



Temperature controller with timer

MS8109TU



TECHNICAL DESCRIPTION AND USER MANUAL

PLOVDIV 2018

CONTENTS

1.	DESIGNATION	2
2.	ORDER CODE	3
3.	TECHNICAL DATA	4
4.	FRONT AND BACK PANEL. DISPLAY AND KEYBOARD	5
5.	CONNECTION OF INPUT-START TIMER	6
6.	CONNECTION OF TEMPERATURE SENSORS AND TRANSMITTERS	6
6.1	Connection of resistive sensor (pt100 and other)	6
6.2	Connection of thermocouple	7
6.3	Connection of transmitter	8
7.	CONNECTION OF THE OUTPUTS OF THE CONTROLLER	9
8.	WORK PRINCIPLE	9
9.	OPERATING MODE	12
10.	LEVELS OF PROGRAMMING	14
10.1	User level	15
10.2	Level “system parameters”	16
10.3	Level “service parameters”	16
11.	USER TUNING OF THE OFFSET OF THE TEMPERATURE CHANNEL	17
12.	MEASURES AGAINST INTERFERENCE	18
12.1	Recommendations for usage of connecting conductors	18
12.2	Limiting of the noise by using of the built-in filter	18

1. DESIGNATION

The model **MS8109TU** is designed for controlling of one process parameter (temperature) and one timer block. The temperature channel and the timer block work independently or with a connection between them. The timer can work in different formats of the time – 99.9 seconds, 999 seconds or 999 minutes.

MS8109TU has one analog input and three discrete outputs. The outputs can be – one controlling, one alarm and one controlled by the built-in timer block. The controller can realize ON/OFF or proportional algorithm of controlling (program selectable). The output is controlled respectively by logic ON/OFF or by impulses with variable duration (PWM).

2. ORDER CODE

ORDER CODE:

MS8109TU - x.x.x.x.x.x.x.x.

Housing

Code

M1 - box Ip40 96x48x125
horizontal panel

1M - box Ip40 96x48x125
vertical panel

Display

Code

R1-14mm-red
G1-14mm-green
R2-20mm-red
G2-20mm-green
R4-10mm-red
G4-10mm-green
Y4-10mm-yellow
W4-10mm-white

Input channel 1(C1)

Code

	Code	
	C1	
Pt100	1	0.0÷100.0 °C
	2	0.0÷200.0 °C
	4	0÷250 °C
	5	0÷400 °C
	6	0÷600 °C
	7	-50÷400 °C
	Pt1000	8
9		-50.0÷100.0 °C
10		-50÷200 °C
J K	11	0÷600 °C
	13	0÷1200 °C
Transmitter	15	4÷20 mA DC-2W
	16	0÷20 mA DC-3W
	17	0÷10 V DC-3W
	9X	other by order

Discrete output **K3**

Discrete output **K2**

Discrete output **K1**

Code

K1	K2	K3
AA	BA	CA - not connected
AB	BB	CB - Relay 5A/250V
AD	BD	--- - Triac 2A / 250V
AE	BE	CD - OC NPN uniso $U_{CEmax}=65V, I_{Cmax}=100mA$
AF	BF	CF - OC NPN iso. $U_{CEmax}=80V, I_{Cmax}=1A$

Supply voltage**

Code

PA - 230 VAC / 50Hz
PF - 24 VAC ±30% isolated
PB - 24 VDC ±30% isolated
PC - 12 VDC ±15% unisolated
PD - 24 VDC ±15% unisolated
PX - other

Supply for transmitter

Code

T0 - not available
T1 - 11...14V 150 mA
T2 - 24V 150 mA

! Decimal point, upper and lower limit of the desired scope must be specified!

* In option PC and PD does not recommended sensor power supply to be the same as the unit!

Example:

MS8109TU - M1.2.T0.PA.AB.BA.CB

Housing - horizontal panel

Input **C1**- Pt100 0.0÷200.0 °C

Power supplt for a transmitter - not connected

Discrete output **K3** - Relay 5A/250V

Discrete output **K2** - not connected

Discrete output **K1**- Relay 5A/250V

Supply voltage - 230 VAC 50Hz

3. TECHNICAL DATA

Analog inputs		1
RTD Sensor		Pt 100
Thermocouple		J, K, S ...
Linear – voltage, current		0...5 (10) V; 0 (4) ... 20 mA
Digital input		1
Start of the timer		TTL active 0
Outputs		3
K1 – ON / OFF or PWM		Relay 250 V / 5,10 A or OK for TTL
K2 – Timer		Relay 250 V / 5,10 A
K3 – Alarm		Relay 250 V / 5,10 A
Options		Triac 250 V / 2 A; Relay 250 V / 5,10 A OK for TTL or SSR 250 V / 10,20,40 A
Indication and keypad		
Display		2 x 3 digits LED 10 mm
Range of the display		0 ... 999
Accuracy		± 1 LSB
Format of the display		X.XX XX.X XXX
Keypad		Four membrane keys
Power supply		
Power supplying voltage		220 V / max 20 mA
Frequency of the power supplying voltage		50 Hz (± 1 Hz)
Operating conditions		
Operating temperature		0 ... 50 °C
Operating relative humidity		0 ... 80 % RH
Dimensions		
Overall dimensions (WxHxL)		96 x 48 x 128 mm
Installation		Panel in hole 90 x 44 mm
Weight		max 300 g
Degree of protection		IP40
Storage		
Storage Temperature		-10 ... 70 °C
Storage Relative humidity		0 ... 95 % RH

5. CONNECTION OF INPUT-START TIMER

The start of the timer can be done by button, connected as it is shown on fig.1.

