microsyst

COMPETENCE IN
MEASUREMENT

# Universal microprocessor-based ON/OFF and P programmable controller

# MS8131A
# MS8131B


TECHNICAL DESCRIPTION AND INSTRUCTIONS FOR USAGE

PLOVDIV 2003

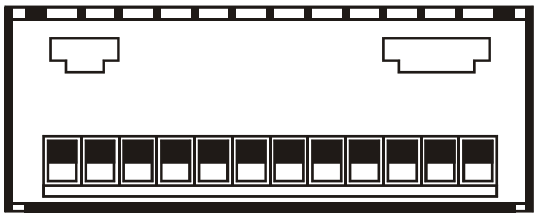
## I. TECHNICAL DATA

| | |
|---|---|
| **Analog inputs** | 1 |
| Linear current | 0 (4) ... 20 mA DC |
| Linear voltage | 0 … 1 (10) V DC |
| Resistive thermal sensor | Pt 100 |
| Thermocouple | type J, K, S, B |
| **Relay outputs** | 3 |
| K1 – ON / OFF or PWM | Relay 250 V / 5 A or OK for TTL |
| K2 – ON / OFF or PWM (or Alarm for MS8131B) | Relay 250 V / 5 A or OK for TTL |
| K3 – Alarm – only for MS8131A | Relay 250 V / 5 A or OK for TTL |
| Options | Triac 250 V / 2 A; Relay 250 V / 5, 10 A or OK for TTL |
| **Analog output** | 2 |
| Transmitting current | 0 (4) ... 20 mA DC |
| Transmitting voltage | 0 … 1 (10) V DC |
| **Indication and keypad** | |
| Display | 1x3 digits LED |
| Range of the display | -199 ... 999 |
| Accuracy | ± 1 LSB |
| Format of the display | X.XX XX.X XXX |
| Keypad | Four membrane keys |
| **Power supply** | |
| Power supply voltage | 80 … 250 V AC<br>24 V AC/DC<br>12 V AC/DC |
| **Operating Conditions** | |
| Operating temperature | 0 … 50 °C |
| Operating relative humidity | 0 … 80 % RH |
| **Dimensions** | |
| Overall Dimensions (WxHxL) | 72 x 36 x 55 mm |
| Installation | Panel in hole 71 x 29 mm |
| Weight | max 100 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 MOCROSYST, of the series MS8131 are designed for measurement and controlling of different process parameters. MS8131 is produced in two basic modifications - MS8131A – with three discrete outputs and MS8131B – with two discrete and one analog outputs. The controller can realize ON/OFF or proportional algorithm of controlling (program selectable). The outputs are controlled respectively by logic ON/OFF or by impulses with variable duration (PWM).

## III. FRONT AND BACK PANEL

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

## IV. CONNECTION OF TEMPERATURE SENSORS AND TRANSMITTERS

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

### 1. Connection of resistive sensors (Pt100 or other)

The sensors can be connected by two-wire or by three-wire line. The connection of two-wire sensors with three-wire line can be done as it is shown on fig.1, and cable jumper must be placed obligingly between terminals 2 and 3 of the controller.

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 sensors with the controller can be done as it is shown on fig. 2, and to terminals 2 and 3 of the controller must be connected the shortly connected cables in the sensor.

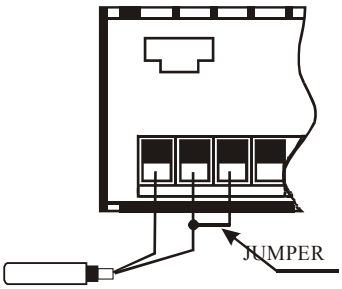



**Fig. 1**

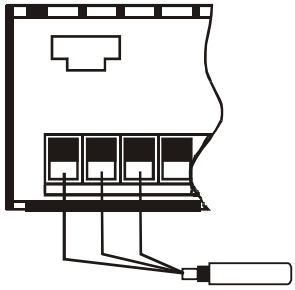


**Fig. 2**

## 2. Connection of thermocouples

At the connection of sensor – type thermocouple, you 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. 3).

