



**COMAC CAL**

**CZECH PRODUCER  
AND DEVELOPER  
OF MEASUREMENT  
AND SENSOR TECHNOLOGY**

# **FLOW 38 Batch**

Ver.8.24

***Instalation and technical manual***

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## ***Description of device***

The FLOW 38 Batch meter is based on measurement principle by a well-known Faraday's electromagnetic induction law according to which an electric voltage is induced during the flow of a conductive liquid through the flow meter magnetic field. This is picked up by two electrodes in direct contact with the measured medium and evaluated in the electronic unit.

The FLOW 38 Batch type of induction meters are suitable exclusively for measurement of volumetric flow of electrically conductive liquid substances with a minimum conductivity of 20  $\mu\text{S}/\text{cm}$  (at a lower conductivity, upon agreement with the manufacturer).

Meters are designed for flow measurement where the velocity of liquid is in the range of  $0.01 \div 12$  m/s. The best measurement accuracy can be obtained in the range of  $1 \div 10$  m/s.

## ***Scope of delivery***

Accessories vary according to the variant of flow sensor and above standard optional features.

### ***Threaded design***

Electronic evaluation unit with a fixing bracket for wall mounting (not for the compact design), flow sensor (in case of compact design, the electronic unit is integral part of the flow sensor), connecting grounding cable, installation manual.

### ***Sandwich design***

Electronic evaluation unit with fixing adapter for wall mounting (not for the compact design), flow sensor (in case of compact design, the electronic unit is integral part of flow sensor), bolts for installation of the sensor between flanges (quantity as per tightening torque table, see below) with nuts and washers, connecting grounding cable, installation manual.

### ***Flanged design***

Electronic evaluation unit with fixing adapter for wall mounting (not for the compact design), flow sensor (in case of compact design, the electronic unit is integral part of flow sensor), connecting grounding cable, installation manual.

### ***Food industry design***

Electronic evaluation unit with a fixing bracket for wall mounting (not for the compact design), flow sensor (in case of compact design, the electronic unit is integral part of the flow sensor), adapter piping connection according to DIN 11851, installation manual.

*In case of detached design, a special cable for connection of the meter (it must not be extended or cut short) is part of the flow sensor.*

## ***Storage conditions***

The temperature during transportation and storage of the meter must be within the range of -10 °C to 50 °C.

Wooden boards installed on the flanges in the factory are used for protection of lining on the flanges during storage and transportation (for PTFE lining). Remove these protective boards just before installing in the pipeline!!!

Do not lift the flanged meters by the transducer head or by the connecting box of the detached design during transportation! Use slings and place them round both process connections for transportation of meters up to DN125 (chains may damage the meter head)! Use only the metallic lugs on the flange for transportation, lifting and installation of the sensor in piping in case of DN150 and bigger!!!

## ***Warranty***

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

In case of returning the meters for inspection or repair to the COMAC CAL s.r.o. factory, enclose please the completed form, see the last page of this manual. Without having one, we will not be able to handle your requirement for modification or possibly repair your meter correctly and promptly.

## ***Installation in pipeline***

### ***Important information for selection of location***

***!!! The cable must not be extended or cut short!!!***

#### ***Outdoor conditions***

It is necessary to ensure that the flow sensor is not exposed to weather effects and that the measured medium cannot freeze in the flow sensor as it would damage the measuring tube.

In case of outdoor location of the electronic evaluation unit, the manufacturer recommends using a protective box or a roof to avoid direct solar exposure so that the evaluation electronics cannot get overheated.

#### ***Sources of disturbances***

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

- Abrupt changes in pipe cross-section if not performed as a cone with an angle of  $\alpha \leq 7^\circ$  (where  $\alpha$  is the angle made by bevelled walls of the pipe reduction).
- Incorrectly centred sealing, low ID sealing or sealing made of soft elastic materials which are pushed out into the interior pipe cross-section after flanges are tightened.
- Anything interfering in the flow of liquid, for example thermowells, branch pipes, T-pieces, bends, elbows, slide valves, cocks, flap valves, shut-off valves, control valves, butterfly valves and check valves. Pipe outlets from tanks, heat exchangers and filters.
- No intensive magnetic fields in the proximity of the induction flow sensor (detector) must be present.

