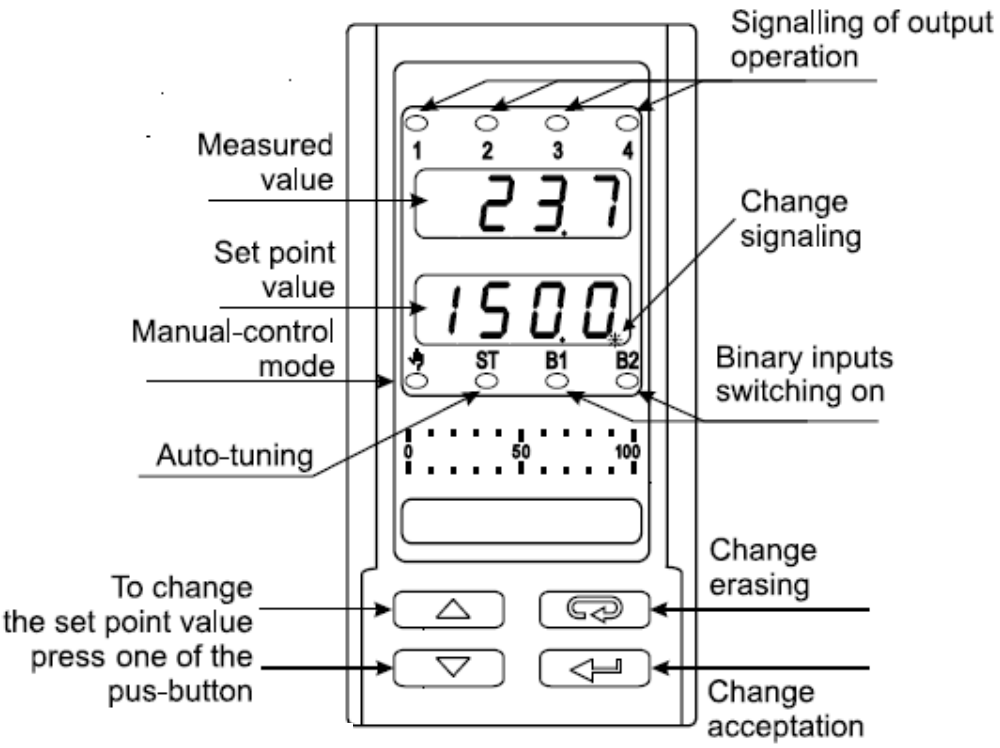


Figure 5: Front panel button functions and displayed information.

8. SERVICE

Figure 6 displays a diagram with the menu of the controller in normal working mode.

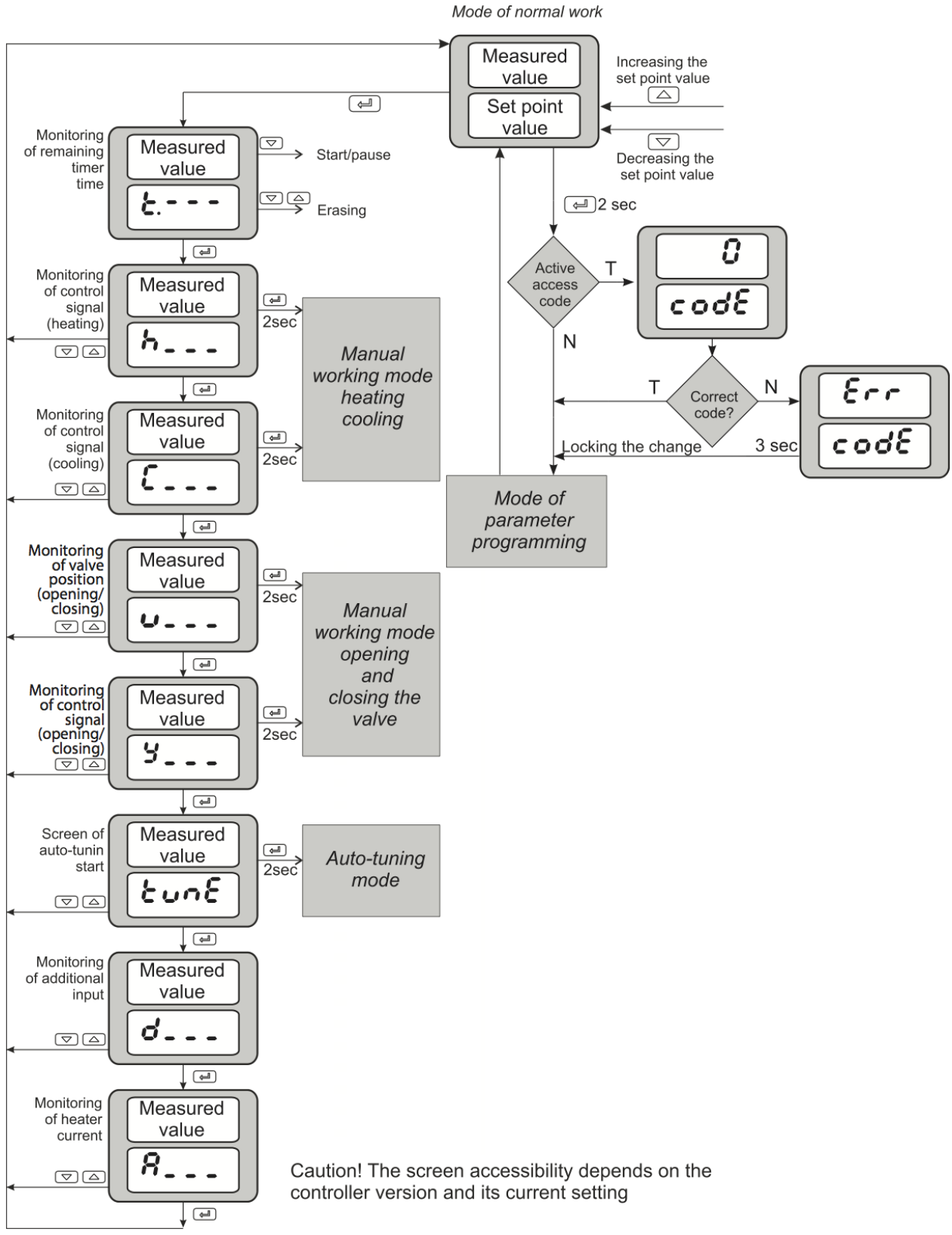


Figure 6: Menu of the controller in normal working mode.

8.1. PROGRAMMING

By pressing and holding down ↵ during approx. 2 seconds one can enter the programming matrix. The programming matrix can be protected by an access code. When giving a wrong code value, it is only possible to see the settings through, with no possibility of changes.

Figure 7 presents the transition matrix in the programming mode. The transition between levels is carrying out by means of the ▼ or ▲ 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 ▲ push-buttons. In order to change the parameter setting, proceed according to section 7.3. In order to exit from the selected level, 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, transit between levels until the symbol [. . .] appears and press the ↵ push-button.

Some controller parameters can be invisible – it depends on the current configuration of the device.

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

8.2. PROGRAMMING MATRIX

inP Input parameters	unit Unit	in.tY Kind of main input	dP Pos. of decimal point	i n.Lo Indic. of lower threeshold	i n.Hi Indic. of higher threeshold	SHiF Shift of measured value	i 2.tY Kind of auxiliary input	dP2 Pos. of decimal point	i 2.Lo Indic. of lower threeshold
outP Output parameters	out1 Function of output 1	o1tY Type of output 1	out2 Function of output	o2tY Type of output 2	out3 Function of output 3	out4 Function of output 4	YFL Damage control signal	to1 Impulse period Out 1	to2 Impulse period Out 2
ctrL Control parameters	ALG Control algo-rithm	tYPE Kind of control	HY Hysteresis	Hn Deed zone	t.nuo Valve opening time	t.nuc Valve closing time	nmt.u Valve min. operation time	Y-Lo Min. control signal	Y-Hi Max. control signal
Pid PID Parameters	Submenu: Pid1				Submenu: Pid2, Pid3, Pid4		Submenu: PidC		
	Pb Proportional band	ti Integration time constant	td Different time constant	Y0 Correction of control signal	Parameters as for PID1		PbC Proportional band	t iC Integration time constant	tdC Diffrent time constant
ALAr Alarm parameters	A1SP Set value for alarm 1	A1du Deviation for alarm 1	A1HY Hysteresis for alarm 1	A1LE Memory of alarm 1	A2SP ... A2LE Parameters of alarm 2 (as for alarm 1)		A3SP...A3LE Parameters of alarm 3 (as for alarm 1)		A4SP... A4LE Param. of alarm 4 (as for alarm 1)
SPP Parameters of set-point value	SPnd Kind of set-point value	C.PrG Program No to carry out	SP Set value SP	SP2 Set value SP2	SP3 Set value SP3	SP4 Set value SP4	SPL Lower limitation SP	SPH Upper limitation SP	SPrr Accretion rate of set
PrG Programm control parameters	Description in programming control chapter								
rEtr Retransmission param.	RoFn Retransmis. function	RoLo Lower retransmis. threeshold	RoH1 Lower retransmis. threeshold	↺ Transit to higher level					
intE Interface param.	Addr Controller address	bAud Baud rate	Prot Transmis. protocol	↺ Transit to higher level					
SErv Service param.	SECU Access code	St.Fn Autotuning function	t inr Timer function	t inE Count down of timer time	d.i2 View of auxiliary output	dCt View of the heater current	tout Exit time from view	bAr1 Function of upper bargraph	bAr2 Function of lower bargraph
...									
↺ Exit from menu									

i2Hi Indic. of higer thre-eshold	FiLt Time constant of filter	bAi n Binary input 1 function	... ↩ Transit to higher level
to3 Impulse period Out 3	to4 Impulse period Out 4	... ↩ Transit of higher level	

GEy „Gain Schedul" function	GSnb Number of PID for GS	GL 12 Switching level PID1-2	GL 23 Switching level PID2-3	GL 34 Switching level PID3-4	GSEt Con-stant PID set	StLo Lower thres-hold ST	StHi Upper thres-hold ST	Fdb Re-ver-sible signal	i2FL Vale position when auxiliary input error	... ↩ Transit to higher level
... ↩ Transit to higher level										

A4SP_ A4Lt Parameters of alarm 4 (as for alarm 1)	AbSP Set value of current alarm	AbHy Hyste-resis of current alarm	oSSP Set value of current alarm	oSHy Hyste-resis of current alarm	... ↩ Tran-sit to higher level
.. ↩ Transit to higher level					

bArL Lower threeshold for bar-graph	bArH Upper thre-eshold for bargraph	... ↩ Transit to higher level

Figure 7: Programming matrix

8.3. CHANGING SETTINGS

The configuration of the parameter settings 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 seconds since the last push-button pressure.

The way to change settings is shown on Figure 8.

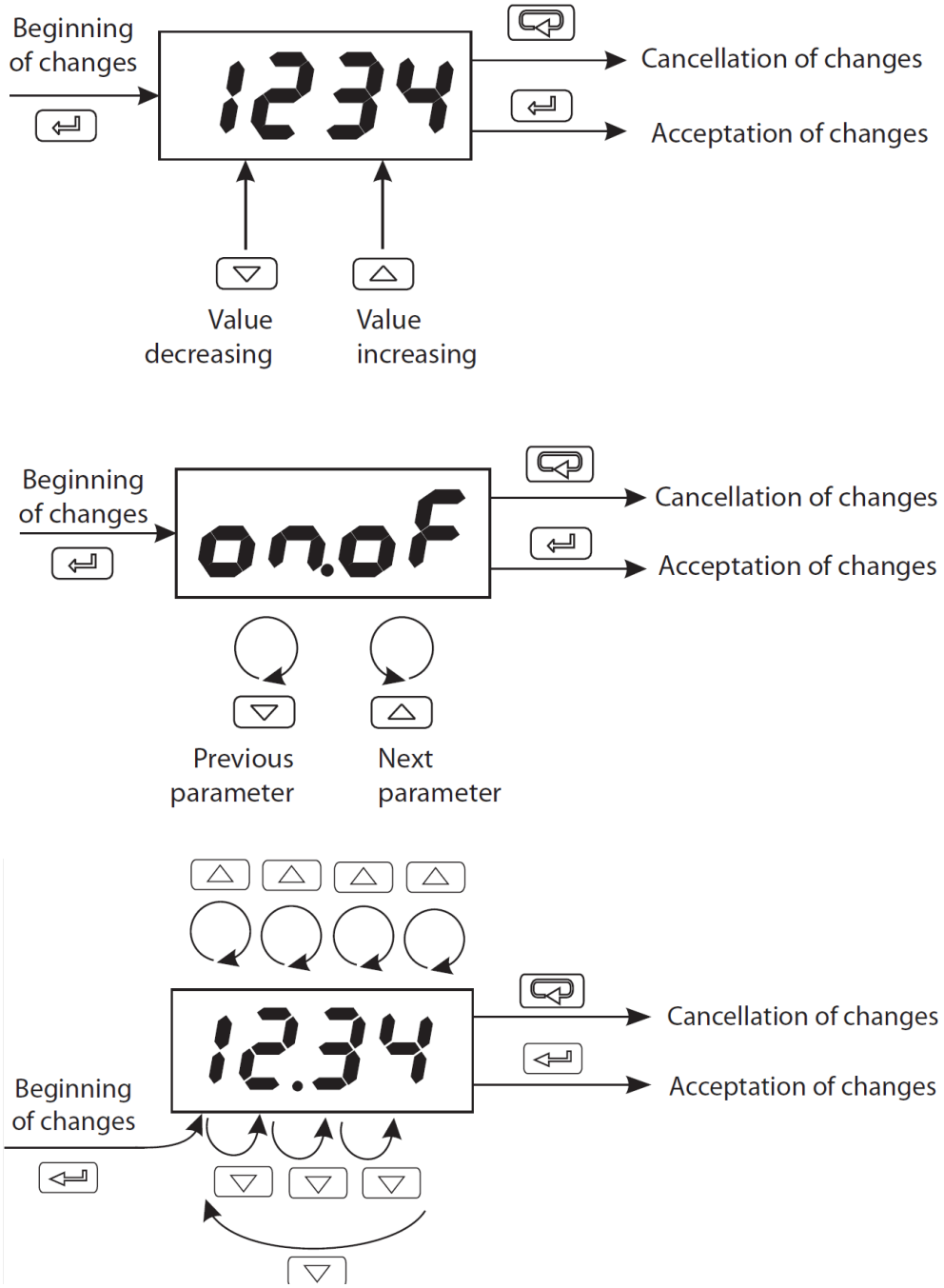


Figure 8: Change of number, text and time parameter settings.