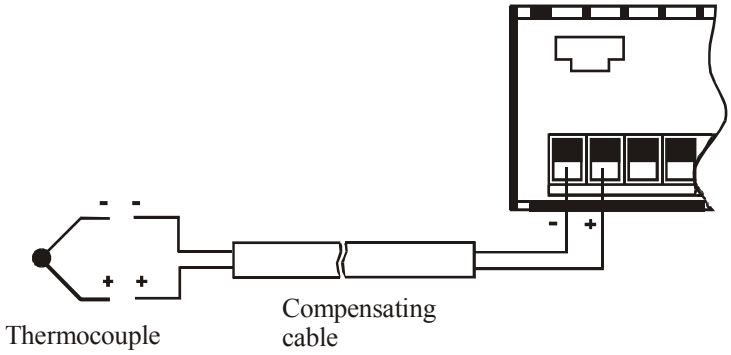



**Fig. 3**

## 3. Connection of transmitters

### 1) Transmitters with two-wire switching on (loop powered)

The power for the transmitter is supplied by the instrument.

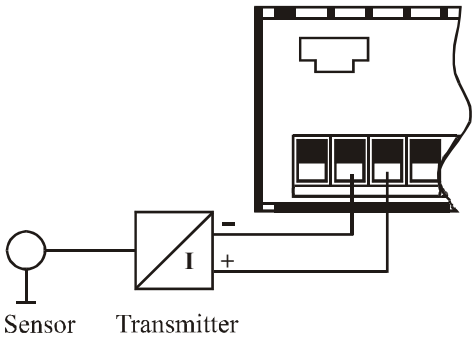



**Fig. 4**

***** The instrument provides voltage, which is not stable.

**2) Transmitter with own power supply**

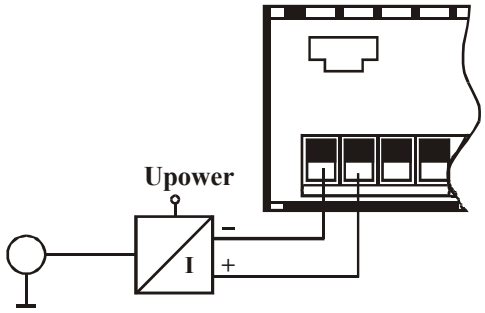



**Fig. 5**

**3) Three-wire transmitter supplied by the instrument**

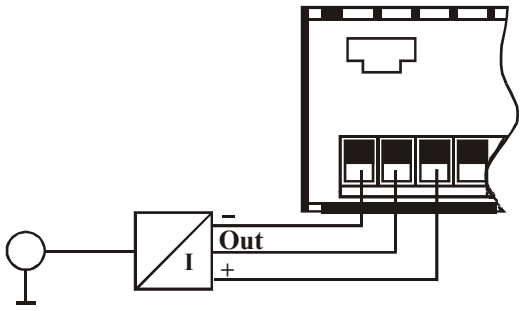



**Fig. 6**

* The instrument provides voltage, which is not stable

## V. CONNECTION OF THE OUTPUTS OF THE CONTROLLER

When the outputs are realized by relays, in parallel to the contacts of the relays there are RC groups for better noise immunity. *Minimal current flows in trough* the open 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. 7.

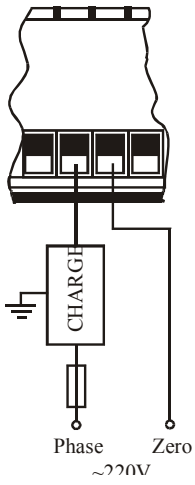



Fig. 7

## VI. WORK PRINCIPLE

Logically the controllers of the series MS8131 are designed with one (universal) analog input and 2 independent channels for controlling, each of them with own set-point and own parameters specifying its operating mode, and each of the channels can work with logic "heating" or "cooling". This internal organization enables the realization of two- positional, three-positional ON/OFF, proportional, and degree controlling by them. A simple block-scheme of a controller is shown on fig. 8.