**No sources of disturbances** affecting the steady flow must be present in the straight pipeline sections. They must be located in the piping after the flow sensor or at the farthest distance before it. Sources of disturbances may substantially reduce the measuring range and accuracy of the flow meters.

#### ***Vibration***

We recommend supporting the connecting pipes on both sides of the meter for partial elimination of vibrations. Levels and range of vibrations must be under 2.2 in the frequency range of 20 ÷ 50 Hz according to IEC 068-2-34. If the pipeline is exposed to excessive vibrations (e.g. from pumps), using compact meters is not recommended.

#### ***Actual location***

The flow sensor (detector) must not be at the top position of the pipe which may be airlocked, or in declining or even in horizontal pipelines with open ends in which air may penetrate. Impurities may accumulate during long-term measurement of very low flow rates  $Q < 0.1$  m/sec. There must be a sufficient pressure in the place of flow sensor installation so that the expulsion of gas or vapour bubbles from the liquid is avoided. Little bubbles that always occur in liquids may accumulate at any of the electrodes and this may result in incorrect operation of the meter. Gas bubbles are expelled also at an abrupt pressure drop. Therefore, butterfly valves and similar elements should be located **after the flow**

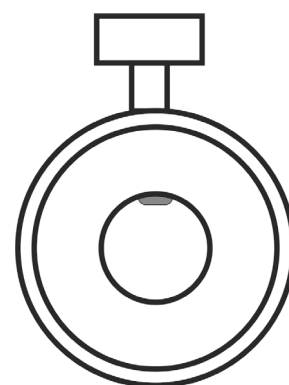
**sensor.** For the same reason, the flow sensor should not be placed at the suction side of the pump. To prevent the bubbles from accumulation at a low flow in the flow sensor, it is suitable, e.g. that the pipe is slightly ascending or that the flow sensor is located in the vertical section of the pipeline.

If the meter is populated with measuring electrodes only (2 or 3 electrodes located **beyond the upper profile** of the tube), it is necessary for proper function of the meter, to fill up the flow sensor with the fluid to be measured so that erroneous readout of quantity of liquid passing through the meter can be avoided when the pipe is empty. It is necessary to select the location of the meter in such a way that the flow sensor aeration can be avoided. In the case of an open system, the flow sensor is placed in the bottom position of the U-profile pipework, ensuring that the fluid will not flow out of the sensor.

In the case that the sensor is equipped with an empty pipe testing electrode (3rd or 4th electrode in the upper part of the measuring tube profile), there is no risk of erroneous readout of quantity of liquid passing through the meter due to aeration of measuring electrodes. This function must be activated in PARAMETERS (EMPTY TUBE TEST) menu. If it be to the contrary, the same conditions apply as if the testing electrode is not populated.

The function of empty tube detection in horizontal mounting position operates correctly only if the evaluation unit is oriented upwards (see Fig. below). Alternatively, it is not possible to ensure that the activation of empty tube detection in case of partly filled or empty pipes will take place.

Due to the principle, it is necessary that the maximum conductivity of medium is 6000  $\mu\text{S}$  for ensuring the functional evaluation of empty tube. Beyond this limit, errors may occur in empty tube test, and in this case, it is necessary to deactivate the empty tube test. If the conductivity of medium is beyond the permissible range, the meter may, despite the flooded system, register empty pipeline and the measurement will not start.

