microsyst

COMPETENCE IN
MEASUREMENT

TÜV
TÜV Rheinland Bulgaria
Certificate Nr. 75 100 007

Universal microprocessor-based

PID and ON/OFF controller

MS8106

TECHNICAL DESCRIPTION AND INSTRUCTION FOR USAGE

v 1.2

PLOVDIV 2007

I. TECHNICAL DATA

Digital inputs				3
DIG1	Input for selection of set-point			Active level GND
DIG2	Input for selection of set-point			Active level GND
HOLD	Input for reset of the output			Active level GND
Analog inputs				1
Linear current				0 (4) ... 20 mA DC
Linear voltage				0 … 1 (10) V DC
Resistive temperature sensor				Pt 100
Thermocouple				type J, K, S, B
Relay outputs				3
K1 – ON / OFF or PWM				Relay 250 V / 5 A or OC for TTL
K2 – ON / OFF or PWM (or alarm low level)				Relay 250 V / 5 A or OC for TTL
K3 – alarm high and low level (or only high)				Relay 250 V / 5 A or OK for TTL
Options				Triac 250 V / 2 A; Relay 250 V / 5,10 A or OC for TTL
At realization of the outputs by relays, there are RC groups in parallel with the contacts of the relays for better noise immunity.				
Analog outputs				2
Transmitting or controlling current				0 (4) ... 20 mA DC
Transmitting or controlling voltage				0 … 1 (10) V DC
Indication and keyboard				
Display				1x4 digits LED
Range of the display				-1999 ... 9999
Accuracy				± 1 LSB
Format of the display	X.XXX	XX.XX	XXX.X	XXXX
Keyboard				folio
Power supply				
Power supplying voltage				220 V AC 24 V AC/DC 12 V AC/DC
Operating conditions				
Operating temperature				0 … 50 °C
Operating relative humidity				0 … 80 % RH
Dimensions				
Overall dimensions (WxHxL)				48 x 96 x 128 mm
Installation				Panel in a hole 44^{+} x 90^{+} mm
Weight				max 400 g
Storage				
Storage temperature				-10 … 70 °C
Storage relative humidity				0 … 95 % RH
Version (can be seen at exit from menu 'PARAMETERS'):		**v 1.2**		

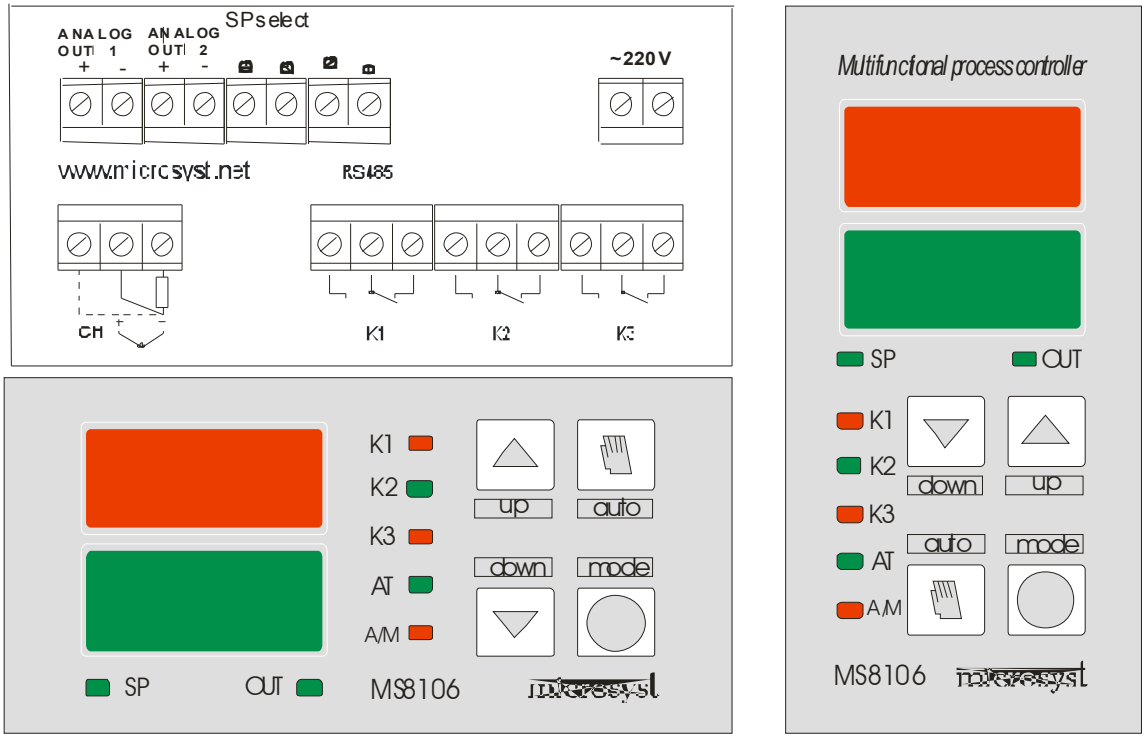
II. DESIGNATION

The microprocessor-based PID controller MS8106 of MICROSYST is designed for measurement and control of different process parameters. It can realize P, PI or PID algorithm of control (program selectable), and there is a possibility for limitation of the integral component. There are also 2 and 3-states modes built-in. The outputs are controlled by impulses with wide modulation (PWM), there is a possibility for set-pointing of different times for forming of "positive" (K1) and "negative" (K2) output.

