microsyst

COMPETENCE IN
MEASUREMENT

CE

Universal Microprocessor- Based

PID and ON / OFF Controller

MS8106 / MS8106AL

User Manual
v1.43

PLOVDIV 2018

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CONTENTS

	*In case of a failed calibration or incorrect configuration of parameters, you can reset the factory settings! / page 27 /*
	*In the absence of a reaction after pressing a key, the keypad may be locked. For this purpose, the keyboard needs to be unlocked.*

Version	RS485 MODBUS	Analog Set Point	Choice of SP	HOLD input	Filters out, display	Calibration at temperature standards	Second variable. Tab. set measurement function	'Window' alarm	Universe. input
v1.41 (ASP)	+	+	Galley switch	+	-	-	-	-	-
v1.43	+	-	Galley switch	+	+	+	-	+	-
v1.44	+	-	Galley switch	+	-	-	+	-	-
v1.45	+	-	Buttons (not holding.)	-	-	+	-	-	-
v1.5	+	-	Galley switch	+	+	-	-	+	+
* The version of the device is visible when you exit the 'PROGRAMMING MODE'									

I. DESIGNATION

Compact microprocessor PID controllers MS 8106 / 8106AL of MICROSYST , are designed for measuring and controlling the different process variables. They can achieve the P, PI, PD or PID control strategy (program selectable), with the possibility of limiting the integral component. 2 and 3 position ON/OFF modes are also integrated. Outputs are controlled by pulse with variable duration (PWM), it is possible to set different times to form a "positive" (K1) and "negative" (K2) output.

All data is stored in a non-volatile memory, including the current state of the controller, so after restoring the supply voltage, it enters the same control mode as it was before it dropped (in this case the integral component is reset).

A smooth switching between automatic and manual mode is provided, with direct observation of process variable (Pv), setpoint (SP) and output (Out). By using the Autotuning function, the parameters for P, PI or PID mode are easily set.

The device communicates with MODBUS RTU protocol, RS485 line, which allows remote monitoring of processes and set different parameters and modes of up to 32 connected controllers (without repeater).

II. ORDER CODE

MS8106 - x.x.x.x.x.x.x.x.x.x.x

Case code
M1 - IP5496x48x125 horizontal
1M - IP5496x48x125 vertical

Input

Code

Pt100
- **1** 0.0÷100,0 °C
- **2** 0.0÷200.0 °C
- **3** 0÷250 °C
- **4** 0÷400 °C
- **5** 0÷600 °C
- **6** -50÷400 °C

Pt1000
- **7** -50.0÷50.0 °C
- **8** -50.0÷100.0°C
- **9** -50÷200 °C

J
- **10** 0÷600 °C

K
- **12** 0÷1200 °C

Transmitter
- **15** 4÷20 mA DC-2W
- **16** 0÷20 mA DC-3W
- **17** 0÷10 V DC-3W

9X друг по заявка

Power supply for transmitter code
T0 - without
T1 - 11...14V 150 mA
T2 - 24V 80 mA stabilized
T3 - 15 V 80mA stavilazid

Power supply **
Code
PA - 230 VAC +10%-15%/50Hz
PF - 24 VAC +10%-30% isolated
PG - 24 VAC +10%-30% not isolated
PB - 24 VDC ±30% isolated
PC - 12 VDC ±15% not isolated
PD - 24 VDC ±15% not isolated

Digital inputs code
D0- without
D1- DIG1,DIG2,HOLD

Communication code
C0- without
C1- RS485 MODBUS RTU

Analog outputs (ISO)
I0 - without
I1 - 1x4-20mA DC
I2 - 1x0-20mA DC
I3 - 1x0-10V DC
I4 - 2x4-20mA DC
I6 - 2x0-20mA DC
I8 - 2x0-10V DC
I9 - 2x0-1V DC
IX- other / must specified

Digital output K1
Digital output K2
Digital output K3

code		
K1	**K2**	**K3**
AA	**BA**	**CA** - without
AB	**BB**	**CB** - Relay 5A/250V
AD	**BD**	**---** - Triac 2A / 250V
AE	**BE**	**CE** - OC NPN not iso U_{CEmax}=65V, I_{Cmax}=100mA
AF	**BF**	**CF** - OC NPN iso U_{CEmax}=80V, I_{Cmax}=1A

** In power supply options PF,PB,PC,PD,PG the analog outputs are only currents:
- passive
- active

In power supply options PC,PD и PG (not recomendated), the sensor is not isolated .

! It is obligatory to specified the range , lower and upper limit and decimal point !

Example : MS8106 - M1.4.T0.PA.D1.C1.I1.AB.BB.CA

- Case - IP5496x48x125 horizontal
- **Вход K1** - Pt100 0÷400.0 °C
- **Power supply for transmitter** without
- **Power supply** - 220 VAC
- **Digital output K3 - without**
- **Digital output K2** - Реле 5A/250V
- **Digital output K1-** Реле 5A/250V
- **Analog outputs** - 1x 4-20mA ISO
- **Communication** - RS485 MODBUS
- **Digital inputs** - DIG1,2,HOLD

MS8106AL - x.x.x.x.x.x.x.x.x.x

Case code
A3 - IP40 72x72x105
A4 - IP40 96x96x105

Input

Code

Pt100
- **1** 0.0÷100,0 °C
- **2** 0.0÷200.0 °C
- **3** 0÷250 °C
- **4** 0÷400 °C
- **5** 0÷600 °C
- **6** -50÷400 °C

Pt1000
- **7** -50.0÷50.0 °C
- **8** -50.0÷100.0°C
- **9** -50÷200 °C

J / K
- **10** 0÷600 °C
- **12** 0÷1200 °C

Transmitter
- **15** 4÷20 mA DC-2W
- **16** 0÷20 mA DC-3W
- **17** 0÷10 V DC-3W

9X друг по заявка

Power supply for transmitter code
T0 - without
T1 - 11...14V 150 mA
T2 - 24V 80 mA stabilized
T3 - 15 V 80mA stavilazid

Power supplly **
Code
PA - 230 VAC +10%-15%/50Hz
PF - 24 VAC +10%-30% isolated
PG - 24 VAC +10%-30% not isolated
PB - 24 VDC ±30% isolated
PC - 12 VDC ±15% not isolated
PD - 24 VDC ±15% not isolated

Digital inputs code
D0- without
D1- DIG1,DIG2,HOLD

Communication code
C0- without
C1- RS485 MODBUS RTU

Analog outputs(ISO)
I0 - without
I1 - 1x4-20mA DC
I2 - 1x0-20mA DC
I3 - 1x0-10V DC
I4 - 2x4-20mA DC
I6 - 2x0-20mA DC
I8 - 2x0-10V DC
I9 - 2x0-1V DC
IX- other / must specified

Digital output K3
Digital output K2
Digital output K1

code		
K1	**K2**	**K3**
AA	**BA**	**CA** - without
AB	**BB**	**CB** - Relay 5A/250V
AE	**BE**	**CE** - OC NPN not iso U_{CEmax}=65V, I_{Cmax}=100mA

** In power supply options PF,PB,PC,PD,PG the analog outputs are only currents:
- passive
- active

In power supply options PC,PD и PG (not recomendated), the sensor is not isolated .

! It is obligatory to specified the range , lower and upper limit and decimal point !

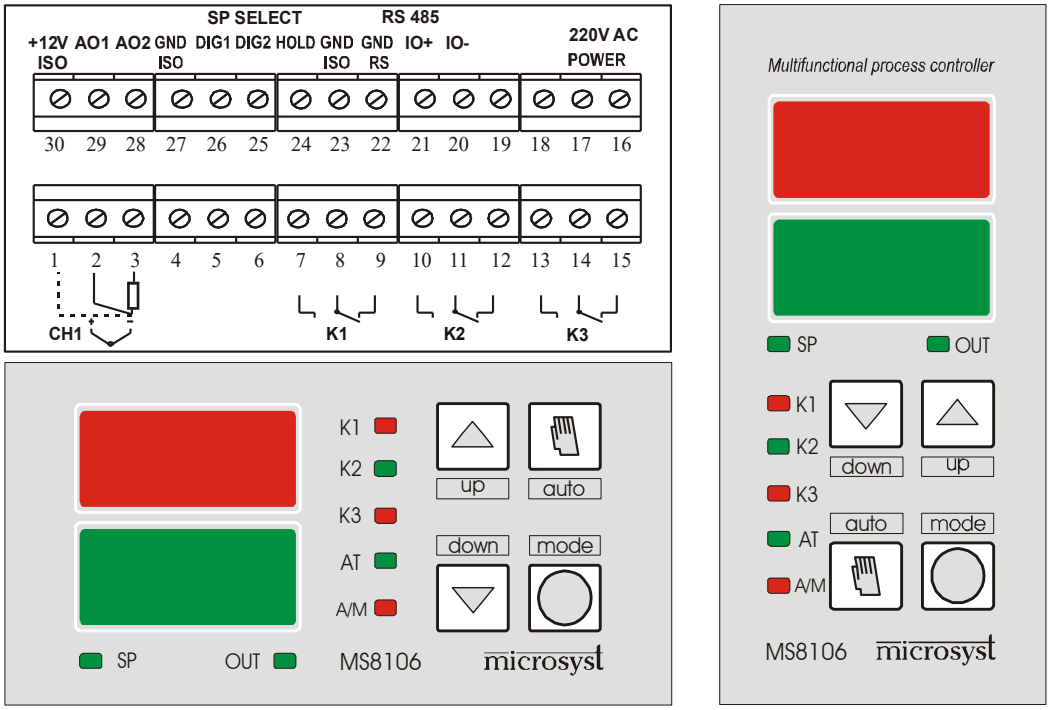
Example : MS8106AL - A4.4.T0.PA.D1.C1.I1.AB.BB.CA

Case - IP5496x48x125 horizontal
Вход K1 - Pt100 0÷400.0 °C
Power supply for transmitter without
Power supplly - 220 VAC
Digital output K3 - without
Digital output K2 - Реле 5A/250V
Digital output K1- Реле 5A/250V
Analog outputs - 1x 4-20mA ISO
Communication - RS485 MODBUS
Digital inputs - DIG1,2,HOLD

