microsyst

COMPETENCE IN
MEASUREMENT

Universal two-channel microprocessor-based programmable controller

MS8112

TECHNICAL DESCRIPTION AND INSTRUCTION FOR USAGE

PLOVDIV 2003

I. TECHNICAL DATA

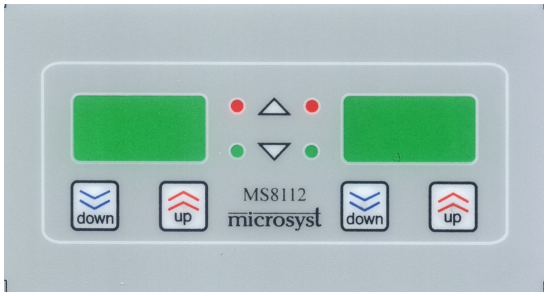
Analog inputs	2
RTD Sensor	Pt 100
Thermocouples	J, K, S …
Linear – voltage, current	0...5 (10) V; 0 (4) … 20 mA
Digital inputs	2
Selection of set-point (SP1/SP2)	TTL active 0
Start of timer	TTL active 0
Outputs	3
K1 – ON / OFF or PWM	Relay 250 V / 5,10 A or OK for TTL
K2 – ON / OFF or PWM	Relay 250 V / 5,10 A or OK for TTL
K3 – Alarm or timer	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 keyboard	
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
Keyboard	Folio
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 a 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

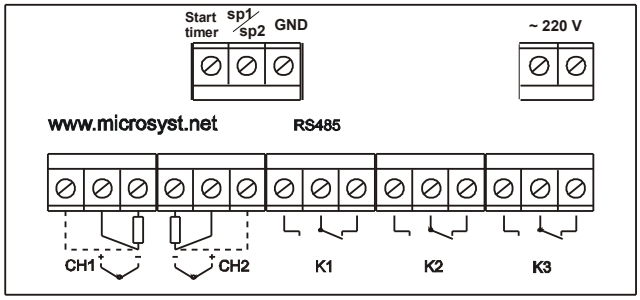
II. DESIGNATION

The model **MS8112** is designated for control of two process parameters, for example temperature and temperature, temperature and humidity, etc.

MS8112 is being produced in two basic modifications (according to output 3) – with timer block or alarm. The device has two analog inputs and three discrete outputs. The outputs can be – two controlling, respectively for channel 1 and 2, and alarm or controlled by the built-in timer block. The controller can realize ON/OFF or proportional algorithm of control (program selectable). The outputs are controlled respectively by logic ON/OFF or by pulse width modulation (PWM).

III. FRONT AND BACK PANEL





IV. CONNECTION OF TEMPERATURE SENSORS AND TRANSMITTERS

For better operation it is important to locate the probes at suitable position in the medium, in which the temperature control will be done. If they are installed in a hole, it is better to use gasket, improving the heat release.

1. Connection of resistive sensors (Pt100 or other)

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 by the scheme, shown on fig. 1, and between terminals 1 and 2 and terminals 5 and 6 of the controller you must obligingly put cable jumpers.

When the distances between sensor and controller are bigger it is recommended to use three-wire line, because the error at the measurement of the temperature from the additional resistance, carried by the connecting wires. The connection of three-wire sensors to the controller can be done by the scheme, shown on fig. 2, and to terminals 1 and 2 and terminals 5 and 6 of the controller, the cables, shortly connected in the sensor, must be connected.

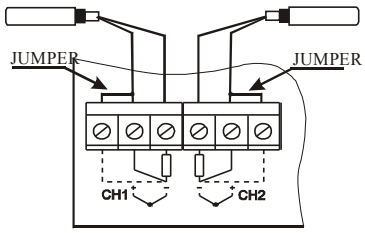


Fig. 1

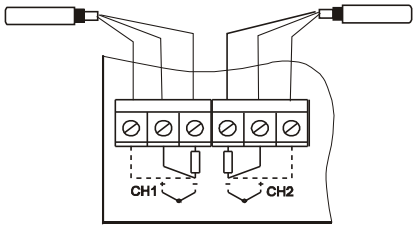


Fig. 2

2. Connection of thermocouples

At the connection of sensor – type thermocouple, you must pay attention to the polarity of the sensor. At reversed polarity the indications of the device will be incorrect. At operation with thermocouples you must use a compensation cable, corresponding to the type of the used thermocouple (fig. 3).