All data are saved in non-volatile memory, including the current status of the controller, i.e. after restoring of the power supplying voltage, it enters the same mode of control, in which it has been before its fault (the integral component is reset in this case, so till its next accumulation there will be interference in the controlled parameter for PI or PID controller).

There is a shock-less switching between automatic and manual mode, direct supervision of the process variable (Pv), the set-point (SP) and the output (Out). By the function Autotuning the PID parameters are being tuned.

III. FRONT AND BACK PANEL



	– Selection of mode: manual – automatic
	– Tuning of parameters; – Editing of the set-point for control (heating) – Tuning of system parameters – Confirmation of made correction – Exit from mode TUNING OF THE PARAMETERS
	– Change **Out (output) <=> SP (set-point, selected by the inputs for selection of set-point DIG1,2)** at the second line of the display – Increases the value of the parameter
	– As the upper one, but it decreases the value of the parameter

IV. CONNECTION OF TEMPERATURE SENSORS AND TRANSMITTERS

For good operation as a whole it is important the sensors to be located at the suitable place in the medium, in which the temperature control, will be made. At their installation in a hole it is good to use a gasket for better heating.

1. Connection of resistive sensors (Pt100 or others.)

The sensors can be connected by two-wire or three-wire line. The connection of two-wire sensors to three-wire line can be done as it is shown on fig. 1, and between the shown terminals cable jumper must be put obligingly.

If the distances between the sensor and the controller are bigger, it is recommended to use a three-wire line, because the error at measurement of the temperature, caused by the additional resistance, made by the connecting wires. The connection of three-wire sensors to the controller can be done as it is shown on fig. 2, and at the terminals 1 and 2 there must be the shortly connected cables in the sensor.

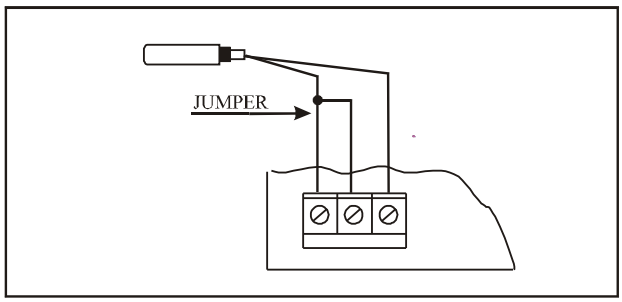


Fig. 1

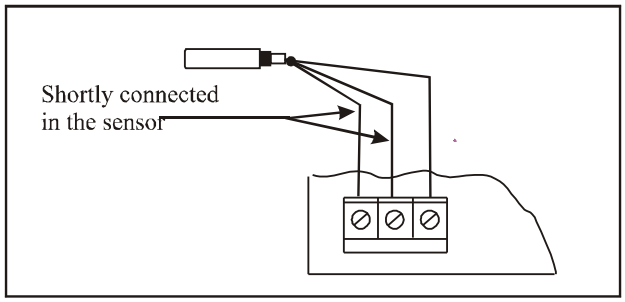


Fig. 2

2. Connection of thermocouples

At connection of sensor – type thermocouple you must pay attention to the polarity of the sensor. At opposite polarity the indications of the device will be incorrect.

At operation with thermocouples you have to use a compensation cable, corresponding to the type of the used thermocouple (fig. 3).

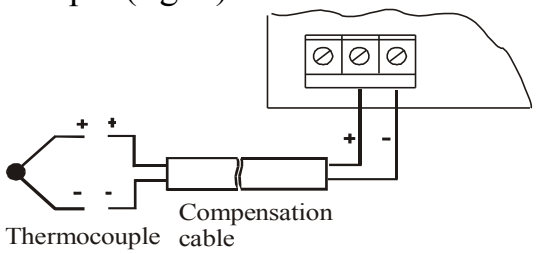


Fig. 3

3. Connection of transmitters

1) Transmitters with two-wire switching on

The power supply of the transmitter is provided by the device.

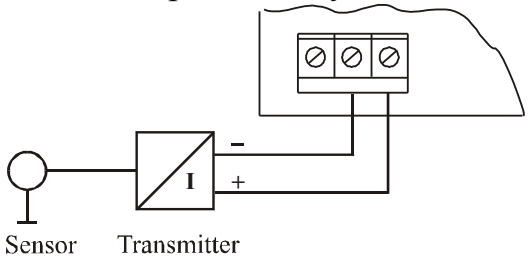


Fig. 4

* The device provides voltage, which is not stable.