8.4. PARAMETER DESCRIPTION

The list of the menu configuration parameters is presented in Table 1.

Table 1: List of configuration parameters.

Parameter symbol	Parameter description	Manufacturer setting	Range of parameter changes	
			Sensors	Linear input
InP – Input parameters				
unit	Unit	°C	°C: Celsius degrees °F: Fahrenheit degrees PU: Physical units	
inty	Kind of main input	Pt 1	Pt 1: Pt100 Pt 10: Pt1000 t-J: thermocouple J t-t: thermocouple T t-K: thermocouple K t-S: thermocouple S t-r: thermocouple R t-b: thermocouple B t-E: thermocouple E t-n: thermocouple N t-L: thermocouple L 0-20: linear current 0-20mA 4-20: linear current 4-20mA 0-5: linear voltage 0-5 V 0- 10: linear voltage 0-10 V	
dP	Position of the main input decimal point	1-dP	0_dP: without decimal point 1_dP: 1 decimal place	0_dP:without decimal point 1_dP: 1 decimal point 2_dP: 2 decimal point

i nLo	Indication for the lower threshold of the linear main input	0.0	-	-1999...9999 1)
i nHi	Indication for the upper threshold of the linear main input	100.0	-	-1999...9999 1)
SHi F	Measured value shift of the main input	0.0 °C	-100.0...100.0 °C (-180.0...180.0 °F)	-999...999 1)
i 2tY	Kind of the auxiliary input	4-20	0-20: linear current 0-20mA 4-20: linear current 4-20mA	
dP2	Position of the decimal point	1-dP	-	0_dP: without decimal point 1_dP: 1 decimal point 2_dP: 2 decimal point
i 2Lo	Indication for the lower threshold of the auxiliary linear input	0.0	-	-1999...9999 1)
i 2Hi	Indication for the upper threshold of the auxiliary linear input	100.0	-	-1999...9999 1)
FiLt	Time constant of the filter	0.5	oFF: filter disabled 0.2: time constant 0.2 s 0.5: time constant 0.5 s 1: time constant 1 s 2: time constant 2 s 5: time constant 5 s 10: time constant 10 s 20: time constant 20 s 50: time constant 50 s 100: time constant 100 s	

bn. 1	Function of the binary input 1	nonE	nonE: none StoP: control stop HAnd: switching into manual working SP2: switching SP1 into SP2 rSAt: erasing of timer alarm PStA: program start PnSt: jump to the next segment PHLd: 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 , nSP: switching SP into additional input value
bn. 2	Function of the binary input 2	nonE	nonE: none StoP: control stop HAnd: switching into manual working SP2: switching SP1 into SP2 rSAt: erasing of timer alarm PStA: program start PnSt: jump to the next segment PHLd: 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 , nSP: switching SP into additional input value
outP – Output parameters			
out 1	Function of output 1	y	oFF: without function y: control signal heating or control signal „open" for analog valve y0P: control signal for the stepper control – opening[5)] yCL: control signal for the stepper control - closing[5)] CooL: control signal - cooling or control signal „close" for analog valve AH.: upper absolute alarm AL.o: lower absolute alarm

			dwH : upper relative alarm dwLo: lower relative alarm dwin: inner relative alarm dwou: outer relative alarm RLtr: timer alarm rEtr: retransmission[6] Eu 1: 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
o1tY	Type of output 1	4-20 2)	rELY: relay output SSr: voltage output 0/5 V 4-20: continuous current output 4 – 20 mA 0-20: continuous current output 0 – 20 mA 0- 10: continuous voltage output 0 – 10 V
out2	Function of output 2	oFF	oFF: without function Y: control signal heating or control signal „open" for analog valve YOP: control signal for the stepper control – opening[5] YCL: control signal for the stepper control - closing[5] CooL: control signal - cooling or control signal „close" for analog valve RH : upper absolute alarm RLo: lower absolute alarm dwH : upper relative alarm dwLo: lower relative alarm dwin: inner relative alarm dwou: outer relative alarm RLtr: timer alarm RLhb: heater damage alarm RLoS: controlling element damage alarm (short circuit) rEtr: retransmission[6] Eu 1: 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
o2ty	Type of output 2	4-20 2)	rELY: relay output SSr: voltage output 0/5 V 4-20: 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 Y: control signal heating or control signal „open" for analog valve Y.oP: control signal for the stepper control – opening5) Y.CL: control signal for the stepper control - closing5) CooL: control signal - cooling or control signal „close" for analog valve AHi: upper absolute alarm ALo: lower absolute alarm duHi: upper relative alarm duLo: lower relative alarm du.in: inner relative alarm du.ou: outer relative alarm ALtr: timer alarm ALhb: heater damage alarm ALoS: controlling element damage alarm (short circuit) Eu 1: 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

out4	Function of output 4	oFF	oFF: without function Y: control signal heating or control signal „open" for analog valve YOP: control signal for the stepper control – opening[5)] YCL: control signal for the stepper control - closing[5)] CooL: control signal - cooling or control signal „close" for analog valve AHi: upper absolute alarm ALo: lower absolute alarm duHi: upper relative alarm duLo: lower relative alarm duin: inner relative alarm duou: outer relative alarm ALtr: timer alarm ALhb: heater damage alarm ALoS: controlling element damage alarm (short circuit) Eu1: auxiliary output for the program-following control Eu2: auxiliary output for the program-following control Eu3: auxiliary output for the program-following control ALFL: alarm in case of sensor failure or exceeding the measuring range
YFL	Control signal of control output for proportional control in case of the sensor damage or for program control in case of control stop [7)]	0.0	0.0....100.0

to1	Pulse period of output 1	20.0 s	0.5...99.9 s
to2	Pulse period of output 2	20.0 s	0.5...99.9 s
to3	Pulse period of output 3	20.0 s	0.5...99.9 s

to4	Pulse period of output 4	20.0 s	0.5...99.9 s
ctrL – Control parameters			
ALG	Control algorithm	Pid	onoF: control algorithm on-off Pid: control algorithm PID
tYPE	Kind of control	inu	dir: direct control (cooling) inu: reverse control (heating)
HY	Hysteresis	1.1 °C	0.2...100.0 °C (0.2...180.0 °F)
Hn	Displacement zone for heating-cooling control for dead zone for stepper control.	0.4 °C	0.0...100.0 °C (0.0...180.0 °F) / 0...999 1)
tmuo	Valve open time	60.0 s	3.0...600.0 s
tmuc	Valve close time	60.0 s	3.0...600.0 s
mnto	Minimum valve work time	0.2 s	0.1...99.9 s
y-Lo	Minimum control signal	0,0 %	0.0...100.0 %
y-Hi	Maximum control signal	100.0 %	0.0...100.0 %
GtY	"Gain Scheduling" function	oFF	oFF: disabled SP: from the set point value SEt: constant PID set
GSnb	Number of PID sets for "Gain Scheduling" from the set point value	2	2: 2 PID sets 3: 3 PID sets 4: 4 PID sets
GL 12	Switching levels for PID1 and PID 2 sets	0.0	MIN...MAX 3)
GL23	Switching levels for PID2 and PID 3 sets	0.0	MIN...MAX 3)

GL34	Switching levels for PID3 and PID 4 sets	0.0	MIN...MAX 3)
GSEt	Selection of the constant PID set	P1d1	P1d1: PID1 sets P1d2: PID2 sets P1d3: PID3 sets P1d4: PID4 sets
StLo	Lower threshold for auto-tuning	0.0 °C	MIN...MAX 3)
StHi	Upper threshold for auto-tuning	800.0 °C	MIN...MAX 3)
Fdb	Stepper control algorithm type	no	no: algorithm without feedback YES: algorithm with feedback
i2FL	Valve position, when auxiliary input error	u_CL	u_CL: valve closing u_oP: valve opening u_no: valve position unchanged
P1d – PID parameters			
P1d1	Pb Proportional band	30.0 °C	0.1...550.0 °C (0.1...990.0 °F)
	ti Integration time constant	300 s	0...9999 s
	td Differentiation time constant	60.0 s	0.0...2500 s
	Y0 Correction of the command signal, for P or control type PD	0.0 %	0...100.0 %
P1d2	Pb2 Second set of PID parameters ti2 td2 Y02	as PB, TI, TD, Y0	
P1d3	Pb3 Third set of PID parameters ti3 td3 Y03	as PB, TI, TD, Y0	

P.d4	Pb4 t.4 td4 Y04 Fourth set of PID parameters	as PB, TI, TD, Y0	
P.dC	PbC Proportional range for cooling loop (in relation to PB)	100.0 %	0.1...200 %
	t.C Integration time constant	300 s	0...9999 s
	tdC Differentiation time constant	60.0 s	0.0...2500 s
AL Ar – Alarm parameters			
A1.SP	Set point value for absolute alarm1	100.0	MIN...MAX [3]
A1.du	Deviation from the set point value for relative alarm 1	2.0 °C	-200.0... 200.0 °C (-360.0... 360.0 °F)
A1.HY	Hysteresis for alarm 1	1.0 °C	0.2...100.0 °C (0.2...180.0 °F)
A1.Lt	Memory of alarm 1	oFF	oFF: disabled on: enabled
A2.SP	Set point value for absolute alarm 2	100.0	MIN...MAX [3]
A2.du	Deviation from the set point value for relative alarm 2	2.0 °C	-200.0... 200.0 °C (-360.0... 360.0 °F)
A2.HY	Hysteresis for alarm 2	1.0 °C	0.2...100.0 °C (0.2...180.0 °F)

A2Lt	Memory of alarm 2	oFF	oFF: disabled on: enabled
A3SP	Set point value for absolute alarm 3	100.0 °C	MIN...MAX 3)
A3du	Deviation from the set point value for relative alarm 3	2.0 °C	-200.0... 200.0 °C (-360.0... 360.0 °F)
A3HY	Hysteresis for alarm 3	1.0 °C	0.2...100.0 °C (0.2...180.0 °F)
A3Lt	Memory of alarm 3	oFF	oFF: disabled on: enabled
A4SP	Set point value for absolute alarm 4	100.0 °C	MIN...MAX 3)
A4du	Deviation from the set point value for relative alarm 4	2.0 °C	-200.0... 200.0 °C (-360.0... 360.0 °F)
A4HY	Hysteresis for alarm 4	1.0 °C	0.2...100.0 °C (0.2...180.0 °F)
A4Lt	Memory of alarm 4	oFF	oFF: disabled on: enabled
hbSP	Set point for the heater damage alarm	0.0 A	0.0...50.0 A
hbHY	Hysteresis for the heater damage alarm	0.1 A	0.1...50.0 A
oSSP	Set point for the controlling element damage alarm (short-circuit)	0.0 A	0,0...50.0 A
oSHY	Hysteresis for the controlling element damage alarm (short-circuit)	0.1 A	0.1...50.0 A