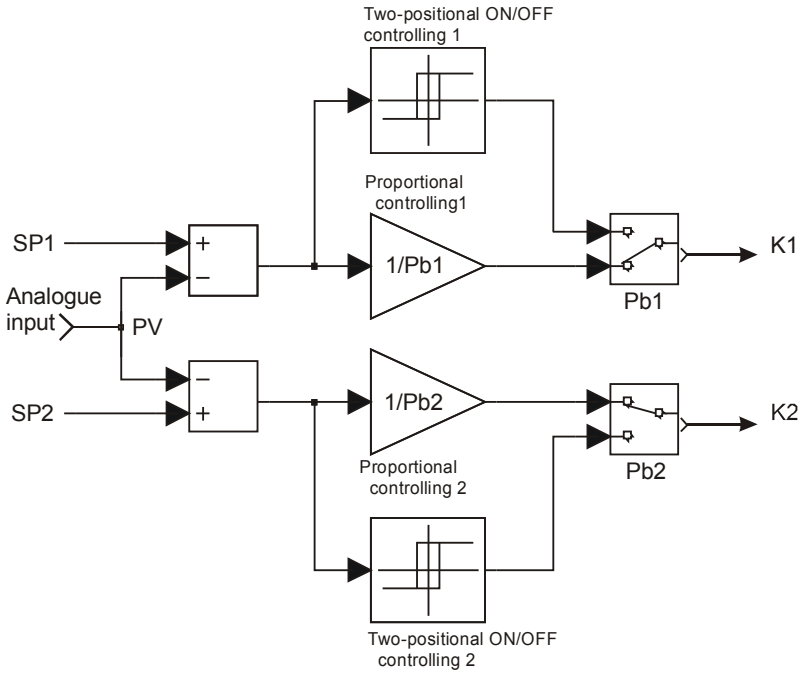



**Fig. 8**

Basic parameters used in the instrument:

SP -set-point for controlling

Pb -proportional band or hysteresis *(when the sign of the parameter is changed the logic of work is changed too (heating or cooling)*

PV -input parameter

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

ti -time for impulse at PWM controlling

tp -time for pause at PWM

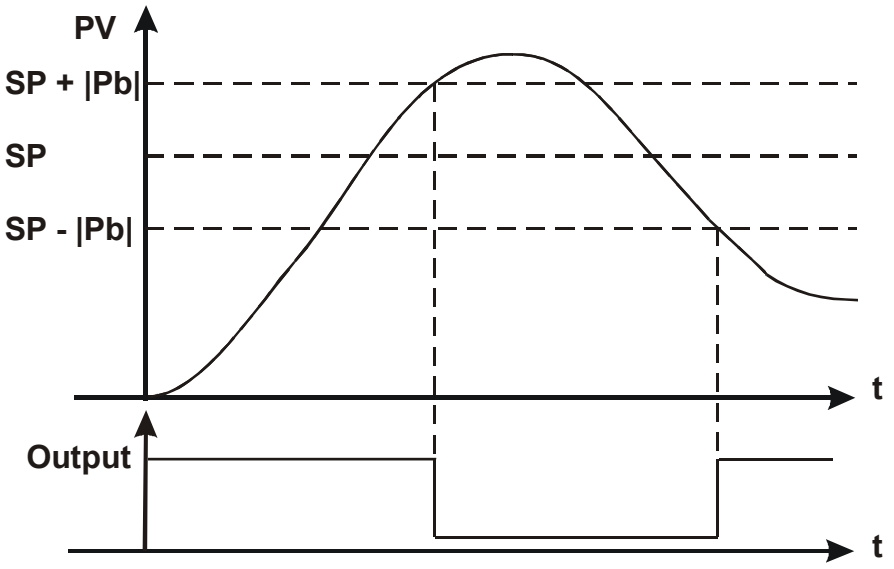



**Fig. 9**

On Fig. 9 is shown the operation principle of two-ON/OFF controller with output logic "heating" (t1=0, Pb1>0 for channel 1 and t2=0, Pb2<0 for channel 2).

