COMAC CAL

CZECH PRODUCER
AND DEVELOPER
OF MEASUREMENT
AND SENSOR TECHNOLOGY

Flow switch

FS 10;11;15;20

Exia

>> Intrinsically safe device <<

Mounting and technical conditions
(Accessory for explosion-proof design)

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Description of the device

The FS xx flow switches are designed for liquid media and they are based on the calorimetric measurement principle according to which the flow velocity of the measured medium is proportional to the heat transferred from the sensor to the ambient environment. Basic advantages include quick and simple installation and a lower price due to simple construction.

The sensors are not limited by the electrical conductivity of media. Due to the calorimetric principle of the measurement method used, the measurement is dependent on the thermal conductivity of media. The device can reach its highest sensitivity within the measuring range of 15 ÷ 150 cm/s when used with water. The measuring range for media with different thermal conductivities is different. The measuring range can be modified by user to some extent, but it holds true that the lower thermal conductivity of the medium, the higher flow rates can be measured.

Scope of delivery

The device is delivered separately without any other add-on elements ant it is ready for installation with the process connection by means of fitting onto the cutting ring according to EN ISO 8434-1 (DIN 2353) with the 24° sealing cone.

Process connection

It is possible to use direct connections in various designs and made with special treatment. The heavy “S” connections have M18x1.5 nuts; the light connections have M16x1.5 nuts. The stainless steel cutting ring or the PTFE ring are standard for 10 mm diameter. After installation of the stainless steel cutting ring onto the sensor, the insertion length of the sensor inside the piping cannot be changed, it is only possible to do so when the PTFE ring is used.
The FS xx flow switches are delivered with stainless steel M16x1.5 sleeve nuts with cutting rings fitted in the position providing the maximum insertion length of the sensor inside the piping.

When a different position of the cutting ring or the use of PTFE ring is required, this must be agreed with the manufacturer

The accessories for flow sensor may include various connections (adapters) used for process installation and the M12 (4-pin) connector for electrical connection. However, these are not part of delivery owing to standard solution of individual elements and thus the possibility of deliveries also from other manufacturers of these parts

Storage conditions

Temperatures for shipment and storage must be within the range of -10 °C to 80 °C.

Warranty

Unprofessional installation or using the flow rate sensors (devices) may result in a loss of warranty as well as failure to comply with installation or operating conditions according to this manual.

Repairs are not possible. The warranty becomes null and void by repairs or intervention in the device by a person other than the manufacturer.

Installation in pipeline

Important information for selection of location

Outdoor conditions
It is necessary to ensure that the sensor is not exposed to weather effects and that the measured medium cannot freeze round the flow sensor as it would damage the sensor itself.
In case of outdoor location, the manufacturer recommends using a protective roof to avoid direct solar exposure so that the evaluation electronics cannot get overheated.

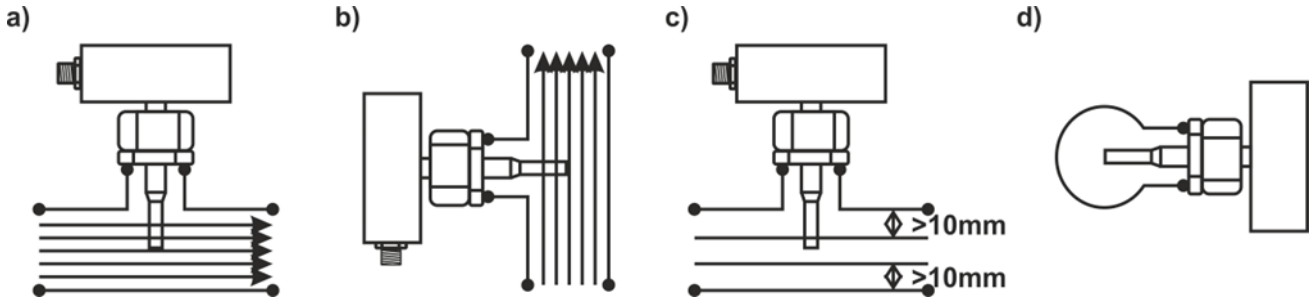
Vibration
Levels and range of vibrations must be under 2.2 in the frequency range of 20 ÷ 50 Hz according to IEC 068-2-34.

Actual location
The flow sensor (sensing element) or its tip must be fully immersed (see Fig. a). On this account, it is not recommended to install it at the top of the pipeline which may get aerated, or even in the horizontal pipeline with an open end into which air may enter, but conversely, in the ascending pipeline (see Fig. b).

