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**CZECH PRODUCER  
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OF MEASUREMENT  
AND SENSOR TECHNOLOGY

# **Flow monitor FS 05**

Double-make contact (flow velocity measurement)

Ver. 1.9

***Installation and technical conditions***

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## ***Unit description***

The FS 05 flow monitor is designed for liquids and is based on the calorimetric measuring principle, according to which the flow rate of the measured liquid is proportional to the function of heat transfer from the sensor to the surroundings. Prompt and simple installation and lower costs thanks to its simple construction are the principal advantages.

The sensors are not restricted by the electrical conductivity of the liquid. Owing to the calorimetric measuring principle used, the measurement is dependent on thermal conductivity of the liquid. The meter can reach its highest sensitivity within the range of  $4 \div 150$  cm/s for use with water. For other liquids with different thermal conductivity, the measuring range is different. The measuring range can be modified by user to a certain extent, whereas it holds true that the lower thermal conductivity of medium, the higher flow rates can be measured.

## **Scope of delivery**

The unit is delivered separately without other additional elements and is ready for installation with a process connection by means of the adapter for cutting ring couplings according to EN ISO 8434-1 (DIN 2353) with the 24° cone.

## **Process connection**

The FS 05 flow monitor is usually delivered with a stainless steel sleeve nut M16x1.5 and with installed stainless steel cutting ring in the position that allows maximum insertion of the sensor into piping. After installation of the stainless steel cutting ring onto the sensor, it is not possible to change the depth of insertion of the sensor into piping; it is only possible when the PTFE ring is used special order necessary.

The accessories to the flow sensor may include various necks (adapters) serving for process installation and M12 (4-pin) connectors for electrical connection. However, these are not included in delivery due to standard solutions of individual elements and so these may be delivered by other manufacturers of such elements.

For hygienic process connection is flowswitch delivered in version with CLAMP connection.

## ***Storage conditions***

The temperature during transportation and storage of the meter must be within the range of -10 °C up to 80°C.

## ***Warranty***

Unprofessional installation or using the flow sensors (meters) can result in a loss of warranty as well as the failure to follow installation or operating conditions according to this manual. Repairs are not possible. The warranty becomes null and void by repairing or any intervention in the device carried out by any other person than manufacturer.

## *Installation in piping*

### **Important information for selection of placement**

#### *Outdoor conditions*

It is necessary to ensure that the sensor is not directly exposed to climatic factors and the measured liquid round the the sensor cannot freeze up which might lead to direct damage to the sensor itself.

In case of outdoor location, the manufacturer recommends using a protective shelter to avoid direct sun radiation so that the evaluation electronics cannot get overheated.

#### *Vibration*

The scope and level of vibrations must be below 2.2 g in the range of 20 ÷ 50Hz frequencies according to IEC 068-2-34 standard.

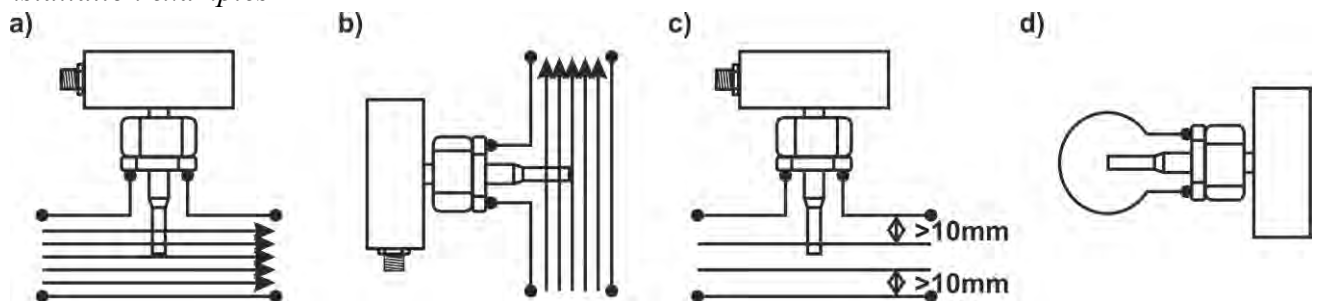
#### *Actual placement*

The flow detector (sensor), particularly its tip must be fully immersed (see Fig. a). For this reason, we do not recommend installing in the highest point of piping that may become aerated, or in sloping or even in horizontal piping with the open end into which air may penetrate, but conversely, in rising piping (see Fig. b).