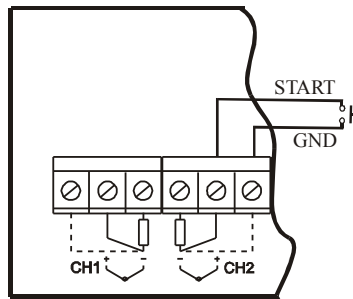


Fig. 1

6. CONNECTION OF TEMPERATURE SENSORS AND TRANSMITTERS

For the correctness of the work it is important the probe to be installed at a suitable place in the environment, in which the temperature will be controlled. When it is installed in a hole, it is good a seal, which improve the heat release, to be used.

6.1 Connection of resistive sensor (Pt100 or other)

The sensor can be connected by two-wire or three-wire line. The connection of two-wire sensor with three-wire line can be done as it is shown on fig. 2, and between terminals 1 and 2 of the controller cable jumper must be obligingly put.

When the distances between sensor and controller are bigger it is recommended a three-wire line to be used, because the error in measurement of the temperature, made by the added resistance of the connecting wires, is compensated with it. The connection of three-wire sensor with the controller can be done as it is shown on fig. 3, and with terminals 1 and 2 of the controller are connected the shortly connected cables in the sensor.

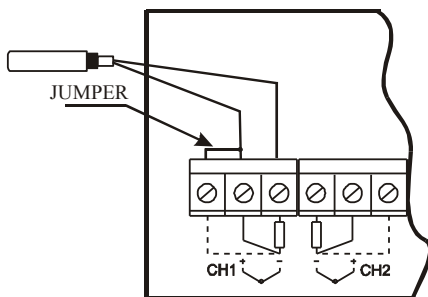


Fig. 2

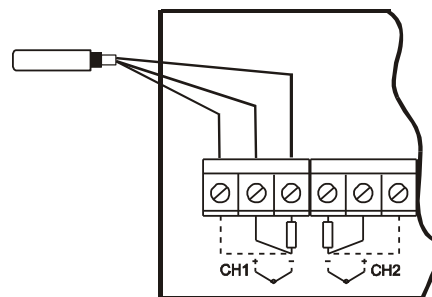


Fig. 3

6.2 Connection of thermocouple

When a sensor – thermocouple is connected, we have to pay attention to the polarity of the sensor. When the polarity is not right the indications of the instrument will be incorrect.

When you work with thermocouples you have to use a compensating cable, suitable for the kind of the used thermocouple (fig. 4).

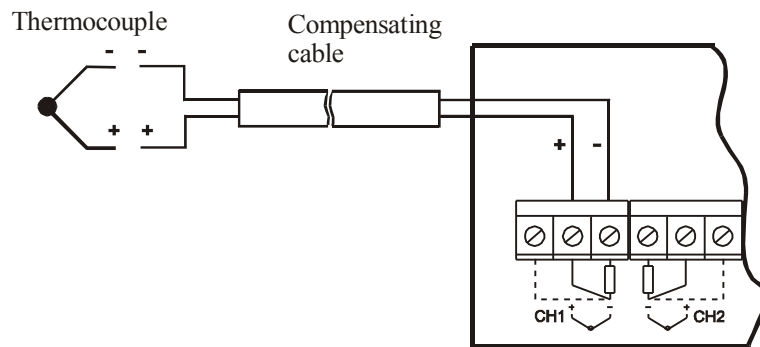


Fig. 4

6.3 Connection of transmitter

1) Transmitter with two-wire switching on (loop power)

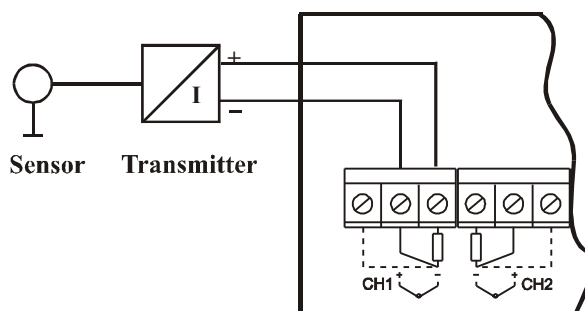
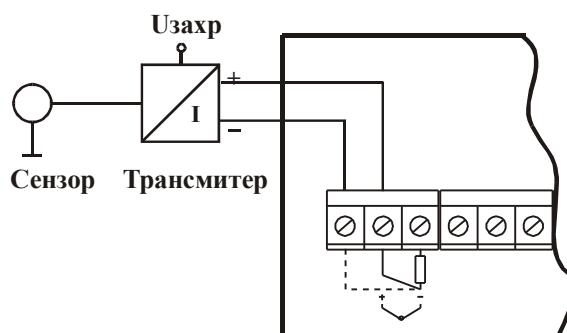