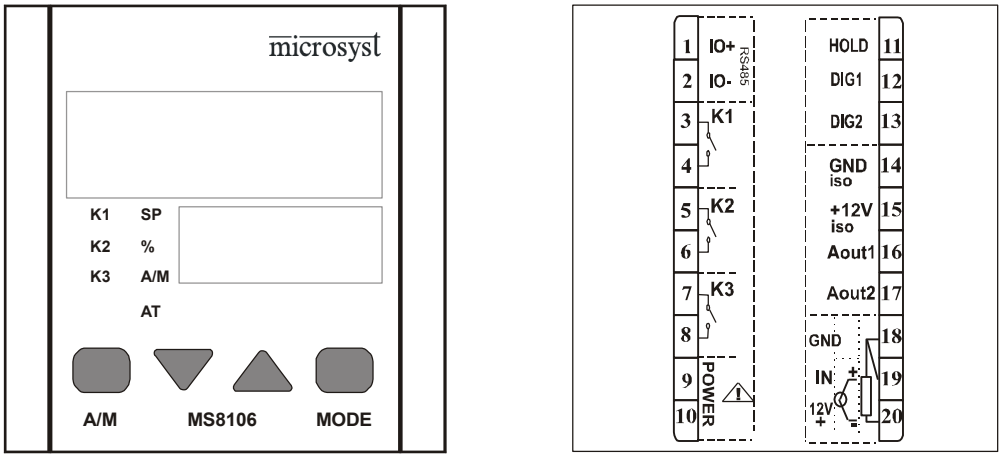
III. TECHNICAL DATA

Analog inputs			1
Linear current	0 (4) ... 20 mA DC		
Linear voltage	0 … 1 (10) V DC		
Pt RTDs	Pt 100, P1000 and other by order		EN 60751
Thermocouple types	J, K, S, B		EN 60584
Accuracy of measurement	± 0.15% of FS		
Digital inputs – optoisolated (optional – in standard not available , on sticker information)			**3**
DIG1,2 Inputs to select setpoint	Active level GND		
HOLD Input to reset output	Active level GND		
Digital outputs			**3**
K1 – ON / OFF or PWM	Relay 250 V / 5 A or OC for TTL		
K2 – ON / OFF or PWM (or Hi Alarm)	Relay 250 V / 5 A or OC for TTL		
K3 – Alarm upper and lower limit / Hi Alarm	Relay 250 V / 5 A or OC for TTL		
options	Triak 250 V / 2 A; Relay250 V / 5 A and OC for TTL		
Analog outputs AnOut1,2 optoisolated (optional – in standard not available , on sticker information)			**2**
Transmitting or controlling current Transmitting or controlling voltage	0 (4) ... 20 mA DC 0 … 1 (10) V DC limiting -1,56% .. +105,4% - i.e. for 4-20 mA – lim. 3,75-20,86 mA (NAMUR level detection)		
Indication and keyboard			
Display Range of display Reading format Keyboard	2x4 digits LED -1999 ... 9999 ± 1 LSB X.XXX XX.XX XXX.X XXXX semi-sensory		
Power supply			
Power supply voltage	230 V AC /50HZ		
Sensor power supply	MS8106	12 V DC unstable	
	MS8106 AL	24 VDC stable.; 12 V DC unstable	
Communication (optional)			
RS485	RS485 2WIRE MODBUS RTU SLAVE 9600, 19200bps; parity – NONE, EVEN; 1, 2 stop bit		
Environmental Conditions			
Temperature and relative humidity non-condensing	Operating conditions: -10 ÷ 70 °C / 10 ÷ 85 % rh Storage conditions : -20 ÷ 70 °C / 10 ÷ 90 % rh		
Dimensions			
Overall dimensions (WxHxL) Montage	MS8106	48 x 96 x 128 mm Panel Cutout 44^{+} x 90^{+} mm	
	MS8106AL	72x72x104 mm Panel Cutout : 67^{+}x 67^{+}mm	96x96x92 mm Panel Cutout : 89^{+}x 89^{+}mm
Weight	max 400 g		
Protection	IP40		

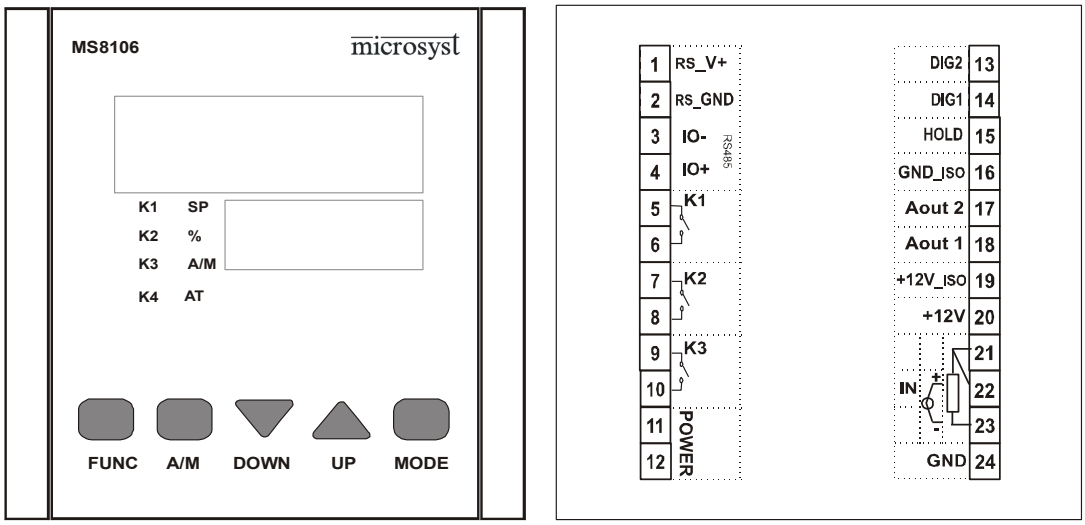
IV. FRONT AND REAR PANEL



MS8106

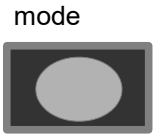


MS8106AL (box 72x72)



MS8106AL (box 96x96)

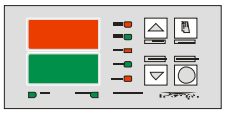
V. CONTROL BUTTONS AND LEDs INDICATION

CONTROL BUTTONS		
MS8106	**MS8106AL**	**ACTION**
Pressed  and 		**UNLOCK / LOCK KEYBOARD** (Loc / UnLc)
		Mode selection: manual - automatic
		Parameter setting;(it holds for 4 sec.) Editing Setpoint for control (heating) System parameters Set up Confirm a correction Exit from PARAMETER SETTING MODE(it holds for 4 sec.)
		Change **Out <=> SP** (setpoint selected from the DIG1.2 assignment inputs) on the second line of the display Increases, decreases the value of a parameter
СВЕТОДИОДНА ИНДИКАЦИЯ		
MS8106	**MS8106AL**	**ФУНКЦИЯ**
SP	**SP**	Displayed value SP (SP II, III, IV)
OUT	**%**	Displayed primary process variable in Manual mode
K2	**K2**	Active output - lights up (under alarm conditions and configured - K2 blinks)
K1, K3	**K1,K3**	Active output - lights up (under alarm conditions - K3 blinks)
AT	**AT**	Activated self-tuning
A/M	**A/M**	Auto / Manual mode+Blinking decimal point

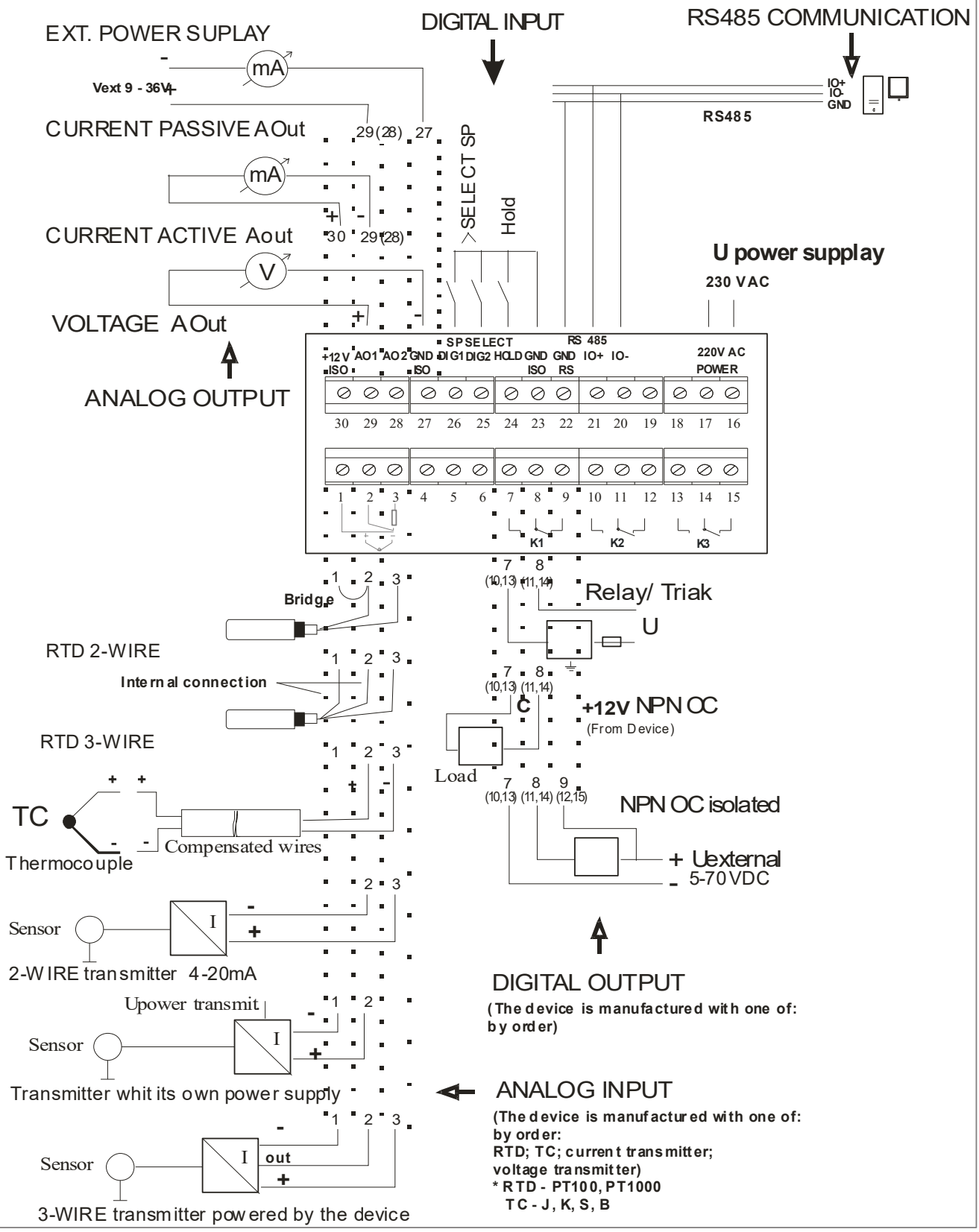
MS8106 **has three levels of programming** , which are accessed on the 'SP' display (LED SP illuminated) with different codes by a combination of pressing and holding the control buttons (see Section IX). Programming is done by accessing and changing parameters from the respective levels. At each level of programming, the functionality of the controller changes to varying degrees, and this requires a corresponding competence:

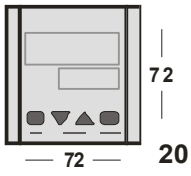
Level	PARAMETERS	CODE	FUNCTIONALITY	COMPETENCY
I	SYSTEM PARAMETERS	**------**	Customization according to the terms and purposes of the operation	User familiar with the technical description
II	HIDDEN SYSTEM PARAMETERS	**12**	Output and measurement scope configuration options. Restore to factory settings	Person with technical competence for setting up familiar with the technical description
III	SERVICE PARAMETERS	**23**	Factory settings	Manufacturer's Service Specialist

VI. WIRING INSTRUCTIONS



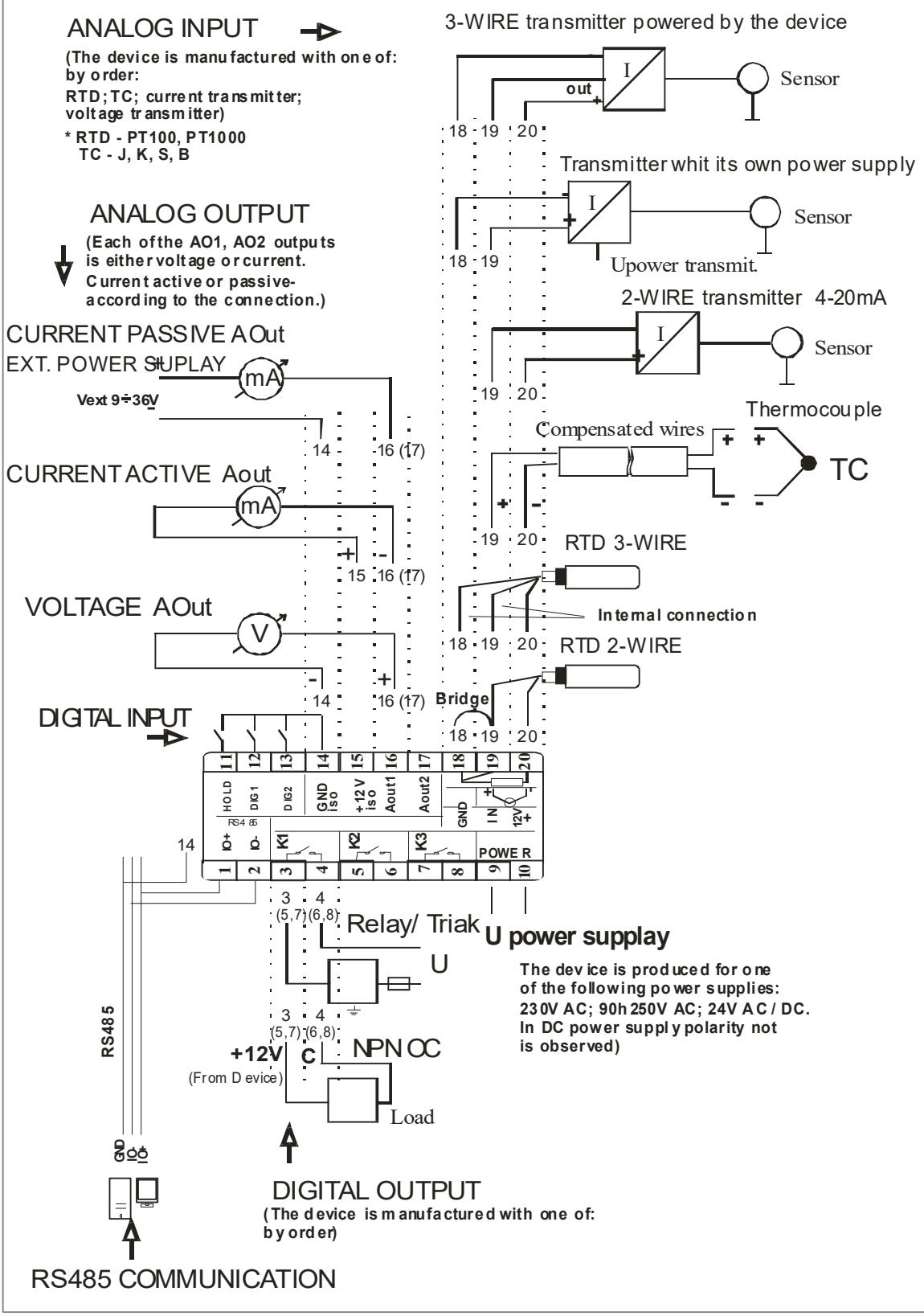
CONNECTION SCHEME OF MS8106

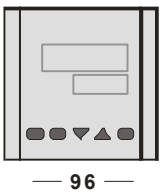




CONNECTION SCHEME OF MS8106AL (BOX 72x72)

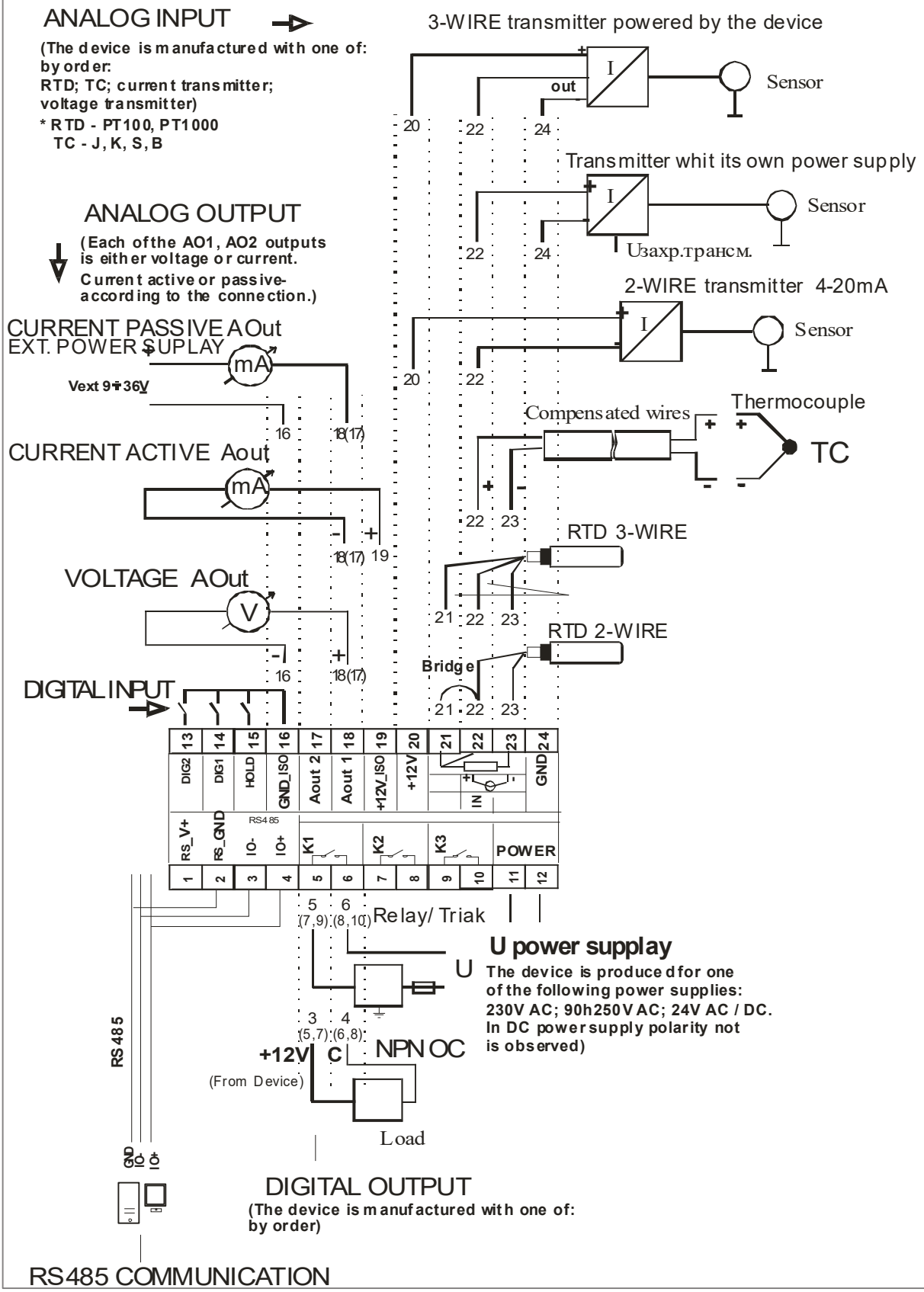
20 TERMINALS





CONNECTION SCHEME OF MS8106AL (BOX 96x96)

24 TERMINALS



• CONNECTING TEMPERATURE SENSORS AND TRANSMITTERS

In order to work well in general, it is important that the sensors are located in a suitable place in the environment where the temperature is to be regulated. At their installation in the hole is better to use a gasket improving heat exchange.

Connecting resistive sensors (Pt100 or others)

The sensors can be connected via a two-wire or three-wire line. The connection of two-wire sensors to a three-wire line is done by placing a cable bridge between certain terminals (see Connection Schemes).
For larger distances between a sensor and a regulator, it is advisable to use a three-wire line because it compensates for the temperature measurement error due to the additional resistance implied by the connecting wires.

Connecting thermocouples

When connecting a sensor - type thermocouple, attention must be paid to the polarity of the sensor. In inverted polarity the readings will be incorrect.

At thermocouples use, it is necessary to use a compensation cable corresponding to the type of thermocouple.