2) Transmitter with own power supply

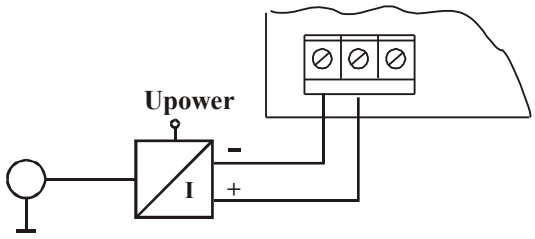


Fig. 5

3) Three-wire transmitter, power supplied by the device

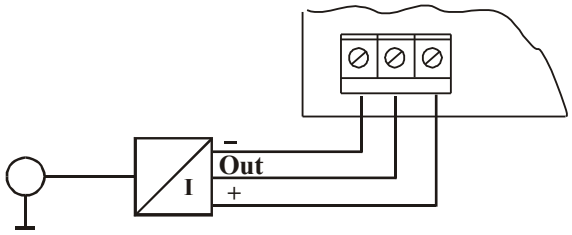
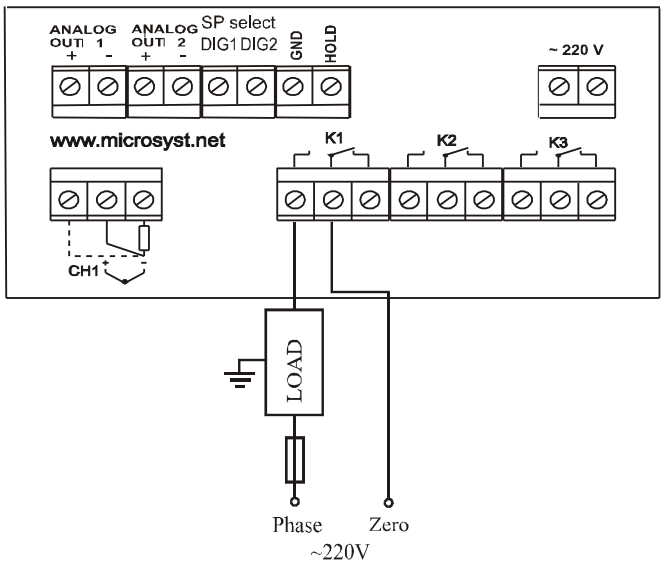


Fig. 6

* The device provides voltage, which is not stable.

V. CONNECTION OF THE OUTPUTS OF THE CONTROLLER

At realization of the outputs by relays, in parallel to the contacts of the relays there are RC groups for better noise immunity. *A minimum current flows* through the open contact of the relay in the AC circuit. The connection of output of the controller, when it is SSR, to the load can be done as it is shown at fig. 7.



VI. OPERATION PRINCIPLE

Forming of the output at PID control:

$$Out_{(n)} = \frac{1}{\mathbf{Pb}} \times \Delta_{(n)} + \frac{1}{\mathbf{Pb}} \times \frac{\mathbf{T_0}}{\mathbf{Ti}} \times \sum_{j=1}^{n} \Delta_{(j)} + \frac{1}{\mathbf{Pb}} \times \frac{\mathbf{Td}}{\mathbf{T_0}} \times [\Delta_{(n)} - \Delta_{(n-1)}] + OF$$

Forming of the output at 2-states control:

$$Out_{(n)} = +100\% \quad \{PV < SP - \mathrm{HIST1}\}$$
$$Out_{(n)} = -100\% \quad \{PV > SP + \mathrm{HIST1}\}$$
$$Out_{(n)} = Out_{(n-1)} \quad \{(SP - \mathrm{HIST1}) \le PV \le (SP + \mathrm{HIST1})\}$$

Forming of the output at 3-states control:

$$
\begin{aligned}
Out_{(n)} &= +100\% && \{PV < SP - Db - \mathrm{HIST1} \\
Out_{(n)} &= -100\% && \{PV > SP + Db + \mathrm{HIST2}\} \\
Out_{(n)} &= 0\% && \{SP - Db < PV < SP + Db\} \\
Out_{(n)} &= Out_{(n-1)} && \{ (SP - Db - HIST1) \le PV \le (SP - Db) \text{ или } (SP + Db) \le PV \le (SP + Db + HIST2) \}
\end{aligned}
$$

Logically the controllers of the series MS8106 are built as it is shown at fig. 8.