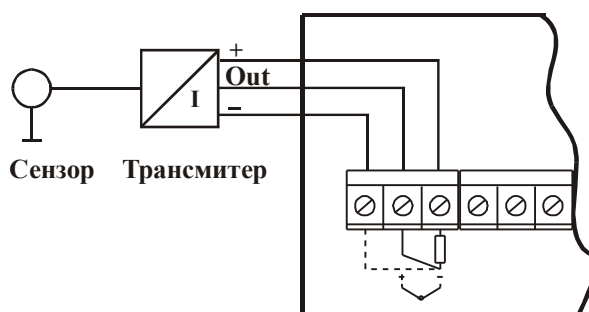
Fig. 5

2) Transmitter with own power supply



Фиг. 6

3) Transmitter with own power supply



Фиг. 7

8. CONNECTION OF THE OUTPUTS OF THE CONTROLLER

When the outputs are realized by relays, in parallel with the contacts of the relays there are RC groups for higher noise immunity. *Minimal current flows in trough* the opened contact of the relay in an AC circuit.

The connection of an output of the controller, when it is type SSR, with the charge can be done as it is shown on fig. 8.

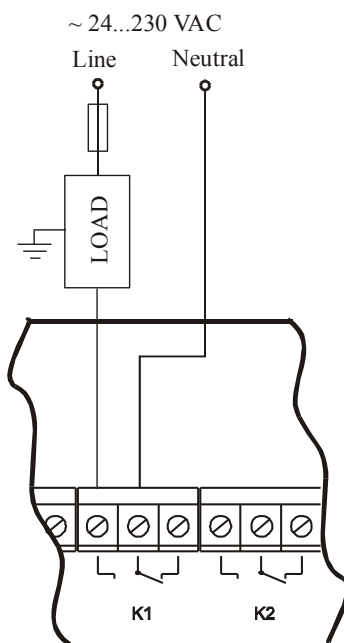


Fig. 8

8. WORK PRINCIPLE

Basic parameters used in the instrument:

- SP -set-point for controlling of temperature
- SPt -set-point of the timer section
- * -proportional band or hysteresis (when the value of the parameter is positive – logic heating, when it is negative – logic cooling)
- PV -input parameter
- H -higher limit of the alarm
- L -lower limit of the alarm
- P -period of PWM = $t_i + t_p$ (at 0 – ON/OFF algorithm of controlling)
- t_i -time for impulse at PWM controlling
- t_p -time for pause at PWM

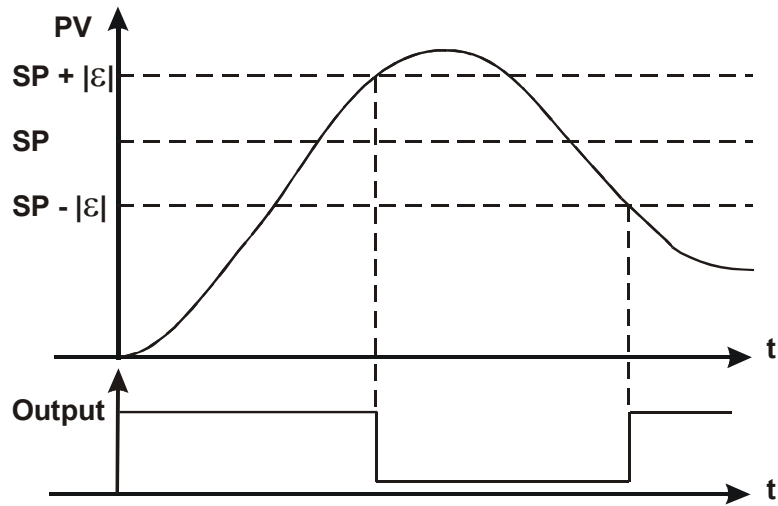


Fig. 9

On Fig. 9 is shown the principle operation of a 2 ON/OFF controller with output logic “heating” ($\epsilon > 0$).