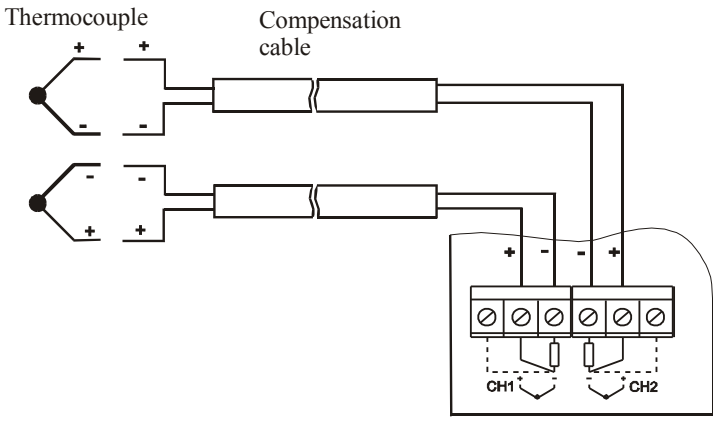


Fig. 3

3. Connection of transmitters

1) Transmitters with two-wire switching on

The power for the transmitters is supplied by the device.

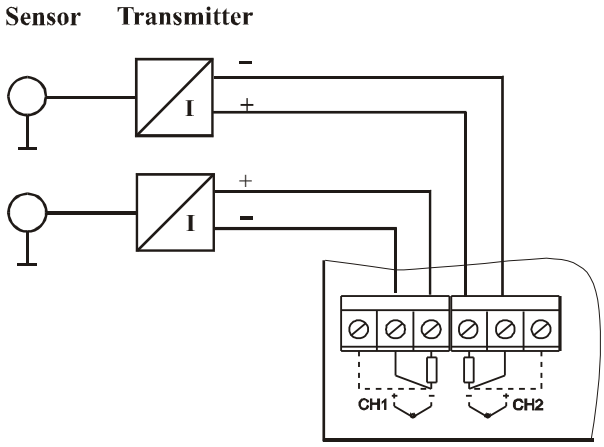


Fig. 4

* The device supplies voltage from 11,5V to 14,5V / max 50mA, which is unstable.

2) Transmitter with own power supply

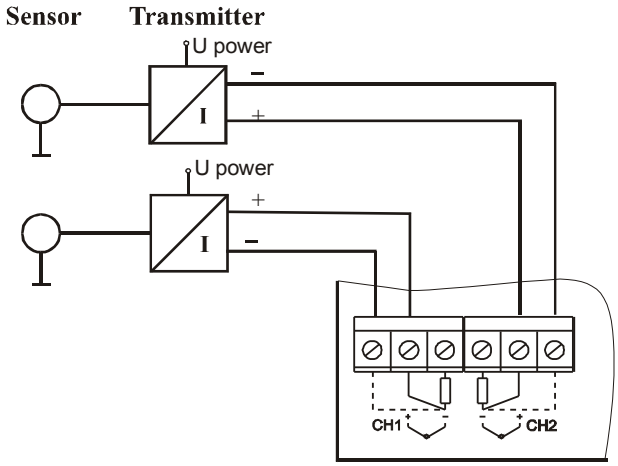


Fig. 5

3) Three-wire transmitter, supplied by the device

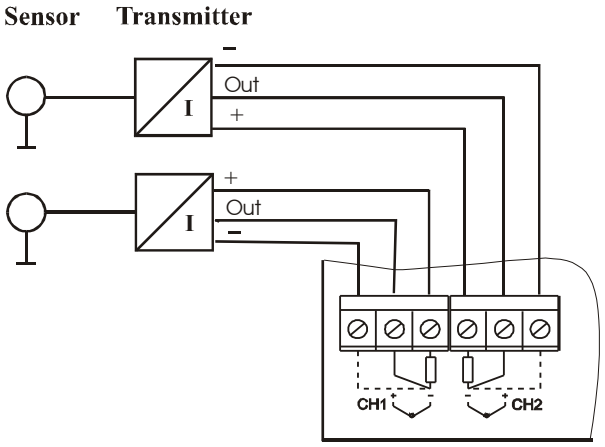


Fig. 6

* The device supplies voltage from 11,5V to 14,5V / max 50mA, which is unstable.

