Universal microprocessor-based ON/OFF and P programmable controller

MS8122A
MS8122B

TECHNICAL DESCRIPTION AND INSTRUCTION FOR USE

PLOVDIV 2003

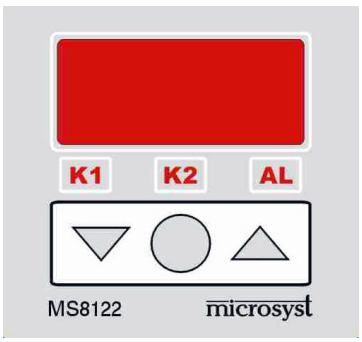
I. TECHNICAL DATA

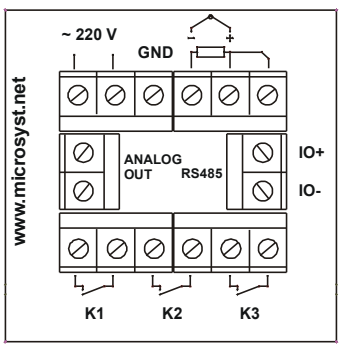
Analog inputs				1
Linear current				0 (4) ... 20 mA DC
Linear voltage				0 … 1 (10) V DC
RTD sensor				Pt 100
Thermocouple				type J, K, S, B
Relay outputs				3
K1 – ON / OFF or PWM				Relay 250 V / 5 A or OC for TTL
K2 – ON / OFF or PWM (or Alarm for MS8122B)				Relay 250 V / 5 A or OC for TTL
K3 – Alarm – only for MS8122A				Relay 250 V / 5 A or OC for TTL
Options				Triac 250 V / 2 A; Relay 250 V / 5,10 A or OC for TTL
Analog outputs				2
Transmitting current				0 (4) ... 20 mA DC
Transmitting voltage				0 … 1 (10) V DC
Indication and keypad				
Display				1x4 digits LED
Range				-1999 ... 9999
Accuracy				± 1 LSB
Format of the display	X.XXX	XX.XX	XXX.X	XXXX
Keypad				folio
Power supply				
Power supply voltage				80 … 250 V AC 24 V AC/DC 12 V AC/DC
Operating conditions				
Operating temperature				0 … 50 °C
Operating relative humidity				0 … 80 % RH
Dimensions				
Overall dimensions (WxHxL)				48 x 48 x 97 mm
Installation				panel in a hole 44 x 44 mm
Weight				max 200 g
Storage				
Storage temperature				-10 … 70 °C
Storage relative humidity				0 … 95 % RH

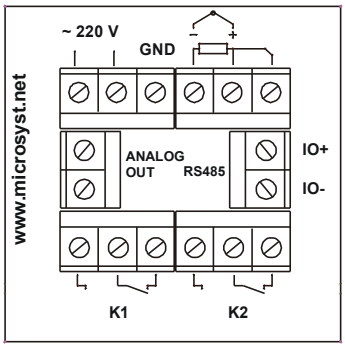
II. DESIGNATION

The compact microprocessor-based ON/OFF and P controllers of MICROSYST, of the series MS8122, are designed for measurement and control of various process parameters. Two main modifications of MS8122 are manufactured: MS8122A – with three digital outputs and MS8122B - with two digital and one analog output. The controller may realize ON/OFF or proportional algorithm of control (program selectable). The outputs are, respectively, controlled by logic ON/OFF or by pulse width modulation (PWM).

III. FRONT AND BACK PANEL







– Tuning of parameters
– Editing of the set-point for control (heating)
– Tuning of system parameters
– Confirmation of correction
– Exit from mode TUNING
– Change of parameters
– Tuning of the analog input
– Change of parameters

IV. CONNECTING OF TEMPERATURE SENSORS AND TRANSMITTERS

To obtain the best results, the sensors must be located in appropriate places within the media where the temperature adjustment is to be achieved. If they are installed into a hole use a heat-conducting sealing.

1. Connecting of resistive sensors (Pt100 or other)

The sensors can be connected by two-wire or three-wire line. The connecting of two-wire sensors to three-wire line can be done by the scheme, shown on fig. 1. Between two of the terminals of the controller you have to put a cable jumper obligingly, as it is shown on the figure.

If the distances between the sensor and the controller are larger, it is recommended to use a three-wire line, because the error from the temperature measurement, due to the additional resistance, entered by the connecting wires, is compensated this way. The connecting of three-wire sensors to the controller can be done according to the scheme, shown on fig. 2.

