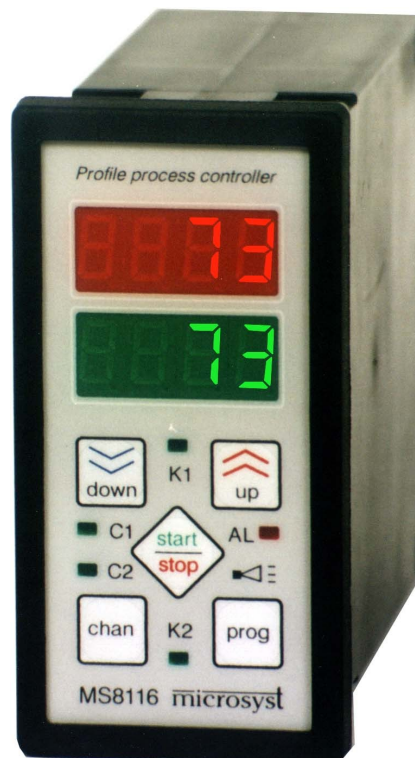


Microprocessor-based ON/OFF and PID controller

MS8111TAB



TECHNICAL DESCRIPTION AND INSTRUCTION FOR USAGE

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I. DESIGNATION

The microprocessor-based ON/OFF and PID controller of MICROSYST, model MS8111TAB, is designed for measurement and control of two process parameters (temperature and humidity), by supervision of the revolutions of a fan in a tobacco drying chamber. The controller has two inputs – from humidity transmitter and from thermal sensor, and has a possibility for calibration of the input parameter.

All data are saved in non-volatile memory, including the current status of the controller, i.e. when the power supply is restored again; the controller enters the same mode and stage of control, in which it has been before the power fault.

The device has a possibility for direct change of the set-points during work of the system. When relative alarm is selected this change will influence its limits. The controller can work without sensor for supervision of the turnovers of a fan.

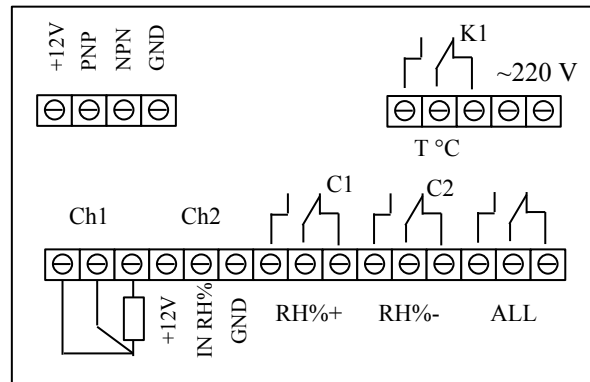
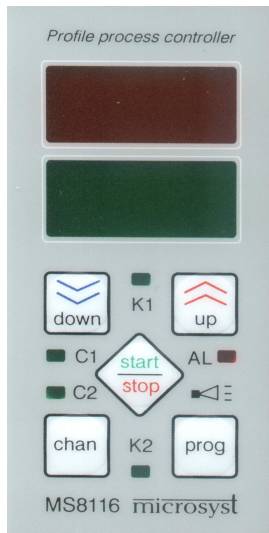
II. TECHNICAL DATA

Analog inputs	2
Linear current	0 (4) ... 20 mA DC
Resistive thermal sensor	Pt100
Digital inputs	1
From inductive sensor	12 V
Relay outputs	4
C1 – PID positive	250 V / up to 5 A*
C2 – PID negative	250 V / up to 5 A*
ALL – alarm	250 V / up to 5 A*
K1 - ON / OFF	250 V / up to 5 A*
Indication and keyboard	
Display	2x4 digits LED 14 mm
Range of the display	-1999 ... 9999**
Accuracy	± 1 LSB
Keyboard	folio
Power supply	
Power supplying voltage	220 V
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)	vertical 48 x 96 x 128 mm
Installation	Panel in a hole 44 x 90 mm
Weight	max 400 g
Storage	
Storage temperature	-10 ... 70 °C
Storage relative humidity	0 ... 95 % RH