SPP – Set point value parameters				
SP.Md	Kind of set point value	SP 1.2	SP 1.2: set point value SP1 or SP2 r.Mn: set point value with soft start in units per minute r.Hr: set point value with soft start in units per hour , n2: set point value from the additional input PrG: set point value from programming control SP, n: set point value SP or from the additional input	
C.PrG	Program No to carry out	1	1...15	
SP	Set point value SP	0.0 °C	MIN...MAX 3)	
SP2	Set point value SP2	0.0 °C	MIN...MAX 3)	
SP3	Set point value SP3	0,0 °C	MIN...MAX 3)	
SP4	Set point value SP4	0.0 °C	MIN...MAX 3)	
SPL	Lower limitation of the set point value change	-200 °C	MIN...MAX 3)	
SPH	Upper limitation of the set point value change	850 °C	MIN...MAX 3)	
SP.r	Accretion rate of the set point value SP1 or SP2 during the soft start.	0.0 °C	0...999.9 / time unit 4)	0...9999 1)/ time unit 4)
PrG – Programming control parameters				
The description of parameters is in the table 5: Programming control				
, ntE – Serial interface parameters				
Addr	Device address	1	1...247	
bAud	Baud rate	9.6	4.8: 4800 bit/s 9.6: 9600 bit/s 19.2: 19200 bit/s 38.4: 38400 bit/s 57.6: 57600 bit/s	

Prot	Protocol	r8n2	nonE: none r8n2: RTU 8N2 r8E 1: RTU 8E1 r8o 1: RTU 8O1 r8n 1: RTU 8N1
rEtr – Retransmission parameters			
RoFn	Quantity retransmitted on the continuous output	Pu	Pu: measured value on the main input PV Pu2: measured value on the additional input PV2 P 1-2: measured value PV - PV2 P2- 1: measured value PV2 – PV SP: set point value du: control deviation (set point value – measured value)
RoLo	Lower threshold of the signal to retransmit	0.0	MIN...MAX 3)
RoHi	Upper threshold of the signal to retransmit	100.0	MIN...MAX 3)
SErP – Service parameters			
SECU	Access code to the menu	0	0...9999
StFn	Auto-tuning function	on	oFF: locked on: available
ti ñr	Timer function	oFF	oFF: disabled on: enabled
ti ñE	Recounting time by the Timer	30.0 min	0.1...999.9 min
di 2	Monitoring of the auxiliary input	oFF	oFF: disabled on: enabled
dCt	Monitoring of the heater current	oFF	oFF: disabled on: enabled
tout	Time of the automatic exit from the monitoring mode	30 s	0...9999 s

bAr 1	Function of the upper bargraph	Pu	Pu: measured value on the main input PV Pu2: measured value on the additional input PV2 SP: set point value y 1: control signal on the output 1 y2: control signal on the output 2 S-tn: segment time P-tn: program time
bAr2	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 y 1: control signal on the output 1 y2: control signal on the output 2 S-tn: segment time P-tn: program time
bArL	Lower threshold for bargraphs (for PV, PV2 and SP)	0 °C	MIN...MAX 3)
bArH	Upper threshold for bargraphs (for PV, PV2 and SP)	850 °C	MIN...MAX 3)

1) The definition at which the given parameter is shown depends on the parameter dP – position of the decimal point.
2) 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 SPnd (rnin, rHr).
5) Applies to binary output.
6) Applies to analog output.
7) For control ALG = onoF and yFL <= 50%, control signal h = 0%, yFL > 50%, control signal h = 100%.

ATTENTION

- The accessibility of parameters depends on the controllers version and its current settings.

Table 2: Input signal details.

Symbol	Input/ sensor	MIN	MAX
Pt 1	Thermoresistor Pt100	-200 °C (-328 °F)	850 °C (1562 °F)
Pt 10	thermoresistor Pt1000	-200 °C (-328 °F)	850 °C (1562 °F)
t-J	Thermocouple of J type	-100 °C (-148 °F)	1200 °C (2192 °F)
t-t	Thermocouple of T type	-100 °C (-148 °F)	400 °C (752 °F)
t-K	Thermocouple of K type	-100 °C (-148 °F)	1372 °C (2501,6 °F)
t-S	Thermocouple of S type	0 °C (32 °F)	1767 °C (3212,6 °F)
t-r	Thermocouple of R type	0 °C (32 °F)	1767 °C (3212,6 °F)
t-b	Thermocouple of B type	0 °C (32 °F)	1767 °C (3212,6 °F)
t-E	Thermocouple of E type	-100 °C (-148 °F)	1000 °C (1832 °F)
t-n	Thermocouple of N type	-100 °C (-148 °F)	1300 °C (2372 °F)
t-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)

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

9. CONTROLLER INPUTS AND OUTPUTS

9.1. MAIN MEASURING INPUTS

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

The main input is a universal type 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 **, nty**.

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, set the indication for the lower and upper analog input threshold **, nLo** and **, nHi** .

The correction of the measured value indication is carried out by the parameter **SHiF**.

9.2. ADDITIONAL MEASURING INPUTS

The additional input can be the source of remote set point value (**SP.nd** set on **, n2**) or the signal for retransmission (**RoFn** set on **Py2**).

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 **, 2ty**. The position of the decimal point which defines the display format of the measured and set point value is set by the parameter **dP2**. Set the indication for the lower and upper analog input threshold **, 2Lo** and **, 2Hi** .

The signal from the additional input is displayed with the character **d** on the first position. To display the value, hold down the ↵ push-button until the moment of its appearance on the lower display (according to the Figure 6). The return to the set point value display is set by the manufacturer for 30 seconds, but it can be changed, or disabled via the parameter **tout**.

9.3. BINARY INPUTS

Functions of binary inputs are set by the **bn 1** and **bn 2** parameters. A different function must be set for each input.

Following are the binary input functions 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 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 increasing and one for decreasing the set point value, one can replace the change by pressing the upward and downward push-buttons and changing through the binary inputs.

- **Switching SP on IN2**: Change the set point value during the control between the SP and the value of the additional input (SP.nd parameter must be set to SP.1 n, the other binary input cannot have set the function switching SP on SP2).

9.4. 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 the 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, the lower the pulse period, the better the control, but for a relay output it should be as large as possible in order to prolong the relay lifetime.

Table 3: Recommendations concerning the pulse period.

Output	Pulse period	Load
Electromagnetic relay	Recommended >20 s, min. 10 s	2 A/230 V a.c.
	min. 5 s	1 A/230 V a.c.
Transistor output	1...3 s	SSR relay

10. CONTROL

10.1. 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; however the appearance of oscillations may occur, even at small hysteresis values.

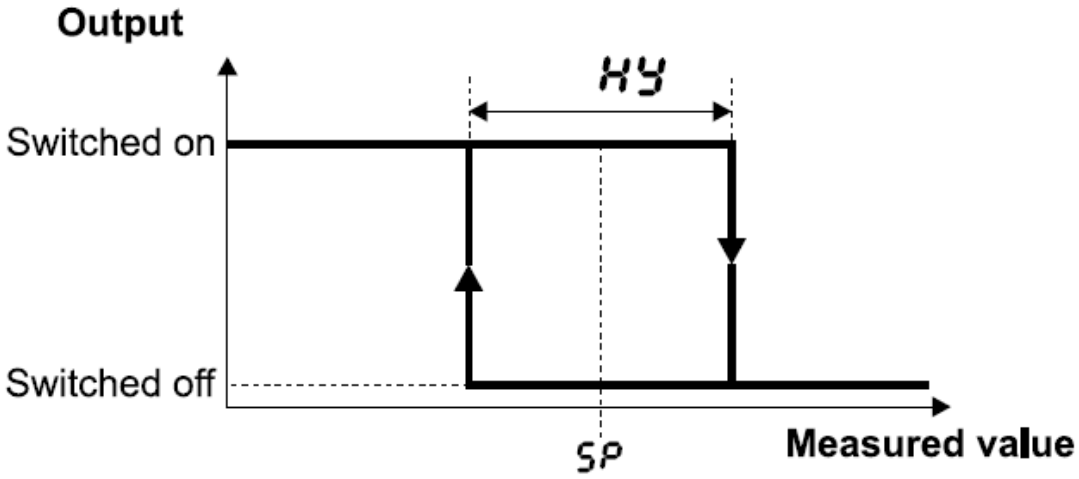


Figure 9: Heating type output in ON/OFF control mode.

10.2. INNOVATIVE SMART PID ALGORITHM

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

The applied innovative SMART PID algorithm is characterized by an increased accuracy for a wider 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.

10.2.1. AUTO-TUNING

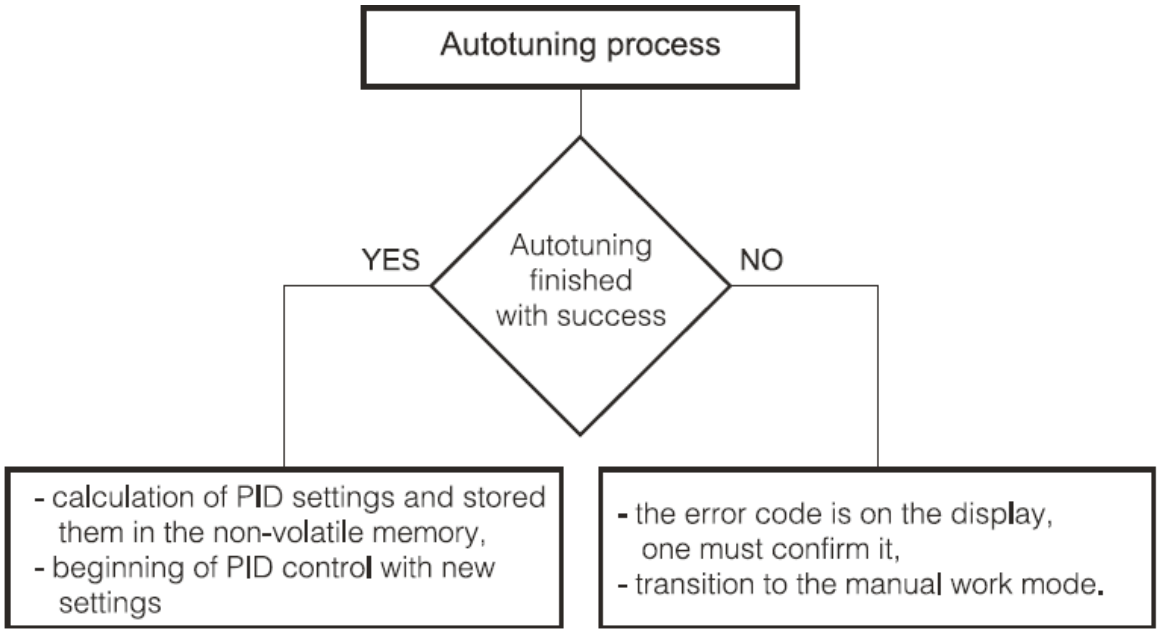
The controller has a function that is able to select suitable PID settings automatically. These settings ensure in most cases an optimal control. To begin the auto-tuning, transit to the tunE (according to the Figure 6) and hold down the ↵ push-button during at least 2 seconds. If the control algorithm is set to on-off or the auto-tuning function is locked, then the tunE message will be hidden.

For the correct execution of the auto-tuning function, the setting of St.Lo and St.Hi parameters is required. Set the St.Lo parameter on the value corresponding to the measured value at the switched off control. For object temperature control, set 0ºC.

Set the St.Hi parameter to 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 the dynamic object properties and can last a total of 10 hours. During the auto-tuning or immediately afterwards, over-regulations may occur, and for this reason, if possible, set a smaller set point.

The auto-tuning is composed by the following stages:



If the power supply is turned off or the ↵ push-button is pressed the auto-tuning process will be stopped without considering the auto-tuning PID settings. In that case, the control with the current PID settings begins.

If the auto-tuning is not achieved with success, an error code will be displayed, according to Table 4.

Table 4: Error codes on auto-tuning.

Error code	Reason	How to proceed
E5.01	P or PD control was selected.	One must select PI, PID control, i.e. the TI element must be higher than zero.
E5.02	The set point value is incorrect.	One must change the temperature set-point or parameters SE.Lo, SE.Hi . Set point value should be in the range: (SE.Lo + 10% of range ... SE.Hi - 10% of range) range = SE.Hi - SE.Lo Example: SE.Lo = -50°C, SE.Hi = 100°C range = 150°C, 10% of range = 15°C set-point value range (-35°C...135°C)
E5.03	The ↵ push-button was pressed.	
E5.04	The maximal duration time of auto-tuning was exceeded.	Check if the temperature sensor is correctly placed and if the set point value is not set too higher for the given object.
E5.05	The waiting time for switching was exceeded.	
E5.06	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.
E5.20	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.

10.2.2. AUTO-TUNING AND "GAIN SCHEDULING"

When "Gain Scheduling" is used, the auto-tuning can be carried out in two ways.