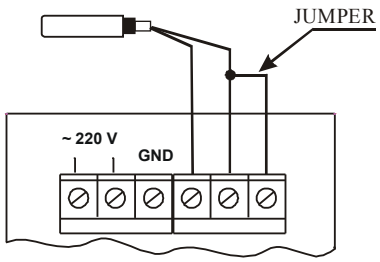


Fig. 1

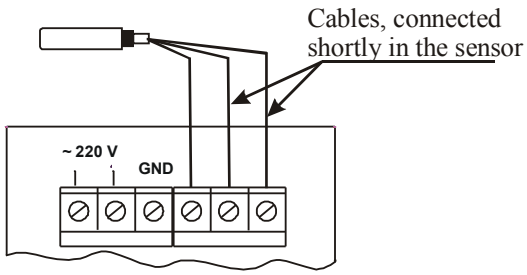


Fig. 2

2. Connecting of thermocouples

When connecting a sensor – thermocouple, you have to pay attention to the polarity of the sensor. If the polarity is inverted, the indications of the device will be incorrect.

When operating with thermocouples, it is necessary to use a compensation cable, corresponding to the type of the used thermocouple (fig. 3).

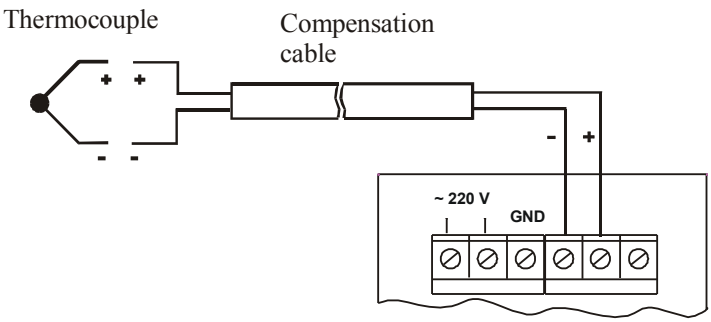


Fig. 3

3. Connecting of transmitters

1) Two-wire connection transmitters

The transmitter is power supplied by the device.

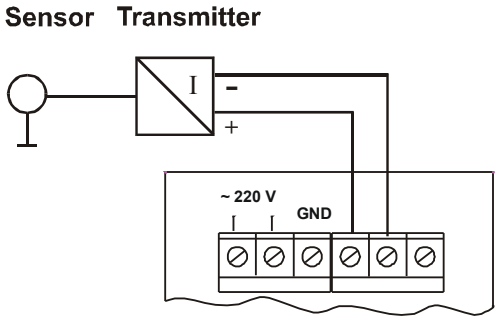


Fig. 4

* The voltage, provided by the device, is not stable.

2) Self-supplying transmitter

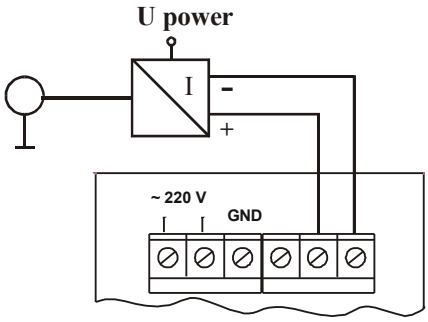


Fig. 5

3) Three-wire transmitter, supplied by the device

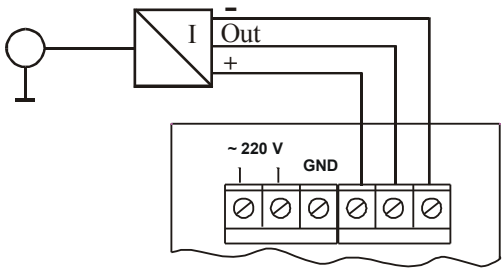


Fig. 6

* The voltage, provided by the device, is not stable.

V. CONNECTING OF THE OUTPUTS OF THE CONTROLLER

When the outputs are equipped with relays, RC units are connected in parallel to the contacts of the relays for better noise immunity. In an AC circuit, through the open contact of the relay flows *minimum current*.

If the output of the controller is of the type SSR, it must be connected as it is shown on fig. 7.