Furthermore, the distance of the sensor tip from piping should be more than 11mm (see Fig. c).

During long-lasting measurements of very low flow rates ( $Q < 0.1$  m/s), impurities may be deposited. In this case, carry out installation at horizontal piping sideways (see Fig. d).

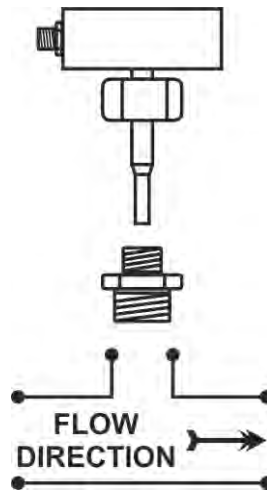
#### *Installation examples*



The flow of liquid in the flow detector should be **settled and free of whirls**. The sources of interference may substantially decrease the accuracy. For this reason, the location of the sensor is selected in such a way that there are sufficiently straight pipe segments before and after it. The minimum length of straight segments is  $(5\div 10)\times d$  before the sensor and  $(3\div 5)\times d$  after the flow sensor where  $d$  is the pipe diameter. In the prescribed straight sections, **no sources of interference** of the stable flow must be found. They must be located in the pipe after the flow sensor, or at the longest distance before it.

When a mixture of substances is made, you need to install the flow detector either before the mixing location or at a sufficient distance after it ( $\text{min.}30\text{xd}$ ), otherwise the indication may be unstable.

## Mounting procedure



Before mounting is started, make sure that the system is depressurized or discharged. After that, install a suitable adapter to a T-piece or in some case in a welded-on piece or right on the pipe wall with adequate thread sealing. Then install the flow monitor in the adapter. In case of the stainless steel cutting ring, the length of insertion of the sensor in the adapter is given by the assembly of the built-in ring and cannot be changed. The length of insertion of the sensor can only be changed when using a ring made of PTFE. Tighten the stainless steel ring sleeve nut with the torque of 70Nm max. (in case of PTFE ring, 50Nm max).

When installing into pipe, in order to ensure the most exact interpretation of the flow, it is necessary to keep the angular displacement of the flow monitor so that the cable gland for electrical connection makes up the upstream side. The medium should flow from the same side where this cable gland is located.

## Interference sources

The most frequent interference sources affecting the stable flow of liquid are as follows:

- The flow of liquid in the flow detector should be **settled and free of whirls**. Minimal recommended distances of the straight pipe section are 5xd before and 3xd after sensor.
- Pumps and bends or elbows located closely one after another in various planes. These elements should be found at least at a distance of 20xd (where d is the inside diameter of the meter in millimetres) before the flow sensor.
- Abrupt variations of pipe cross-section if not made as a cone with an angle of  $\alpha \leq 10^\circ$  (where  $\alpha$  is the angle made by bevelled walls of the pipe adapter).
- Whatever interfering in the flow of liquid.
- Branch lines, T-pieces, bends, elbows, slide valves, taps, flaps. Shut-off valves, control valves, butterfly valves and non-return valves. Pipe outputs from reservoirs, exchangers and filters.
- When a mixture of substances is made (or mixture of the same liquids with different temperatures) you need to install the flow meter either before the mixing location or at a sufficient distance after it (min.30xd), otherwise the indication may be unstable.

## *Electrical installation*

*Always carry out any handling operations or installation of the device after disconnection of the supply voltage!!!*