V. CONNECTION OF THE OUTPUTS OF THE CONTROLLER

If the outputs are realized by relays, in parallel with the contacts of the relays there are RC groups for higher noise immunity. Through the open contact of the relay in the alternating current circuit *minimum current flows.*

The connection of an output of the controller, when it is SSR, to the load can be done by the scheme on fig.7

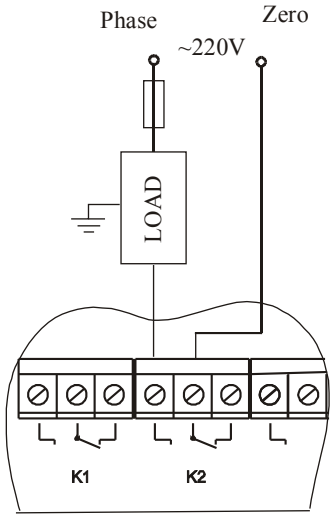


Fig. 7

VI. OPERATION PRINCIPLE

Basic parameters, used in the device:

SP -set-point for control
ε -proportional band or hysteresis *(at positive value of the parameter – logic heating, and at negative – logic cooling)*
PV -input parameter
H -higher limit of the alarm
L -lower limit of the alarm
A. and B. -period of PWM = ti+tp *(at 0 – positive algorithm of control)*
ti -time for impulse at PWM control
tp -time for pause at PWM

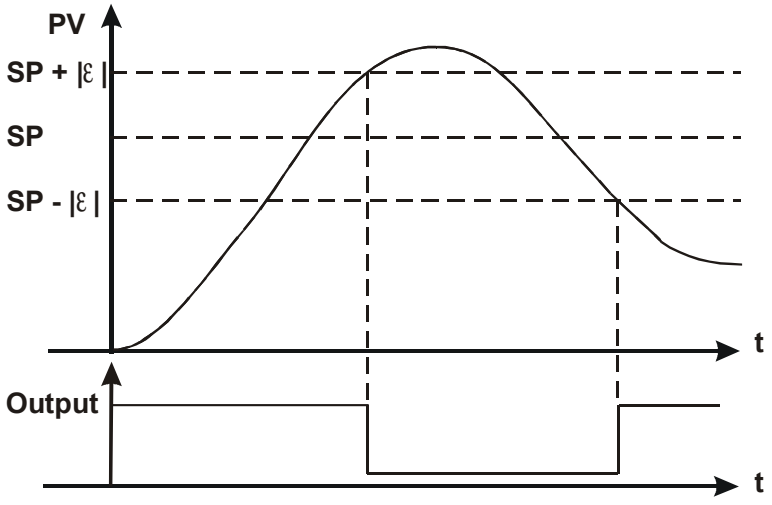


Fig. 8

The principle operation of ON/OFF controller with output logic "heating" (**ε**>0) is shown on fig 8.

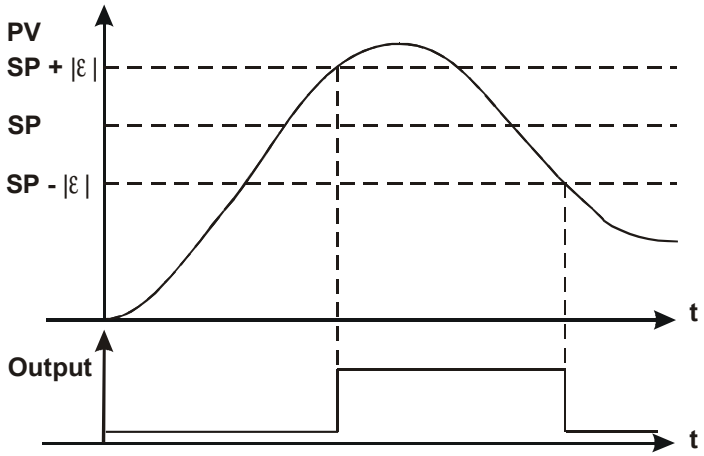


Fig. 9

The principle operation of ON/OFF controller with output logic "cooling" (**ε**<0) is shown on fig 9.