The first way consists in choosing a suitable set of PID parameters, in which the calculated PID parameters will be stored. Set the **GtY** parameter on set, and choose **GSEt** between **P1 d1** and **P1 d4**.

The second way enables the automatic realization of the auto-tuning for all PID sets. Set the **GtY** parameter on **SP**, and choose the number of PID sets for setting – parameter **GSnb**. Set point values for individual PID sets must be defined in **SP**, **SP2**, **SP3**, **SP4**, from the lowest to the highest.

10.2.3. PROCEEDING WAY IN CASE OF UNSATISFYING PID CONTROL

The best way to select PID parameters is to change each constant by incrementing or decrementing in a multiplier of two (e.g. if **t1** is set to 300 and the control in unsatisfying, change it to 150 or 600). During changes, respect the following principles in the respective order:

a) Oscillations:
1st. Increase the proportional band.
2nd. Increase the integration time.
3rd. Increase the differentiation time.

b) Over-regulations:
1st. Increase the proportional band.
2nd. Increase the integration time.
3rd. Increase the differentiation time.

c) Instability:
1st. Decrease the proportional band.
2nd. Decrease the differentiation time.

d) Free jump response:
1st. Decrease the proportional band.
2nd. Decrease the integration time.

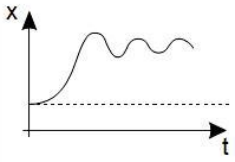
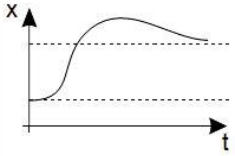
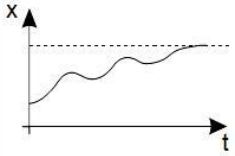
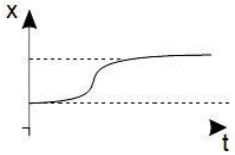
Run of controlled value	Algorithms of controller operations			
	P	PD	P	PID
	Pb↑	Pb↑ td↓	Pb↑	Pb↑ ti↑ td↓
	Pb↑	Pb↑ td↑	Pb↑ ti↑	Pb↑ ti↑ td↑
		Pb↓ td↓		Pb↓ td↓
	Pb↓	Pb↓	ti↓	Pb↓ ti↓

Figure 10: How to adjust the PID parameters.

11. THREE-STEP CONTROL

The controller offers two algorithms for three-step control:

a) With no feedback signal from the valve (open loop): opening and closing of the valve is based on PID parameters and control deviation.

b) With a feedback signal from the valve positioning feedback device (closed loop): opening and closing of the valve is based on PID parameters, control deviation and valve position readings from the additional input (0/4 ... 20 mA).

To select the three-step control, set one of the outputs **out 1**...**out4** to **3OP** and one of the outputs **out 1**...**out4** to **3CL**. For the algorithm with no feedback - the parameter **Fdb** should be set to **no**, for the algorithm with positioning feedback - the parameter **Fdb** should be set to yes. Additionally, set the insensitivity range for the set point, in which the valve does not change its position - the parameter **Hn** and select the set of PID parameters. Auto-tuning algorithm is not available for the three-step control.

For the algorithm with positioning feedback signal the parameter **, 2FL** is available. It specifies the state of the valve when a feedback signal error on the secondary auxiliary input occurs.

Three-step control with no feedback additionally requires the following parameter settings: valve open time **tmuo**, valve close time **tmuc**, and minimum valve working time **mntu**.

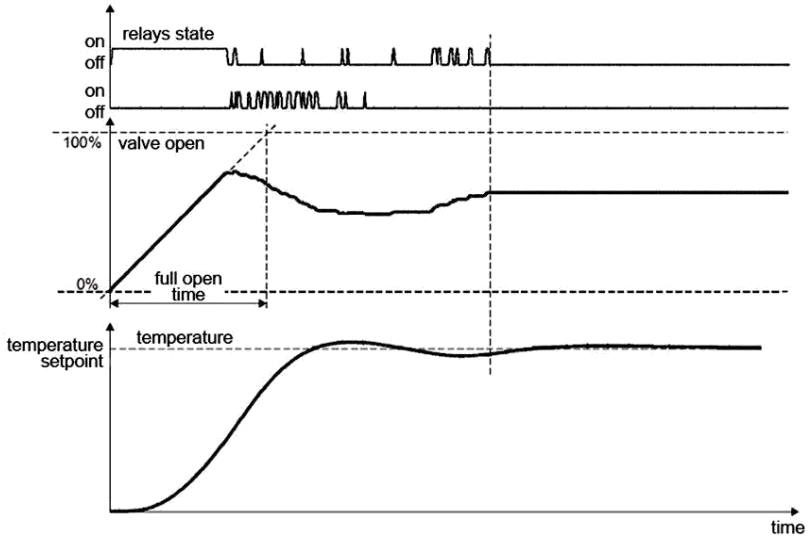


Figure 11: Three-step control with no feedback.

The differences between the calculated and the actual valve position are unavoidable because of multiple changes in the direction of the valve movement due to the inertia of a drive or its wear in the absence of a feedback signal. The controller uses the function of automatic positioning of a drive during operation to eliminate these differences. This function does not require the users' intervention and its function is to extend the switching 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 valve full opening/closing time, since the moment that a 100%/0% signal is reached. The positioning of the valve will stop once the signal is different from the maximum value.

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

- Turning the controllers supply on.

- Changing the full opening/closing time.

12. "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 the storage of up to four sets of PID parameters and is able of switching them over automatically. The switching between PID sets runs percussively and with hysteresis, in order to eliminate oscillations on switching limits.

The **GtY** 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 - GSnb, parameter, and set their switching levels GL 12, GL23, GL34. b) b) For the programmed control, one can set the PID set individually for each segment. Then for the given Prnn, program, in the PCFG group, one must set the Pid parameter on on.
SEt	Permanently setting of one PID set. The PID set is set through the GSEt parameter.

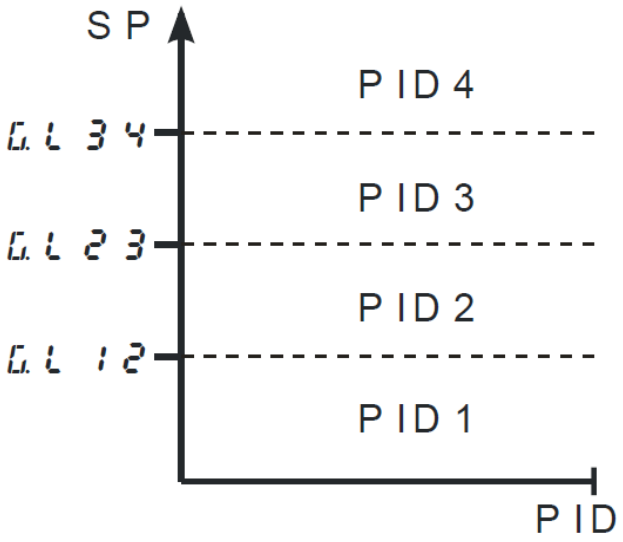


Figure 12: "Gain Scheduling" switching over from SP to SP.

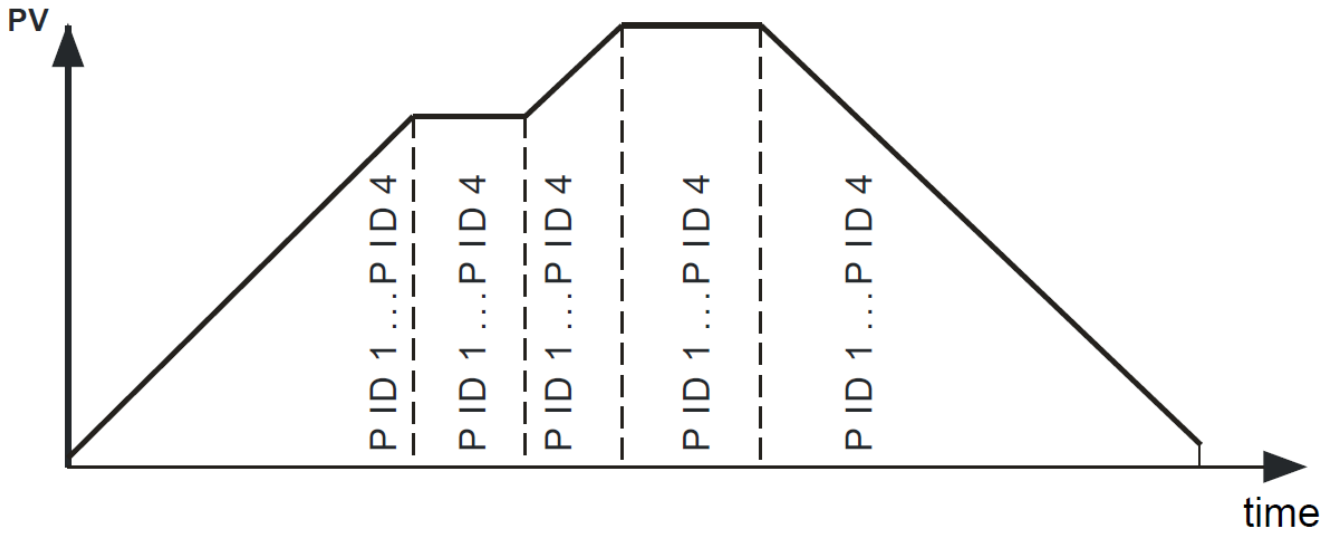


Figure 13: “Gain Scheduling” switched over for each segment in the programmed control.

13. CONTROL OF HEATING-COOLING TYPE

For the heating-cooling control, one of the outputs **out 1**...**out4** should be set to **4**, one of the outputs **out 1**...**out4** should be set to **Cool** and the displacement zone **Hn** for cooling should be configured.

For the heating loop, the PID parameters (**Pb**, **ti** , **td**) should be configured. The same should be done for the cooling loop PID parameters (**PbC**, **tiC**, **tdC**). The parameter **PbC** 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 **to 1**...**to4**).

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 to upper relative alarm.

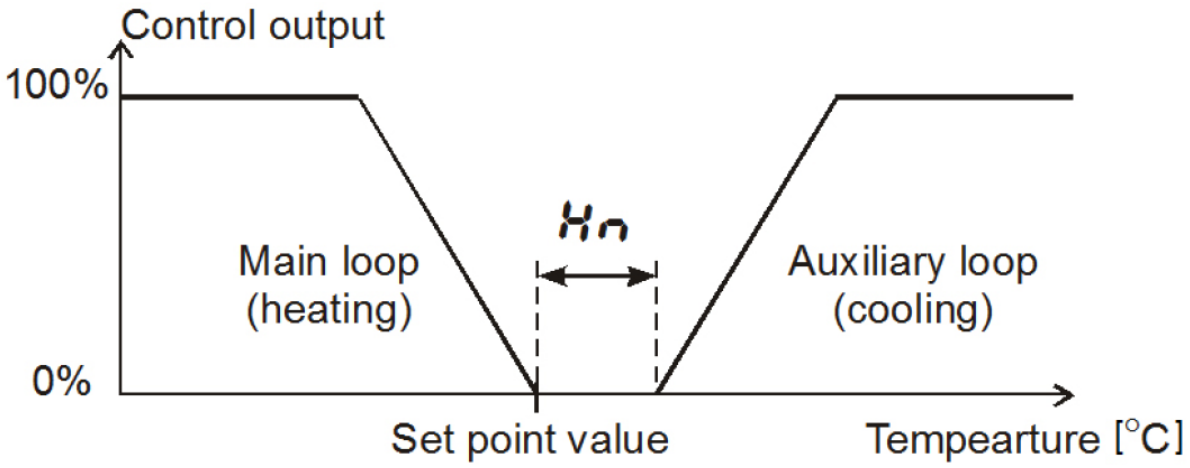


Figure 14: Control with two loops (heating-cooling type).

14. ALARMS

Four alarms are available in the controller, which can be assigned to each relay output. The alarm configuration requires the selection of the alarm through setting the **out 1**, **out2**, **out3** and **out4** parameters on the suitable type of alarm. Figure 15 shows the different types of available alarms.