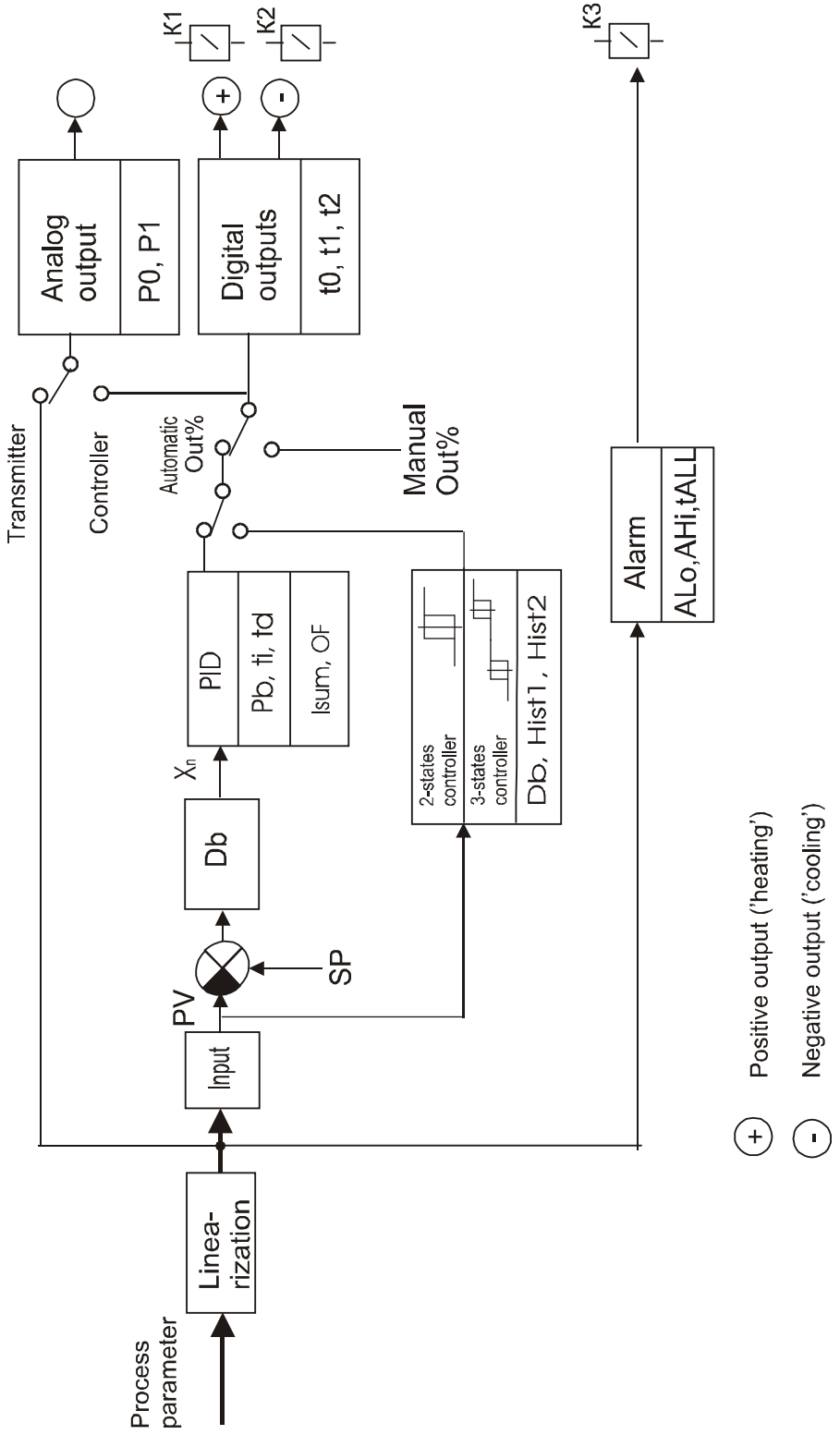


Fig. 8 **Block-scheme**

VII. OPERATING MODE

After switching on of the power supply, the controller enters the last operating mode – automatic or manual and indicates the measured parameter at the upper line on the display and the set-point – at the lower line. In manual mode the output has its value from the time before the power fault, the LED A/M on the front panel is emitting light, and the decimal point is flashing. In automatic mode the output is formed according to the selected algorithm of control and the decimal point is emitting light constantly (if the parameters are in format with decimal point), A/M is not emitting light.

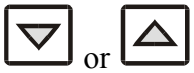
The LEDs K1 and K2 indicate if the corresponding output K1 or K2 is active. At reaching of the limits of alarm it is being waited for defined (programmable) time, in which the LED K3 is flashing. When this delay runs out K3 is emitting light constantly. Then output alarm (K3) switches on. You can set time for activation of the alarm output. In this case the LED K3 is flashing after switching off of the output till disappearing of the alarm conditions. By parameter (ConF) the alarm may be divided to high limit – out. K3 and low limit – out. K2, and the LED K2 is flashing at crossing of low limit and is emitting light at switched on alarm output K2.

1. **Selection of mode - automatic/manual**

Passing from Manual to Automatic mode

– Passes to automatic mode and is indicated by ”Auto” and the decimal point stops flashing. The LED A/M isn’t emitting light.

Passing from Automatic to Manual mode

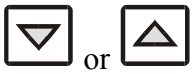


– Selects displayed parameter Out

– Passes to manual mode and it is indicated by ”HAnd” and flashing of the decimal point. The LED A/M is emitting light.

The device provides shock-less switching between the two modes – from automatic to manual and back, i.e. at switching of the modes the value of the output, which has been in the previous mode, remains in the new selected one. In manual mode at indication on the display **Out %** you can directly manipulate the output (p.4). Every change of the output in manual mode **stops the autotuning** of the PID parameters, if this function has been activated.

2. **Change of displayed parameter**



– The name and the value of the parameter appear at the lower line consecutively. If the device is in Automatic mode 10 seconds, after the releasing of a button, the set-point appears back at the lower line.

3. **Editing of the set-point for control (SP)**

– **At parameter SP on the display, by pressing and releasing of the button, the value of the set-point starts flashing and its edition is permitted. It is the set-point, selected by the inputs for selection of set-point DIG1,2 for example. SP^{II}, but if it is necessary to edit another one, for example. SP^{IV}, without releasing press and release till reaching of the desired index, then release the buttons and the value of the selected set-point starts flashing. At this time the controller logically is operating with the set-point, selected by the inputs DIG1,2 (for example.SP^{II}). You can correct the number. If you do not press any button in 5 seconds, the controller passes to normal operation.**

– Editing of the set-point

– Accepting of the new value (it can be done also automatically 5 seconds after the last pressed button).

4. **Editing of the output influence (Out)**

Editing of the output influence is possible only in Manual mode.

– At displayed parameter Out by pressing of the button the value of the output starts flashing and its edition is permitted. If you do not press any button in 5 seconds, the controller returns to normal operation.

– Editing of the value of the output

– Accepting of the new value (it can be done also automatically 5 seconds after the last pressed button).

5. **Locking / Unlocking of the keyboard**

At locked keyboard there is no possibility for change of the parameters and the operating mode, but only for selection of the displayed parameter by the pointers. This function is a protection against unintentional interference in the operation of the device, and in such situation **Loc** appears on the display.

and

Press together, but first

– Switches from unlocked to locked status **(Loc)** and back (**UnLc**)

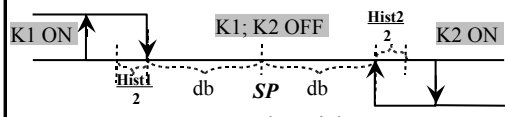
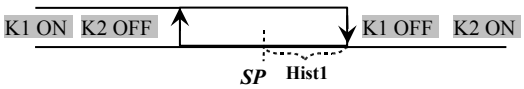
VIII. LEVELS OF PROGRAMMING

1. **Level "system parameters**"

You can enter this mode only at displayed set-point at the low line.