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

When measuring at very low flow rates (Q < 0.1 m/s) for a long time, impurities may settle down. In this case, install the sensor for horizontal pipeline edgeways (see Fig. d).

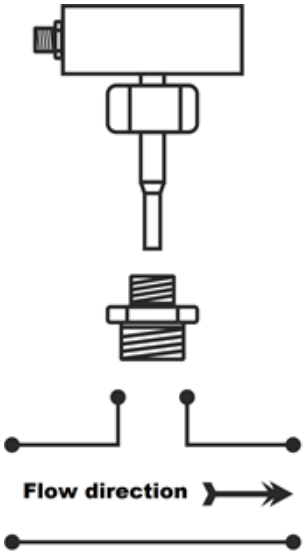
Installation examples



The flow of liquids in the flow rate sensor should be **steady and with no turbulence**. Sources of disturbances may reduce the accuracy substantially. On this account, the location of the sensor is selected in such a way that straight pipe sections are found upstream and downstream of the sensor. The minimum length of straight pipe sections is $(5 \div 10) \times d$ upstream and $(3 \div 5) \times d$ downstream of the flow rate sensor where d is pipeline diameter. In the specified straight pipeline sections, **no sources of disturbances** affecting the steady flow are allowed. These must be positioned in the pipeline downstream of the flow-rate sensor or at a maximum upstream distance of it.

When a mixture of substances is blended, the flow meter should be installed upstream of the blending position or at a sufficient downstream distance of it (30xd min.), alternatively the indication may be unstable.

Assembly procedure



Before starting the actual assembly, make sure that the system is depressurized or discharged. After that, install a suitable adapter in the T-piece or welded-on piece or right in the pipeline wall using the appropriate thread seal. Finally, install the flow switch in the adapter. In the case of the stainless steel cutting ring, the length of sensor insertion inside the adapter is given by installation of the ring pressed-in and it cannot be changed. The sensor insertion length can only be changed when using the PTFE ring. Tighten the stainless-steel sleeve nut to 70 Nm torque max. (for PTFE ring, 50 Nm max.).

When installed in piping and for the most precise flow rate evaluation, adhere to the orientation of the unit so that the M12 connector for electrical connection can form an upstream edge. The medium should run from the same side where this connector is found.

Sources of disturbances

The following items rank among the most frequent sources of disturbances to the steady flow of liquid:

- Pumps and pipe bends or elbows located closely one after another at different levels. These elements should be found at a distance of 20×d at least (where d is the internal diameter of the sensor) upstream of the flow rate sensor.
- Abrupt changes in pipeline cross-section if not made as a cone at an angle $\alpha \leq 16°$ (where α is the angle made by skewed walls of the pipe reduction).
- Anything interfering with the flow of liquid, e.g. thermometer well.
- Branch pipes, T-pieces, pipe bends, elbows, slide valves, cocks, throttles. Closing, control, throttling and check valves. Pipe outlets from tanks, heat exchangers and filters.

Wiring system

Any installation or manipulation with the device must always be carried out after disconnection of supply voltage!!! Unprofessional implementation of the below-mentioned operations results in expiration of warranty claims for failures that may occur as a result!!!

All assembly operations and installation of the device in potentially explosive atmospheres must be carried out conformable to applicable undermentioned standards and regulations by skilled workers. It is necessary to respect the provisions of the undermentioned standards and other devices

connected to this meter must meet the requirements of the undermentioned safety specifications according to applicable classification for the environment in question. It must be noted that safety specifications of the meter are different, depending on whether the device belongs to "I" or "IIC" groups.

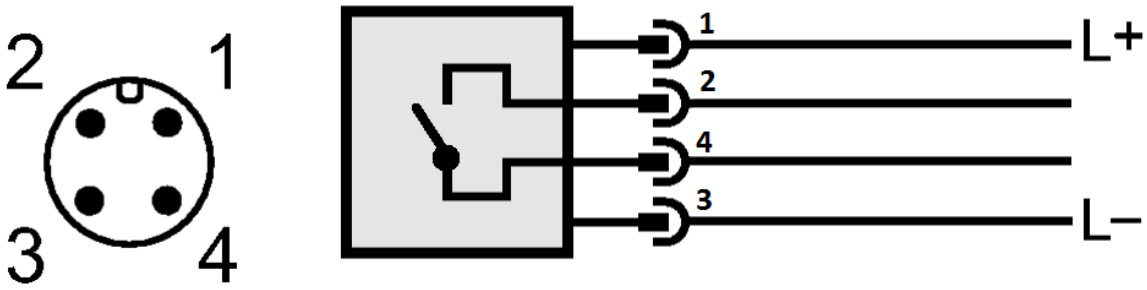
Meter wiring

Caution:
When used in potentially explosive atmospheres and in gaseous mines, it is an "intrinsically safe device" and it can only be connected to intrinsically safe devices so that its safety according to the standards is not impaired.
Wiring must be carried out in accordance with ČSN EN 60079-25:2011 and ČSN EN 60079-14:2014.