Connecting Transmitters

To be implemented in accordance with the attached Connection Schemes. To power the transmitters, the unit provides power voltage as follow: MS8106AL - 12V DC (unstable) or 24V DC (stable) , MS8106– 12VDC unstable .

• CONNECTING OUTPUTS

When connecting the outputs must be observed limits of applicability presented in the technical specifications (Umax, Imax).

When realizing outputs with relays, there are built-in RC groups in parallel with the contacts, for higher noise immunity. A minimum current flows through the open contact of the relay in the AC circuit. This can lead to subtle vibration in the off state when controling low power electromagnets and micromotors.

VII. OPERATING PRINCIPLE

Output at PID Control:

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

Output at 2-position ON/OFF control:

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

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

$Out_{(n)} = Out_{(n-1)}$ $\{ (SP - \mathrm{HIST1}) \le PV \le (SP + \mathrm{HIST1}) \}$

Output at 3-position ON/OFF control:

$Out_{(n)} = +100\%$ $\{PV < SP - Db - \mathrm{HIST1}$

$Out_{(n)} = -100\%$ $\{PV > SP + Db + \mathrm{HIST2}\}$

$Out_{(n)} = 0\%$ $\{SP - Db < PV < SP + Db\}$

$Out_{(n)} = Out_{(n-1)}$ $\{ \begin{matrix} (SP - Db - HIST1) \le PV \le (SP - Db) \text{ или} \\ (SP + Db) \le PV \le (SP + Db + HIST2) \end{matrix} \}$

Logical the controllers of the MS8106 ***series are constructed according to the block diagram of Fig.1***

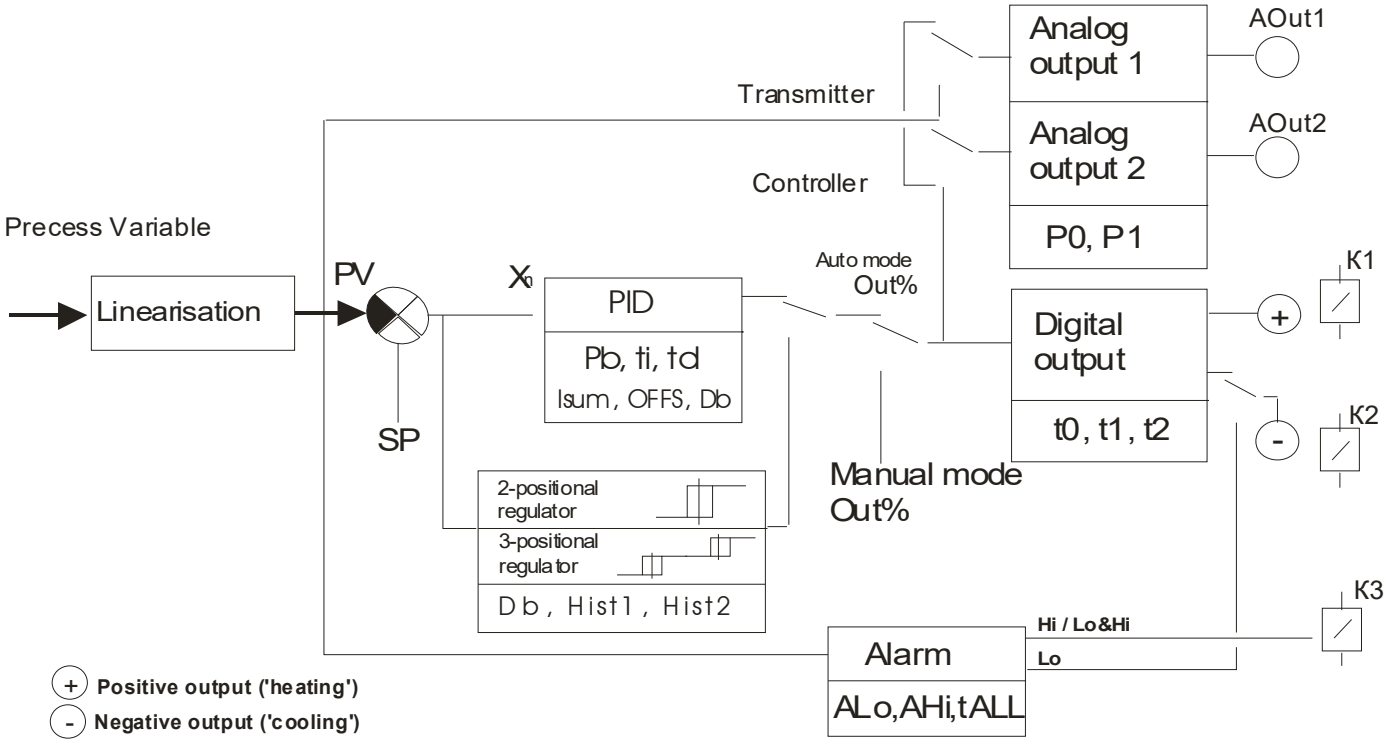


Fig.1 block diagram

VIII. OPERATING MODE

After switching on the power supply, the controller enters the last operating mode - automatic or manual and displays the process variable of the top row of the display and the setpoint of the lower row. In manual mode, the output is with its value before power failure, the A / M on the front panel lights up, the decimal point flashes. In automatic mode the output is formed according to the selected control law, the decimal point is permanently lit (if the values are in decimal format), LED A / M is not lit.

LEDs K1 and K2 indicate whether the corresponding output is active. When reaching the limits the alarm is waiting for a time T0AH (T0AL), during which the LED K3 flashes. When this delay expires, K3 lights up continuously. Then alarm output (K3) is switched on. Alarm time (T1AH, T1AL)can be set for the alarm output .In this case K3 LED flashes after switching off the output until the alarm conditions have dropped. By means of a parameter (ConF, 2A), the alarm can be divided to the upper limit - out. K3 and lower limit - out. K2, where the LED K2 flashes after crossing the lower limit and illuminates when the alarm output K2 is switched on.

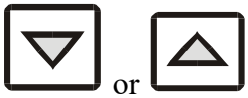
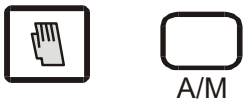
Indicators that the measured process variable is out of range (parameter rnGL, rnGH) serve symbol ┌ - - ┐ - above the range and └ - - ┘ - under the range when on display is PV

1. Mode selection - automatic / manual

Switching from Manual to Automatic mode

	switches to automatic mode, indicates "Auto" message and stops flashing of decimal point, A / M LED goes out.

Switching from Automatic to Manual mode

	the display value Out is selected
	witches to manual mode, which is indicated by "Hand" and blinking the decimal point. LED A / M on the front panel lights up

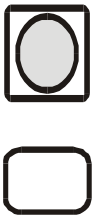
The device provides a smooth switching between the two modes - from automatic to manual and vice versa; when switching modes, the value of the output that was in the previous mode is preserved the same in the newly selected mode. In manual mode, when displaying **Out** %, the output can be directly controlled(p.4).

In manual mode, **self-tuning of PID parameters is discontinued** if this function has been activated (see ch.IX).

2. Selection of the variables to display

	Exchange SP ↔ OUT% to the second row of the display. In automatic mode OUT% remains on the screen for 10 seconds after the last button press.

3. Setpoint Configuration (SP)

	When SP (or SP $^{II, III, IV}$) is displayed, pressing and releasing the button will cause the SP value to flash and editing enabled. This is the assignment selected from the inputs DIG1,2 eg. SP^{II}, but if it is necessary to correct another, eg. SP^{IV}, then without leave  is pressed and relaxed  until the desired index is reached. Meanwhile, the controller logically works with the SP selected from the DIG1.2 inputs (e.g.SP^{II}). A number correction can be made. If no button is pressed within 5 seconds, the main menu returns.
	Set the desired value for Setpoint
	Confirm the new value (also this can be automatically, 5 seconds after the last button pressed).

4. Adjusting Output (Out)

Only possible in Manual mode!

	When displaying the **Out** value by pressing the button, the value of the output starts blinking and editing is enabled. If the button is not pressed within 5 seconds, the controller returns to normal operation.
	Adjusting Output Value
	Confirm the new value (also this can be automatically, 5 seconds after the last button pressed).

5. Lock / Unlock the keyboard

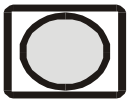
With a locked keypad, it is not possible to change the parameters and the operating mode, but only to select the display variable by the arrows. This function is a protection against accidental pushing of a button -**"Loc"** is displayed.

Pressed  and without releasing press 	Switching from unlocked to locked state (labeled **Loc**) and back (labeled **UnLc**)

IX. PROGRAMMING MODE

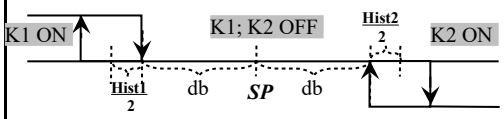
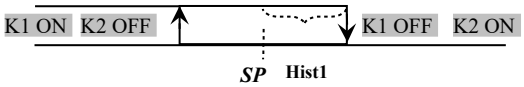
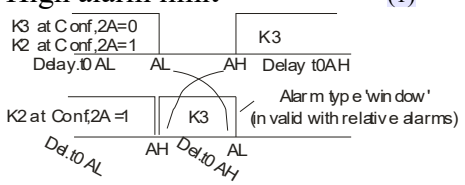
MS8106 /MS8106AL has three levels of programming that are accessed with different codes.

Access is only possible when is displayed 'Setpoint' (lit - LED SP)!			
TYPES OF PARAMETERS	**CODE**	**Display at entrance**	**Keyboard**
System	---	PROG	 is pressed and hold until an inscription appears “ProG”.
Hidden System	12	CODE	 is pressed and hold until an inscription appears “ProG”. Without releasing, press and  until an inscription appears **CodE.**
Service	23		

Set code, select and edit a parameter in Program mode	
	Set code The parameters navigation Changes the value of the selected parameter
	Confirm the new value. This reflects immediately on the current regulation. Exit - when a parameter name is displayed on the display, it is hold to inscription appears **^{v}1_4 End_ to exit PARAMETERS SETTING mode** **^{v}1_4** is the software version of the device.
Two minutes after the last operation, the device returns to operating mode.	