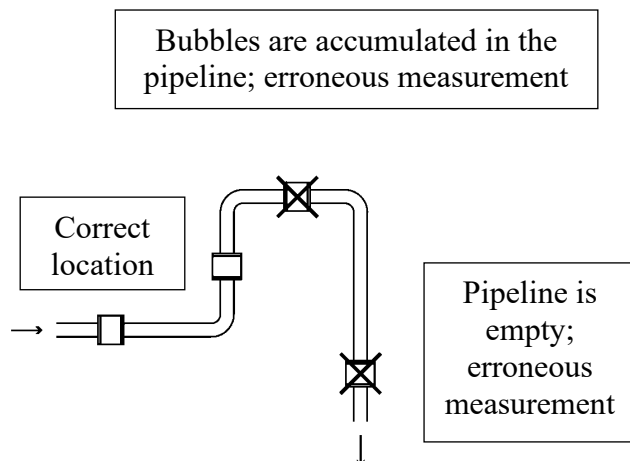


*In case of any intervention into the measuring circuit must be accessed like a pipe is fulfilled of medium, and regardless of the displayed information “empty pipe test” on the display meter !!!*

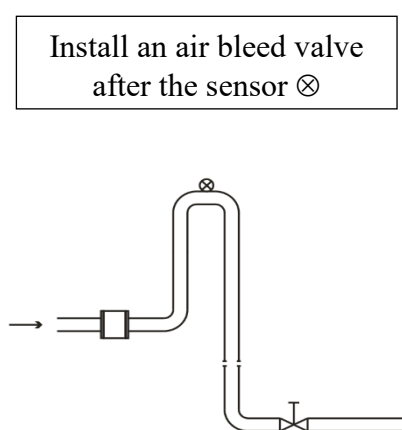
## *Installation examples*

Trouble-free and exact operation of the meter is dependent on its correct location in the system. The most frequent methods of the placement are shown in the following figures:

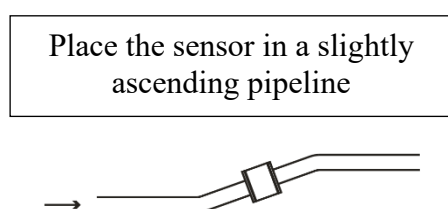
### Recommended installation locations



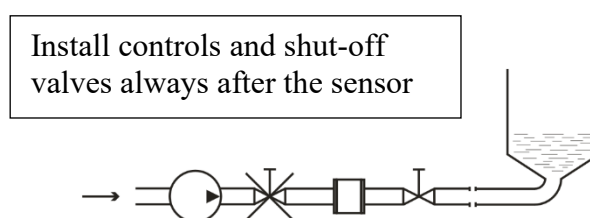
### Downtake pipe



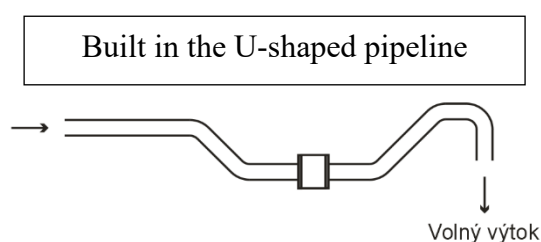
### Horizontally laid pipeline



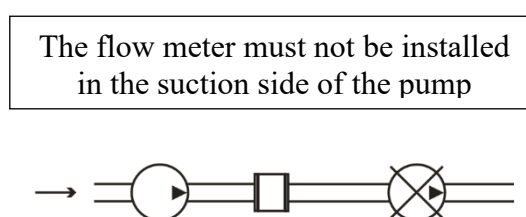
### Long pipeline



### Free inlet or outlet



### Pumps



The flow of liquid flow in the flow sensor should be **steady and free of whirling**. For this reason, straight sections of pipeline with the same ID as that of the flow meter before and after the flow sensor (with permissible deviation of +5%). Recommended minimum length of straight sections is  $5 \times d$  before the flow sensor and  $3 \times d$  after the flow sensor where  $d$  is the inside diameter of the meter in millimetres. The same principles apply before and after the flow sensor in case of bi-directional flow measurement.