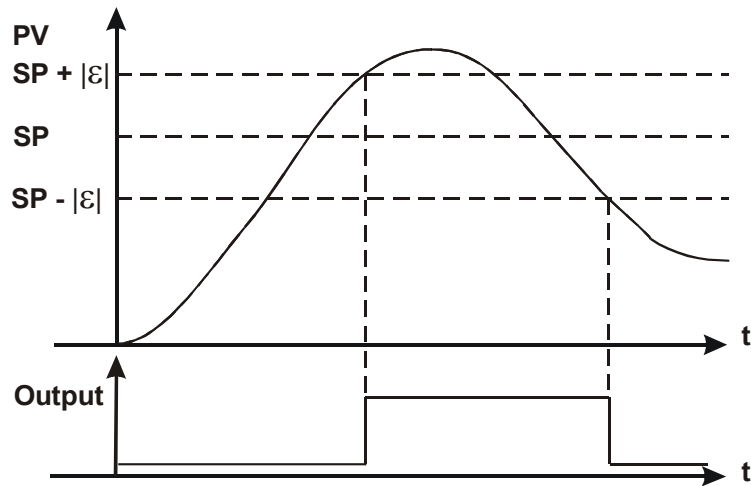


Fig. 10

On Fig. 10 is shown the principle operation of a 2 ON/OFF controller with output logic “cooling” ($\epsilon < 0$).

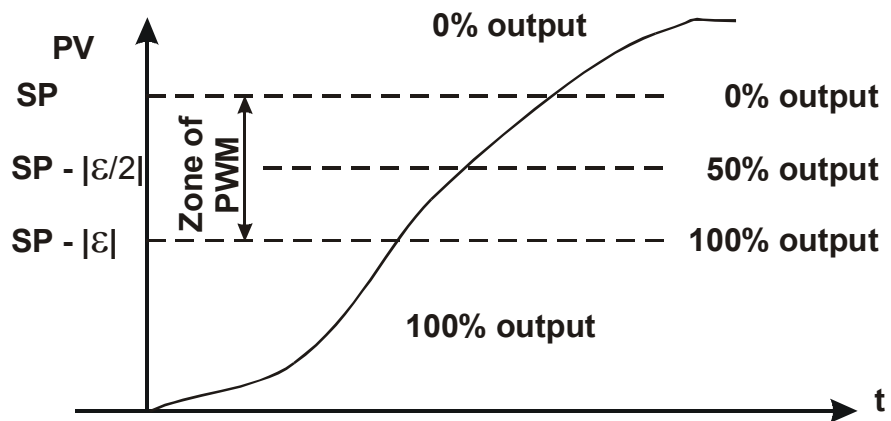


Fig. 11

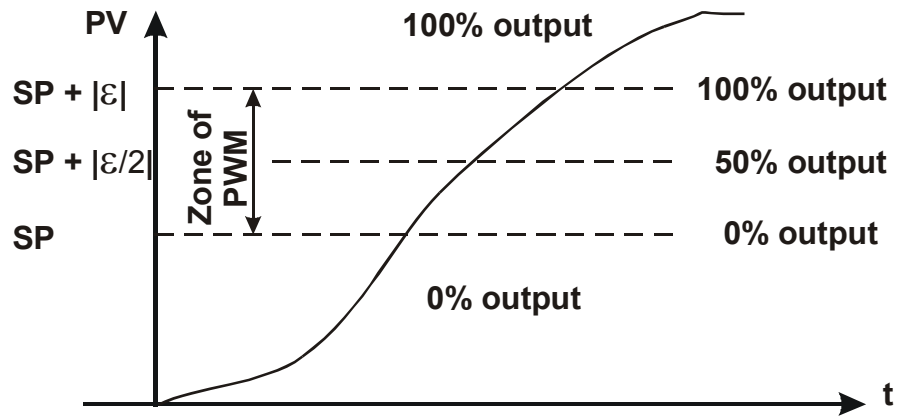


Fig. 12

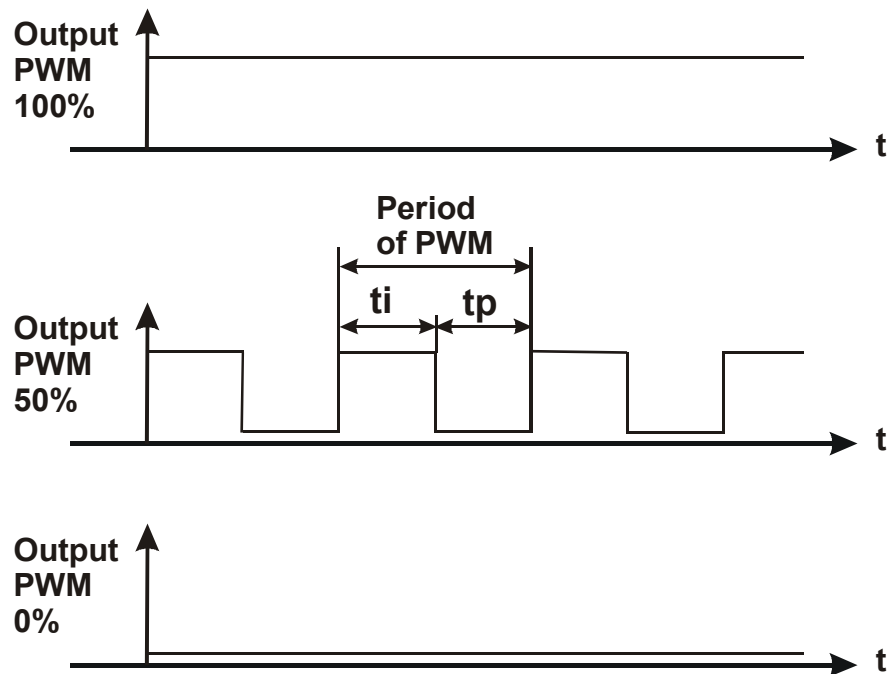


Fig. 13

On Fig. 11 is shown the principle operation of controller with PWM output logic “heating” ($\epsilon > 0$), and on Fig. 12 – the principle operation of controller with PWM output with logic “cooling” ($\epsilon < 0$). On Fig. 13 is shown the principle operation of PWM output. At 50% PWM output $t_i = t_p$.