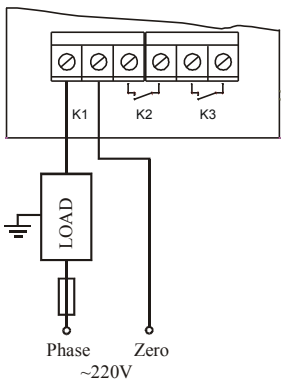


Fig. 7

VI. OPERATION PRINCIPLE

Logically, the controllers of the series MS8122 are designed with one (joint) analog input and 2 independent channels for control, each of them with its set-point and own parameters, determining its operating mode, and each of the channels can operate by logic “heating” or “cooling”. This eternal organization gives a possibility for realization of ON/OFF 2 states or 3 states, proportional, and step control. Simple block-scheme of a controller is shown on figure 8.

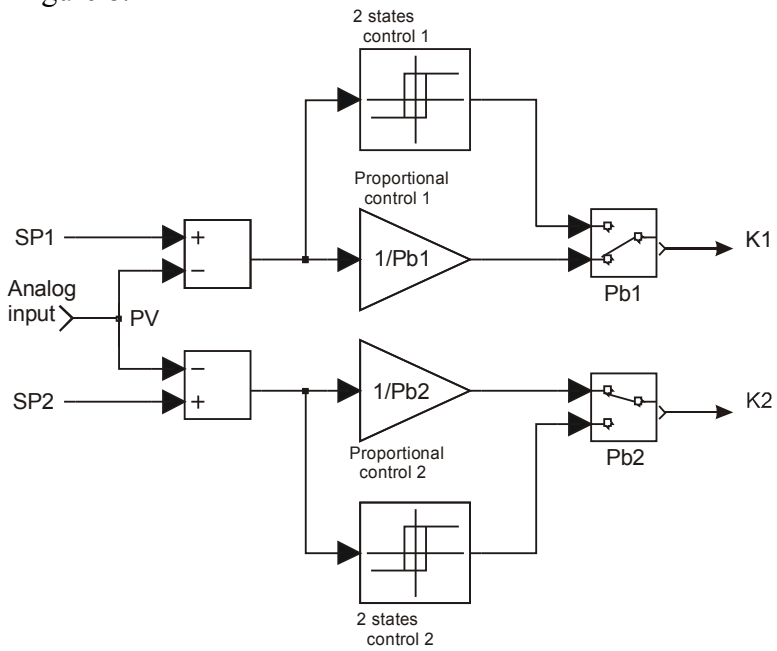


Fig. 8

Basic parameters, used in the device:

SP -set-point for control

Pb -proportional band or hysteresis *(changing the sign of the parameter’s value changes the operation mode: heating or cooling)*

PV -input parameter

t1 and t2 -period of PWM = ti+tp *(at 0 – ON/OFF algorithm of control)*

ti -time for impulse at PWM control

tp -time for pause at PWM control

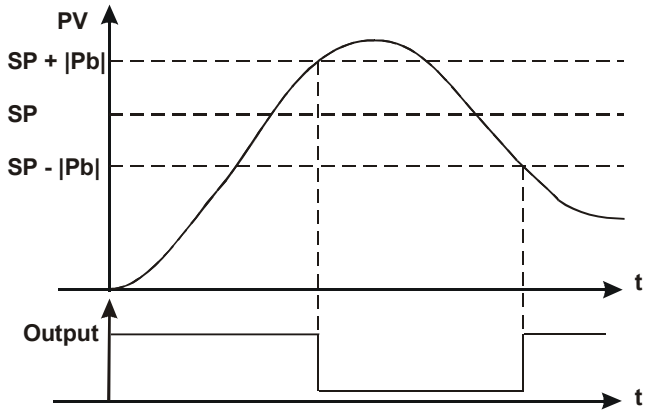


Fig. 9

Figure 9 shows the operation principle of controller 2 states with output logic “heating” (t1=0, Pb1>0 for channel 1 and t2=0, Pb2<0 for channel 2).

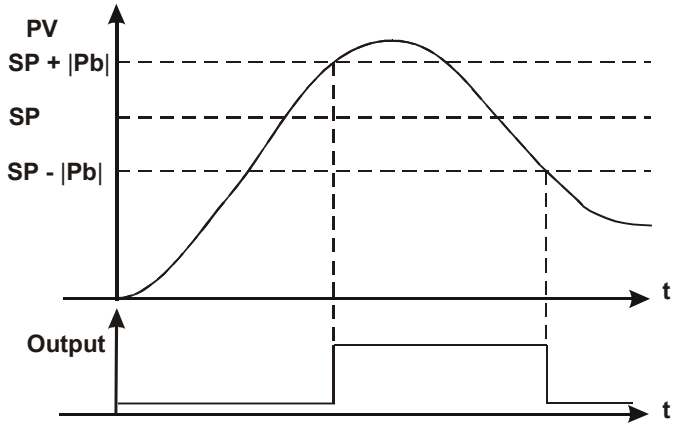


Fig. 10

Figure 10 shows the operation principle of 2 states controller with output logic "cooling" (t1=0, Pb1<0 for channel 1 and t2=0, Pb2>0 for channel 2).