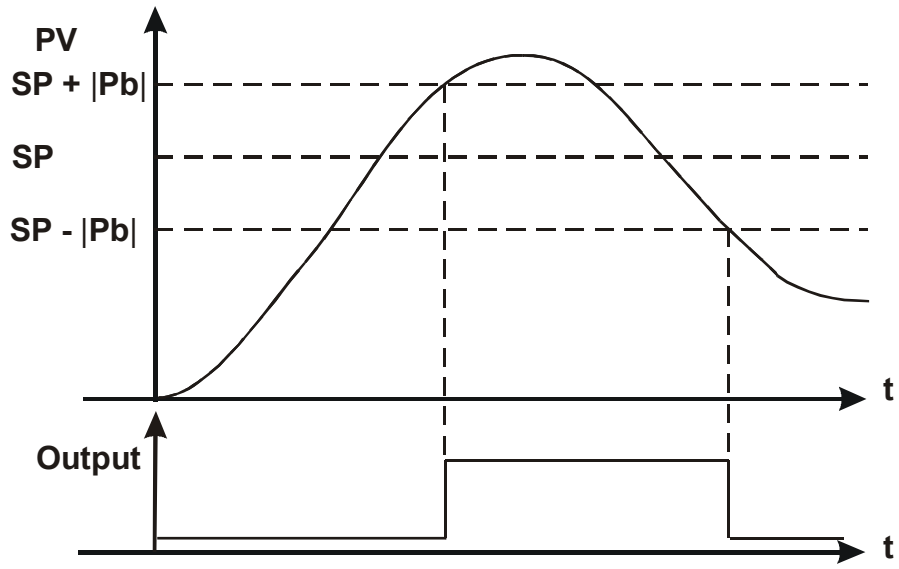



**Fig. 10**

On Fig. 10 is shown the operation principle of 2 ON/OFF controller with output logic "cooling" (t1=0, Pb1<0 for channel 1 and t2=0, Pb2>0 for channel 2).