For changing the logic of work of the controller to logic “cooling” you have to make negative the parameter ϵ .

9. OPERATING MODE

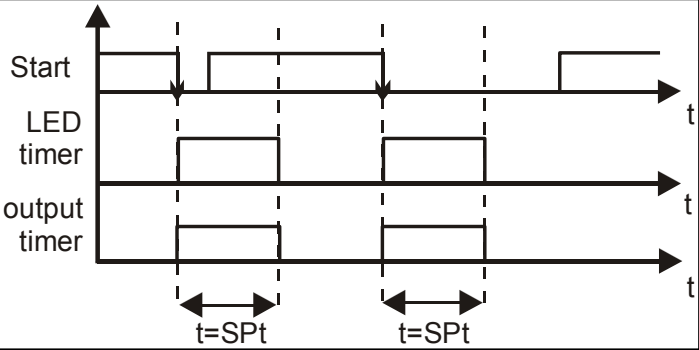
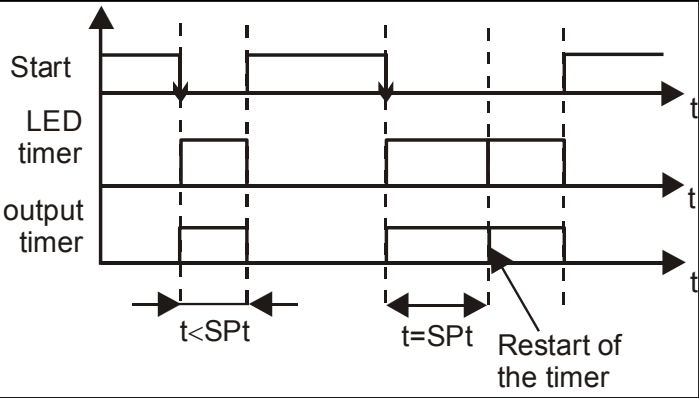
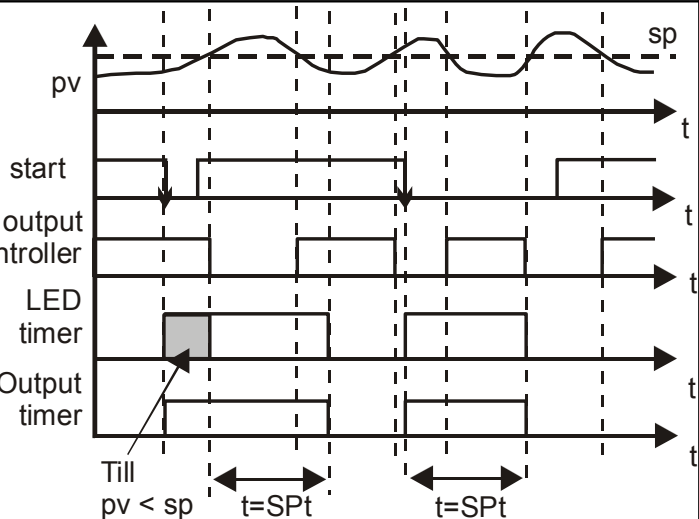
In operating mode on the left display is read the value of the temperature channel, on the right – the indication of the timer (if it is not tuned to be hidden see p.IX.2). The left red LED indicates if the output of the temperature channel is active. The right red LED indicates if the output of the timer section is active.