SYSTEM PARAMETERS

Para-meter	**Description**	**Range**	**RS485 COMMUNICATION HOLDING REGISTER ADDRESS, TYPE, SCALE. Where not noted, the scale depends on the decimal point (par dP) (REG №= REG ADDRESS+1)**	**factory default**
Pb	Proportional band Pb>0 means P, PI, PID, PD control Pb =0 - 2 or 3 position control (1)	0 ÷ 9999 (Dimension and decimal point according to the measured variable)	Pb ADR=38; Pb^{II} ADR=54; Pb^{III} ADR=76; Pb^{IV} ADR=82 TYPE Unsigned Int; The variable format is determined by the decimal point	
	If it is reset during self-tuning, the last one stops.			
The next 10 parameters to Atun included are only visible if Pb> 0				
ti	Time Constant by integration (1)	0 ÷ 9999 Sec.	ti-39; ti^{II}-55; ti^{III}-77 ; ti^{IV}-83, Uint, *1	
td	Derivative Time Constant (1)	0.0 ÷ 999.9 Sec .	td-40; td^{II}-56, td^{III}-78, td^{IV}-84, Uint, *0,1	
ISuL	Lower limit accumulation of the integral factor (2)	-100 ÷ 0 %	48, Signed Int, *1	
ISuH	High limit accumulation of the integral factor (2)	0 ÷ 100 %	49, Sint, *1	
	There is a way in the controller to avoid the effect *Integral Windup* , independent of the parameters IsuL and **ISuH**			

OF	Addendum to output Out% in **automatic** mode (1)	-100.0 ÷ 100.0 %	OF-43; OF^{II}-59;OF^{III}-81; OF^{IV}-87, Sint, *0,1	
t0	Term of PID gain calculation	1 ÷ 255 Sec.	35, Uint, *1	
tn1	Relay K1 trigger time at 100% calculated (or set) output.	1 ÷ t0 Sec.	36, Uint, *1	
tn2	Relay K2 trigger time at 100% calculated (or set) output.	1 ÷ t0 Sec.	37, Uint, *1	
AoFt See ch.IX!	Setpoint offset during self-tuning (Autotuning). For less assignment, negative values are entered, and for larger ones - positive	-1999 ÷ 9999 (Dimension and decimal point according to the measured variable)	46, Sint	
Atun See ch.IX!	Self-tuning (Autotuning) of parameters : Pb, ti, td	0 – off (stop) 1 – on (start)	45, Uint, *1	
db	Deadband in P,PI, PID, PD controller (Pb>0) At On / Off controller (Pb=0) : **db>0** - 3 position control  **db=0 - 2 position control**  In the above charts Hist1>0; Hist2>0 ; K2 is not configured as 'Alarm'	0 ÷ 9999 (Dimension and decimal point according to the measured variable)	44, Uint	
HYST1 **Visible to Pb=0**	Hysteresis at operate output : K1 at 3 position control K1 and K2 at 2position control A negative value inverts the corresponding output	-1999 ÷ 9999 (Dimension and decimal point according to the measured variable)	33, Sint	
HYST2 **Visible to Pb=0 and db>0**	Hysteresis at operate output : K2 at 3 position control A negative value inverts the output K2	-1999 ÷ 9999 Dimension and decimal point according to the measured variable)	34, Sint	
AL	Lower alarm limit (1)	**rnGL÷rnGH**{SYST,rA=0} -1999 ÷ 9999 {SYST,rA=1} Dimension and decimal point according to the measured variable)	ALL-41; ALL^{II}-57; ALL^{III}-79;ALL^{IV}-85, Sint	
AH	High alarm limit (1)  		ALH-42; ALH^{II}-58; ALH^{III}-80; ALH^{IV}-86, Sint	
t0AL	Time to trigger an alarm under limit AL	0 ÷ 100 Sec.	50, Uint, *1	
t0AH	Time to trigger an alarm above limit AH	0 ÷ 100 Sec.	50, Uint, *1	

HIDDEN SYSTEM PARAMETERS **Available with CODE = 12** (2)

! Change with extreme caution. Changing may cause incorrect operation of the unit!

Para-meter	Description	Range	RS485 COMMUNICATION HOLDING REGISTER ADDRESS, TYPE, SCALE. Where not noted, the scale depends on the decimal point (par dP) (REG №= REG ADDRESS+1)	factory default
ANALOG OUTPUTS AOut1, AOut2 SCALE By the next 8 parameters are set range and the operation of the analog outputs.				
OtrL (Visible to Syst,tr=1)	PV, corresponding to the lower limit of **Aout** at the transmitter analogue out. (for example 0°C at 4 mA)	-1999 ÷ 9999 (Dimension and decimal point according to the measured variable)	18, Sint	
OtrH at Syst,tr=1	PV for the high limit of **Aout** in transmiter Output (for example 100 ° C at 20mA)	-1999 ÷ 9999(Dimension and decimal point according to the measured variable)	19, Sint	
OdrL at Syst,tr=0	Out%, corresponding to the lower limit of **Aout** at the analogue control out. (example .0% за 4mA)	-100.0 ÷ 100.0 %	16, Sint, *0.1	
OdrH at Syst,tr=0	Out% , corresponding to the high limit of **Aout** at the analogue control out(for example 100% at 20mA)	-100.0 ÷ 100.0 %	17, Sint, *0.1	
O2tr (Visible to Conf,2t=1)	PV, corresponding to the lower limit of **Aout2** at the transmitter analogue out. (for example 0°C at 4 mA)	-1999 ÷ 9999 (Dimension and decimal point according to the measured variable)	92, Sint	
O2tr at Conf,2t=1	PV for the high limit of **Aout2** in transmiter Output (for example 100 ° C at 20mA)	-1999 ÷ 9999(Dimension and decimal point according to the measured variable)	93, Sint	
O2dL at Conf,2t=0	Out%, corresponding to the lower limit of **Aout2** at the analogue control out. (example .0% за 4mA)	-100.0 ÷ 100.0 %	90, Sint, *0.1	
O2dH at Conf,2t=0	Out% , corresponding to the high limit of **Aout2** at the analogue control out(for example 100% at 20mA)	-100.0 ÷ 100.0 %	91, Sint, *0.1	
SCOPE OF MEASUREMENT, OTHER				
rnGL	Measuring range - lower limit (when measuring under range - display ┗- - ┛)	-1999 ÷ 9999 (Dimension and decimal point according to the measured variable)	20, Sint	
rnGH	Measuring range - upper limit (when measuring over range - display ┌-- ┐)	-1999 ÷ 9999 (Dimension and decimal point according to the measured variable)	21, Sint	
dPnt	Decimal point Note: After a change is needed to verify / corrected all parameters with the dimension of the displayed value.	**0 ÷ 4** 0-xxxx; 1-xxxx.; 2-xxx.x; 3-xx.xx; 4-x.xxx **(modes 3 and 4 only available for SenS> 4)**	29, Uint, *1	
A db	Input filter area	0 ÷ 9999 (Dimension and decimal point according to the measured variable)	24, Uint	
Adbt	Time to perceive value outside the **A db** area	0 ÷ 255 c	25, Uint, *1	
FILt	Input filter coefficient	1 ÷ 100	26, Uint, *1	

SYST Output configuration options, options for different parameters depending on SP input selection, BackUp options. The output value can be seen on the display in Out mode and ranges from -100% ÷ 100%. From this magnitude are formed two analog (if they are controlling) and two (one if K2 is an alarm) digital outputs. **Digital outputs:** If used in the ON / OFF mode, they depend on the **Hist1** and **Hist2** character - minus means inverting. If not in ON / OFF, the field **iv** (inverse out) is determined. **Analog Output AOut1:** The field **tr** specifies a control (proportional to the output Out) or a Transmitter (proportional to the input PV). The values corresponding to the range of the analog output are in the **OtrL, OtrH** for transm. parameters. and **OdrL, OdrH** for control exit. In addition, the **ob** (out band) field determines these values for 0-100% outputs refer to either 20-100% (serves for easy transition from 0-20mA ↔ 4-20mA). **Analog output Aout2** is configured by param.**Conf, 2t.** The **dA** and **dP** fields indicate whether the different assignments of the task selection key work with the same or different sets of parameters for each **SP** –,II,III,IV**.** **BackUp options:** The input / output settings as well as some parameters (p.2) keep a backup. By matching the **rE = 1** option, these settings and parameters **return factory values and lose currents.** **ACCESS TO OPTIONS: SYST** ◯ → tr ◯ → iv ◯ → .... **At≡** **CHANGE OF OPTION** ▽ or △, example: tr=0 △ → tr=1		**tr= 0** - control analogue output **1** - transmitter analogue output **iv= 0** - K1 "heating"; K2 "cooling" **1** - K2 "heating"; K1 "cooling" **rA=0** - absolute alarm **1 -** relative alarm **ob=0** - Aout 0-100% (example 0-20mA) **1** - Aout 20-100% (example 4-20mA) **dA=0** – **ALL,ALH SP**, SP^{II},**SP**^{III},**SP**^{IV} **1** – ALL –,II,III,IV,ALH –,II,III,IV for SP –,II,III,IV **dP=0**– **Pb,ti,td,OF** com. to **SP**, SP^{II},**SP**^{III},**SP**^{IV} **1**– Pb –,II,III,IV,ti –,II,III,IV,td –,II,III,IV,OF –,II,III,IV for SP –,II,III,IV **rE=1**- Resets the factory settings to I / O and parameters labeled (2),then automatically**rE= 0.** **Warning -** the current settings are lost! **St=1** – Creates a backup of the settings and parameters marked with (2), (thus losing the recorded copy at the factory), after which automatic St = 0. The option is visible on the display only after a special service code has been entered in **COdE.** **MODBUS HOLDING REGISTER ADDRESS** ***30, Uint, *1 .*** **MODBUS COIL ADDRESS** ***at RS485 COMMUNICATION*** *(COIL №= COIL ADR+1)* **St** **rE** **dP** **dA** **ob** **rA** **iv** **tr** 4 4 4 4 4 4 4 4 9 9 9 9 9 9 8 8 5 4 3 2 1 0 9 8	
t1AL	Trigger Time of the alarm output after it is switched on below the AL limit	1÷100 sec., 0- permanently on *MODBUS HOLD.REG. ADDRESS 97, Uint, *1*	**0**
t1AH	Trigger Time of the alarm output after it is switched on above the AH limit	1 ÷ 100 sec., 0-permanently on *MODBUS HOLD.REG. ADDRESS 98, Uint, *1*	**0**
At ≡	Self-tuning options (see section IX)	1 ÷ 4 *MODBUS HOLD.REG. ADDRESS 47, Uint, *1*	**4**
FOut	Output filter coefficient	1 ('heavy' filter) ÷ 100 (without filter) *MODBUS HOLD.REG. ADDRESS* 114,Uint, *1	**100**
ZnFo	Output filter area	1 ÷ 100 % Out *MODBUS HOLD.REG.ADDRESS* 115,Uint, *1	**1**
FdSP	Coefficient filter on display	1 ('heavy' filter) ÷ 100 (without filter) *MODBUS HOLD.REG.ADDRESS*116, Uint, *1	**100**
ZnFd	Filter area on display	0 ÷ 9999 (Dimension and decimal point according to the measured variable) *MODBUS HOLD.REG. ADDRESS* 117, Uint	1

Abbreviations: Uint – UNSIGNED INT, Sint – SIGNED INTEGER

SERVICE PARAMETERS **Available with CODE = 23** (2)

! Change with extreme caution. Changing may cause incorrect operation of the unit!