## *Recommendations*

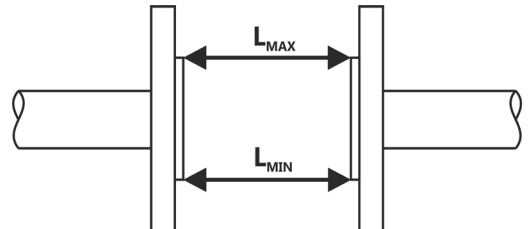
- In case of whirled up flow, extend the calming sections of pipeline or integrate a flow conditioner.

- When blending a mixture of substances, it is necessary to install the flow meter either before the point of blending or at a sufficient distance after it ( $30 \times d$  min. where  $d$  is the inside diameter of the meter in millimetres), otherwise it will result in instability of indication.
- When plastic pipeline is used or in case of metallic pipes with internal non-conductive layer, earthing rings are needed.
- Do not install the sensor at the suction side of the pumps; this will eliminate the risk of vacuum and possible damage to the measuring tube lining.
- Pumps, bends and elbows found closely in succession in various levels should be at a distance of  $20 \times d$  at least before the flow sensor. In case of a separate elbow or bend, the placement  $10 \times d$  before the meter is recommended.
- When piston pumps, diaphragm pumps, and flexible tube pumps are used, it is necessary to install a pulse damper in the system.
- In order to provide the highest accuracy, it is important to ensure permanent flooding for the sensor (for example, by installation of the sensor in the U-shaped pipeline) even if the sensor is equipped with empty tube test. This will serve as an additional safety measure for detection of non-flooded tube.

The responsibility for suitability and adequacy of application of induction flow meters is borne by the designer or possibly the user himself.

### *Actual installation in pipeline*

When welding both counter-flanges to the pipelines, it is necessary to maintain their **alignment** so that levelness of bearing surfaces of the flanges onto the front faces of the detector is ensured (at the same time, this must not be achieved by unequal tightening of the bolts as there is a risk of leakage due to thermal loading in the future or the measuring tube may break during such tightening). The difference of  $L_{MAX}$  and  $L_{MIN}$  distances of the sealing surfaces of the flanges before the flow sensor is installed **must not be greater than 0.5 mm**.



The opposition of the holes in the counter-flanges for the bolts should be ensured in the same manner and a sufficient room behind the flanges should be available for the bolts and nuts so that the actual installation of the sensor in pipeline and its attachment with the bolts is made possible.

The manufacturer recommends using an intermediate piece during welding. It is absolutely excluded to use the flow sensor as an intermediate piece due to thermal damage. The welding current must not run through the flow sensor during electrical welding. The installation of the flow sensor is carried out after welding, coating, building and similar works are completed.

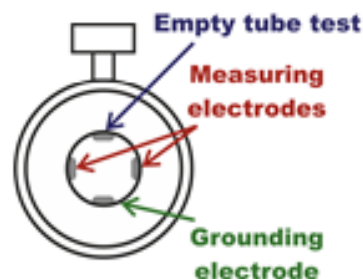
The actual installation is performed by the fixation between the counter-flanges that are welded to the calming pipeline ( $5 \times d$  before and  $3 \times d$  in the direction of flow) whereas the liquid must run through the flow sensor in the direction **indicated by the arrow** on the sensor name plate.

During installation, do not lift the meter by the evaluation unit housing (in case of detached design, by the sensor terminal box), possibly under the meter's metallic housing but always use slings round the process connection or use the lifting lugs on the flanges.

### ***Installation position***

The inductive flow sensor is installed in arbitrary position in vertical piping. In case of horizontal piping, it is necessary to make sure that the sensor is installed with its measuring electrodes in horizontal position. In case of the earthing electrode design, possibly with testing for empty pipeline, then the installation is always performed with the earthing reference electrode facing down (with the sensor terminal box, eventually with the evaluation unit facing upwards). Then the earthing reference electrode is in the bottom position and the empty tube sensing electrode is in the top position of the flow sensor.