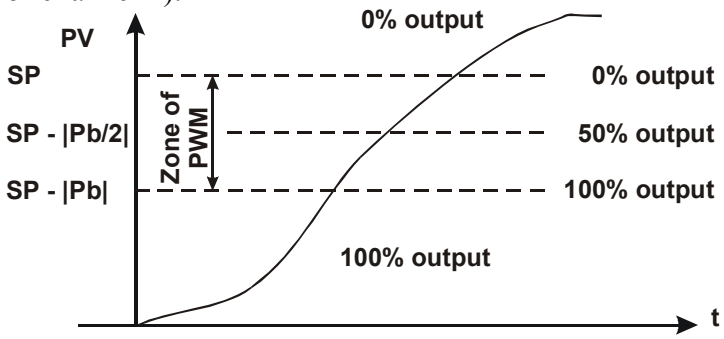


Fig. 11

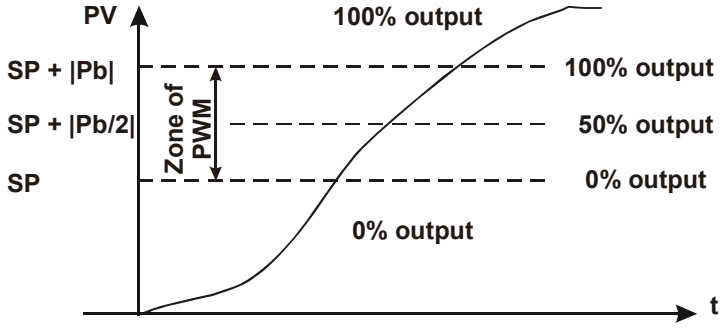


Fig. 12

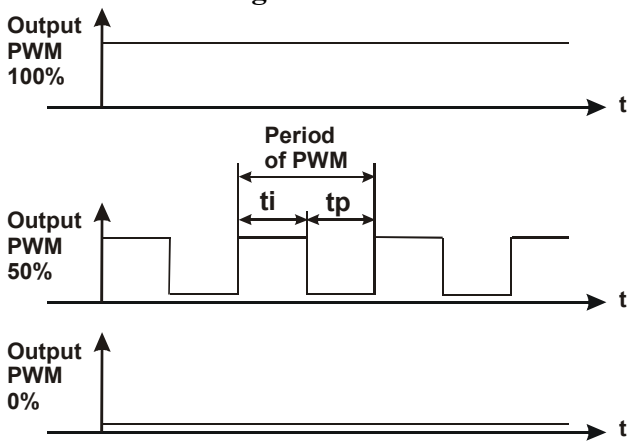


Fig. 13

Figure 11 shows the principle operation of a controller with PWM output with logic "heating" (t1>0, Pb1>0 for channel 1 and t2>0, Pb2<0 for channel 2), and Figure 12 – operation of a controller with PWM output with logic "cooling" (t1>0, Pb1<0 for channel 1 and t2>0, Pb2>0 for channel 2). Figure 13 shows the principle operation of PWM output. At 50% PWM output ti=tp.

VII. OPERATION MODE

After power supplying the controller enters normal operation mode. The value of the input parameter appears on the display. The LEDs K1 and K2 indicate if the respective output K1 or K2. When the value of the process parameter decreases under the lower limit or exceeds the higher limit of the alarm, the time delay of the alarm output starts running out, after that the output activates. The availability of alarm conditions before the activation of the alarm output is indicated by a flashing LED AL, and the activated output – by lit LED AL.

VIII. LEVELS OF PROGRAMMING

1. Displaying and editing of the set-points for control (SP1 and SP2)

– Displays set-point 1 – SP1 for 5 sec., after which it returns to displaying of the input parameter.

– Displays set-point 2 – SP2 for 5 sec., after which it returns to displaying of the input parameter.

– By pressing of the button value of the set-point (SP1 or SP2), which has been displayed before the pressing of the button, starts flashing and its editing is permitted. If you do not press a button in 5 sec., the controller returns to normal operation.