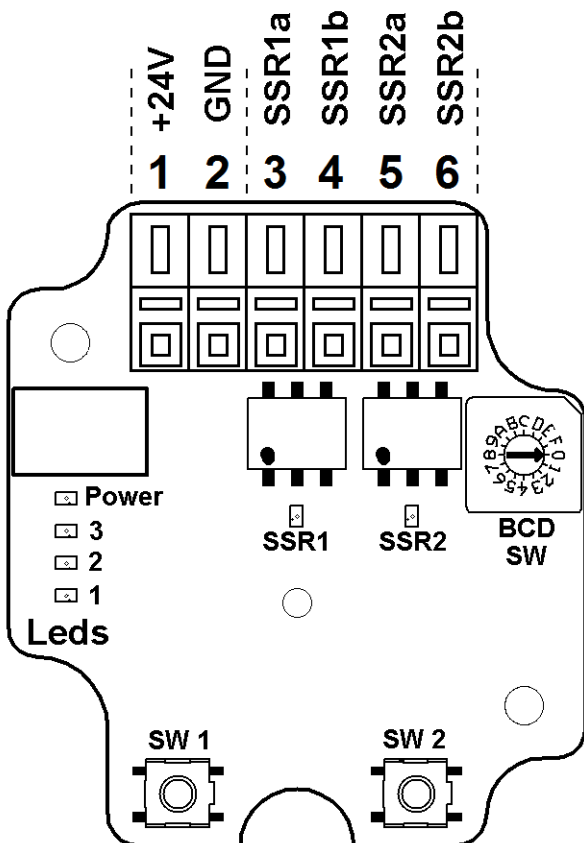
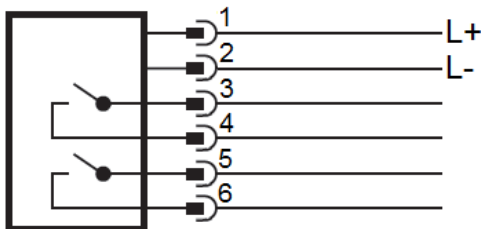
*When the below mentioned operations are carried out unprofessionally, the claim to warranty become null and void!!!*

### **Flow monitor connection**

All necessary signals are on the 6-position terminal board.

Connection of individual terminals conforms to the output type and is indicated on the flow monitor nameplate.

**FS 05**



*Standard connection of switches:*

- PIN 1 – supply voltage +24V
- PIN 2 – supply voltage GND
- PIN 3 – relay contact of the switching point (above-threshold flow)
- PIN 4 – relay contact of the switching point (above-threshold flow)
- PIN 5 – relay contact of the switching point (below-threshold flow)
- PIN 6 – relay contact of the switching point (below-threshold flow)

*Options for connection of PNP and NPN switch contacts:*

*PNP*

- connect PIN 3 and PIN 1, switch output PIN 4
- connect PIN 5 and PIN 1, switch output PIN 6

*NPN*

- connect PIN 3 and PIN 2, switch output PIN 4
- connect PIN 5 and PIN 2, switch output PIN 6

*Description of individual LEDs:*

- POWER – supply voltage indication
- LED1 – flashing indicates the zero flow or the flow lower than  $Q_{min}$
- LED2 – value of switching point SSR2 (BCD SW)
- LED3 – value of switching point SSR1 (BCD SW)
- SSR1 – indicates SSR1 relay contact closure
- SSR2 – indicates SSR2 relay contact closure

As a standard, the evaluation unit delivered for 24VDC $\pm$ 10%, 150mA power. The signal outputs of the monitor may be connected only to devices where the personal accident protection is ensured by a safe low voltage and where the generated voltages do not exceed limits specified for safe low voltage.

*Note: Connector wiring is always indicated on the label found on the sensor housing.*

## NO/NC contact

The manufacturer delivers the meter with the first switching point (below-threshold) set as a make contact switch and with the second switching point (above-threshold) set as a break contact switch. If the flow velocity is above the first switching point (below-threshold flow), the SSR1 switch is closed. If the flow is above the second switching point (above-threshold flow), the SSR2 switch is open. If the flow varies between the set switching points (above the below-threshold flow and below the above-threshold flow), both switches are closed.