Para-meter	Description	Values, MODBUS HOLD. REG. ADR , TYPE SCALE.	factory default
PARAMETERS FOR FACTORY CALIBRATION OF ANALOG OUTPUTS. **When changing the values using the front panel buttons, Aout enters the calibration mode other than the operating mode. This should be taken into account when connected measuring instruments! The settings are made in Syst, ob = 1.** **In case of a user change, use the AOut scaling parameters (p.18).**			
PA0	Offset for AOut1. Adjust to AOut1 = 4mA (Current Output)	-1999 ÷ 9999 *MODBUS HOLD.REG. ADDRESS* 22, Sint, *1	
PA1	Multiple coef. for Aout1. Adjusts after PA0 to AOut1 = 20mA.	-1999 ÷ 9999 *MODBUS HOLD.REG. ADDRESS* 23, Sint, *1	
PA20	Offset for AOut2. Adjust to AOut2 = 4mA (Current Output)	-1999 ÷ 9999 *MODBUS HOLD.REG. ADDRESS 95*, Sint, *1	
PA21	Multiple coef. for Aout2. Adjusts after PA20 to AOut1 = 20mA. .	-1999 ÷ 9999 *MODBUS HOLD.REG. ADDRESS 94*, Sint, *1	
OTHER SERVICE PARAMETERS			
SenS	Input type **Set up by the manufacturer!**	**J-0 , K-1 , S-2, B-3, Pt100 –4, Linear-5, other-6** *MODBUS HOLD.REG. ADDRESS 28, Uint, *1*	
nEtA	MODBUS device address	1 ÷ 255 *MODBUS HOLD.REG. ADDRESS 127*, Uint, *1	**1**
ConF	**System Settings:** **2A**-Output mode K2. **2t -** Analog Output AOut2 Control / Transmitter. The values corresponding to the range of **AOut2** are in the parameters **O2tL, O2tH** for transmitter. and **O2dL, O2dH** for Control output. The field **Syst, ob (out band)** determines these values for 0-100% output refer to either 20-100% (0-20 / 4-20 mA). **BAUDRATE, PARITY, STOP BIT** are communication parameters in the RS485 network. ACCESS TO OPTIONS: **Conf** ◯ → 2A ◯ → 2t ◯ → br .... → **Pb** CHANGE OF OPTION ▽ or △	**2A = 0** –K2 is a control output : **2A = 1**-K2 is Alarm **2t = 0**-Controll AOut2; **2t** = 1- Transmit AOut2 **br=0** BAUDRATE 9600 bps ; **=1**-19200 bps **Pr=0** PARITY NONE ; **=1**-EVEN **Sb=0** - 1 stop bit; **=1** - 2stop bits **bC=0** BROADCAST requests are executed (such to device address 0). **=1**-BROADCAST requests are not executed **tF=0** - Transmit Aout is not filtered with FdSP **=1**-Transmit Aout is filtered with FdSP ***MODBUS COIL ADDRESS at RS485 COMMUNICATION*** - | tF | bC | Sb | Pr | br | 2t | 2A 4 6 | 4 5 | 4 4 | 4 3 | 4 2 | 4 1 | 4 0 MODBUS HOLDING REG ADDRESS *27, Uint, *1*	**2A=0** **Br=0** **Pr=0** **Sb=0** **bC=0** **tF=0**

Note 1: There are 4 sets of parameters marked(1), indicated by -^{II,III,IV} after the name - eg. Pb^{II}, which refers to the operation of a selected SP^{II} (via the input of a SP assignment) Access is done by scrolling between the parameters with ▽ △, When the next parameter appears, without releasing the button, press the other arrow - eg. Pb ▽&△ → Pb^{II}. Each press of it switches Pb→Pb^{II}→Pb^{III} →Pb^{IV} →Pb ...

(Initially, the index selected from the inputs DIG1,2)

The operation of the parameters for the selected SP 'depends also on the SYST-dA, SYST-dP options.

Note 2: For the parameters marked (2) (hidden, service without nEtA) and for the calibration of the input, a backup is preserved, from which the factory set values can be returned via SYST, rE = 1. Factory parameters may need adjustments for the particular application.

X. SELF ADJUSTMENT OF THE CONTROLLER (AUTO TUNING)

Indication: running decimal point and **AT** LED on the front panel

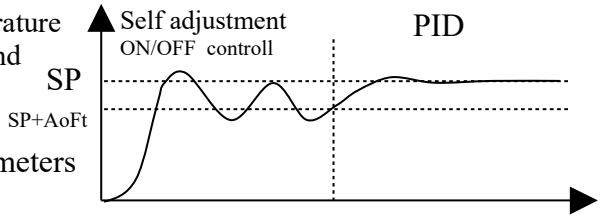
Activation: Atun = 1 **Deactivation: Atun = 0 (done automatically);**

In manual mode, self-tuning is canceled

This feature allows the device to only set values for the Pb, Ti, and Td parameters. Before starting, all other parameters must be specified. Pb, Ti, and Td also have to set any protection values that remain valid if the self-tuning is unsuccessful - for example, for a PID gain, a large Pb (Proportional band), a long integration time Ti, a short Derivative Time **Td.** Activating self tuning when **Atun** is assigned **1**. The procedure can be stopped at any time using **Atun = 0. Changing the output in manual mode also deactivates it.** After the PID factors are calculated, this is done automatically. **The value of Pb, Ti and Td before the end of the procedure determines what control strategy will be implemented:** all **Pb> 0, Ti> 0 and Td> 0** are set for **PID control;** for **PI** are set **Pb> 0, Ti> 0, and Td = 0;** for **P** are set **Pb> 0, and Ti = 0 and Td = 0. S**elf-tuning does not change the parameters with value 0, but takes into account the type of controller you want. **It is possible for the controller to register an unsuccessful self-tuning - then the initial values of Pb, Ti and Td will not be changed automatically.** Therefore, it is advisable to have defensive values that do not occur in the unacceptable conditions of the object.

With the 'Self-tuning' function started, it switches to ON / OFF control without hysteresis, resulting in oscillations. This lasts for two periods, after which the main mode returns with set parameters. **Attention! In this ON / OFF mode, the Setpoint can be significantly exceeded.** Therefore, during self-tuning, the Setpoint is sum of **SP + AoFt.** Thus, by means of the offset **AoFt** and **SP**, a safe area can be selected for self-tuning, possibly closer to in normal operation For example, when set to SP = 150° and AoFt = -20°, then the actual SP in self-tuning will be 130°. As long as the process lasts, maximum changes in object characteristics and disturbing impacts must be avoided. When selecting t0, it should be borne in mind that for a period of oscillation less than **8.t0** or greater than **1024.t0** the procedure is considered unsuccessful. In this case, the controller automatically returns to the same mode as it was before the start of the procedure. The process variable must be filtered using the tools provided in the device and not to be out of range. **Power off does not deactivate the procedure.** In this case, after restoring, the self-tuning starts from the beginning. The final result also depends on the At≡ parameter.

For comparison, the transition process of a test object (temperature control) is shown after a PID controller self-tuning in SP change and a change in load for the four possible values of At ≡.



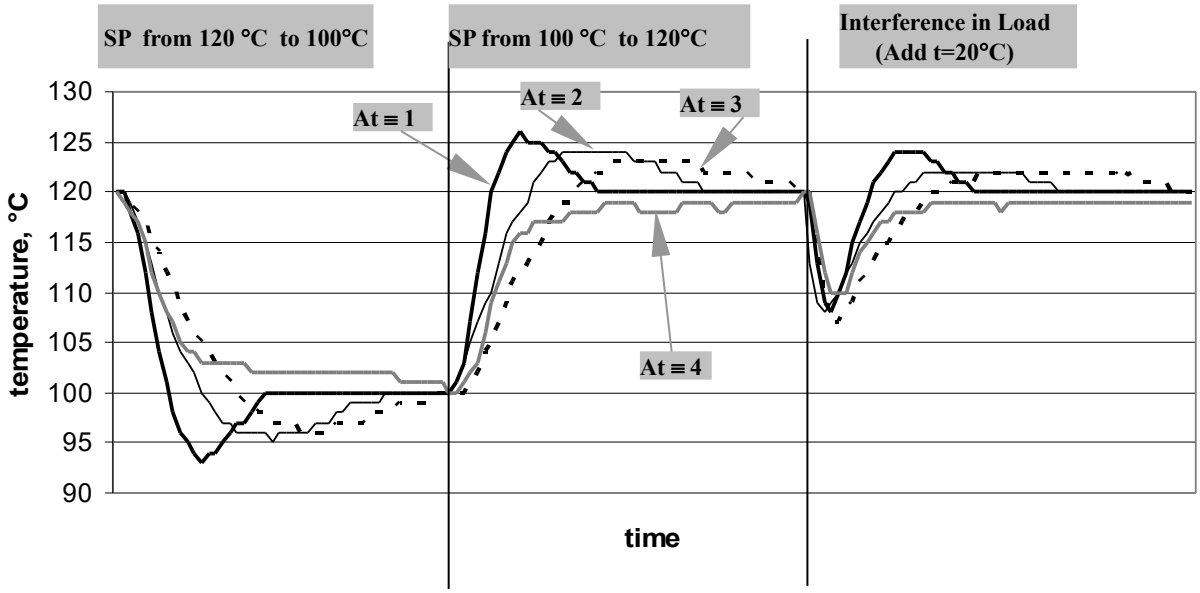
It is possible to leave reserves for improving the performance of the device by manually adjusting the parameters according to the specific object and criteria.