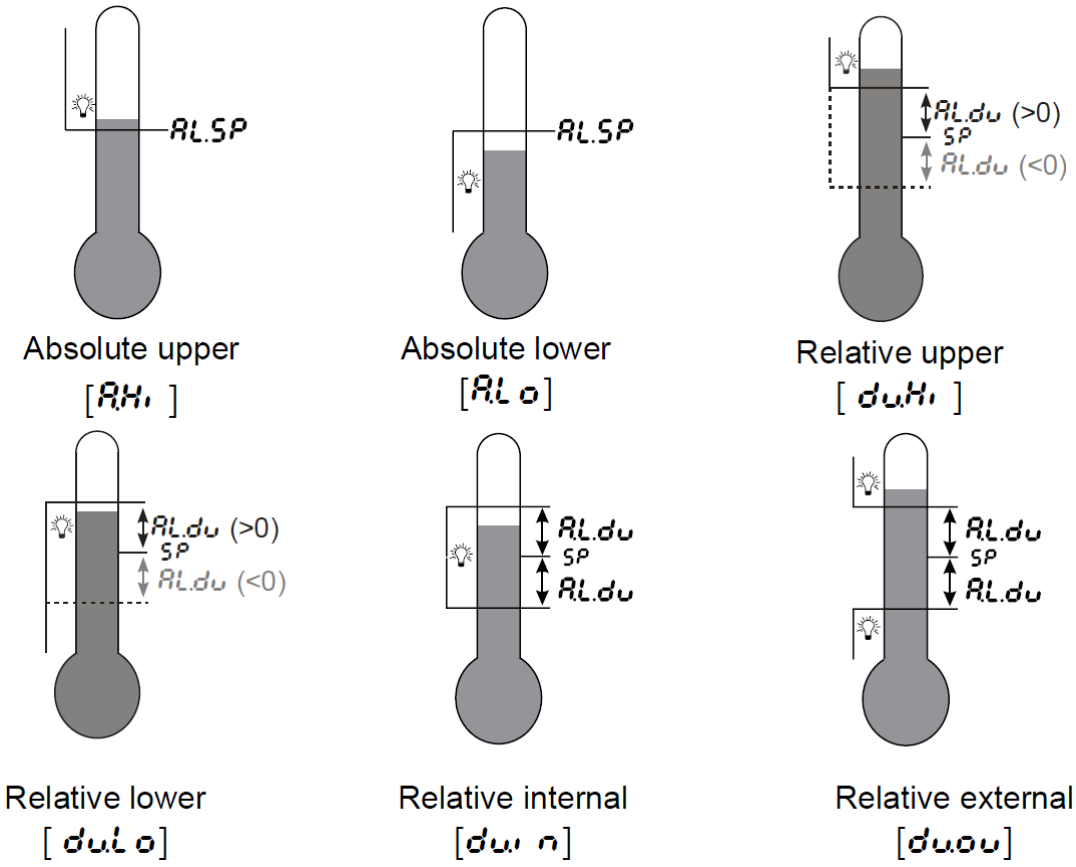


Figure 15: Types of alarms.

The set point value for absolute type alarms is the value defined by the **AL.SP** parameter, and for relative alarms, it is the deviation from the set point value in the main loop, **AL.du** parameter. The alarm hysteresis, i.e. the zone around the set point value, in which the output state does not change, is defined by the **AL.HY** parameter.

One can set the alarm latch, i.e. the memorization of the alarm state after the alarm conditions has stopped (parameter **AL.Lt** set as **on**). The erasing of the alarm memory can be made by the pressure of the ⏎ push-button in the normal working mode or interface.

Note: Hysteresis does not work with relative type alarms.

15. TIMER FUNCTION

When reaching the set point temperature, the timer begins the countdown of the time defined by the **t1 nE** parameter. After counting down to zero, the timer alarm is set, and it remains active until the moment of the timer erasing.

To activate the timer function, set the parameter **t1 nr** to **on**. To indicate the alarm state on an output, one of the outputs **out 1**...**out3** should be set to **AL.tr**.

The timer status / remaining time is displayed with the mark "t" on the first position. To display it, press the ↵ push-button until the moment of its appearance on the lower display (according to the Figure 6).

The return to the set point value display is set by the manufacturer to 30 sec, but can be changed, or disabled using the tout parameter.

Status	Description	Signaling
timer stopped		t - - -
Starting of the timer	- temperature over SP - Press the ▼ push-button	Remaining time in minutes: e.g. (t 23)
Pause of the timer	Press the ▼ push-button	Flickering remaining time in minutes
End of the countdown	Reaching zero by the timer	tEnd
Timer erasing	During the countdown: Press ▼ and ▲ push-buttons	
	After the countdown end: - press the ▲ push-button - through the binary input	

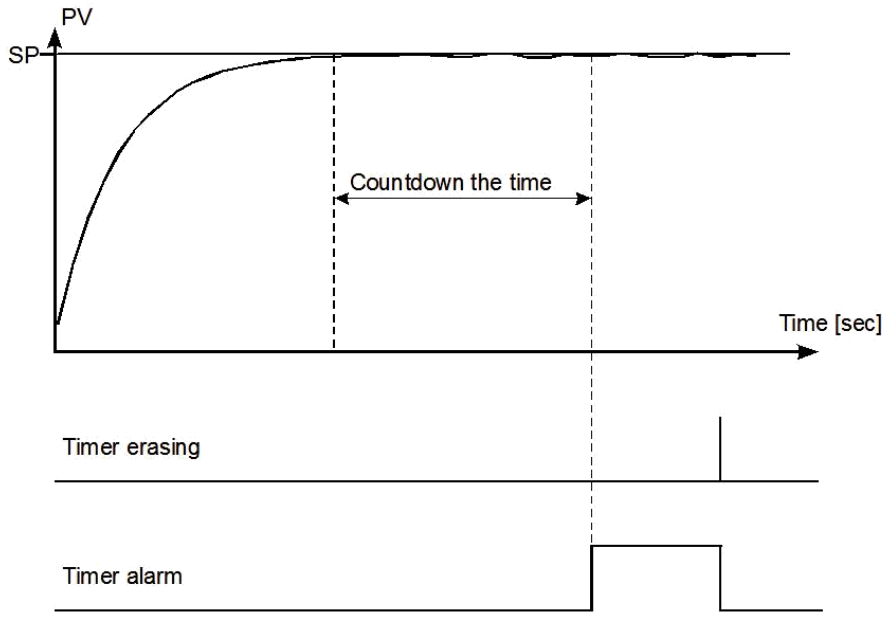


Figure 16: Principle of the timer operation.

16. 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. This 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 ms.

The transformer working range is 0 to 50 A. The heater current is displayed with the mark "A" in the first position.

In order to display the heater current, press the ↵ push-button until the moment of its appearance on the lower display (according to Figure 6). The return to the set point value display is set by the manufacturer to 30 sec, but can be changed, or disabled using the tout 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 type alarm is performed by the current measurement when the control element is disabled, on the other hand the burnout alarm type is realized when the control element is enabled.

The alarm configuration includes setting the alarm type. For the heater damage alarm out2...out4=AL.hb, and for the controlling element damage alarm out2 ... out4=AL.oS. Remaining parameters to set are the alarm set point value hbSP, oSSP and the hbHY, oSHY hysteresis.

ATTENTION

- For a correct detection of the heater alarm burnout, the heating element cannot be connected posteriorly to the controller.

17. ADDITIONAL FUNCTIONS

17.1. CONTROL SIGNAL MONITORING

The control signal of heating type is displayed with the mark "h" on the first position, in cooling type it's displayed with the mark "C". For valve position (opening / closing) it's displayed with the mark "u".

The access to the control signal depends on the suitable controller configuration. To display the control signal press the ↵ push-button until the moment of its appearance on the lower display (according to Figure 6). The return to the set point value display is set by the manufacturer to 30 sec, but can be changed, or disabled using the tout parameter.

17.2. MANUAL CONTROL

To enter the manual control mode hold down the ↵ push-button during the control signal display. The manual control is signalled by the pulsation of a LED light (see Figure 5). 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 "h" – for the main loop and "C" – for the auxiliary loop (cooling).

The ↵ push-button transits between loops (if the heating / cooling control mode is selected). The ▼ and ▲ push-buttons change the control signal. The controller switches to the normal working mode after the pressure of the ↩ push-button.

17.3. SIGNAL RETRANSMISSION

The continuous output can be used for the retransmission of the selected parameter: measured value on the main input PV, set point value, etc...

The signal retransmission is possible if output 1 or 2 is of analog type. We begin the signal retransmission by setting the **out 1** or **out2** parameter into **rEtr**. Additionally, set the upper and lower limit of the signal to be retransmitted (**RaLo** and **RaHi**). The signal selection for retransmission is carried out through the **RaFn** parameter. The retransmission signal thresholds should be selected according to Figure 17.

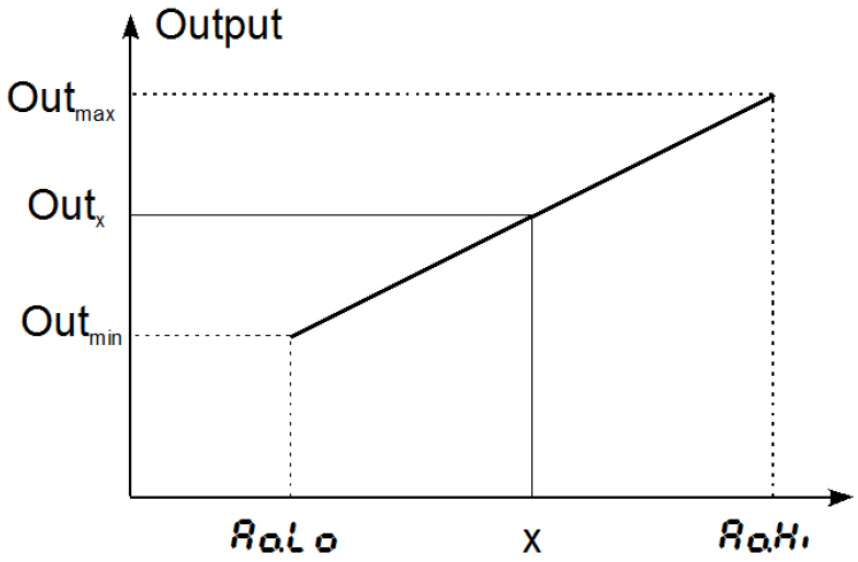


Figure 17: Retransmission signal threshold settings.

The output signal is calculated according to the following formula:

$$Out_x = Out_{min} + (x - RaLo)(Out_{max} - Out_{min})/(RaLo - RaHi)$$

The **RaLo** parameter can be higher than **RaHi** however the output signal will be consequently inversed.

17.4. SET POINT CHANGE RATE (SOFT START)

The limitation of the temperature accretion rate is carried out through the gradual changes on the set point value.

This function is activated after the controllers' supply connection and during the change of the set point value. This function allows reaching softly from the current measured value to the set point value. Write the accretion value in the **SPrr** parameter and the time unit in the **rAnP** parameter. An accretion rate equal to zero means that the soft start is disabled.

17.5. DIGITAL FILTER

If the measured value is instable, one can enable a programmed low-pass filter. Set the lowest time constant of the filter at which the measured value is stable. A high time constant can cause control instability. The filter time constant **Filt** can be set from 0.2 up to 100 seconds.

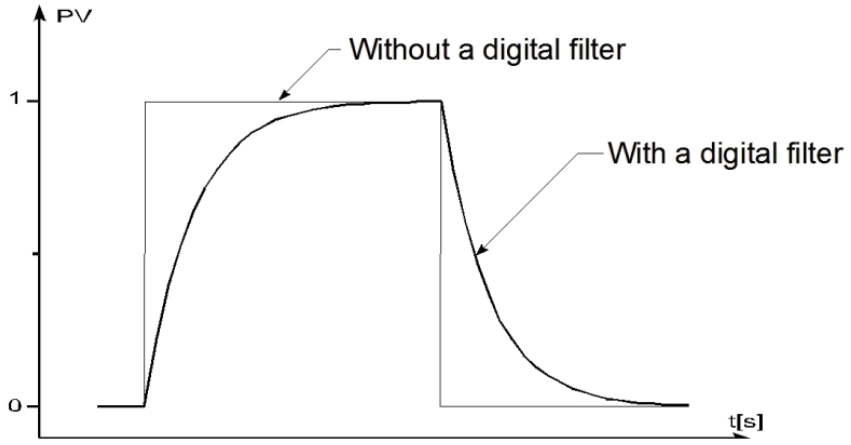


Figure 18: Time characteristic of the filter.

17.6. MANUFACTURER'S SETTINGS

The manufacturer's settings can be restored while connecting the controller to the power supply, by holding down [▼] and [▲] push-buttons simultaneously, until FAbr appears on the display.

18. PROGRAMMING CONTROL

18.1. DESCRIPTION OF THE PROGRAMMING CONTROL PARAMETERS

Table 5: List of configuration parameters.