The typical response time is  $1 \div 6$ sec and it is influenced by the rate of change of flow:

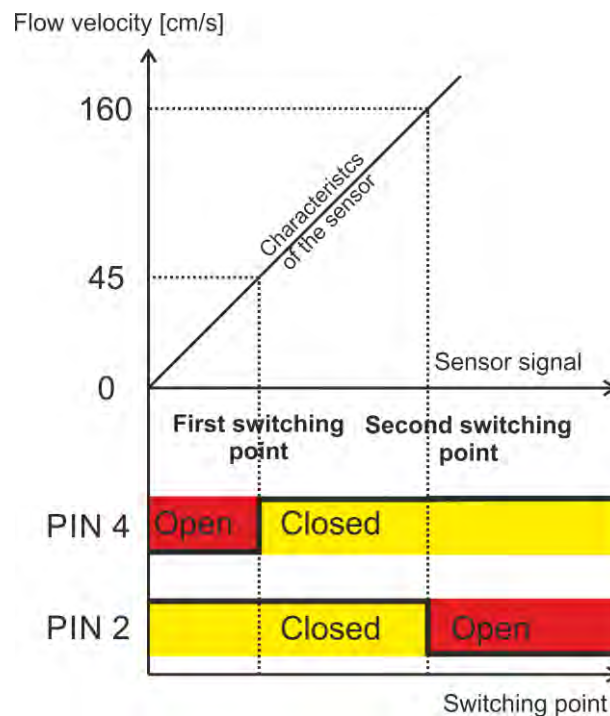
- The change of flow moves close to the switching point – slower response.
- The change of flow jumps over the switching point – quick response.

How to find out the switching point flow rate setting:

Turn the BCD switch until the LED3 starts flashing. The value on the BCD switch indicates the SSR1 switching point value.

Turn the BCD switch until the LED2 starts flashing. The value on the BCD switch indicates the SSR2 switching point value.

The BCD switch is a 6-way switch. Value 1 (indication 0) corresponds to  $1/16$  of the  $Q_{max}$ . Value 16 (indication F) corresponds to  $16/16$  of the  $Q_{max}$ .



## Starting up

After powering the flowswitch make a self-test and self-diagnostics LED, then goes fluently to the measuring mode.

*If none of the LEDs is lit or flashing, the device is most likely disconnected from the supply voltage!!!*

### *Basic parameter default setting*

From the production plant, the unit is set to standard parameters (see Table below) unless it is set to different values upon agreement with the manufacturer. The operator can make changes by means of the pair of buttons on the control panel and using the BCD switch (page 9).

### *Factory settings for water*

Minimum flow speed	4cm/sec (2% Qmax)
First Switching point (below-threshold)	50cm/sec (25% Qmax)
Second Switching point (above-threshold)	150cm/sec (75% Qmax)
Maximum flow speed	>200cm/sec (100%)

Note: The value of switching point in the table are only informative and depend on the fact if the flow rate increase or decrease with time, i.e. this switching point have a hysteresis, which is set by the manufacturer.



## *FS 05 monitor adaptation and control*

### *1. Switching point – below-threshold*

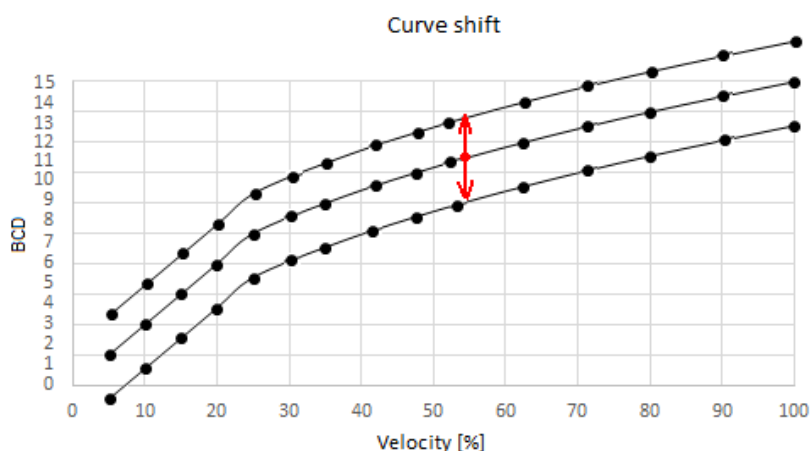
Set the BCD switch to the required switching point value from Qmax. Press the button 1 and hold it until the LED3 is ON. Release the button. To complete setting, wait until automatic saving is finished and the unit is switched into measuring mode.

### *2. Switching point - above-threshold*

Set the BCD switch to the required switching point value from Qmax. Press the button 2 and hold it until the LED3 is ON. Release the button. To complete setting, wait until automatic saving is finished and the unit is switched to measuring mode.