The activation of this menu does not change the operation of the controller. The change of a parameter influences the current control right after its confirmation. Two minutes after the last action, it returns to the normal operating menu.

	– When the set-point is at the lower line of the display, press and hold the button to enter mode TUNING OF PARAMETERS. "ProG**"** appears on the display till releasing of the button.
	– For correction of the value (the lower line is flashing)
	– Scrolling between the parameters. Some of the parameters (marked with * in the table) have different values for the different combinations **I, II, III, IV** of the inputs for selection of set-point DIG1, DIG2. At reaching of such parameter, it can be seen by index after the name, for example Pb^{II}., defined by these inputs. But if it must be selected manually, for example edition of Pb^{IV}, without releasing the pressed pointer, press and release the other one for change of the index. So you can reach the wanted index, which is valid only for the current parameter and is not operating – the controller in this time logically indexes according to inputs DIG1,2. – Changes the value of the selected parameter
	– Confirms the change – When it is not in correction of the value, hold till **v12_** (software version) **End_**for exit from mode TUNING OF PARAMETERS

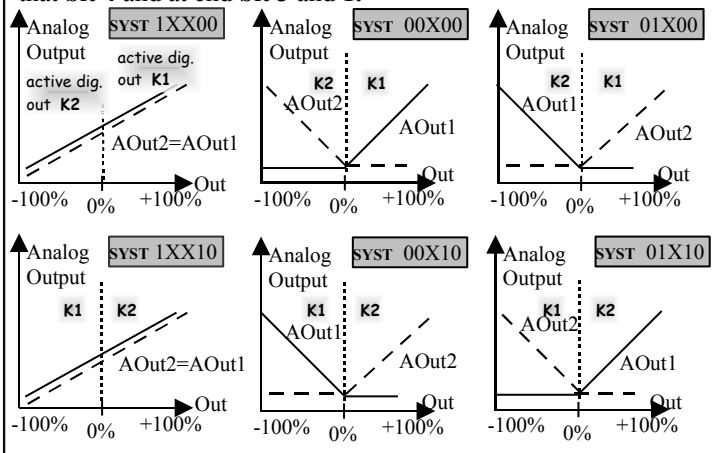
Parameter	Description	Range of change	Factory Value
Pb *	Proportional band Pb>0 means P, PI, PID, PD controller Pb=0 - 2 or 3 states controller	0 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
	If it is reset during autotuning, it is stopped.		
The next 10 parameters to Atun including can be seen only if Pb > 0			
Ti *	Time constant of integration	0 ÷ 9999 Sec.	
Td *	Time constant of differentiation	0.0 ÷ 999.9 Sec .	
IsuL	Lower limit of accumulation of the integral component	-100 ÷ 0 %	
IsuH	Higher limit of the accumulation of the integral component	0 ÷ 100 %	
	There is a mechanism for avoiding of the effect ***Integrall Windup*** in the controller, independent on the parameters **ISuL** and **IsuH**		
OF*	Addition of the PID algorithm	-100.0 ÷ 100.0 %	
t0	Tact of calculation of the PID algorithm	1 ÷ 255 Sec.	
tn1	Time for action of relay K1 at 100% calculated (or set-pointed) output.	1 ÷ t0 Sec.	
tn2	Time for action of relay K2 at 100% calculated (or set-pointed) output.	1 ÷ t0 Sec.	
AoFt See IX !	Offset from set-point by time of Autotuning. For smaller set-point enter negative values, for bigger one – positive	-1999 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
Atun See IX !	Autotuning of the parameters Pb, ti, td	0 – OFF (stop) 1 – ON (start)	
Db	**Dead band** at P,PI, PID, PD controller (Pb>0) At On/Off control (Pb=0) : **db>0** - 3 states algorithm  **db=0** - 2 states algorithm  On the upper graphics Hist1>0; Hist2>0 ; K2 is not configured as 'Alarm'	0 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
The next 2 parameters cane be seen only if Pb = 0			
HYST1	Hysteresis at operation of output : K1 at 3 states controller K1 and K2 at 2 states controller Negative value inverts the corresponding output	-1999 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
HYST2 Can be seen only if **db>0**	Hysteresis at operation of output K2 at 3 states controller Negative value inverts output K2	-1999 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
AL *	Lower limit of alarm	-1999 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
t0AL	Delay at activation of output K3 (or K2 according to config.) after reaching of AL.	0 ÷ 255 Sec.	
AH *	Higher limit of alarm	-1999 ÷ 9999 (Dimension and decimal point according to the measured parameter)	
t0AH	Delay at activation of output K3 after reaching of AH	0 ÷ 255 Sec.	

*** The parameters, marked with *, may be configured to be different for the different set-points, selected by the inputs DIG1, DIG2 (parameter ConF, p.XII). Then after the name of the parameter you can see the combination of these inputs – for example AH, AH ^{II}, AH ^{III} or AH ^{IV}**

2. Level “hidden system parameters”

– At power supplying of the device, hold the button. Hidden parameters appear in the beginning of the menu with basic parameters. The access to them is possible after switching off of the device.