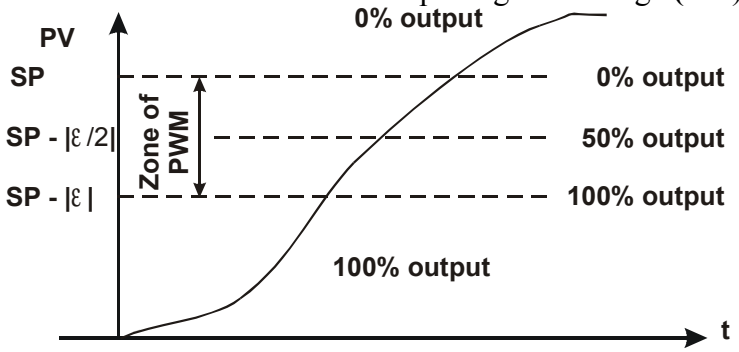


Fig. 10

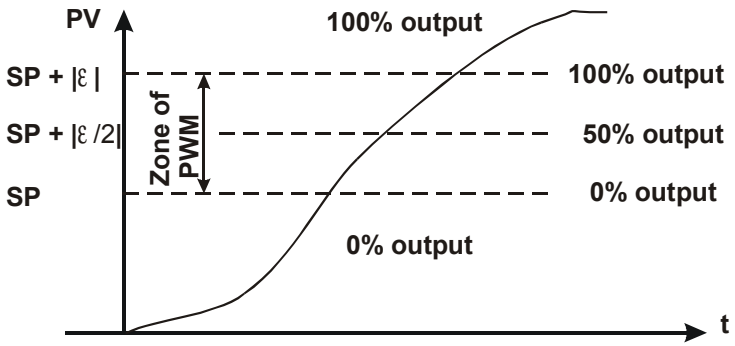


Fig. 11

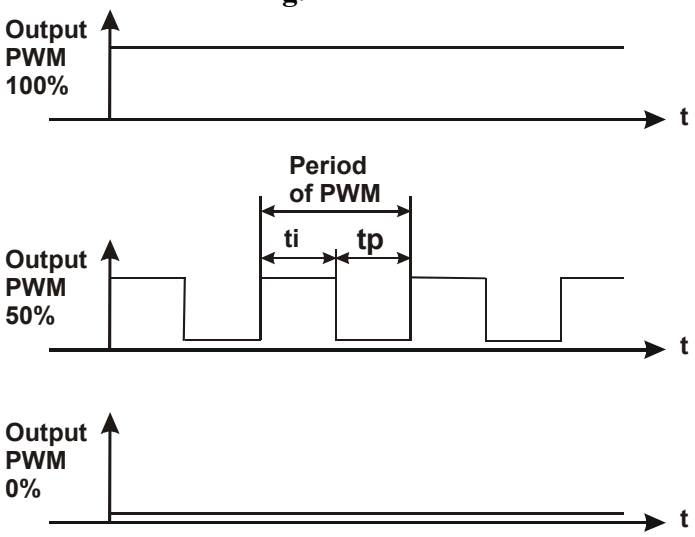


Fig. 12

The principle operation of a controller with PWM output logic "heating" (**ε**>0) is shown on fig. 10, and the operation of controller with PWM output with logic "cooling" (**ε**<0) is shown on Fig.11. The principle operation of PWM output at 50% PWM output ti=tp.

To change the logic of operation of the controller to logic "cooling" it is necessary to make the parameters ε_1 and ε_2 negative.

The alarm output is joint for the two channels and it activates independently on that which of the channels is in alarm situation, and "**ALL**" and the measured value alternate one after another.

VII. OPERATING MODE

In operating mode the value of the parameter of Channel 1 appears on the left display, and of Channel 2 – on the right one. The red LEDs indicate if the respective output – the left one for Channel 1 and the right one for Channel 2 - is active.

When the value of the parameter for a certain channel exceeds (decreases under) the higher (lower) limit of the alarm, it activates and the message "**ALL**" starts appearing periodically on the display for the channel.

The timer section operates independently from the rest part of the controller according to the selected operating mode. (See p.VIII. 3.2)

MODE 1: The timer starts by pressing of an external button and so activating the timer output and starts decreasing the set-pointed time. The output of the timer is active till running out of the time or till second pressing of the external button. The lower left LED is flashing when the timer is started.

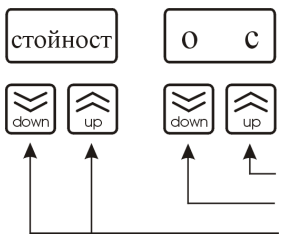
MODE 2: The timer can be started by pressing of an external button, the lower left LED is flashing. The output activates after running out of the set-pointed time, the LED is emitting light constantly. The output can be stopped by the external button, the LED is extinguished.

By the switching on an external switch you can select one of the two possible sets of set-points (**SP1** and **SP2**) for control.

VIII. LEVELS OF PROGRAMMING

Operation principle of the keyboard:

- When there is a symbol (parameter) on the display, the button under the symbol selects its edition.
- When on there is the digit on the display, by the buttons under it you can change the value, and by the buttons under the symbols "**o**" and "**c**" this value can be confirmed or refused.