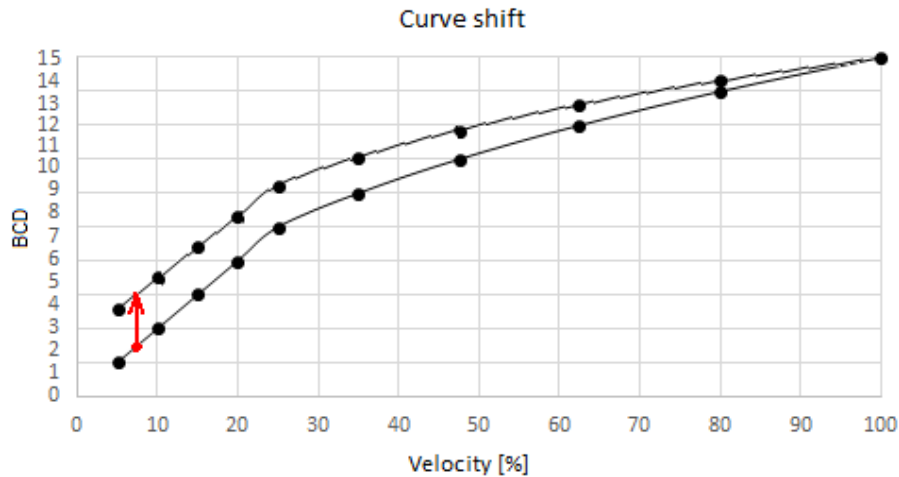
### *Customizing to a medium different from water (oil, glycol-based mixtures, etc.)*

For the liquids with different thermal conductivity than water, it is necessary to perform adaptation (curve shift) to the medium in question. With zero flow and filled sensor press simultaneously the ◀ ▶ buttons on the control panel and hold them until green LEDs start flashing. After releasing the buttons, adaptation to the liquid in question is completed.



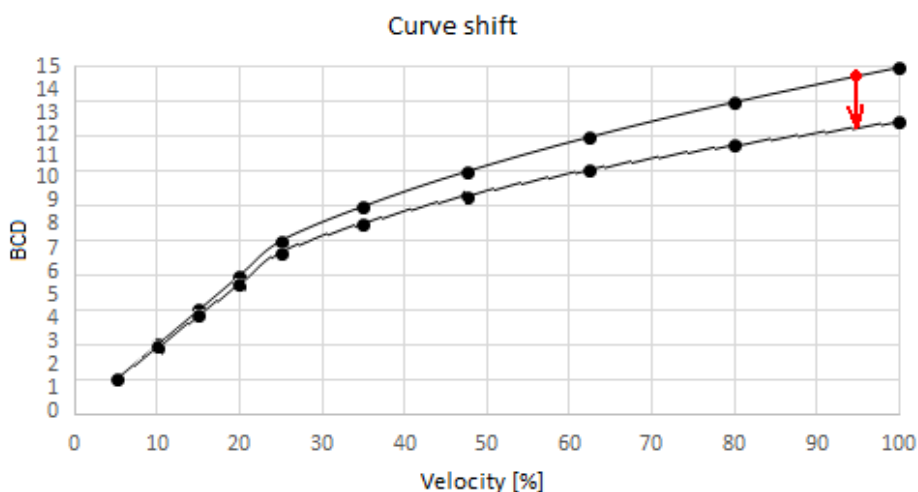
### Calibration of the minimum flow of the monitor

To calibrate the minimum flow, press the 1st button and hold it until LED3 and LED2 are simultaneously ON. After releasing the button, the minimum flow will be automatically registered and the sensor returns to measurement mode. Minimum calibration is completed by this action. Carry out this setting only if necessary (usually, after using with an oil medium, etc.), this default factory setting done for water.



### Calibration of the maximum flow of the monitor

To calibrate the maximum flow, press the 2nd button and hold it until LED3 and LED2 are simultaneously ON. After releasing the buttons, the maximum flow will be automatically registered and the unit returns to measuring mode. Calibration of the maximum flow is completed. Carry out this setting only if necessary and when the default maximum set in the production plant is not satisfactory.