! Change them very carefully, because their change may cause incorrect operation of the device!

Parameter	Description	Values	Factory value
PAA0	Deviation of analog output 1	-1999 ÷ 9999	
PAA1	Multiplying coefficient of analog output 1	-1999 ÷ 9999	
PAb0	Отместване на аналогов изход 2 (когато не е конфигуриран да повтаря AOut1)	-1999 ÷ 9999	
PAb1	Multiplying coefficient of analog output 2 (when it is not configured to repeat AOut1)	-1999 ÷ 9999	
dPnt	Decimal point Change of this parameter may cause necessity of correction of all parameters with the dimension of the input parameter!	0 ÷ 4 (2) 0 – XXXX; 1- XXXX.; 2- XXX.X 3- XX.XX; 4-X.XXX Depending on the type of the input, 3 and 4 mode may be forbidden. Mode 0 is as 1 for devices with 6 LEDs on front panel.	
A db	Band of operation of the filter of ADC	0 ÷ 255 (Dimension and decimal point according to the measured parameter)	
Adbt	Time till accepting of value out of band**Adb**	0 ÷ 255 s	
FILt	Coefficient of the filter of ADC	1 ÷ 100	
SYST	Configuration of the outputs The value of the output ca be seen on the display in mode **Out** and it may vary from –100% ÷ 100%. From this parameter two analog and two (one, if the second is alarm) digital outputs are formed in a way, depending on the parameter **SYST.** **Digital outputs:** If it is used in ON/OFF mode, they depend on sign of the parameters **Hist1 and Hist2** - minus means inversion. Otherwise **bit1** is important – 1 means logic ‘cooling’ of K1 **Analog output:** first check **bit 0** – controlling/transmitter, after that **bit 4** and at end **bit 3** and **1.**  The slope and the offset of the graphics depend on the parameters PAA0, PAA1. If AOut2 operates separately from Aout1, it is determined by PAb0, PAb1. The graphics do not change, if K2 is alarm – in this case active dig.out K2. is not valid. In transmitter mode AOut2=Aout1.	0 ÷ 31 – – – 16 8 4 2 1 bit 7 bit 0 bit 0 - 0 controlling analog outputs 1 transmitter analog outputs bit 1 - 0 K1 “heating”; K2 “cooling” 1 K2 “heating”; K1 “cooling” bit 2 - 0 absolute alarm 1 relative alarm bit 3 - 0 controlling AOut1 by K1, AOut2 by K2 1 controlling AOut1 by K2, AOut2 by K1 bit 4 - 0 controlling analog outputs by K1 or K2 1 controlling analog outputs by K1 and K2 The necessary value is received when the numbers, corresponding to every set in 1 bit are summed (see above). For example for 10010 you must enter 16 + 2 = ***18***	
t1AL	Time for operation of output alarm (K2 or K3 depending on the configuration) after passing of lower limit	**0** – constantly activated output or **1 ÷ 255** x 0,5 Sec.	
t1AH	Time for operation of output alarm (K3) after passing of higher limit	**0** – constantly activated output or **1 ÷ 255** x 0,5 Sec.	
At ≡	Variants at autotuning For mode “autotuning” see p. IX	1 ÷ 4	

3. Level “service parameters”

 and  – At power supplying of the device, hold the buttons. Then the next parameters are added to the menu. The access to them is possible till switching off of the power supply.

! Change them very carefully, because their change may cause incorrect operation of device!

Parameter	Description	Values	Factory value
SenS	Type of the input **Tuned by the producer !**	1 ÷ 7	
ConF	Configures mode of output K2 and the effect of the inputs for selection of set-point on the alarm levels and the PID parameters. At configuration of output K2 as lower alarm you have to know that in this case K2 and K3 operate alternatively, i.e. if you set such limits AH, AL, so the device will be simultaneously in lower and higher alarm, only output K3 will activate.	0 ÷ 31 bit 0 – – – – 8 4 - 1 bit 7 bit 0 bit 0 - 0 – K2 is controlling output 1 - K2 is output ‘Alarm’ bit 2 - 0 – separate alarms for each set-point 1 – joint alarms for the different set-points bit 3 - 0 – separate Pb,ti,td,OF for each set-point 1 – joint Pb,ti,td,OF for the different set-points (p.12 – Inputs for selection of set-point) The necessary value can be received when the numbers, corresponding to each set in 1 bit are summed (see above). For example for 101 you must enter 4+1 = 5	

Calculation of the analog output :	
Transmitter output	Controlling output
AOut1,2= 1023*PV/PAA1 + PAA0	**AOut1= PAA1*Out /100 + PAA0** **AOut2= PAb 1*Out/100 + PAb0 or AOut2=AOut1** **(depending on the way of configuration by SYST)**
PV - value of the measured parameter; **Out -** value of the controlling output, in percents **1023** – range of DAC	

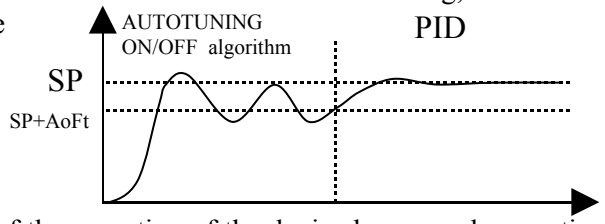
IX. AUTOTUNING OF THE CONTROLLER

Indication: flashing decimal point and LED on the front panel
Activation: Atun = 1 **Deactivation: Atun = 0** (can be made also automatically);
Change of the output in manual mode, and also input HOLD stop it.