Забележка: In P mode at all At ≡ values and in PI mode at At ≡1,2, 3 the same parameters are calculated.

Sample adjustment schedule depending on the selected self-tuning criteria - At≡

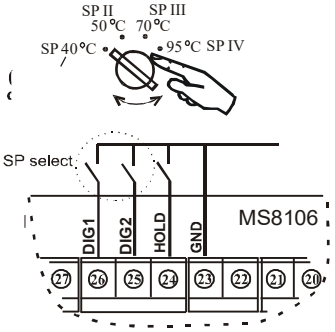
At≡1 – Over - tuning:*bigger* **/ Time to stability:***little;* **At≡2 – Over - tuning:***average* **/ Time to stability:***moderate*

At≡3 –Over - tuning:*moderate* **/ Time to stability:***average ;* **At≡4 – Over - tuning:***little* **/ Time to stability:***bigger*



XI. ВХОДОВЕ ЗА ИЗБОР НА ЗАДАНИЕ (опция)

There are two inputs for selecting the setpoint by active level GND.By means of them you can choose 1 of 4 possible sets of parameters SP, AH, AL, Pb, ti, td,OF with an index I (not displayed), II, III and IV. One or both may not be saturated at production - this limits the possible assignments (and parameters) to SP (unsaturated inputs) or SP, SPII (saturated in DIG1)



N	Input DIG2	input DIG1	setpoint	Hi alarm*	Low alarm*	Proportional band.**	Time Constant by integration**	Derivative Time Constant**	ADD FOR PID CONTROLL **
	-	-	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 param. SYST, dA is set to 0, then for the four states of inputs DIG1, DIG2, the instrument will work with the parameters AH and AL, ie. works with one pair of alarm levels.**

**** If param.SYST, dP is set to 0, and for the four states of inputs DIG1, DIG2, the instrument operates with the parameters Pb, ti, td, OF - ie. it works with one set of PID parameters.**

In case the choice is to work with different alarms and PID parameters at the various combinations of the DIG1, DIG2 inputs, care must be taken to set them correctly and completely!

Changing the state of the inputs DIG1, DIG2 during the correction of any of the described parameters does not select another correction parameter. In terms of managing any change act immediately.Handwriting in the 'PARAMETERS' menu ▲ + ▼ or SP correction ◯ + ▼ is valid only for the current parameter, and does not specify a work index, but only an index for correcting a current parameter. The working index (a set of parameters with which the device logically functions) is indicated only by the DIG1,2 inputs.

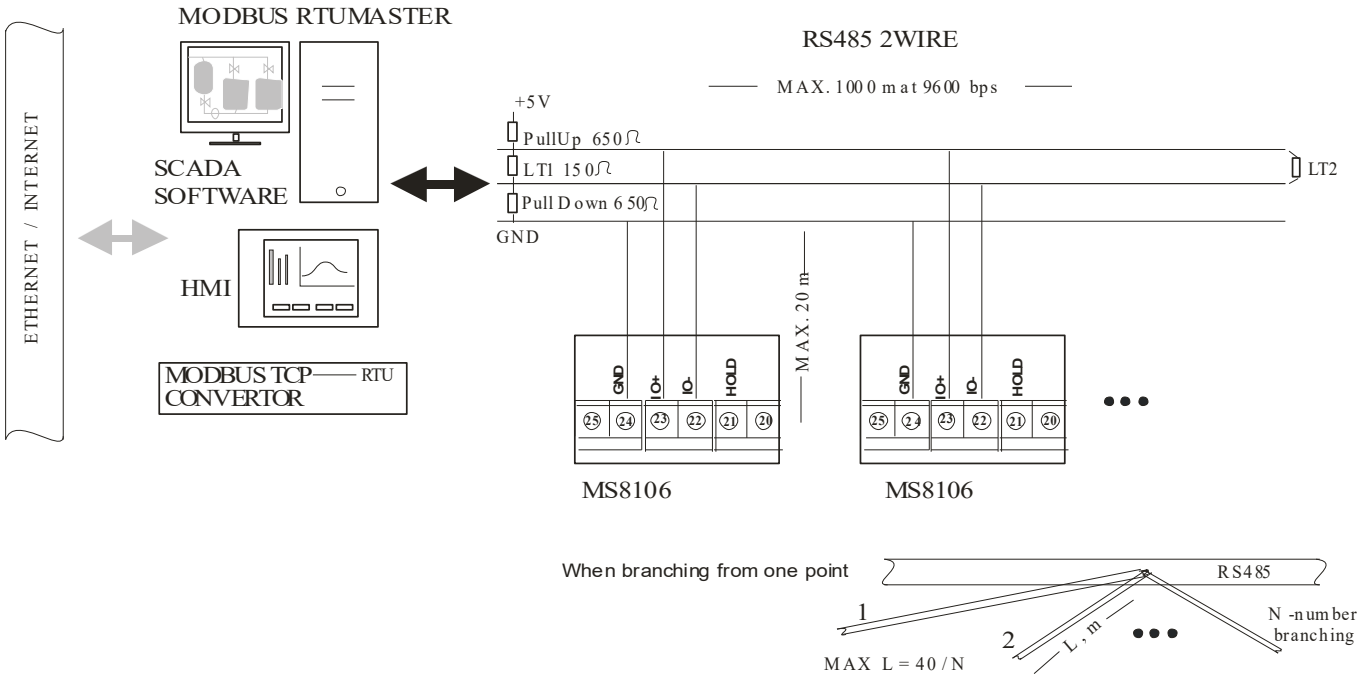
During self-tuning, it is not permissible to change the selected setpoint in order to calculate correct parameters.

In terms of 2 or 3 position mode operation (use as ON / OFF regulator) is the parameter Pb (not $Pb^{II,\ III\ или\ IV}$). If Pb = 0, the controller turns ON / OFF with hysteresis Hist1 (2-position) or Hist1, Hist2 (3-position) for all setpoints and $Pb^{II,\ III,IV}$,$ti^{II,\ III,\ IV}$,$td^{II,\ III,\ IV}$ are irrelevant. Conversely, if PbII, III or IV = 0, this only applies to SPII, III or IV and means PID with zone 1 (or 0.1; 0.01; 0.001 if the display is in decimal format).

XII. ВХОД HOLD IN (опция)

Input to activate HOLD mode (wait mode) - reset the OUT% and the integral factor. It is not saturated in the current version of the appliance unless the sticker of the particular device is specifically labeled. For HOLD mode indication, the HOLD is displayed in 4 seconds

XIII. COMMUNICATION via RS485 with MODBUS RTU protocol (optional)



The device is MODBUS RTU SLAVE capable of communicating at 9600 or 19200 bps on a RS485 2WIRE line **(par.ConF)**. With standard performance without the use of repeaters, up to 32 devices can be connected in one line, with repeaters up to 247. There is a special version option for up to 128 devices without repeaters. HOLDING REGISTER ADDRESS column in tables of parameters is shown the addresses of the relevant parameters. Here are the other options for communication. There is a parity between changing a parameter or operating mode using the buttons on the front panel and changing over the network - that is, the device can be affected simultaneously by both sources. If the network is a priority, the keyboard can be locked (can be unlocked through the front panel).

Implementation MODBUS FUNCTION	
MODBUS FUNCTION	COMMENT. LIMITS. Only addresses with parameter and dimension names specified can be used and the non-listed in the guide are considered reserved. The address fields in the table only indicate that the operation is executable without EXEPTION (protocol error message)
01	Reading a single bit. Max number COILS – 520.
03	Reading of HOLDING REGISTERS, 0< REG ADR <127 – registers in non-volatile memory, 128<REG ADR <256 –reg. in RAM. When adding 512 – FLOAT, calibration coefficients are read in format IEEE754 (otherwise they are in a format EXP, S.B0,B1,B2). Max number of registers in the query – 32.
05	Recording a single bit, 439<COIL ADR<512
06	Recording a single HOLDING REGISTER, 0< REG ADR <127 –registers in non-volatile memory; OUT and SP in RAM.
16	Record multiple consecutive HOLDING REGISTERS. Action Area as a function 06, plus addresses 512-528. At REG ADR>528 recording is not running, but without EXEPTION. At 512<ADR<528 the function is for recording a calibration FLOAT coefficients in IEEE754 format

HOLDING REGISTERS address table for MODBUS RTU RS485 communication																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0																	AOut1 %4	AOut1 %20	AOut1 PV4	AOut1 PV20
20	rnGL	rnGH	A1P1	A1P0	Adb	Adbt	Filt	Conf	Sens	DP	Syst			Hyst1	Hyst2	t0	tn1	tn2	Pb	ti
40	td	ALLo	ALLH	OF	db	Atun	AoFt	At≡	ISuL	ISuH	TALo	SP e	SPII e	OUTe	PbII	tiII	tdII	ALII	AHII	OFII
60																	PbIII	tiIII	tdIII	ALIII
80	AHIII	OFIII	PbIV	tiIV	tdIV	ALIV	AHIV	OFIV	SPIII	SPIV	AOut2 %4	AOut2 %20	AOut2 PV4	AOut2 PV20	A2P1	A2P0	TAHi	T1AL	T1AH	
100															FOut	ZnFO	FdSP	ZnFd		
120							Ver	ADR												
200									OUT	SP	PV									
510			RSP3		RSP2		RSP1		RSP0		HP1		HP0		OFS					

*The gray fields shown are part of the RAM. These parameters when the power is failure and subsequent switching on, initialize (equalize) their values from their respective (non-colored) fields in the non-volatile memory or are formed in the current mode according to the controller. All parameters in the non-volatile memory have a maximum number of records — 1000000.

PROCESS VARIABLE PV: HOLDING REG ADR 210, TYPE SINT, READ ONLY, Dimension according to DP parameter (decimal point). For example, for a temperature in whole C°, the register contains whole degrees. In case of a device with readings in one decimal place of C° (XXX.X C°) , respectively, and the contents of this registry will be in one decimal place of C°.

SETPOINT SP: HOLDING REG ADR 209, TYPE SINT, Dimension according to DP. Assign the controller to its RAM (non-volatile) memory. Suitable for frequent continuous changes. When the power is turned on, switching a SP selection key or recording in one of the non-volatile setpoints is initialized with (equals) the non-volatile setpoints, which is selected by the key.