* - for current over 6 A you have to select other terminals

** - the formats are X.XXX XX.XX XXX.X XXXX

III. FACE, BACK PANEL AND BUTTONS



- Editing of the set-point for control
 - Tuning of parameters
 - Tuning of system parameters
 - Confirmation of correction
 - Exit from mode TUNING
- prog**
- Change of MANUAL and AUTOMATIC MODE
 - Offset of analog input
- chan**
- Change of parameters
 - Change of parameters

IV. WORK PRINCIPLE

Formation of the controlling influence with PID algorithm

1. Linearization
2. Check about alarm
3. Calculation of the error $E(n)$
4. Check about dead zone
5. Calculation of the proportional component
6. Calculation of the integral component, based on the accumulated sum of calculated differences and the coefficient of integration, with limitation in **ISum**
7. Calculation of the differential component, based on the previous and the current differences between the set-point and the input parameter and the coefficient of differentiation
8. Summing of the three components with **OFFS** and formation of the output

$$Out(n) = \frac{1}{Zone} * \Delta(n) + \frac{1}{Zone} * \frac{T_0}{T_n} * \sum_{i=1}^n \Delta(i) + \frac{1}{Zone} * \frac{T_d}{T_0} * [\Delta(n) - \Delta(n-1)] + OFFS,$$

where $Out(n)$ – controlling influence at moment n ;

$Zone$ – zone of proportionality;

$\Delta(n)$ – offset of the controlled parameter from the set-pointed value at moment of time n

$\Delta(n-1)$ – offset of the controlled parameter from the set-pointed value at moment of time $(n-1)$

$\frac{T_0}{T_n}$ – coefficient of integration; $\frac{T_d}{T_0}$ – coefficient of differentiation; $OFFS$ – offset












V. INSTRUCTION FOR USAGE

When switching on the power supply, the basic operating menu appears on the display – first input parameter on the first line and second input parameter on the second line. The device has another operating menu (OUT%), in which “Out” appears on the first line, and the output influence for Automatic mode – on the second line.

If when switching off the power supply, the controller has been started, after second switching, the alarm output activates till pressing of an unspecified button form the keyboard. If the controller has been stopped at a moment, in which it was not controlling, it is waiting for reaching of starting turnovers of the fan for starting of the process of control.

In operating mode, when you reach alarm situation for channel 1 or the supervised turnovers of the fan, the controller stops controlling and activates the alarm output till pressing of an unspecified button. After activation of the alarm output, the controller can be started again when reaching the starting turnovers of the fan.



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

-  – Press and hold, to see the set-points of the two channels
-   – Press the both of the buttons, to control the set-point of the first channel
-   – Edit the set-point of the first channel
-  – Confirm the change.
-   – Press the both of the buttons, to control the set-point of the second channel
-   – Edit the set-point of the second channel
-  – Confirm the change.

* If the changes are not confirmed in 5 sec, the device returns automatically to the basic menu, without changing the set-point.

2. Check of the output influence




The output influence can be checked by change of the basic operating menu, in which the value of the output parameter will appear on the second line of the display.

  – Pressing one of the two buttons, you can change the current menu

* If you don't press any button in 10 sec. in the second operating menu, the device automatically passes to the basic menu.









3. Selection of mode – automatic / manual

In manual mode manual control of the outputs, controlled by the PID algorithm, is possible. When manual mode is selected the LED **K2** emits light. If the controller has been started, the ON / OFF algorithm continues functioning independently of the mode of control of the PID outputs.

-  – Pass from manual to automatic mode of control and back
-  – Press and hold this button to activate output **C1**
-  – Press and hold this button to activate output **C2**


4. Tuning of the parameters

You can enter mode tuning of the parameters ONLY from MANUAL MODE or if the process is NOT STARTED.