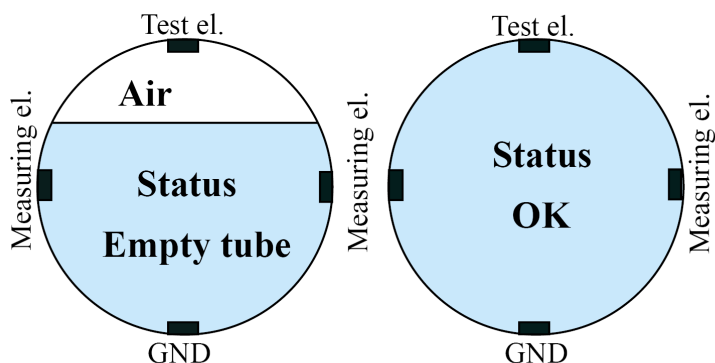
Every time when the empty tube testing electrode is not covered with a liquid for 5sec at least, the flow meter will display the "Empty tube" status, and if it is necessary, it sends out an error message and stops taking measurement. The measurement accuracy is maintained in this way. Once the electrode is covered with the liquid again, the error message disappears and the flow meter starts taking measurement again.



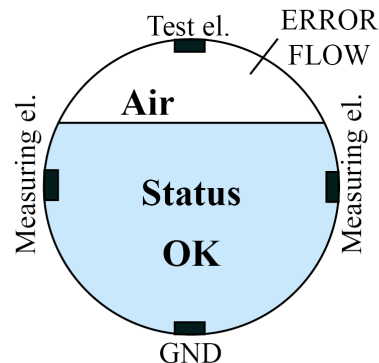
### ***Measurement error caused by incorrect mounting installation***

- 1) *correct installation (flow sensor should be install in arbitrary position in vertical piping)*