NON-VOLATILE SETPOINT SP : HOLDING REG ADR 51, TYPE SINT, Dimension according to DP. Assignment in non-volatile memory. Max. number of records - 1000000. When recording is updated and the CURRENT READING SP . Appropriate for less frequent changes. Value is taken from it, when the device is turn on or change the input to select a SP. Manual change from the buttons on the front panel of the appliance concerns both (non-volatile and current) SP, i.e. they are the same assignment.The control application designer or the Human Mashine Interface (HMI) has a choice to use them as well, only to use the NON-VOLATILE SETPOINT. However, if the application's specificity requires a continuous change, e.g. in a few seconds, the limited number of records in the NON-VOLATILE SETPOINT enforces another scheme - to assign value to the NON-VOLATILE SETPOINT, which is initializing at turned on the power, but to change the CURRENT SETPOINT.

NON-VOLATILE SETPOINTS SPII, III, IV : HOLDING REG ADR 52, 88, 89 TYPE SINT, Dimension according to DP. Assignment SP' in non-volatile memory. Everything said above about NON-VOLATILE SETPOINT SP is also valid for SPII, III, IV. These are separate assignments - one for each of the positions of the task selection key (if one is not saturated, SP is selected).

CURRENT OUTPUT OUT : HOLDING REG ADR 208, TYPE SINT, x 0,1%. From this register reads the status of the device output. In automatic mode, recording a new value does not affect the output. In manual mode, the recording is equivalent to changing the output. This is an non-volatile register that manually initiates the controller when the power is turned on from INITIAL OUTPUT VALUE IN HAND MODE.

INITIAL OUTPUT VALUE IN MANUEL MODE : HOLDING REG ADR 53, TYPE SINT, x 0,1%. Non-volatile register from which in manual mode of the controller, at turned on the power initialize CURRENT OUTPUT OUT. Changing the CURRENT OUTPUT by pushing the buttons on the front panel simultaneously affects the INITIAL VALUE of output in MANUAL MODE. Also when switching to manual mode with button  , INITIAL VALUE is equated to the last value of CURRENT OUTPUT in AUTO MODE.

AUTO / MANUAL MODE : COIL ADR 504. Non-volatile flag. Reflects and manages the mode of operation: 0-manual, 1-automatic. It is also available through HOLDING REG ADR 31, bit0. Sample usage - when you need to set the CURRENT OUTPUT OUT directly on the network, this flag is reset to enter the device in manual mode. Thus, the output signal can be set manually using the buttons on the front panel or via the network. If the keypad is locked, only the second option remains (but the keypad can still be unlocked via the buttons on the panel)

LOCK / UNLOCK THE KEYPAD : COIL ADR 505. Non-volatile flag. Reflects and controls the button mode on the front panel of the device. 0-unlocked, 1-locked. It is also available through HOLDING REG ADR 31, bit1. Manipulate and manually through the front panel.

HOLD COMMAND : COIL ADR 506. Nonvolatile flag for mode control HOLD - reset to OUT% and the integral component, which acts if the HOLD IN input of the controller is inactive or not saturated (ie, the input if saturated prior to network control).If the HOLD IN input is activated, the unit goes into HOLD regardless of the HOLD COMMAND status. When switching to HOLD IN from active to inactive state, HOLD COMMAND is also reset. 0-operating mode, 1-mode HOLD. It is also available through HOLDING REG ADR 31, bit2. To monitoring the controller status, use the next parameter.

STATE HOLD : COIL ADR 3034. HOLD state flag on controller 0-normal mode, 1-HOLD. (Input HOLD IN reads COIL ADR 3030 0-inactive / unsaturated, 1-active) READ ONLY

STATE OF INPUT FOR SELECTION : COIL ADR 3026, 3031. READ ONLY

PV over range rngL-rngH :COIL ADR 3027. 1- PV>rngH 0- PV<rngH READ ONLY

PV under range rngL-rngH : COIL ADR 3028. 1- PV<rngL 0- PV>rngL READ ONLY

SELF ADJUSTMENT : COIL ADR 2528. 0-OFF, 1-ON. READ ONLY

STATUS OF THE ALARM : COIL ADR 2529. 0-OFF, 1-ON READ ONLY

LED INDICATion on front PANEL	K1	K2	K3	AT (autotune)	A/M	Display OUT	Display SP
COIL ADR (READ ONLY)	2535 0-off, 1-on	2534 0-off, 1-on	2533 0-off, 1-on	2530 0-off, 1-on	2531 0-manual, 1-auto	2529 0-no, 1-yes	2528 0-no, 1-yes

MODBUS ADDRESS : HOLDING REG ADR 127, TYPE UINT. Default =1

FIRMWARE VERSION : HOLDING REG ADR 126, TYPE UINT.

КАЛИБРОВЪЧНИ КОЕФИЦИЕНТИ : HOLDING REG ADR 512 - 524 , TYPE FLOAT 4 BYTE IEEE754

RSP3 -512; RSP2-514; RSP1 -516; RSP0-518 - Polynomial calibration coefficients to be used by the device if Sens=6. Convert ADC ==> measured variable by a 3rd degree polynomial.

HP1-520, HP0-522: Linear calibration coefficients used by the device if Sens<6. Convert ADC ==> measured variable (Sens=5), ADC==>Ωx0,1(Sens=4), ADC==>μV(Sens<4)

Offset - 524 - Offset of measured variable

OTHER FEATURES:

- The individual registry bits are available through MODBUS FUNCTION 01 (READ SINGLE COIL) , as COIL ADR = HOLDING REG ADR * 16 + BIT NUMBER (in bytes). Add 8 if it's in the junior byte.
- It should not be read or recorded in registers not specified in the manual. When changing a register, the boundaries characteristic of the relevant parameter are observed - the device performs an automatic check only for the parameters $tn1,2 \leq t0$.
- The device has a 80-byte communication buffer. A long request or one requiring a longer response will not be fulfilled. The limitations of the implemented features are in the table above.
- Address uniqueness must be provided in advance on more than one device per line (par.nEtA).

XIV. RECOMMENDATION AGAINST EMI (Electromagnetic Interference)

● Recommendations for use of connecting wires

- Wires that carry a similar type of signals can be packed together, but if the signals are different, the wires must be separated to prevent electromagnetic interaction.

- When there have to be crossed wires with different signal types this must be done at an angle of 90 degrees and a long distance.

- Wires, which carry weak signals and wires connecting the sensors to the controller must not be near contactors, motors, generators, radios and wires, which carry large currents.

● Noise suppression using the built-in in the controller filter

- If the input variable fluctuates and is not stable it is necessary to reduce the filter coefficient **FILt.** As lower the value, the heavier the filter and slowly change the input parameter.

- If the process variable on the display jumps periodically for short intervals, it is necessary to increase the parameter **AdBt**. When increasing this parameter, the device reacts slower at an unexpected "jump" in the input, but ignores the short-term interference.

XV.	STOP	**USER OFFSET ADJUSTMENT FOR ANALOG INPUT** ***Incorrect intervention results in a measurement error!***

In this mode, users can enter a value that will always be added when measuring the input variable (offset). This can be done when there is a discrepancy between the value displayed by the controller and the measured by reference instrument.

At display SP (LED SP lit) push  and hold until the appearance of an inscription **"ProG"**. Without relaxing press and  until the appearance of an inscription **CodE.**

Entered **COdE= 47** see ch.IX. PARAMETERS). You see message "OFSt". A button is pressed.  .

Seen 0.0 . By  and  che desired offset is set. Confirmed with  (automatically 5 seconds after the last button pressed).

EXAMPLES FOR USE SETTING OF OFFSET

1. Display Indication: 129 enter offset: 3.4
2. New Display Indication: 132 enter offset: 0.6
3. New Display Indication: 133 enter offset: -1.0 New Display Indication: 132

XVI.	STOP	**ANALOG INPUT CALIBRATION** ***Incorrect intervention results in a measurement error!***

The service mode for setting the analogue input is only allowable to a person qualified to do so.

STEP 1 Display [SP]) →  (5s) → Display [Prog] → hold on  and push  → Display [CodE], release →  → Display [0] → with  entered [78] →  → Display [rSt] →  → returns to operating mode, measurement is changed.

STEP 2 The initial steps in step one are repeated, but CodE = 80 →  → Display [tun1] →  → the first reference value is given at the input.→  → with  the input value is dialed eg. in ohms for Pt100 or in mV for TC→  → Display [tun2] →  → a second reference value is given.→  → with  the input value is dialed →  → operation

Can be adjusted with temperature standards, setting ° C (not Ω or mV). To do so, in step 2, enter CodE = 81. Temperature limits of the standards: J: -210..1200; K: -270..1372; S: -50 .. 1768; B: 0 .. 1820; Pt100: -200 .. 850 °C.

The setting dimension dimension is visible under the message [tun1] in step 2. Opportunities are ° C, Ω and mV depicted **°C , _⊓_ , mV**

At linear input, in both cases (Code = 80 or = 81), reference dimensions are set with the magnitude dimension, regardless of the message ° C.

If a temp thermocouple input is set in mV, the temperature of the terminals is measured after completion of calibration with a standard thermometer. The input is 0 mV (shorted) and the offset (p.19) is entered until the display is equal to the temperature of the terminals.

For the calibration, the reference values are selected so that they are at both ends of the measuring range.

XVII. RESTORE TO FACTORY SETTINGS

In case of unsuccessful calibration or incorrect configuration of parameters, it is possible to return the factory settings by aligning the SYST option, rE = 1 (see HIDDEN SYSTEM PARAMETERS). Factory parameters may need adjustments for the particular application.

The function only applies to certain parameters (see ch. IX, item 2) – hidden, service PARAMETERS , calibration of input / output.

WARRANTY CARD

Warranty card №:.....

Warranty term:..... months

Factory number:.....

The items were purchased from :.....

Invoice number:...../..... 20..... year .

GUARANTEE CONDITIONS

The guaranty consists in free repairs of all the factory defects which can occur during the guarantee period. **The repair is performed as in the repair base is being presented the current guarantee card with which the device is bought.** The warranty does notrefer to issue caused by a bad transport, bad conservation, wrong exploitation, naturedisasters, not following the instructions and the cases when there is an attempt to fix anydefects by other people. In those cases the issue is being fixed only against payment.

The maintenance during the guarantee period and doing the claims happens according to the valid legislation.

PERFORMED REPAIRS IN THE SERVICE

Service	Date of receipt	Order number	Type of repairs done	Date of transmission	Carried out the repair

Seller:..... **Buyer:.....**

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