PrG – Programming control						
Pr01	Sub-menu of the program no 1					
⋮						
Pr 15	Sub-menu of the program no 15					
	PCFG	Sub-menu of program parameters				
		Parameter symbol	Parameter description	Manufac-turer's settings	Range of parameter change	
					Sensors	Linear input
		Strt	Way to begin the program	Pu	SP0: from the way defined by SP0 Pu: from the way defined by SP0	
		SP0	Initial set point value	0.0 °C	MIN…MAX [1]	
		tmun	Unit for the segment duration time	mmSS	mmSS: minutes and seconds HH.mm: hours and minutes	
		rrun	Unit for the accretion rate of the set point value	mn.	mn: minutes Hour: hours	
		hold	Locking of the control deviation	oFF	oFF: inactive Lo: lower Hi: upper bAnd: reversible	
		CYCn	Number of program repetition	1	1…999	

		FAIL	Control after the supply decay	Cont	Cont: program continuation StoP: control stoppage and setting the steering signal on control output with the value from parameter YFL
		End	Control on the program end	StoP	StoP: Control stoppage and setting the steering signal on control output with the value from parameter YFL L.SP.: fixed set point control with set point from the last segment. E.SP: fixed set point control with set point from E_SP SP 12: fixed set point control with set point from SP or SP2
		E_SP	Set point value for the control after the program is completed	0,0 °C	MIN…MAX [1]
		Pid	"Gain Scheduling" function for the program	oFF	oFF: disabled on: enabled
	St.01	Submenu of program parameters			
	:	Submenu of program parameters			
	St.15	Submenu of program parameters			

		Parameter symbol	Parameter description	Manufac-turer's setting	Range of parameter change	
					sensors	linear input
		tYPE	Kind of segment	t i nE	t i nE: segment defined by the time rAtE: segment defined by the accretion duEL: set point withstand End: program end	
		t.SP	Set point on the segment end	0.0 °C	MIN…MAX [1]	
		t i nE	Segment duration	00.01	00.01…99.59 [2]	
		rr	Accretion rate of the set point	0.1	0.1..550.0 °C / time unit [4] (0.1...990.0 °F / time unit [4]	1..5500 °C [3]/ time unit [4] (1...9900 °F [3])/ time unit [4]
		HLdu	Value of the control deviation for which the counting of set point is interrupted	0.0	0.0... 200.0 °C (0.0... 360.0 °F)	0...2000 °C [3] (0...3600°F [3])
		Eu1	State of the auxiliary output no 1	oFF	oFF: disabled on: enabled	
		Eu2	State of the auxiliary Output no 2	oFF	oFF: disabled on: enabled	
		Eu3	State of the auxiliary Output no 3	oFF	oFF: disabled on: enabled	
		P i d	PID set for the segment	P i d1	P i d1: PID1 P i d2: PID2 P i d3: PID3 P i d4: PID4	

1) See Table 2.
2) The time unit is defined by the parameter tnun.
3) The resolution to show the given parameter depends on the parameter dP – position of decimal point.
4) The time unit is defined by the parameter rrun

18.2. DEFINITION OF THE SET POINT VALUE PROGRAMS

One can define 15 programs. The maximum number of segments in the program is also equal to 15. In order to render visible parameters related to the programming control in the menu, the parameter **SP.nd** must be set on **PrG**.

For each program, set parameters given in the submenu of the program parameters. For each segment, select the kind of segment followed by the parameters, depending on the kind of segment according to Table 6. The output state should also be set (only when **out 1**...**out4** are set to **Eu 1**, **Eu2**, **Eu3**) – parameter **Eu 1**, **Eu2**, **Eu3**.

Table 6: List of segment configuration parameters.

tYPE = t1 nE	tYPE = rAtE	tYPE = duEL	tYPE = End
t.SP	t.SP	t1 nE	
t1 nE	rr		
hLdu	hLdu		

Figure 19 and Table 7 illustrate an example of a set point value program. It is assumed in the program that the temperature has to increase from the initial temperature to 800 ºC, with a rate of 20 ºC per minute and active locking for the deviation. Following, and during 120 minutes, the temperature is maintained (locking disabled) and then the temperature has to decrease to 50ºC in 100 minutes (locking disabled). During the cooling process, the fan connected output 2, working as auxiliary output, is turned on (parameter **out2** set on **Eu 1**).

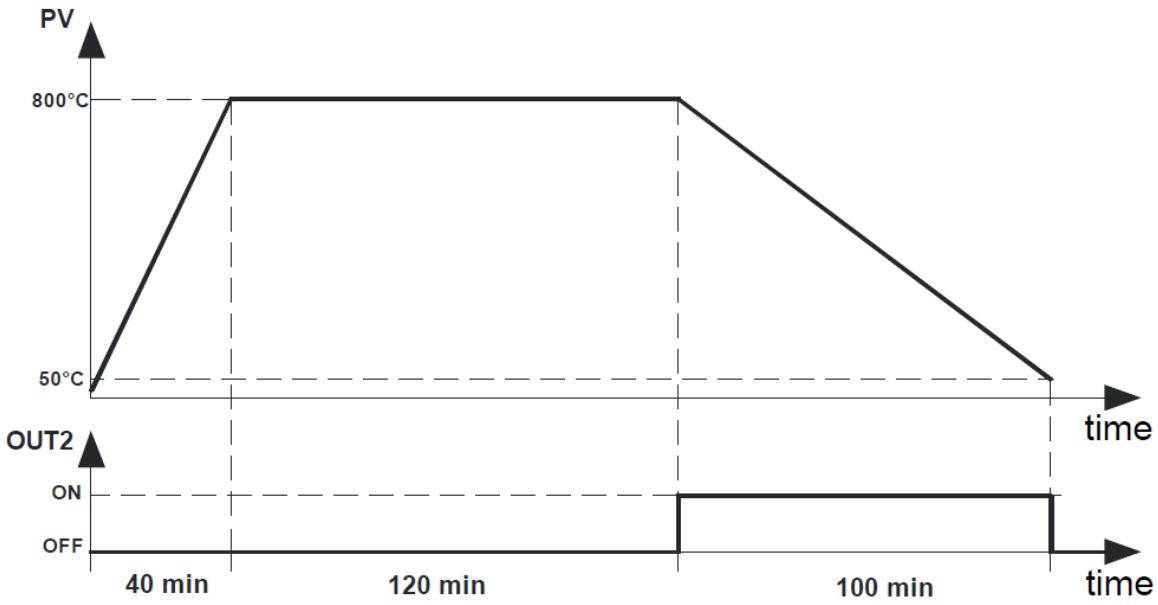


Figure 19: Program example.

Table 7: Parameter values for the example above.

	Parameter	Value	Meaning
PCFG	Strt	Pu	Start to count the set point value from the current temperature
	tUn	HH.mm	Time unit: hour, minute
	rrUn	min	Unit for the accretion rate: minute
	hold	bAnd	Locking for the program: active – two-sided
	CYCn	1	Number of program repetitions
	FAIL	cont	Program continuation after a supply decay
	End	StoP	Control stoppage after the program end
St.01	tYPE	rAtE	Kind of segment: accretion rate
	t.SP	800.0	Target set point value: 800.0 °C
	rr	20.0	Accretion rate 20.0 °C / minute
	HLdU	50.0	Active locking, when the deviation exceeds 50.0 °C
	Ev1	oFF	Output 2 as the auxiliary output Ev1: disabled
St.02	tYPE	duEL	Kind of segment: withstand of set point value
	t.mE	02.00	Segment time 2h00 = 120 minutes
	Ev1	oFF	Output 2 as the auxiliary output Ev1 – disabled
St.03	tYPE	t.mE	Kind of segment: accretion time
	t.SP	50.0	Target set point value: 50.0 °C
	t.mE	01.40	Segment time 1h40 = 100 minutes
	HLdU	0.0	Inactive locking
	Ev1	on	Output 2 as the auxiliary output Ev1: enabled
St.04	tYPE	End	Kind of segment: program end
	Ev1	oFF	Output 2 as the auxiliary output Ev1: disabled

18.3. CONTROL OF THE SET POINT VALUE PROGRAMS

When the SP.nd parameter is set on PrG, the controller controls the object in compliance with the set point value changing in time according to the given program. Before starting the control with the changeable set point value, select the required program (parameter C.PrG).

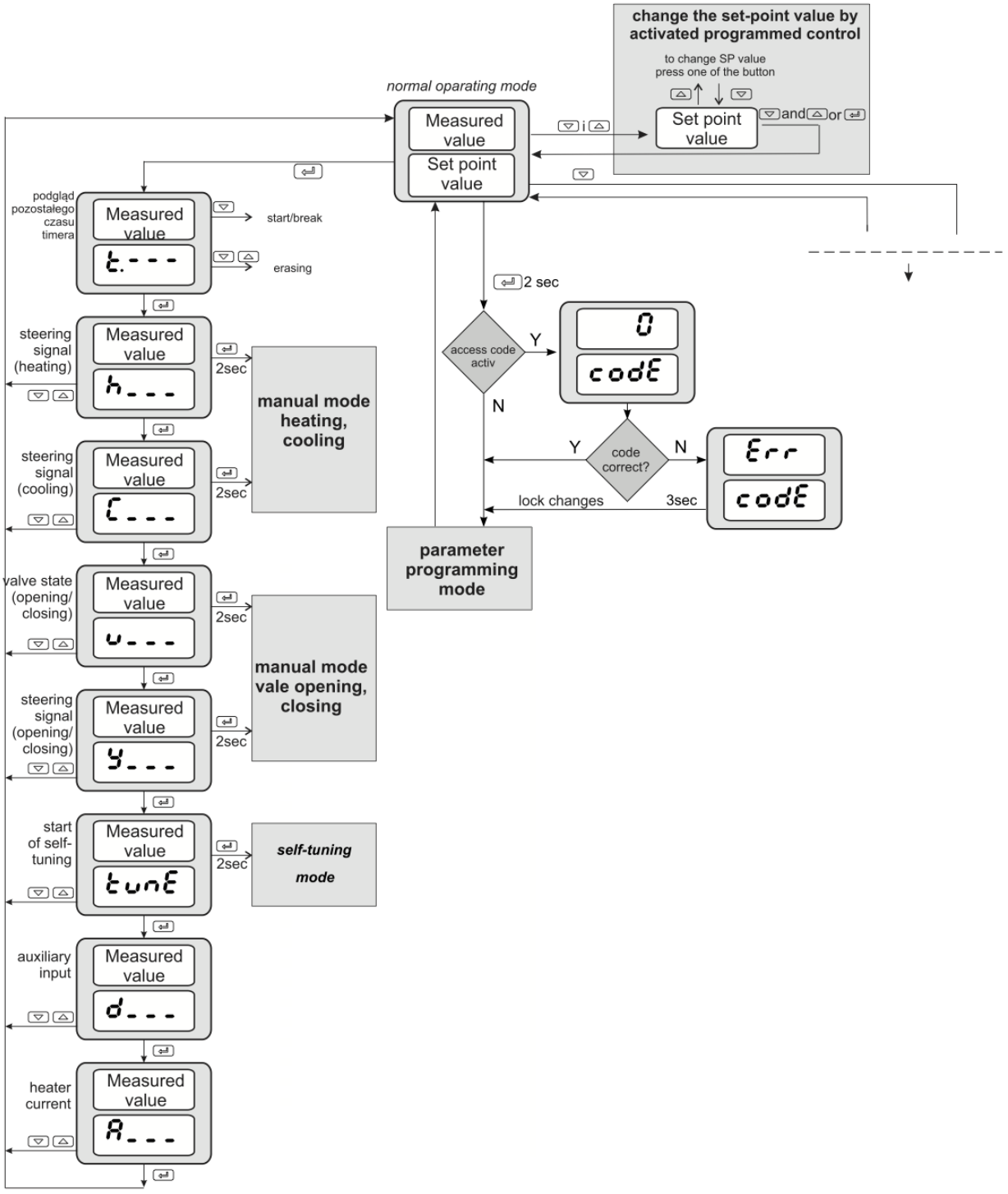
To start the program, press ▼ and ▲ push-buttons when the StoP or End inscription appears on the lower display (see Figure 20).

The glowing segment in the bottom right corner of the lower display (see Figure 5) means that the programming control is in execution. During the program execution, the parameters of the program are visible, i.e. the program status, program number, number of the current segment, number of cycles which still remain to be carried out, time which goes by in the segment, time remaining until the end of the segment, time remaining until the end of the program.

After finishing the program the glowing segment goes off; The program may also restart if the number of the program repetitions CYC.n is higher than 1.

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

When the parameter hold (locking in the program) is set on Lo, Hi or bAnd and the locking value HLdu in the operating segment is higher than zero the amount of control deviation is controlled (set point value minus measured value). If hold is set to Lo the locking is active, when the measured value is below the set point value diminished by the locking value. If hold is set to Hi the locking is active, when the measured value exceeds the set point value by the locking value. If hold is set to bAnd 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 glowing segment in the bottom right corner of the lower display is flickering. The controller controls according to the last calculated set point value.