– Editing of the set-point

– Exit from change of the set-point SP1 or SP2. You can exit the mode automatically, too, 5 seconds after the last pressed button, and the change is memorized.

2. Level "system parameters"

– If the input parameter is displayed, press and hold to enter mode TUNING OF PARAMETERS. "**tun"** appears on the display till releasing of the button.

– You can browse the parameters for tuning by these buttons

– Press to edit the parameter

– You can change the value of the selected parameter

– You can confirm the change

– When **End** appears on the display, while you are looking at the parameters, press this button and the device will exit mode TUNING OF PARAMETERS

Parameters	Description	Values	Factory value
t1	Period of PWM for SP1. At "0" – ON/OFF algorithm of control**.**	0…127 sec.	
Pb1	Proportional band at proportional algorithm or hysteresis at ON/OFF algorithm for SP1. The hysteresis is smaller than the measured parameter with one order.	-1999…9999 (decimal point according to the parameter)	
t2	Period of PWM for SP2. At "0" – ON/OFF algorithm of control**.**	0…127 sec.	
Pb2	Proportional band at proportional algorithm or hysteresis at ON/OFF algorithm for SP2. The hysteresis is smaller than the measured parameter with one order.	-1999…9999 (decimal point according to the parameter)	
Alo	Lower limit o the absolute alarm	-1999…9999 (decimal point according to the parameter)	
Ahi	Higher limit of the absolute alarm	-1999…9999 (decimal point according to the parameter)	
Ald	Delay of activation of the alarm	0…127 sec.	

3.Level “hidden system parameters”

At power supplying of the device, at unlocked keypad, press and hold the button. The hidden parameters appear at the beginning of the menu with the basic parameters. The access to them is possible till switching off of the device from the power supply.

! Change them with great attention, because their change may cause incorrect operation of the device!

Parameter	Description	Values	Factory value
FLJ	Maximum change of the input parameter in two consecutive values, over which the filter of the input parameter is pre-initialized.	0 ÷ 255 (decimal point according to the parameter)	
FLt	Time, after which the filter of the input parameter will be pre-initialized at signal jump over **FLJ**.	0 ÷ 127 sec.	
FiL	Coefficient of filtering of the input parameter. The smaller is the value, the deeper is the filter.	0.01□1.00	
AP1	Multiplying coefficient for the analog output *	-1999 ÷ 9999	
AP0	Offset of the analog output *	-1999 ÷ 9999	
Hid	Maximum value of the displayed parameter. The value must correspond to the input linearization.	-1999 ÷ 9999(dec. point according to parameter)	
Lod	Minimum value of the displayed parameter. The value must correspond to the input linearization.	-1999 ÷ 9999(dec. point according to parameter)	
DP	Tuning of the decimal point.	0 ÷ 4 4 – **X.XXX** 3 - **XX.XX** 2 - **XXX.X** 1 - **XXXX.** 0 – **XXXX**	

*****The calculation of the analog output can be done by the following formula:

$$Aout = \frac{AP1*(PV - Lod)}{(Hid - Lod)*1023} + AP0$$, **PV** is the value of the measured.

IX. LOCKING/UNLOCKING THE KEYPAD

Locking/unlocking the keypad can be done when the device is normally started, by pressing and holding of the right of the buttons, and after that by pressing of the left one. The locking of the keypad is with the aim to avoid unintentional or unauthorized interventions in the tuning and the operation of the device.

X. USER SETTINGS OF ANALOG INPUT OFFSET

In this mode the users can freely enter a programmable coefficient, which will be added every time at the measuring of the channels (“offset”). This mode is used in case the displayed value differs from the value, measured by another **reference** device.

When power supplying the device, at unlocked keypad, hold the button.

If th input parameter is on the display, press and hold the right button, press the left one and “OFS” appears on the display till releasing of the button. The value, which is being tuned, is more accurate than the measured parameter with one order.

Change of the value of the offset.

Confirm the change and the new value is added to the old value of the offset.

EXAMPLES FOR USER TUNING OF THE OFFSET

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

XI. NOISE IMMUNITY MEASURES

1. Recommendations for using of connecting wires

- Wires, which carry signals, close by type, can be packed together, but if the signals are different, the wires must be separated for protection from capacitive and inductive interaction.

- When you have to cross signals with signals, different by type, this must be done at right angle and at 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 wires, which carry big currents.

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

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

- If the input parameter jumps periodically for short time intervals, it is necessary to increase the parameter **FLt**. If this parameter is increased, the device responds slower at sudden change of the input parameter, but it ignores the short-term noise.

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