### Restoring parameters to factory settings

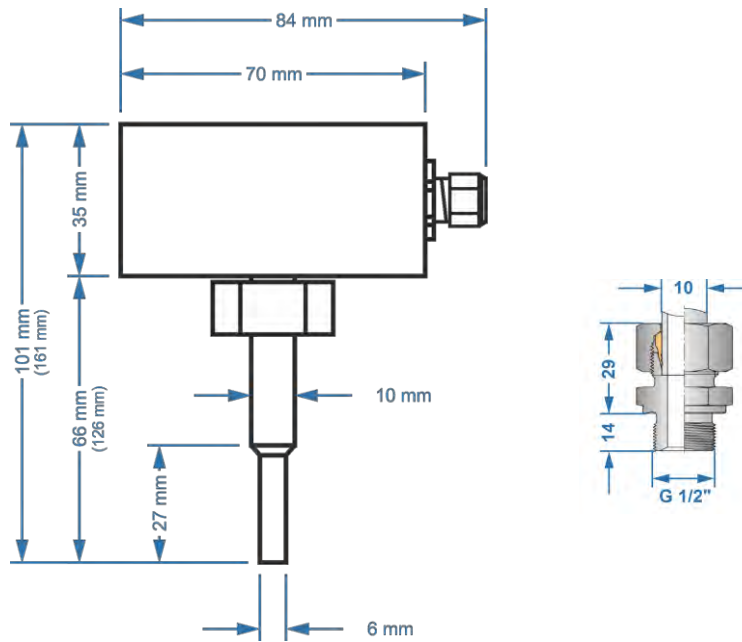
Press simultaneously the buttons 1 and 2 on the control panel and hold them until LED3 and LED2 are simultaneously ON. After releasing the buttons, the unit is RESET to factory settings.

## ***Technical specification***

Supply voltage:	24V $\pm$ 10% DC with polarity reversal protection (standard) (optionally also 12V DC and 12V AC upon agreement with the manufacturer)
Input power:	1.5/4 VA
Electrical connection :	through the terminal board (6 contacts)
Process connection :	according to the DIN2353 by M16x1.5 union nut through the 24° ring into the direct socket with pipe thread ( G ½, G ¼, M14x1.5, NPT 1/4) and clamp connection DN25(50,5mm) or DN50(64mm)
Version :	compact
Indicator:	6x status LED
Status contact :	2x SSR, passive, potential free/PNP/NPN
Response time:	1 ÷ 6sec
Flow ranges:*	4 ÷ 200 cm/sec
Accuracy:	$\pm$ 2 ÷ $\pm$ 8 cm/sec
Hysteresis:	2 ÷ 8cm/sec
Control:	2x button, BCD switch
Temperature of liquid:	0 ÷ +80°C
Ambient temperature:	-10 ÷ +55°C
Material in contact with medium:	stainless steel 1.4404 (according to the connection option)
Maximum pressure:	40 bar
IP code:	IP65
Ambient humidity:	max. 90%
Dimensions (H x W x D):	101x84x60mm (in case of the longer version, the height is 161mm)
Weight:	290g
* for water, 25°C	

## *Basic dimensions*

### *Compact version*



## Additional accessories

### Adapter block

In case when it is necessary to monitor the media flow in pipe with a smaller DN than DN 25 (or the flow velocity is below the sensor range at the pipe diameter given), it is possible to use an adapter block with a corresponding flow velocity and ensure correct operation and keep the installation conditions in this way.

Adapters are designed for short version of sensor 65mm with using direct socket with pipe thread G 1/2.

#### Individual designs :

- FS adapter block DN20/G3/4"  
1 ÷ 10 l/min. (size 150×50×40 mm)
- FS adapter block DN15/G1/2"  
0,5 ÷ 5 l/min. (size 150×50×30 mm)
- FS adapter block DN10/G1/4"  
0,2 ÷ 2 l/min. (size 150×50×30 mm)
- FS adapter block DN4,7/G1/4"  
50 ÷ 500 ml/min. (size 70×50×30 mm)
- FS adapter block DN2,7/G1/4"  
2 ÷ 100 ml/min. (size 70×50×30 mm)



### Order code