Display

Buttons

Returning back without confirmation of the changes
Confirmation (OK)
Change of the value of the parameter

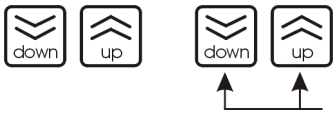
1. User level

Display SP1 and SP2

Set-point1 (SP1) appears on the left display, *Set-point2* (SP2) – on the right one. After releasing of the button the device returns to normal operating mode, where the moment parameter appears on the display.

Tuning of SP1

The buttons must be pressed simultaneously and SP1 appears and starts flashing on the left display. By the same buttons you can change the value of SP1, and the display stops flashing. If in 5 sec., till the display is flashing or a new value is set-pointed, you don't press any button, it returns to operating mode. (-199 ÷ 999)*



Tuning of SP2

The buttons must be pressed simultaneously and SP2 appears and starts flashing on the right display. By the same buttons you can change the value of SP2, and the display stops flashing. If in 5 sec., till the display is flashing or a new value is set-pointed, you don't press any button, it returns to operating mode. (-199 ÷ 999)*

Display timer

The set-point of the timer or the remaining time appears on the left display, if the timer has been started and on the right one "**– t –**". 5 sec. after releasing the button device returns to normal operating mode. **

Tuning of timer

The buttons must be pressed simultaneously and the set-pointed time appears on the right display and starts flashing. By the left two buttons you can change the value of the set-point, the display stops flashing. If in 5 sec., till the display is flashing or a new value is set-pointed, you don't press any button, it returns to operating mode. (1 ÷ 999min. or sec.)**

* Dimension according to the measured parameter

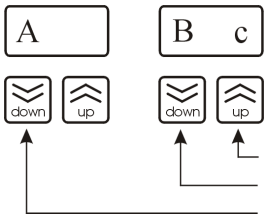
** These buttons are active only, if the timer section is activated. The format of the timer is indicated by the rightest decimal point of the left display. The presence of decimal point means format seconds and the unavailability of such – format minutes.

2. LEVEL "system parameters"

Entering of mode – tuning of system parameters

You must hold the buttons for 3 seconds, after that the main menu for programming appears on the two displays.

1) Main menu

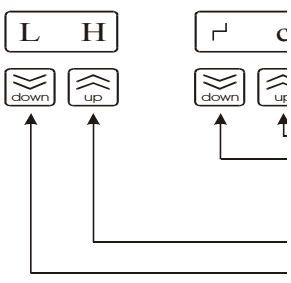


Display

Buttons

Returning to operating mode
Parameters for Channel 1
Parameters for Channel 2

2) Submenu for selection of parameters



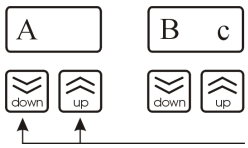
Display

Buttons

Returning to main menu
ε - proportional band or hysteresis at **ε**>0 logic "heating", **ε**<0 logic "cooling" (-199 ÷ 999)*
Higher limit of alarm (-199 ÷ 999)*
Lower limit of alarm (-199 ÷ 999)*

*Dimension according to the measured parameter

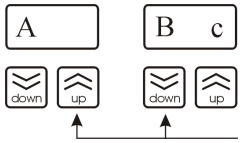
3. LEVEL "service parameters"



Display

Buttons

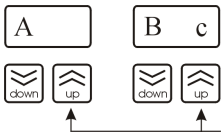
Tuning of the parameters of the filter of Channel 1



Display

Buttons

Tuning of the parameters of the filter of Channel 2

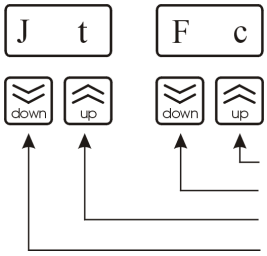


Display

Buttons

Tuning of the PWM period of the outputs of Channel1 and Channel2 and the timer section.