-  – Press and hold to enter mode TUNING OF PARAMETERS. **tune PAr** appears on the display.
-   – By these buttons you can look at the parameters for tuning
-  – Press to edit a parameter
-   – Change the value of the selected parameter
-  – Confirm the change
-  – When on the display, looking at the parameters, **End** appears, press this button and the device exits from mode TUNING OF PARAMETERS

Parameter	Description	Values	Factory value
t0	Tact of calculation of the PID algorithm	1 ÷ 255 sec.	
tn1	Time for action of relay K1 at 100% calculated (or set-pointed) output	1 ÷ t0 sec.	
tn2	Time for action of relay K2 at 100% calculated (or set-pointed) output	1 ÷ t0 sec.	
ZonE	Zone of proportionality	1 ÷ 9999 (decimal point according to the measured parameter of channel 2)	
Ti	Time constant of integration	0 ÷ 9999 sec.	
Td	Time constant of differentiation	0.0 ÷ 999.9 sec.	
ISuL	Lower limit of accumulation of the integral component	-100 ÷ 0 %	
ISuH	Higher limit of accumulation of the integral component	0 ÷ 100 %	
OFFS	Addition of the PID algorithm	-100.0 ÷ 100.0 %	
Db	Dead band	0 ÷ 9999 (decimal point according to the measured parameter of channel 2)	
Alo1	Lower limit of the alarm for channel1	-1999 ÷ 9999 (decimal point according to the measured parameter)	
Ahi1	Higher limit of the alarm for channel1	-1999 ÷ 9999 (decimal point according to the measured parameter)	
Alo2	Lower limit of the alarm or Offset downwards according to SP, defining lower limit of the alarm at relative alarm for channel 2.	-1999 ÷ 9999 (decimal point according to the measured parameter)	
Ahi2	Higher limit of the alarm or Offset upwards according to SP, defining higher limit of the alarm at relative alarm for channel 2.	-1999 ÷ 9999 (decimal point according to the measured parameter)	
taL1	Time for activation of alarm of channel1	0 ÷ 100 sec.	
taL2	Time for activation of alarm of channel 2	0 ÷ 100 sec.	
TstF	Time for initial waiting of the tachometer	0 ÷ 100 sec.	
TaLF	Time for activation of alarm at dropping of the turnovers	0 ÷ 100 sec.	
FStr	Turnovers for starting of the process of control	0 ÷ 9999 turnovers/min.	
FALL	Limit of turnovers for stopping of the process of control	0 ÷ 9999 turnovers/min	
Hst	Hysteresis of the ON/OFF algorithm	1 ÷ 255 (decimal point according to the measured parameter of channel1)	
FLt1	Coefficient of the filter for analog input 1. The smaller is the value, the deeper is the filter	1 ÷ 100	
FLt2	Coefficient of the filter for analog input 2. The smaller is the value, the deeper is the filter	1 ÷ 100	

5. Tuning of system parameters

Access to the system parameters is possible only, if when power supplying the device, you press and hold the button . The hidden parameters appear at the beginning of the menu with basic parameters. The access to them is possible till switching off of the device.

The tuning of the system parameters is possible only in MANUAL MODE!


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

Parameter	Description	Values	Factory value
DP1	Decimal point of channel 1	0 ÷ 4 ⁽¹⁾	
DP2	Decimal point of channel 2	0 ÷ 4 ⁽¹⁾	
Adb1	Value of change of the input signal (jump), causing clearing of the filter of channel 1	0 ÷ 100	
Adb2	Value of change of the input signal (jump), causing clearing of the filter of channel 2	0 ÷ 100	
Dbt1	Time for waiting, at jump of the input parameter over A db, before clearing of the filter of channel 1	0 ÷ 100 sec. * 0.5	
Dbt2	Time for waiting, at jump of the input parameter over A db, before clearing of the filter of channel 2	0 ÷ 100 sec. * 0.5	
SYSt	System configuration word 0 – Absolute alarm for channel 2 1- Relative alarm for channel 2	0 ÷ 1	
F Ob	Number of impulses for a turnover	1 ÷ 255	
SP1H	Limitation from above of the set-point of channel 1	-1999 ÷ 9999 (decimal point according to the measured parameter)	