The flow monitor is normally delivered for 24 V DC ± 20 % power supply. It must be fed from an **intrinsically safe power supply with specifications compatible with our meter** and with regard to the applicable classification according to the environment in which our meter will be used. Signal outputs of the flow switch can only be connected to devices that have necessary protection degree for using in potentially explosive atmospheres and their specifications correspond to applicable safety specifications for connection to our flow switch.

The flow switch is fitted with the standard M12x1 4-pin connector

Example of M12 (FS10 RELAY) connector wiring:



The factual M12 connector wiring, flow switch output signals, controls and settings depend on the version of meter and these are indicated in the quick start guide for the relevant version of meter.

Note: Connector wiring is always indicated in the plate attached to the sensor housing.

Basic specifications

Supply voltage:	(12÷24) V DC ± 20% with reverse polarity protection
Power input:	2.3 W max.
Display:	10 x tri-colour LED
Current capacity of contacts:	130 mA / 60 V / 500 mW
Response time: *	(1 ÷ 6) sec
Flow rate ranges:	(15 ÷ 400) cm/sec
Accuracy:	± (2 ÷ 8) cm/sec
Hysteresis:	(2 ÷ 8) cm/sec

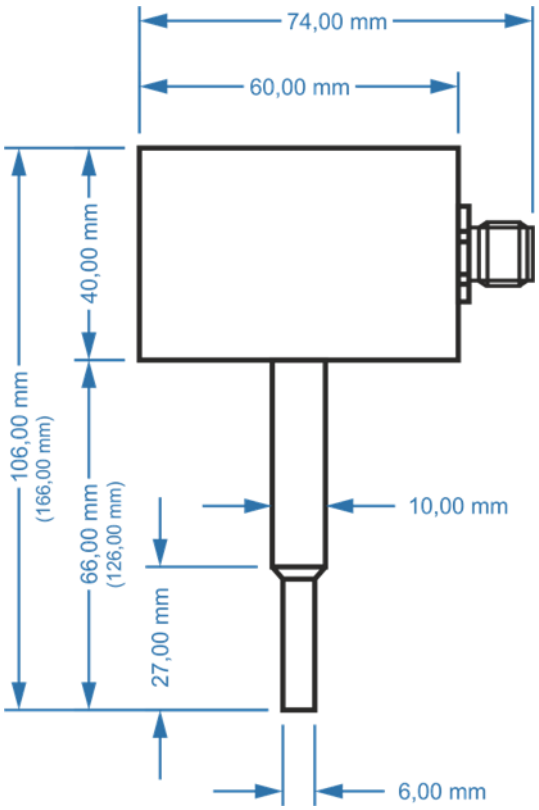
Control:	2x flush-mounted button
Temperature of medium:	(-20 ÷ +80) °C
Ambient temperature:	(-20 ÷ +80) °C
Storage temperature:	(-30 ÷ +80) °C
Material in contact with medium:	stainless steel 1.4404, PTFE (as per connection version)
Maximum pressure:	100 bar
Protection:	IP66/67
Ambient humidity:	Up to 100 %
Dimensions (H x W x D):	(106 x 74 x 60) mm (the height of the long version is 166mm)
Weight:	290 g

* for water 25 °C

Basic dimensions of the construction

Compact version

Connection by cutting ring *Clamp connection*



Safety specifications and standards used

For application in gaseous coal mines, in explosive atmosphere and where flammable dust is released into atmosphere, the following safety specifications and standards apply:

EN IEC 60079-0:2018; EN 60079-11:2012; EN 50303:2000

Safety classification of the meter:

I M1 Ex ia I Ma
II 1G Ex ia IIC T6...T4 Ga
II 2D Ex ia IIIC T85 °C…T135 °C Db

Power:

U_i:	28.5 V
C_i:	0
L_i:	0

Caution:
Seeing that it is "an intrinsically safe device" and all the outputs are intrinsically safe, it can only be connected to intrinsically safe devices. The relay output (pulse output) is always passive (NPN or relay).