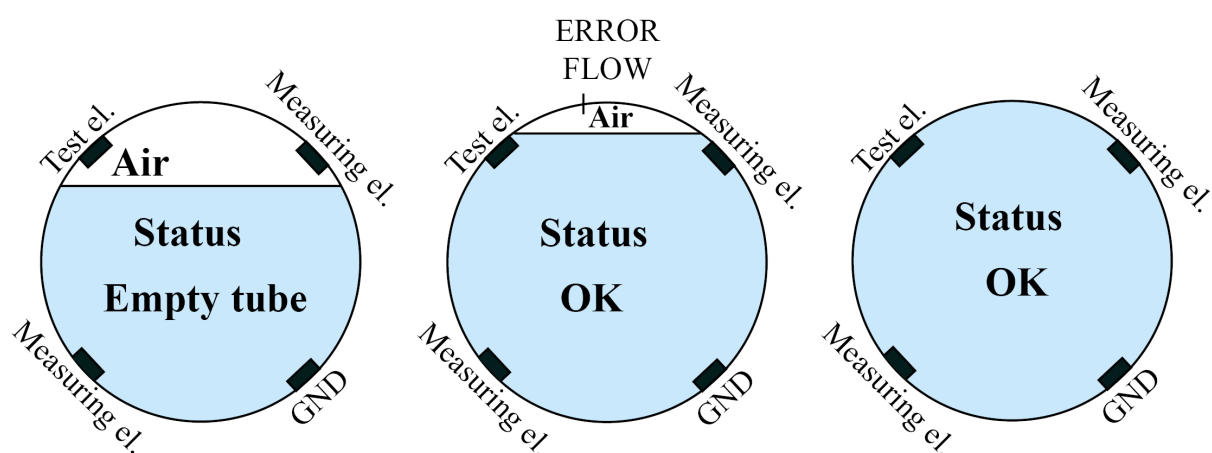
#### **EMPTY TEST – ON**



#### **EMPTY TEST – OFF**

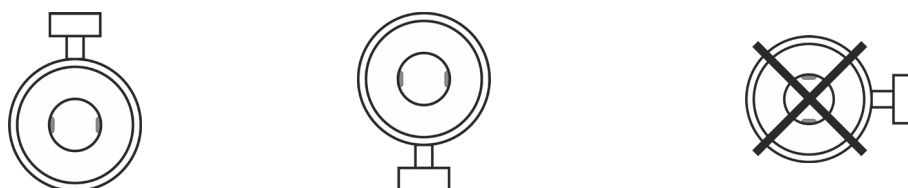


2) *incorrect installation (placing the unit diagonally, Empty test – ON)*



### ***Installation in piping and placement of measuring electrodes in flow sensor***

1) *in the version without the earthed reference electrode and/or empty piping test (2 electrodes)*



2) *in the version with earthed electrode and/or empty piping test electrode (3/4 of the electrode)*

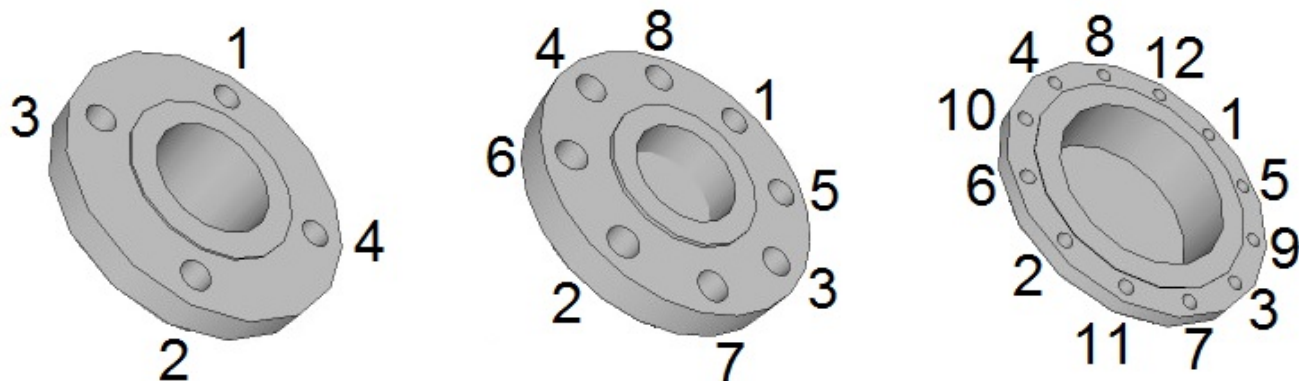


During installation, beware of:

- dropping the meter onto the ground and damaging the measuring tube or electronics
- contamination of the electrodes (do not touch the electrodes, otherwise they get contaminated)
- when additional sealing is used, avoid its interference in the flow profile of the detector between the flanges and the pipeline, otherwise the flow measurement error may be increased

### ***Tightening torques***

It is absolutely necessary to tighten the bolts and nuts equally by alternating sides and in the order shown in figure applying the maximum torque according to the table.



If the bolts are tightened too much during the installation of pipework components, deformation of the sealing surface may occur. In consequence, the torque values indicated in the table are used as a guidance for tightening the screws and bolts.