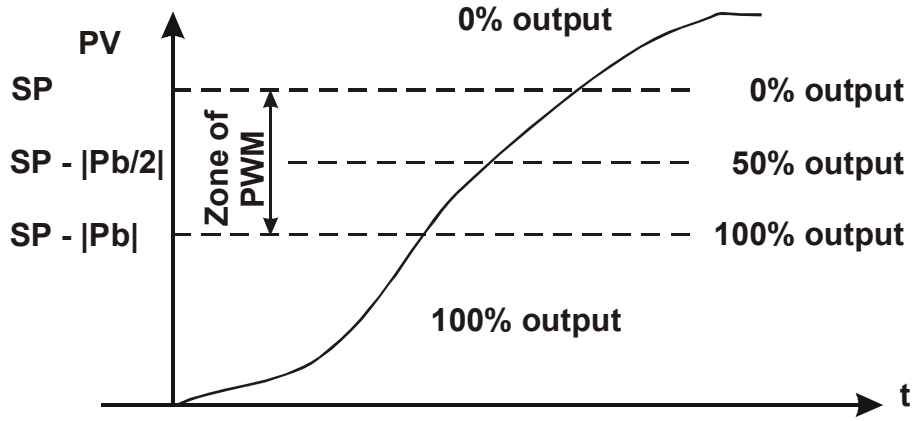



**Fig. 11**

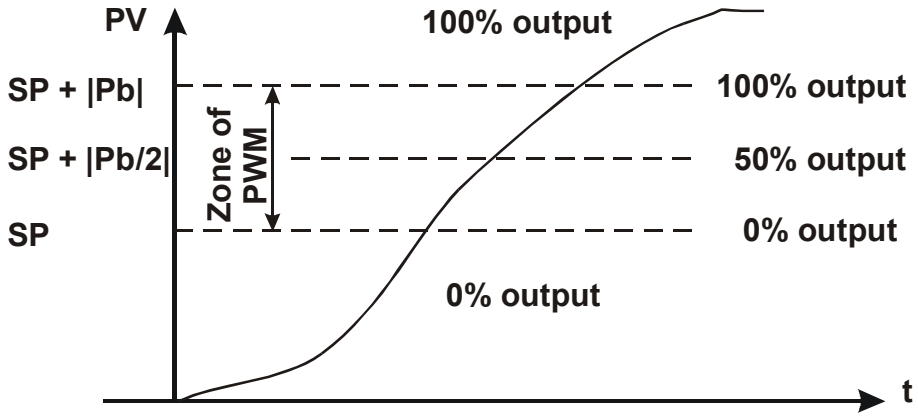



**Fig. 12**

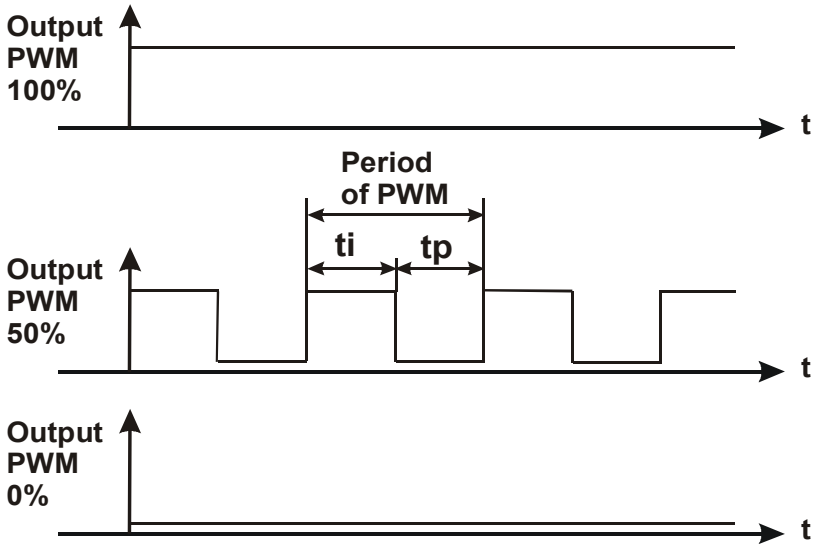



**Fig. 13**

On Fig. 11 is shown the principle operation of controller with PWM output logic "heating" (t1>0, Pb1>0 for channel 1 and t2>0, Pb2<0 for channel 2), and on Fig. 12 - operation of controller with PWM output with logic "cooling" (t1>0, Pb1<0 for channel 1 and t2>0, Pb2>0 for channel 2). On Fig. 13 is shown the principle operation of PWM output. At 50% PWM output ti=tp.

## VII. OPERATING MODE

When the power is supplied the controller is in normal operating mode. The value of the input parameter appears on the display. The LEDs K1 and K2 show if the corresponding output K1 or K2 is active. When the value of the input parameter is under the lower limit or over the higher limit of the alarm, the time delay of the alarm output starts passing, and after that the output is activated. The availability of alarm conditions before the activation of the alarm output is indicated by flashing LED AL, and the activated output - by light emitting LED AL.

## VIII. LEVELS OF PROGRAMMING

### 1. Representation and editing of the set-points for controlling (SP1 and SP2)

- Represents set-point 1 – SP1 for 5 seconds, after that it returns to representation of the input parameter.
- Represents set-point 2 – SP2 for 5 seconds, after that it returns to representation of the input parameter.
- When this button is pressed the value of set-point (SP1 or SP2), which has been represented before the pressing of the button, it starts flashing and its editing is permitted. If you don't press a button 5 seconds the controller returns to normal operating mode.
- Editing of the set-point
- Exit from change of the set-point SP1 or SP2. Exit from this operating mode is realized automatically too 5 seconds after the last pressed button, and the change is in the memory.

## 2. Level “system parameters”

- When an input parameter is represented press and hold in order to enter operating mode TUNING OF PARAMETERS. Inscription “**tun”** appears on the display, till the button is released.