1) Submenu for selection of parameters for the filter



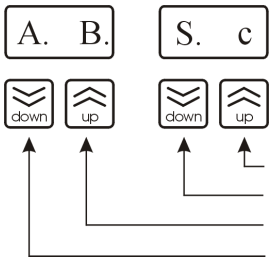
Display

Buttons

Returning to main menu
Coefficient of the filter (1 ÷ 128) *
Time for jump of the filter (1 ÷ 255sec.)
Filter jump (1 ÷ 255)**

* The smaller is the value f the coefficient, the heavier is the filter.
** Dimension according to the measured parameter

2) Submenu for selection of parameters for PWM period of the outputs and timer section



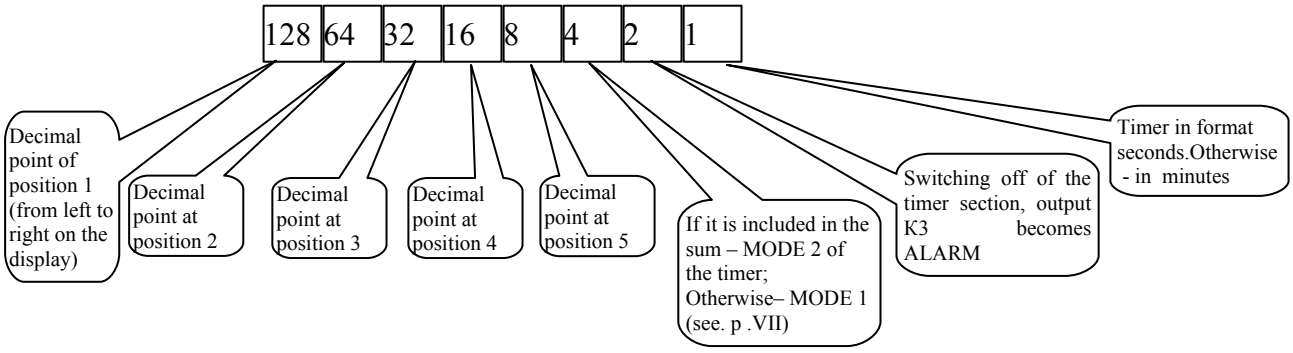
Display

Buttons

Returning to main menu
Tuning of timer section*
Period of PWM of Channel 1(1 ÷ 255 *0,5sec.)**
Period of PWM of Channel 2(1 ÷ 255 *0,5sec.)**

* This parameter is valid only, if the timer section is allowed and has the following valid values:
0 – Timer in format minutes 1 – timer in format seconds

If mode "**Tuning of parameters"** is activated by pressing of the rightest button at power supplying, by the parameter ***S.*** you can tune the mode of the timer and the location of the decimal points. The accurate value is received as a sum of the coefficients, shown below. If we want to activate the respective possibility, we must include its coefficient in the sum, otherwise we miss it.



** At set-pointing of value "0" the respective channel passes to ON/OFF algorithm of control and the parameter **ε** has sense of hysteresis. In the rest of the cases **ε** has sense of proportional band.

IX. USER TUNING OF THE OFFSET OF CHANNEL 1 AND CHANNEL 2

In this mode the users can enter free programmable coefficient, which will be added always at the measuring of the channels ("offset"). This mode is used at noticing of discrepancy between the displayed value and the measured one by another **standard** device.

Mode "offset"

You can enter this mode by pressing of the button at power supplying of the device. Till you hold the button "**OFFSEt"** appears on the display. After releasing of the button, the controller passes to normal operating mode.

The set-pointing of every offset can be done as the tuning of the set-point for control (**SP**) of every channel in normal operating mode, is realized (see VIII.1). The value, which is being tuned, is more accurate than the measured parameter. **At entering in edition, value 0 appears always, i.e. the current displayed value of the channel is accepted a basic.**

EXAMPLES FOR USER TUNING

1. Indication on the display: 129
2. Entered coefficient: 3.4
3. New indication on the display: 132
4. Entered coefficient: 0.6
5. New indication on the display: 133
6. Entered coefficient: -1.0
7. New indication on the display: 132

X. 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 avoiding of capacitive and inductive interaction.

- When signals must be crossed with signals, different by type, you must do that at right angle and in maximum distance.

- Wires, which carry weak signals and wires, connecting the sensors with the controller, must not pass near contactors, motors, generators, radio transmitters and wire, which carry big currents, which switch on and off.

2. Noise immunity by using of the filter, built-in the controller

- If the input parameter hesitates and is not stable you have to decrease the coefficient of the filter **F.** The smaller is the value of the coefficient of the filter, the heavier is the filter and the input parameter changes more slowly.

- If the input parameter jumps periodically for short intervals of time, it is necessary to increase the parameter "time for jump of the filter" **t**. At increasing of this parameter the device reacts more slowly at sudden change of the input parameter, but it ignores the short interferences.

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