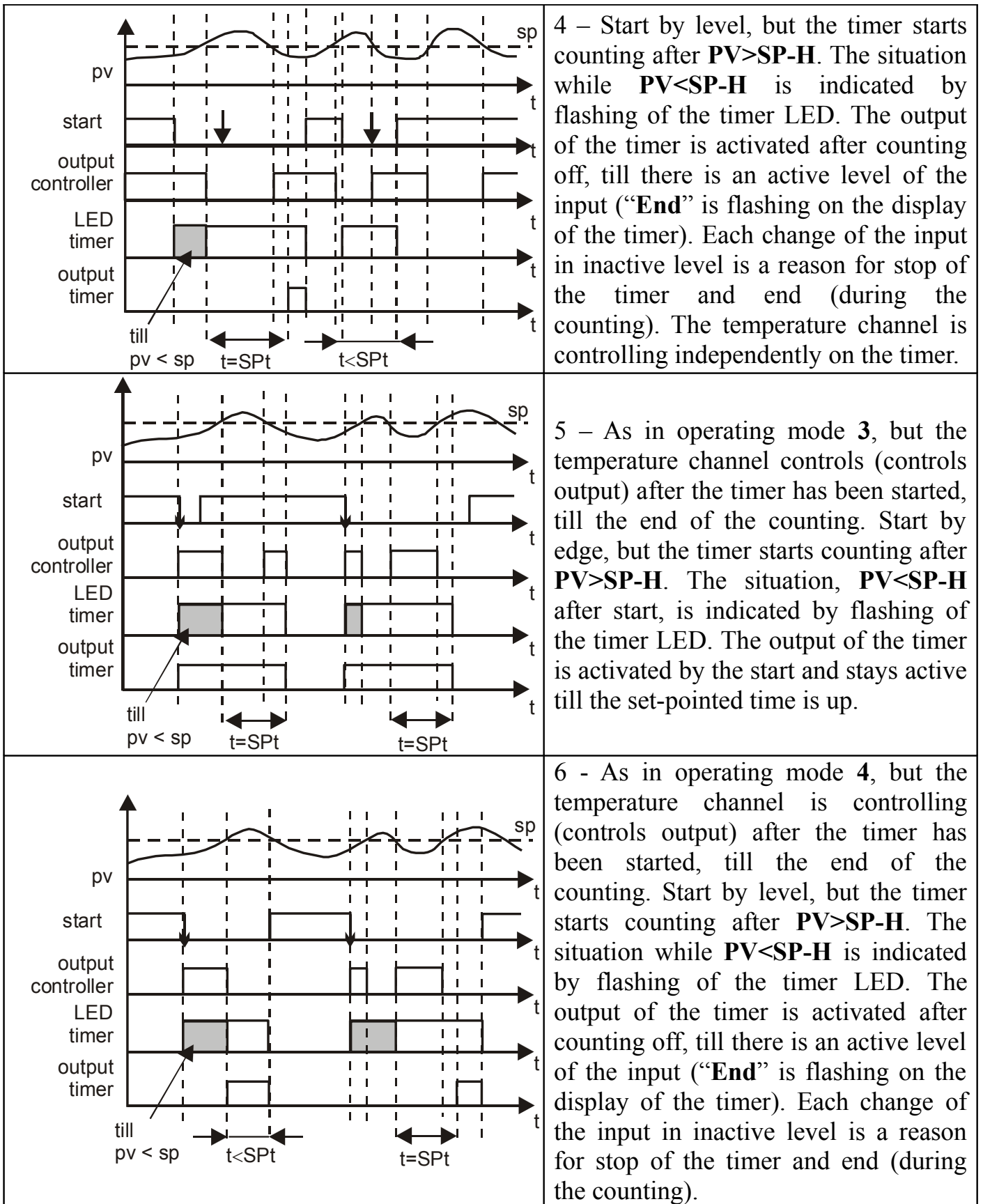
When the value of the temperature is bigger than (or less than) the higher (lower) limit of the alarm, it activates and on the display for the channel a message “ALL” starts appearing periodically.

The timer section works independently or by reciprocal connection with the temperature channel and its operating mode depends on the schemes described below. The output of the timer is active till the time is up.

Operating mode and start of the timer

The operating mode of the timer depends on the value of the parameter $\underline{\quad}$.

Graphics	Description
 <p>The diagram shows three horizontal axes: Start, LED timer, and output timer. The Start signal has three pulses. The LED timer signal is high during each pulse. The output timer signal is high during each pulse. The duration of each pulse is labeled as $t = SPt$.</p>	<p>1 - Start by edge. The output of the timer is switched on while it counting off. The temperature channel controls independently on the timer.</p>
 <p>The diagram shows three horizontal axes: Start, LED timer, and output timer. The Start signal has three pulses. The LED timer signal is high during each pulse. The output timer signal is high during each pulse. The duration of each pulse is labeled as $t < SPt$ and $t = SPt$. A label 'Restart of the timer' points to the start of the second pulse.</p>	<p>2 - Start by edge. The output of the timer is switched on while it is counting off. The temperature channel is controlling independently on the timer. If after the end of counting, the input is in active level, the timer restarts.</p>
 <p>The diagram shows five horizontal axes: pv, start, output controller, LED timer, and Output timer. The pv signal is a wavy line oscillating around a dashed line labeled 'sp'. The start signal has three pulses. The output controller signal is high during each pulse. The LED timer signal is high during each pulse. The Output timer signal is high during each pulse. The duration of each pulse is labeled as $t = SPt$. A label 'Till pv < sp' points to the start of the first pulse.</p>	<p>3 - Start by edge, but the timer starts counting after $PV > SP-H$. The situation, $PV < SP-H$ after start, is indicated by flashing of the timer LED. The output of the timer is activated by the start and stays active till the set-pointed time is up. The temperature channel is controlling independently on the timer.</p>