This function gives a possibility the device to determine values for the parameters **Pb, Ti** and **Td**. Before starting all other parameters must be determined. To **Pb, Ti** and **Td** also must be set-pointed some protecting values, which remain valid only if the autotuning is not successful – for example for PID controller big band **Pb**, long time for integration **Ti**, short time for differentiation **Td.** The activation of the autotuning is done when **Atun** accepts **1**. The procedure can be stopped any time by **Atun = 0. Change of the output in manual mode also deactivates it.** After downloading of PID parameters it will be done automatically. The status of **Pb, Ti** and **Td** before the end of the procedure determines the algorithm of control, which will be realized: for **PID** you must set-point the three parameters **Pb >0, Ti>0** and **Td>0**; for **PI** you must set-point **Pb>0, Ti>0 ,** and **Td= 0 ;** for **P** you must set-point **Pb>0,** and **Ti=0** and **Td= 0.** The autotuning does not change the parameters with value 0, and it

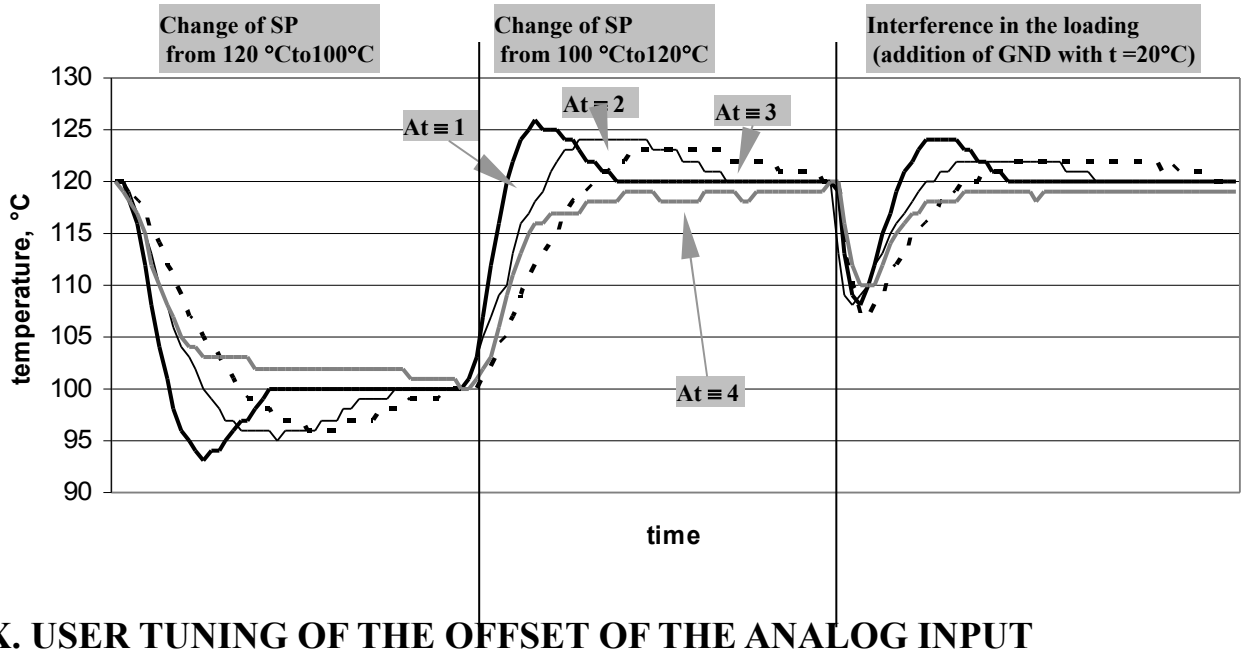
corresponds to the desired type of controller. It is possible the controller to register unsuccessful autotuning – then the initial values of **Pb, Ti** and **Td** will not be changed automatically. So it is good these values to be protective, at which there are not intolerable statuses of the object**.**

By the starting of the function 'Autotuning' you can pass to control ON/OFF without hysteresis, and there are some variations. This lasts two periods, after that the basic mode with tuned parameters returns. **Attention! In this ON/OFF mode the set-point may be exceeded.** So during autotuning the set-point is the sum SP+AoFt. So by the offset AoFt and SP you can select safety zone at autotuning, possibly closer to the set-point in normal operation For example, at set-point SP=150° and AoFt= -20°, so the real set-point at autotuning will be 130°. While the process lasts you have to avoid changes of the characteristics of the object and interfering influences. At the selection of **t0** you have to consider that at period of variations smaller than 8.**t0** or bigger than 1024.**t0** the procedure is accepted as unsuccessful. In this case the controller automatically returns to the same mode, in which it has been before the starts of the procedure. The input parameter must be filtered by the means in the device and must not be out of the range of the device. **Power fault does not deactivate the procedure.** In this case after its restoring, the autotuning starts from the beginning. The final result also depends on the parameter **At ≡.** For comparison there is the transitional process of text object (temperature control) after autotuning of PID controller at change of **SP** and at change in the loading for the four possible values of **At ≡,** shown below.



It is possible some reserves to remain for improving of the operation of the device by manual correction of the parameters according to the object and the characteristics.

Note: In P mode the curves are equal, and for PI there is a difference only between At ≡ 3 and At ≡ 4



X. USER TUNING OF THE OFFSET OF THE ANALOG INPUT

In this mode the users can enter a free programmable coefficient, which will be added every time at measuring of the input parameter (offset). This mode is used at notice of discrepancy between the displayed value and the measured one by another **standard** device.