- By these buttons you can look at the parameter for tuning

- Press to edit parameter

- Change the value of the selected parameter

- Confirm the change

- Looking at the parameters, when inscription **End** appears on the display, press this button and the instrument exits operating mode TUNING OF PARAMETERS

| Parameter | Description | Values | Factory value |
|---|---|---|---|
| **t1** | Period of PWM for SP1.<br>At "0" – ON/OFF algorithm of controlling**.** | 0÷127 seconds. | |
| **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. | -199÷999<br>(the decimal point is according to the parameter) | |
| **t2** | Period of PWM for SP2.<br>At "0" – ON/OFF algorithm of controlling**.** | 0÷127 seconds. | |
| **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. | -199÷999<br>(the decimal point is according to the parameter) | |
| **ALo** | Lower limit of the absolute alarm | -199÷999<br>(the decimal point is according to the parameter) | |
| **AHi** | Higher limit of the absolute alarm | -199÷999<br>(the decimal point is according to the parameter) | |
| **ALd** | Delay of activation of the alarm | 0÷127 seconds | |

## 3. Level “hidden system parameters”

- When the instrument is power supplied and the keypad is unlocked, hold the button. The hidden parameters appear at the beginning of the menu with basic parameters. The access to them is possible till the instrument is switched off.

**! Change them with great attention, because their change can be a reason for incorrect work of the instrument!**

| Parameter | Description | Values | Factory value |
|---|---|---|---|
| **FLJ** | Maximum change of the input parameter in two values, which are coming one after another, in which another initialization of the filter of the input parameter is realized. | 0 ÷ 255 (the decimal point is according to the parameter) | |
| **FLt** | Time, after which another initialization of the filter of the input parameter will be realized at skip of the signal over **FLJ**. | 0 ÷ 127 seconds | |
| **FiL** | Coefficient of filtration of the input parameter. The smaller value means deeper filter. | 0.00÷1.00 | |
| **AP1** | Multiplied coefficient for the analog output * | -199 ÷ 999 | |
| **AP0** | Offset of the analog output * | -199 ÷ 999 | |
| **Hid** | Maximum value of the parameter on the display. It is necessary the value to be conformed to the linearization of the input | -199 ÷ 999 (the decimal point is according to the parameter) | |
| **Lod** | Minimum value of the parameter on the display. It is necessary the value to be conformed to the linearization of the input | -199 ÷ 999 (the decimal point is according to the parameter) | |
| **dP** | Tuning of the decimal point. | 0 ÷ 3<br>3 - **X.XX**<br>2 - **XX.X**<br>1 - **XXX.**<br>0 - **XXX** | |

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

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

## IX. LOCK/UNLOCK THE KEYPAD

– Locking/Unlocking of the keypad can be done when the instrument is normally started and you press and hold the right button from the shown buttons, and after that you have to press the left too. The locking of the keyboard is for protection from unintentional influence on the tuning and the work of the instrument.

## X. USER TUNING OF THE OFFSET OF THE ANALOG INPUT

In this operating mode, the users are free to input a programmable coefficient, which will be added always at the measurement of the channels (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.

– When the instrument is power supplied and the keypad is unlocked hold this button.

– When the input parameter is on the display, press and hold the right button of the shown buttons, press the left and inscription “OFS” appears till the buttons are released. The value, which is being tuned, is more accurate than the measured parameter with one order.

– Change of the value of the removing.

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

**EXAMPLES FOR USER TUNING OF THE OFFSET**

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

## MEASURES AGAINST INTERFERENCE

### 1. Recommendations for usage of connecting conductors

- Conductors, which carry signals close by type, can be packed together, but if the signals are different, the conductors have to be separated for to be prevented from capacitive and inductive interaction.

- When signals have to be crossed with different by type signals, this have to be done at right angles and maximum distance.

- Conductors, which carry weak signals and conductors which connect the sensors with the controller must not be near contactors, motors, generators, radio transmitters and conductors which carry big currents.

### 2. Limiting of the noise by using of the built-in filter

- If the input parameter is not stable you have to reduce 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 overshoots periodically for short intervals of time, it is necessary the parameter **FLt** to be increased. At increase of that parameter the instrument responds more slowly at sharp change of the input parameter, but it ignores the brief interferences.

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