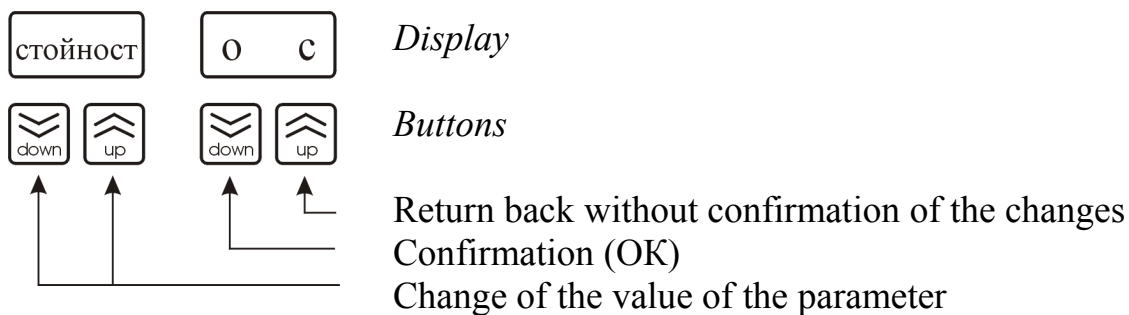


Note – In operating mode 3, 4, 5 and 6 on the graphics the activation of the timer is shown at parameter $H = 0$, an so there is a change of the condition for start of the timer from “ $PV > SP - H$ ” to “ $PV > SP$ ”

10. LEVELS OF PROGRAMMING

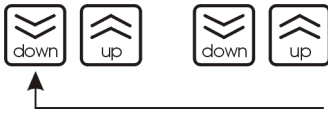
Principle operation of the keypad:

- When there is a symbol (parameter) on the display, the button under the symbol selects its editing
- When on the display there is the number written by the buttons under it the value is changed, and by the buttons under the symbols “o” and “c” this value can be confirmed or refused.



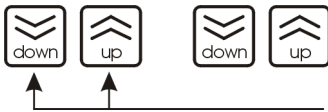
10.1 User level

Display temperature and timer



Set-point1 (SP) for the temperature channel appears on the left display, and *Set-point2* (SPt) for the timer block appears on the right display. When the button is released the instrument returns to normal operating mode, where the parameter, which is read at the moment, appears on the display.

Set the set-point of the temperature channel



The buttons must be pressed at one and the same time and the set-point appears and starts flashing on the left display. Its value can be changed by the same buttons and the display stops flashing. If you don't press any button in 5 seconds, till the value flashes on the display or a new value is already set-pointed, the new set-point is saved and the instrument returns to operating mode. (-199 ÷ 999°C)

Set the set-point of the timer channel



The buttons must be pressed at one and the same time and the set-point appears and starts flashing on the right display. The value of the SPt can be changed by the same buttons and the display stops flashing. If you don't press any button in 5 seconds, till the value flashes on the display or a new value is already set-pointed, it returns to operating mode. If the timer works while its set-point is changing, the new set-point comes into effect at the next start of the timer. (1 ÷ 999)*

Software RESET of the timer



Software RESET of the timer can be realized at any time by the pressing of these buttons. Symbols for restart “---” must appear on the display of the timer.

- The format of the time depends on the set of the system parameter “P”.

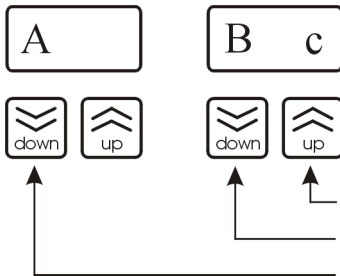
10.2 НИВО “системни параметри”



Enter operating mode – set of system parameters

Hold the buttons 3 seconds, after that the main menu for programming appears on the both displays.

1) Main menu

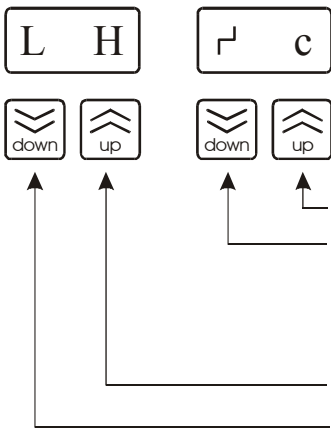


Display

Buttons

Return to operating mode
Parameters for tuning of the timer
Parameters for temperature channel

2) Menu parameters of the temperature channel

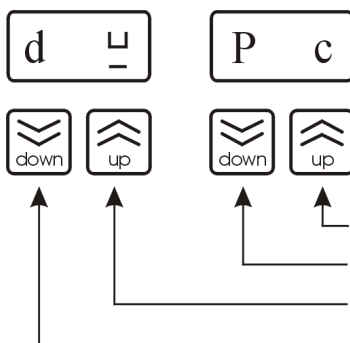


Display

Buttons

Return to main menu
 ϵ - proportional band or hysteresis at $\epsilon > 0$ logic “heating”,
 $\epsilon < 0$ logic “cooling”
(-199 ÷ 999°C)
Higher limit of the alarm (-199 ÷ 999)*
Lower limit of the alarm (-199 ÷ 999)*