Relay output, passive:

Group I devices		**Group IIC devices**	
U_i:	max. 28.5 V	**U_i:**	max. 28.5 V
I_i:	max. 115 mA	**I_i:**	max. 115 mA
P_i:	max. 0.330 W	**P_i:**	max. 0.330 W
C_i:	0	**C_i:**	0
L_i:	0	**L_i:**	0

Current loop 4 ÷ 20 mA active:

Group I devices		**Group IIC devices**	
U_o:	max. 10.8 V	**U_o:**	max. 10.8 V
I_o:	max. 196 mA	**I_o:**	max. 196 mA
P_o:	max. 0.529 W	**P_o:**	max. 0.529 W
C_o:	< 10 μF	**C_o:**	< 1 μF
L_o:	< 0.2 mH	**L_o:**	< 0.015 mH

Special conditions of use:

The conditions of use are listed in the following table and determine the relationship between the ambient temperature, the temperature class (surface temperature) and the temperature of the measured medium.

Ambient temperature: Ta [°C]	Equipment Category 1G Temperature class	Equipment Category 2D Surface temperature without dust layer [°C]	Temperature of the medium Tm [°C]
-20 °C to +40 °C	T6	T85 °C	≤ +40 °C
-20 °C to +80 °C	T4	T135 °C	≤ +80 °C
-20 °C to +80 °C	**Equipment Category M1**		≤ +80 °C

For Equipment category **1G**, Temperature classes **T6** and **T4** are approved.
For Equipment category **2D**, Temperature classes **T85 °C** and **T135 °C** are approved, where the temperature in the individual classes T85 °C and T135 °C means the maximum permissible surface temperature without a layer of dust.

The medium temperature must not exceed the maximum ambient temperature:
for **T6/T85 °C** it must not exceed **40 °C**, and for **T4/ T135 °C** it must not exceed **80 °C**.

Power supply protection: SMD quick-acting fuse SIBA type 157000 160mA

5V barrier protection: SMD quick-acting fuse SIBA type 157000 62mA

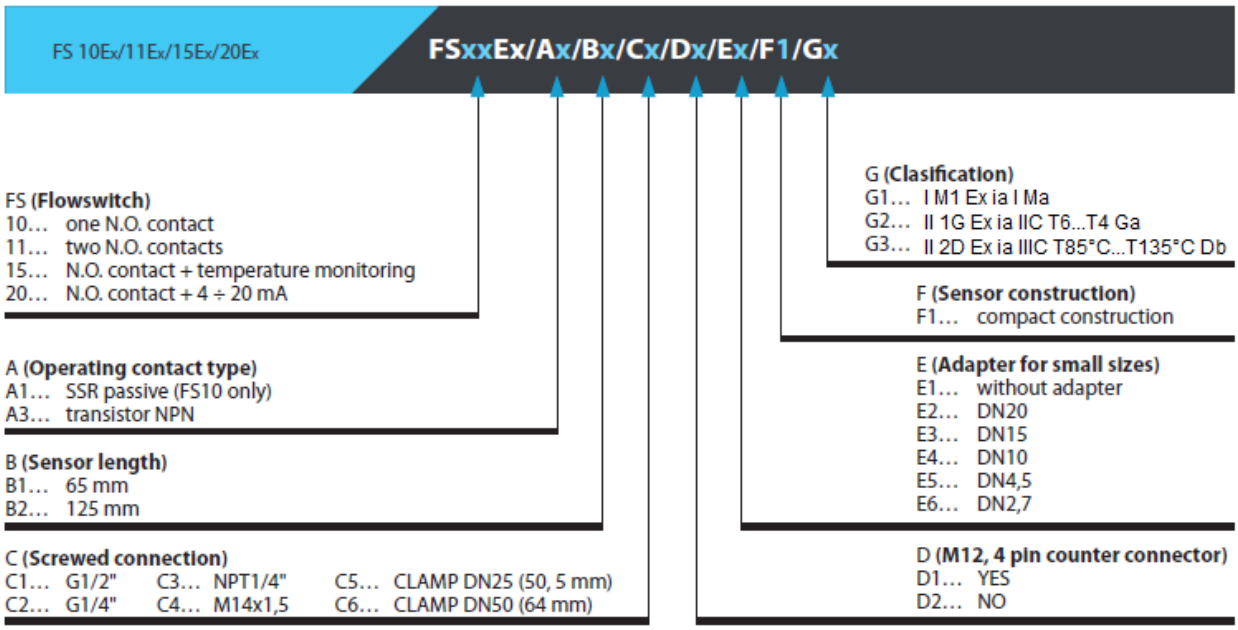
(4÷20) mA output protection: SMD quick-acting fuse SIBA type 157000 62mA

Terminal conector: **M12** **4-pin**

Recommended connector cables: Lapp Cable

Oelflex EB

Oelflex EB CY

Unitronic Li2YCY

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