Note! Availability of screens depends on the controller version and its current settings

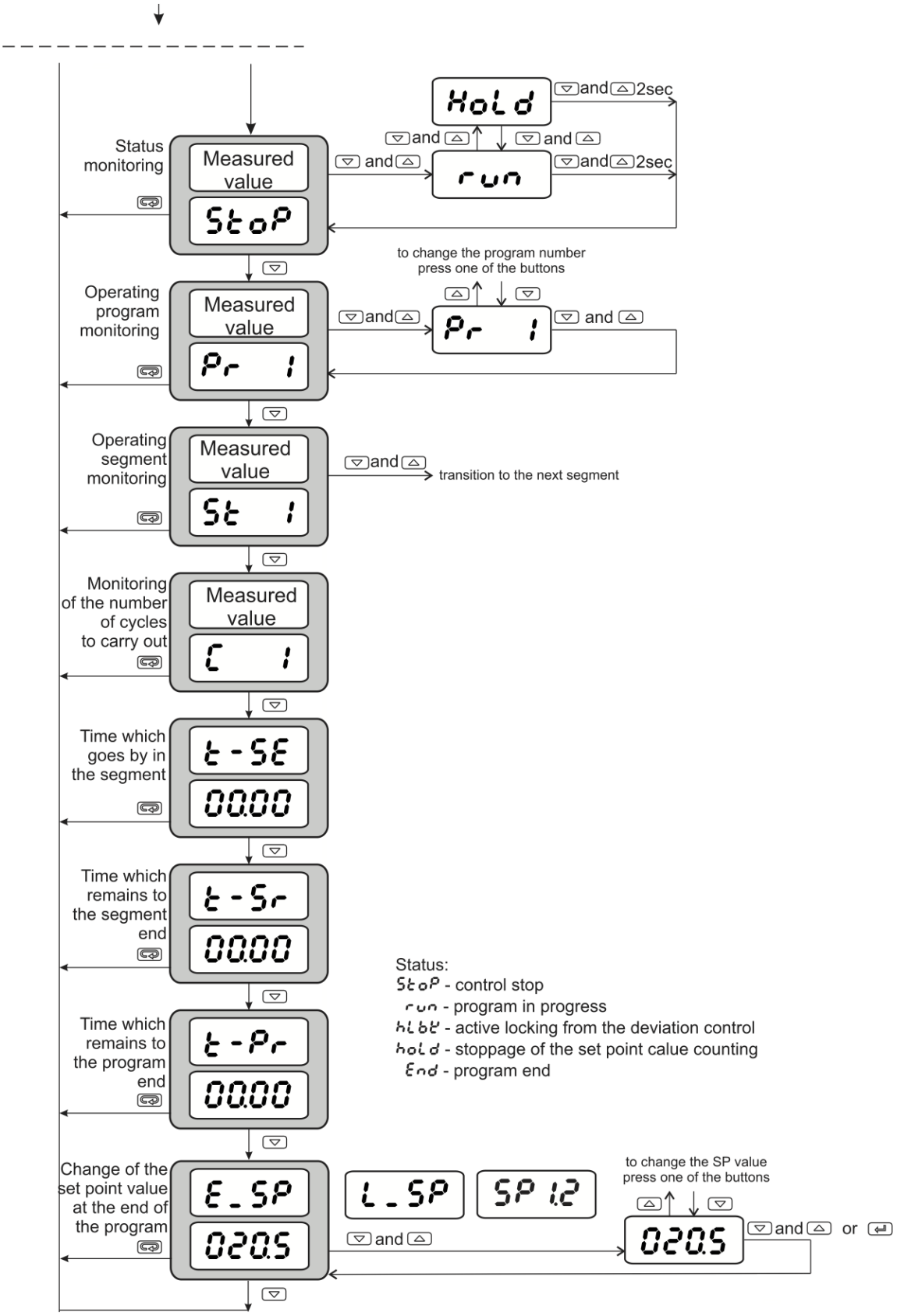


Figure 20: Menu for the programming control service.

19. RS-485 INTERFACE WITH MODBUS PROTOCOL

19.1. INTRODUCTION

The UC-820 controller is equipped with a serial interface in RS-485 standard with implemented asynchronous MODBUS communication protocol.

Following is the list of serial interface parameters for the UC-820 universal process 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 controller performs the following protocol functions:

Table 8: Implemented MODBUS functions.

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

19.2. 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 Table 9.

Table 9: Error codes.

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.

19.3. REGISTER MAP

Table 10 presents the register mapping of the UC-820 universal process controller.

Table 10: Map of register groups.

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.

Possible operations:

- R : Read;
- W : Write;
- RW: Read and write.

Table 11: Register map from address 4000.

Register address	Marking	Ope¬ration	Parameter range	Description
4000		-W	1…6	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-	100…999	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 : 0/4…20 mA 1 0 0 – output 1 – continuous voltage: 0…10 V bit 5 4 3 – OUTPUT 2: 0 0 1 – output 2 – relay 0 1 0 – output 2 – 0/5 V 0 1 1 – output 2 – continuous current: 0/4…20 mA 1 0 0 – output 2 – continuous voltage: 0…10 V

4003		R-	0…0xFFFF	Controller status – description in table 12
4004		R-	0…0xFFFF	Alarm state – description in table 13
4005		R-	0…0xFFFF	Error status – Description in table 14
4006		R-	acc. to table 17[1)]	Measured value PV
4007		R-	-1999…9999	Measured value on additional input
4008		R-	acc. to table 17[1)]	Current set point value SP
4009		RW	0…1000	Control signal of loop 1 [% x10] [2)]
4010		RW	0…1000	Control signal of loop 2 [% x10] [2)]
4011		R-	0…59994	Timer value [s]
4012		R-	0…500	Heater current when the output is turned on [A x10]
4013		R-	0…500	Heater current when the output is turned off [A x10]
4014	UNIT	RW	0…2	Unit: 0 – Celsius degrees 1 – Fahrenheit degrees 2 – physical units
4015	INPT	RW	0…14	Kind of main input: 0 – resistance thermometer Pt100 1 – resistance thermometer Pt1000 2 – thermocouple of J type 3 – thermocouple of T type 4 – thermocouple of K type 5 – thermocouple of S type 6 – thermocouple of R type 7 – thermocouple of B type 8 – thermocouple of E type 9 – thermocouple on N type 10 – thermocouple of L type 11 – current input: 0-20mA 12 – current input: 4-20mA 13 – voltage input: 0-5 V 14 – voltage input: 0-10 V

4016	DP	RW	0…1 [3) 4)] 0…2 [5)]	Position of the decimal point of the main input: 0 – without decimal place 1 – 1 decimal place 2 – 2 decimal places
4017	INLO	RW	-999…9999 [1)]	Indication for the lower threshold of the analog main input.
4018	INHI	RW	-999…9999 [1)]	Indication for the upper threshold of the analog main input.
4019	SHIF	RW	-999…999 [1)]	Shift of the measured value of the main input.
4020	I2TY	RW	0…1	Kind of the additional input: 0 – current inpur: 0-20mA 1 – current input: 4-20mA
4021	DP2	RW	0…2	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	-999…9999 [1)]	Indication for the lower threshold of the analog main input.
4023	I2HI	RW	-999…9999 [1)]	Indication for the upper threshold of the analog main input.
4024	FILT	RW	0…9	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	0…10	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	0…10	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	0…16	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 8 – relative lower alarm 9 – relative internal 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

				15 – auxiliary output EV3 in the programming control 16 – alarm in case of sensor failure or exceeding the measuring range
4028	O1TY	R	1…6	Output 1 type: 1 – relay output 2 – voltage output: 0/5 V 3 – current output : 4-20 mA 4 – current output : 0-20 mA 5 – reserved 6 – voltage output:: 0-10 V
		RW	3…4 [6]	
4029	YFL	RW	0…1000	Control signal of output 1 for proportional control in case of sensor damage [% x10] or for program control in case of control stop [9]
4030	OUT2	RW	0…18	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	0…6	Output 2 type: 0 – without relay 1 – relay soutput 2 – voltage output: 0/5 V 3 – current output : 4-20 mA 4 – current output : 0-20 mA 5 – voltage output: 0-5 V 6 – voltage output:: 0-10 V
		RW	3…4 [6)]	
4032	OUT3	RW	0…17	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 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
4033	OUT4	RW	0…17	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	0…1	Control algorithm: 0 – on-off 1 – PID
4035	TYPE	RW	0…1	Kind of control: 0 – direct control – cooling 1 – reverse control – heating
4036	HY	RW	2...999 [1)]	Hysteresis HY
4037	GTY	RW	0…2	“Gain Scheduling “ function 0 – disabled 1 – from set point value 2 – constant PID set
4038	GSNB	RW	0…2	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 [1)]	Switching level for PID1 and PID2 sets
4040	GL23	RW	acc. to table 17 [1)]	Switching level for PID2 and PID3 sets
4041	GL34	RW	acc. to table 17 [1)]	Switching level for PID3 and PID4 sets

4042	GSET	RW	0…3	Selection of the constant PID set 0 – PID1 1 – PID2 2 – PID3 3 – PID4
4043	PB	RW	0…9999 [1)]	Proportional band PB
4044	TI	RW	0…9999	Integration time constant TI [s]
4045	TD	RW	0…9999	Differentiation time constant TD [s x10]
4046	Y0	RW	0…1000	Correction of control signal (for P or PD control) [% x10]
4047	PB2	RW	0…9999 [1)]	Proportional band PB2
4048	TI2	RW	0…9999	Integration time constant TI2 [s]
4049	TD2	RW	0…9999	Differentiation time constant TD2 [s x10]
4050	Y02	RW	0…1000	Correction of control signal (for P or PD control) [% x10]
4051	PB3	RW	0…9999 [1)]	Proportional band PB3
4052	TI3	RW	0…9999	Integration time constant TI3 [s]
4053	TD3	RW	0…9999	Differentiation time constant TD3 [s x10]
4054	Y03	RW	0…1000	Correction of control signal (for P or PD control) [% x10]
4055	PB4	RW	0…9999 [1)]	Proportional band PB4
4056	TI4	RW	0…9999	Integration time constant TI4 [s]
4057	TD4	RW	0…9999	Differentiation time constant TD4 [s x10]
4058	Y04	RW	0…1000	Correction of control signal (for P or PD control) [% x10]
4059	TO1	RW	5…999	Pulse period of output 1 [s x10]
4060	HN	RW	0…999 [1)]	Displacement zone for heating-cooling control or dead zone for stepper control

4061	PBC	RW	1…2000	Proportional band PBC [% x10] (in relation to PB)
4062	TIC	RW	0…9999	Integration time constant TIC [s]
4063	TDC	RW	0…9999	Differentiation time constant TDC [s]
4064	TO2	RW	5…999	Pulse period of output 2 [s x10]
4065	A1SP	RW	acc. to table 17 1)	Set point value for absolute alarm 1
4066	A1DV	RW	-1999…1999 1)	Deviation from the set point value for relative alarm 1
4067	A1HY	RW	2…999 1)	Hysteresis for alarm 1
4068	A1LT	RW	0…1	Memory of alarm 1 0 – disabled 1 – enabled
4069	A2SP	RW	acc. to table 17 1)	Set point value for absolute alarm 2
4070	A2DV	RW	-1999…1999 1)	Deviation from the set point value for relative alarm 2
4071	A2HY	RW	2…999 1)	Hysteresis for alarm 2
4072	A2LT	RW	0…1	Memory of alarm 2 0 – disabled 1 – enabled
4073	A3SP	RW	acc. to table 17 1)	Set point value for absolute alarm 3
4074	A3DV	RW	-1999…1999 1)	Deviation from the set point value for relative alarm 3
4075	A3HY	RW	2…999 1)	Hysteresis for alarm 3
4076	A3LT	RW	0…1	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	-1999…1999 [1)]	Deviation from the set point value for relative alarm 4
4079	A4HY	RW	2…999 [1)]	Hysteresis for alarm 4
4080	A4LT	RW	0…1	Memory of alarm 4 0 – disabled 1 – enabled
4081	HBSP	RW	0…500	Set point value for the heater damage alarm [Ax10]
4082	HBHY	RW	0…500	Hysteresis for the heater damage alarm [Ax10]
4083	SPMD	RW	0…5	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 [1)]	Set point value SP
4085	SP2	RW	acc. to table 17 [1)]	Set point value SP2
4086	SP3	RW	acc. to table 17 [1)]	Set point value SP3
4087	SP4	RW	acc. to table17 [1)]	Set point value SP4
4088	SPLL	RW	acc. to table17 [1)]	Lower limitation of the fast set point value change
4089	SPLH	RW	acc. to table17 [1)]	Upper limitation of the fast set point value change
4090	SPRR	R	0…9999 [1)]	Accretion rate of the set point value SP1 or SP2 during the soft start
4091	ADDR	RW	1…247	Device address