3) Menu parameters of the timer



Display

Buttons

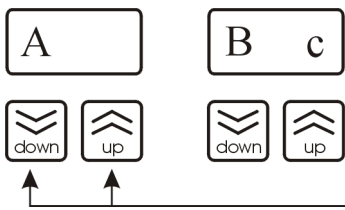
Return to main menu
Format of the time of the timer (1 ÷ 3)*
Operating mode and start of the timer (1 ÷ 6)**
Display the set-point of the timer ***

***The following formats are valid:**
1 - 99.9 seconds
2 - 999 seconds
3 - 999 minutes

**For various modes see section 9 "Operating Mode"

*** The following values are valid:
0 - The Set Point is displayed
1 - The Set Point is not displayed.
Only the current counting value is displayed on the timer display.

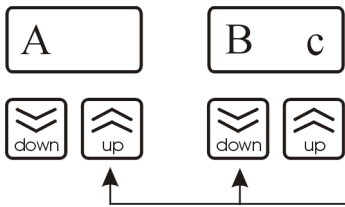
10.3 LEVEL “service parameters”



Display

Buttons

Set of the parameters of the filter of the temperature channel

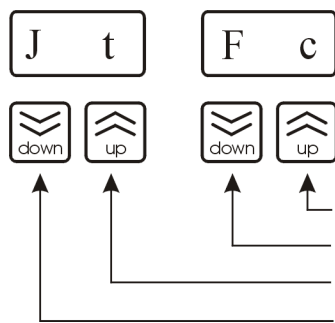


Display

Buttons

Set of the period of PWM and shift in comparison with the set-point

1) Menu for selection of parameters for the filter



Display

Buttons

Return to main menu

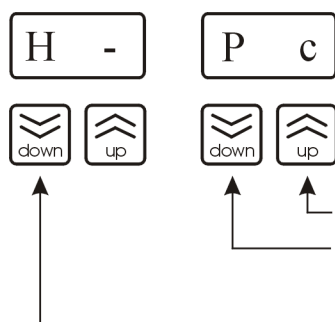
Coefficient of the filter (1 ÷ 128)*

Time for jump of the filter (1 ÷ 255sec.)

Jump of the filter (1 ÷ 255°C)

* The smaller is the value of the coefficient, the heavier is the filter.

2) Menu for selection of parameters for period of PWM and shift in comparison with the set-point



Дисплей

Бутони

Връщане в главно меню

Период на ШИМ на температурния канал
(1 ÷ 255 * 0,5сек.)*

Отместване спрямо заданието на температурния канал
(1 ÷ 255°C)**

* At setting of value “0” the temperature channel passes into ON/OFF algorithm of controlling and the parameter ϵ is hysteresis. In the other cases ϵ is proportional band.

** It is used in operating mode 3,4,5 and 6 of the Timer. The comparison for the start of the counting of the timer is realized at the condition $PV > (SP-H)$.

11. OFFSET OF THE TEMPERATURE CHANNEL

In this operating mode, the users can input freely programmable coefficient, which will be added always at the measuring of the channel (the so called “offset”). This operation must be realized with a great attention, because the instrument is tuned by the factory. The measuring can be realized indirectly.



Set of the “offset”

To enter this operating mode, press the button at the supply of the power of the instrument. During the period of time in which you are pressing the button an inscription “**OFFSEt**” appears on the display. After releasing the button, the controller passes into normal operating mode.

The set-point of every offset can be realized in the way, in which the tuning of the set point for controlling (SP) of every channel in normal operating mode can be realized (see VIII.1). The value, which is set up, is more precise than the measured parameter with one digit. **At entry in editing you always have to specify value 0, i. e. the current value of the channel on the display is accepted as basic.**

EXAMPLES FOR USER TUNING

1. Показание на дисплея: 129
2. Въведен коефициент: 3.4
3. Ново показание на дисплея: 132
4. Въведен коефициент: 0.6
5. Ново показание на дисплея: 133
6. Въведен коефициент: -1.0
7. Ново показание на дисплея: 132

12.RECOMMENDATION AGAINST EMI (Electromagnetic Interference)

12.1 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.

12.2 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 **F**. 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 “ **t** ”. When increasing this parameter, the device reacts slower at an unexpected “jump” in the input, but ignores the short-term interference.

WARRANTY CARD

Warranty Card № :

Warranty : months

Serial number :

The product is bought by :

with invoice № :/..... 20.....

WARRANTY CONDITIONS

The warranty consists of free repair of all manufacturing defects that can occur during the warranty period. **The repair is done by presenting of this warranty card in the service base with which is bought the product.** The warranty does not cover damage caused by poor transport, poor storage, incorrect usage, forces of nature, failure to follow instructions and when others made an attempt to remove the defects. In these cases the defect can only be removed for a fee.

Service during the warranty period and settlement of claims is done under the current legislation.

REPAIRS MADE IN THE SERVICE BASE

Service	Data of entry	Order number	Type of the repair	Date of delivery	Performer of the repair

Seller:

Buyer:

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