There is an access to this option only, if the access to **"hidden system parameters"** is possible.

– At displayed input parameter and manual mode press the shown button. "OFSt" appears at the lower line till its releasing. The value, which is being tuned, is more accurate than the measured parameter with one order. The measured parameter can be seen.

– Change of the value of the offset at the lower line.

– Confirms the change and the new value is added to the old one of the offset. (it can be done also automatically 5 seconds after the last pressed button).

EXAMPLES FOR USER TUNING OF THE OFFSET

1. Indication on the display: 129 Entered offset: 3.4
2. New indication on the display: 132 Entered offset: 0.6
3. New indication on the display: 133 Entered offset: -1.0 New indication: 132

XI. MEASURES AGAINST INTERFERENCE

1. Recommendations for usage of connecting wires

- Wires, which carry signals, close by type, can be packed together, but if the signals are different, the wires must be separated for protection from capacitive and inductive interaction.
- When different signals must be crossed, it must be done at right angle and in maximum distance.
- Wires, which carry weak signals, and wires, connecting the sensors with controller, must not pass near contactors, motors, generators, radio transmitters and wires, which carry big currents.

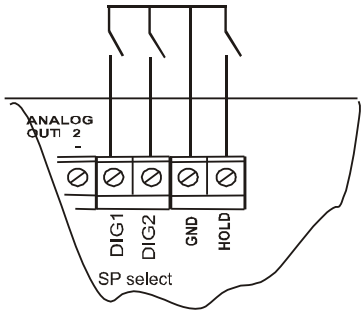
2. Muffling of the noise by usage of the filter, built-in in the controller

- If the input parameter varies and is not stable, it is necessary to decrease the coefficient of the filter **FILt.** The smaller is the value, the heavier is the filter and the input parameter changes more slowly.
- If the input parameter jumps periodically for short time intervals, it is necessary to increase the parameter **AdBt**. Then the controller reacts slowly at change of the input parameter, but ignores the short problems.

XII. INPUTS FOR SELECTION OF SET-POINT.

There are two inputs for selection of set-point with active level GND. By them you can select 1 of 4 possible sets of parameters SP, AH, AL, Pb, Ki, Kd, OF with index I (it is not displayed), II, III and IV. One or two of them may not be saturated during the production – that limits the possible set-points (and parameters) to SP (non-saturated inputs) or SP, SP^{I} (saturated input DIG1)

Connection of the inputs for selection of set-point and reset of the output (HOLD)



N Set-point	Input DIG2	Input DIG1	Set-point	Higher alarm*	Lower alarm*	Proportional band **	Time constant Integration**	Time constant Differentiation**	Addition of PID algorithm**
I	**-**	**-**	**SP**	**AH**	**AL**	**Pb**	**ti**	**Td**	**OF**
II	**-**	**GND**	**SP^{II}**	**AH^{II}**	**AL^{II}**	**Pb^{II}**	**ti^{II}**	**td^{II}**	**OF^{II}**
III	**GND**	**-**	**SP^{III}**	**AH^{III}**	**AL^{III}**	**Pb^{III}**	**ti^{III}**	**td^{III}**	**OF^{III}**
IV	**GND**	**GND**	**SP^{IV}**	**AH^{IV}**	**AL^{IV}**	**Pb^{IV}**	**ti^{IV}**	**td^{IV}**	**OF^{IV}**

*** If bit2 of the parameter Conf sets in 1, so for the four statuses of the inputs DIG1, DIG2 the device will operate with the parameters AH and AL, i.e. it operates with one couple of alarm levels.**
**** If bit3 of the parameter Conf sets in 1, so for the four statuses of the inputs DIG1, DIG2 the device operates with the parameters Pb, ti, td, OF - i.e. it operates with one set of PID parameters.**

If you have selected to operate with different alarms and PID parameters for the different combinations of the inputs DIG1, DIG2, you have to be careful for their correct and full set-point!

Change of the status of the inputs DIG1, DIG2 during correction of some of the described parameters does not select another parameter for correction. About the control every change activates immediately. The indexing manually in menu 'PARAMETERS' [▲] + [▼] or at correction of SP [◯] + [▼] is valid only for the current parameter, and does not indicate operating index, but only index of correction of current parameter. The operating index (set of parameters, with which the device functions logically) is indicated only by the inputs DIG1, 2.

The activation of procedure for autotuning blocks the operation of the inputs DIG1, DIG2. Till its end the device operates with the previous set of parameters. The autotuning determines only one set of PID parameters, which has been selected before its start.

XIII. INPUT RESET OF THE OUTPUT (HOLD)

The active level GND of this input resets the parameter Out % (output) with all dependences for the digital and the analog outputs (according to the tunings and the configuration) – the digital outputs switch off and the analog ones set at the levels, corresponding to Out=0. The accumulated integral component is reset. At displayed SP at the lower line, the value of the set-point periodically changes with message **HOLd**. The passing to display Out% is blocked at the lower line. If display Out% at the lower line is the status, it does not change automatically to SP. In this case the manual changes of the output parameter are made after the stop of the signal HOLD. The signal HOLD stops the autotuning, if it has been activated before.

Bulgaria, 4000 Plovdiv, 4 Murgash str.
Tel.: (+359 32) 642 519, 640 446 Fax: (+359 32) 640 446
www.microsyst.net e-mail: info@microsyst.net