(1) Tuning of the decimal point



0 – XXXX1 – XXXX. 2 – XXX.X 3 – XX.XX 4 – X.XXX

6. Addition of offset of the analog input

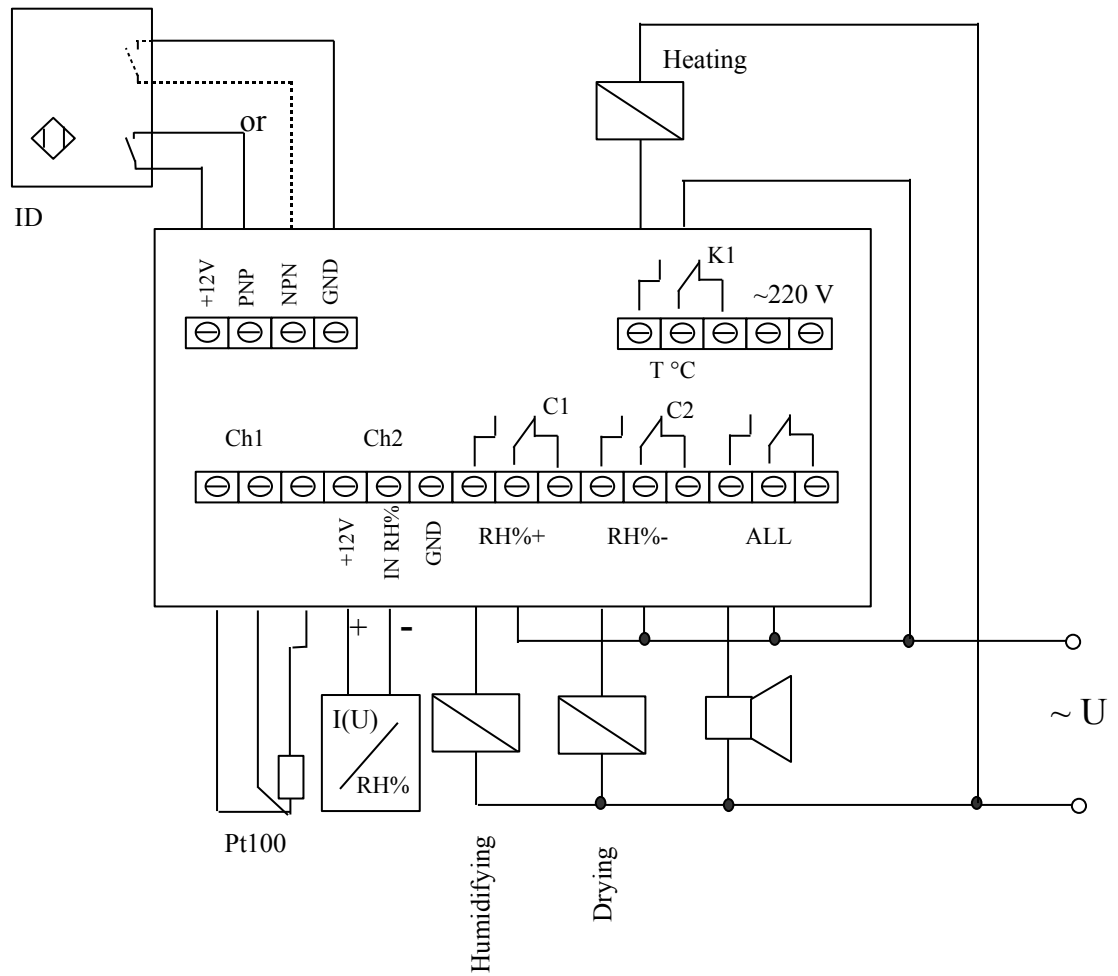
Access to that option is possible only, if when power supplying the device, you press and hold the button . You can change the offset in the same way, in which you tune set-point in normal operating mode. The offset has resolution bigger than the measured parameter with one order. The access to the offset is possible till switching off of the device.

Note!

In all operating modes the keyboard gives possibility for automatic increasing or

decreasing of the values by pressing and holding of one of the buttons  .

VI. SCHEME OF CONNECTION



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