4092	BAUD	RW	0…4	Baud rate: 0 – 4800 1 – 9600 2 – 19200 3 – 38400 4 – 57600
4093	PROT	RW	0…4	Protocol: 0 – none 1 – RTU 8N2 2 – RTU 8E1 3 – RTU 8O1 4 – RTU 8N1
4094	-	RW	0…65535	Reserved
4095	AOFN	RW	0…5	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 [1)]	Lower limit of signal for retransmission
4097	AOHI	RW	acc. to table 17 [1)]	Upper limit of signal for retransmission
4098	SECU	RW	0…9999	Access code to the menu
4099	STFN	RW	0…1	Auto-tuning function: 0 – locked 1 – unlocked
4100	STLO	RW	acc. to table 17 [1)]	Lower limit of signal for retransmission
4101	STHI	RW	acc. to table 17 [1)]	Upper limit of signal for retransmission
4102	TOUT	RW	0…250	Time of automatic output from the monitoring mode

4103	TIMR	RW	0…1	Timer function: 0 – disabled 1 – enabled
4104	TIME	RW	1…9999	Time counted down by the timer [min x 10]
4105	DI2	RW	0…1	Monitoring of the auxiliary input: 0 – disabled 1 – enabled
4106	DCT	RW	0…1	Monitoring of heater current: 0 – disabled 1 – enabled
4107	BAR1	RW	0…6	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	0…6	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 [1)]	Lower threshold for bargraphs
4110	BARH	RW	acc. to table 17 [1)]	Upper threshold for bargraphs
4111	TO3	RW	5…999	Pulse period of output 3 [s x10]
4112	TO4	RW	5…999	Pulse period of output 4 [s x10]

4113	FDB	RW	0…1	Algorithm for stepper control 0 – without feedback 1 – with feedback
4114	OSSP	RW	0…500	Set point for the controlling element damage alarm (short- circuit) [Ax10]
4115	OSHY	RW	0…500	Hysteresis for the controlling element damage alarm (short-circuit) [Ax10]
4116	TMVO	RW	30…6000	Valve open time [s x10]
4117	TMVC	RW	30…6000	Valve close time [s x10]
4118	MNTV	RW	1…999	Minimum valve work time [s x10]
4119	YLO	RW	0…1000	Minimum control signal [% x10]
4120	YHI	RW	0…1000	Maximum control signal [% x10]
4121	I2FL	RW	0…2	State of the valve when auxiliary input error 0 – valve closing 1 – valve opening 2 – valve position unchanged

1) Value with the decimal point position defined by bits 0 and 1 in the register 4003.
2) 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 ALG = onoF and YFL <= 50%, control signal h = 0%, YFL > 50%, control signal h = 100%.

Table 12: Register 4003 – controller status.

bit	Description
0-1	Decimal point position for MODBUS registers from address 4000, depending on the input (0...2)[1)]
2-3	Decimal point position for MODBUS registers from address 4000, depending on the additional input (0...2)[1)]
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

1) For sensor input values it is equal to 1; for linear inputs the value depends on the parameter dP (register 4023).

Table 13: Register 4004 – alarm state.

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
6-15	Reserved

Table 14: Register 4005 – error register

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

Table 15: Map of register from address 4150.

Register address		Marking	Operation	Parameter range	Description
4150			RW	0…14	Program number for realization (0 – means first program)
4151			RW	0…1	Program start/stop: 0 – program stop 1 – program start (the write causes the program start from the beginning)
4152			RW	0…1	Stoppage of set point value counting in the program: 0 – disabled 1 – enabled
4153			RW	0…14	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]

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	0…65535	Reserved
4163				RW	0…65535	Reserved
4164				RW	0…65535	Reserved
4165				RW	0…65535	Reserved
4166				RW	0…65535	Reserved
4167				RW	0…65535	Reserved
4168				RW	0…65535	Reserved
4169				RW	0…65535	Reserved
4170	Program 1	Program parameters	STRT	RW	0…1	Way to begin the program: 0 – from value defined by SP0 1 – from current measured value
4171			SP0	RW	acc. to table 17[1)]	Initial set point value
4172			TMUN	RW	0…1	Unit for the segment duration: 0 – minutes and seconds 1 – hours and minutes
4173			RRUN	RW	0…1	Unit for the accretion rate of the set point value: 0 – minutes 1 – hours
4174			HOLD	RW	0…3	Lockings of control deviations 0 – inactive 1 – lower 2 – upper 3 – two-sided
4175			CYCN	RW	1…999	Number of program repetitions
4176			FAIL	RW	0…1	Control after a supply decay: 0 – program continuation 1 – control stoppage

4177		END	RW	0…3	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	0…1	"Gain Scheduling" function for the program: 0 – disabled 1 – enabled
4179	Segment 1	TYPE	RW	0…3	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 [1)]	Set point value on the segment end
4181		TIME	RW	1…5999	Segment duration
4182		RR	RW	1…5500 [1)]	Accretion rate of the set point
4183		HLDV	RW	0…2000 [1)]	Value of the control deviation, over which the set point value counting is interrupted
4184			RW	0…3	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	0…3	PID set for the segment: 0 – PID1 1 – PID2 2 – PID3 3 – PID4
…	…				

4277		Segment 15	TYPE	RW	0…3	Kind of segment
4278			TSP	RW	wg tablicy 17 [1)]	Set point value on the segment end
4279			TIME	RW	0…5999	Segment duration
4280			RR	RW	1…5500 [1)]	Accretion rate of the set point value
4281			HLDV	RW	0…2000 [1)]	Control deviation value, over which the set point value counting is interrupted
4282				RW	0…3	State of auxiliary outputs
4283			PID	RW	0…3	PID set for the segment
…						
5766	Program 15	Program parameters	STRT	RW	0…1	Way of program beginning
5767			SP0	RW	acc. to table 17[1)]	Initial set point value
5768			TMUN	RW	0…1	Unit for the segment duration
5769			RRUN	RW	0…1	Unit for the accretion rate of the set point value
5770			HOLD	RW	0…3	Blockings of the control deviation
5771			CYCN	RW	1…999	Number of program repetitions
5772			FAIL	RW	0…1	Way of the controller behaviour after a supply decay.
5773			END	RW	0…1	Way of the controller behaviour on the program end
5774			PID	RW	0…1	“Gain Scheduling “ function for the program
5775		Segment 1	TYPE	RW	0…3	Kind of segment
5776			TSP	RW	acc. to table 17[1)]	Set point value on the segment end
5777			TIME	RW	0…5999	Segment duration
5778			RR	RW	1…5500[1)]	Accretion rate of the set point value

5779			HLDV	RW	0…2000 1)	Control deviation value, over which the counting of the set point value is interrupted
5780				RW	0…3	State of auxiliary outputs
5781			PID	RW	0…3	PID set for the segment
...		...				...
5873		Segment 15	TYPE	RW	0…3	Kind of segment
5874			TSP	RW	acc. to table 17 1)	Set point value on the segment end
5875			TIME	RW	0…5999	Segment duration
5876			RR	RW	1…5500 1)	Accretion rate of the set point value
5877			HLDV	RW	0…2000 1)	Control deviation value, over which the counting of the set point value is interrupted
5878				RW	0…3	State of auxiliary outputs
5879			PID	RW	0…3	PID set for the segment
5880	Pro-gram1		ESP	RW	acc. to table 17 1)	Set point value after completing the program 1
5881	Pro-gram2		ESP	RW		Set point value after completing the program 2
…						
5894	Pro-gram15		ESP	RW		Set point value after completing the program 15

1) Value with the decimal point position defined by 0 and 1 in the register 4002

Table 16: Register map from address 7000 and 7500.

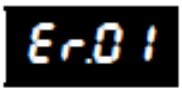
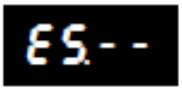
Register address	Register address	Symbol	Operatione	Description
7000	7500		R-	Measured value PV
7002	7501		R-	Measured value on the additional input
7003	7502		R-	Current set point value SP
7006	7503		R-	Control signal of loop 1
7008	7504		R-	Control signal of loop 2
7010	7505	SP	R-	Set point value SP
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

Table 17: Input ranges.

Kind of sensors	Range		
	UNIT = °C [x10]	UNIT = °F [x10]	UNIT = PU
Pt100	-2000...8500	-3280...15620	
Pt1000	-2000...8500	-3280...15620	
Fe-CuNi (J)	-1000...12000	-1480...21920	
Cu-CuNi (T)	-1000...4000	-1480...7520	
NiCr-NiAl (K)	-1000...13720	-1480...25016	
PtRh10-Pt (S)	0...17670	320...32126	
PtRh13-Pt (R)	0...17670	320...32126	
PtRh30-PtRh6 (B)	0...17670	320...32126	
NiCr-CuNi (E)	-1000...10000	-1480...18320	
NiCrSi-NiSi (N)	-1000...13000	-1480...23720	
chromel – kopel (L)	-1000...8000	-1480...14720	
Linear current (I)			-1999...9999
Linear current (I)			-1999...9999
Linear voltage (U)			-1999...9999
Linear voltage (U)			-1999...9999

20. ERROR SIGNALING

Table 18: Character messages.

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.
	Incorrect controller configuration.	After selecting the valve opening on one output, the valve closing should be set on another output.
	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.
	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.dA	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.

21. TECHNICAL DATA

TECHNICAL DATA		
RATED OPERATING CONDITIONS		
Supply Voltage	85...253 V ac/dc or 20...40 V ac/dc	
Temperature	Ambient: 0…23…50 ºC; Storage: -20…70ºC	
Humidity	< 85% without condensation	
Operating Position	Any	
SAFETY AND COMPATIBILITY REQUIREMENTS		
Electromagnetic Compatibility	Noise immunity acc. to EN 61000-6-2	
	Noise emissions acc. to EN 61000-6-4	
Pollution level	Level 2 acc. to EN 61010-1	
Installation category	Cat. III acc. to EN 61010-1	
Maximal phase-to-earth operating voltage	Supply/Output circuits: 300 V; Input circuits: 50 V acc. to EN 61010-1	
INPUT		
Type	***Range***	***Error***
PT100	-200…850 ºC	0.2%
PT1000	-200…850 ºC	0.2%
Fe-CuNi (J)	-100…1200 ºC	0.3%
Cu-CuNi (T)	-100…400 ºC	0.3%
NiCr-NiAl (K)	-100…1372 ºC	0.3%
PtRh10-Pt (S)	0…1767 ºC	0.5%
PtRh13-Pt (R)	0…1767 ºC	0.5%
PtRh30-PtRh6 (B)	200…1767 ºC	0.5%
NiCr-CuNi (E)	-100…1000 ºC	0.3%
NiCrSi-NiSi (N)	-100…1300 ºC	0.3%
Chromel-kopel (L)	-100…800 ºC	0.3%
Current channels (I)	0/4…20 mA	0.2% +/-1 digit
Voltage channels (U)	0…5/10 V	0.2% +/-1 digit
Binary	Voltageless	
OUTPUT		
Type	***Properties***	***Load Capacity***
Relay (voltageless)	NO contacts	2 A/ 230 V ac
OC open-collector	0/5 V	Max. 40 mA
Continuous voltage	0…10 V	$R_{load} \geq 1k\Omega$
Continuous current	0/4…20 mA	$R_{load} \leq 500\Omega$
Transducer supply output	24 V dc	Max. 30 mA
DIGITAL INTERFACE		
Interface type	RS-485	
Protocol	Modbus RTU 8N2, 8E1, 8O1, 8N1	
Baud rate	4.8, 9.6, 19.2, 38.4, 57.6 kbit/s	
EXTERNAL FEATURES		
Readout field	2 x 4 digits; Digit height: 10 mm; Colors: red and green	
Overall dimensions	48 x 96 x 93 mm	
Weight	< 0.2 kg	

Protection grade	From frontal side: IP65; From rear side: IP20
Bargraph	2 x 21 points; Colors: red and green

22. ORDERING CODES

ORDERING CODES UC-820					
Group Designation	**UC820**	**.1**	**3**	**1**	**.1**
Universal process controller	**UC820**				
Output 1					
Relay		**.1**			
OC open-collector (0/5 V)		**.2**			
Continuous current (0/4...20 mA)		**.3**			
Continuous voltage (0...10 V)		**.4**			
Output 2					
Relay [1]			**1**		
OC open-collector (0/5 V)			**2**		
Continuous current (0/4...20 mA)			**3**		
Continuous voltage (0...10 V)			**4**		
Transducer Supply 24 V					
None				**0**	
Supply for transducers 24 V dc 1 W				**1**	
Power Supply					
85...253 V ac/dc					**.1**
20...40 V ac/dc					**.2**

1) Only when a relay or voltage output 0/5 V is selected on output 1.

23. PRODUCT RETURNING

ATTENTION

- Information regarding any hazards and precautions to be considered because of contaminating fluids and residues or mechanical damage that may represent a health, safety or environmental risk, must be provided in writing by the distributors and customers when returning products to Valsteam ADCA engineering.
- Health and safety data sheets regarding substances identified as hazardous or potentially hazardous must be provided with the information mention above.

ATTENTION

- **LOSS OF WARRANTY: Total or partial disregard of above instructions involves loss of any right to warranty.**