**Table with tightening torques for screws/bolts (EN 1092-1):**

| Diameter nominal | PN 10    |                        |                        | PN 16    |        |                        |
|------------------|----------|------------------------|------------------------|----------|--------|------------------------|
| DN               | Screws   | Tightening torque [Nm] |                        | Screws   | Screws |                        |
|                  |          | Rubber                 | PTFE,PFA<br>ETFE, PVDF |          | Rubber | PTFE,PFA<br>ETFE, PVDF |
| 10               | 4 x M12  | 10                     | 15                     | 4 x M12  | 10     | 15                     |
| 15               |          | 15                     | 20                     |          | 15     | 20                     |
| 20               |          | 20                     | 25                     |          | 20     | 25                     |
| 25               |          | 20                     | 25                     |          | 20     | 25                     |
| 32               | 4 x M16  | 20                     | 25                     | 4 x M16  | 20     | 35                     |
| 40               |          | 20                     | 25                     |          | 20     | 35                     |
| 50               |          | 20                     | 45                     |          | 20     | 45                     |
| 65               |          | 20                     | 46                     |          | 20     | 46                     |
| 80               | 8 x M16  | 20                     | 48                     | 8 x M16  | 20     | 48                     |
| 100              |          | 20                     | 50                     |          | 20     | 50                     |
| 125              |          | 20                     | 80                     |          | 20     | 65                     |
| 150              | 8 x M20  | 24                     | 90                     | 8 x M20  | 27     | 90                     |
| 200              |          | 27                     | 115                    | 12 x M20 | 35     | 80                     |
| 250              | 12 x M20 | 35                     | 95                     | 12 x M24 | 55     | 100                    |
| 300              |          | 50                     | 100                    |          | 80     | 110                    |
| 350              | 16 x M20 | 60                     | 70                     | 16 x M24 | 95     | 105                    |
| 400              | 16 x M24 | 75                     | 120                    | 16 x M27 | 140    | 150                    |
| 500              | 20 x M24 | 100                    | 150                    | 20 x M30 | 250    | 230                    |
| 600              | 20 x M27 | 165                    | 240                    | 20 x M30 | 400    | 360                    |

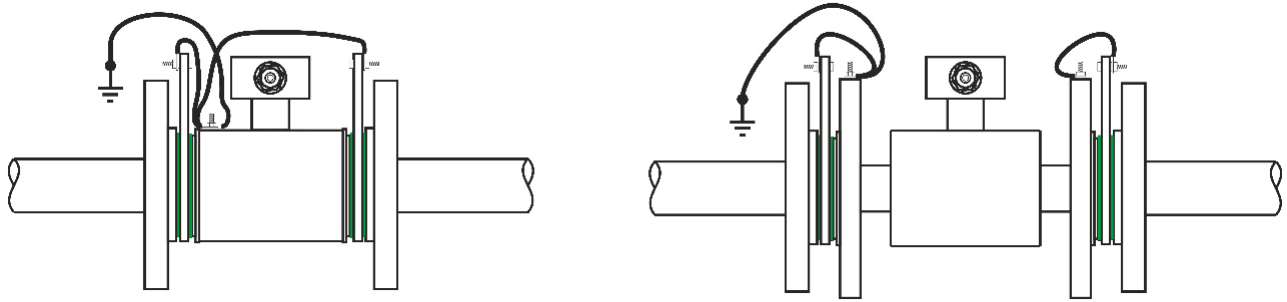
| Diameter nominal<br>DN | PN 25    |                        |                       | PN 40    |                        |                       |
|------------------------|----------|------------------------|-----------------------|----------|------------------------|-----------------------|
|                        | Screws   | Tightening torque [Nm] |                       | Screw    | Tightening torque [Nm] |                       |
|                        |          | Rubber                 | PTFE, PFA, ETFE, PVDF |          | Rubber                 | PTFE, PFA, ETFE, PVDF |
| 10                     | 4 x M12  | 15                     | 15                    | 4 x M12  | 15                     | 15                    |
| 15                     |          | 20                     | 20                    |          | 25                     | 25                    |
| 20                     |          | 25                     | 25                    |          | 25                     | 25                    |
| 25                     |          | 25                     | 25                    |          | 25                     | 25                    |
| 32                     | 4 x M16  | 25                     | 35                    | 4 x M16  | 25                     | 40                    |
| 40                     |          | 25                     | 35                    |          | 35                     | 50                    |
| 50                     |          | 35                     | 45                    |          | 35                     | 60                    |
| 65                     | 8 x M16  | 35                     | 46                    | 8 x M16  | 45                     | 55                    |
| 80                     |          | 40                     | 48                    |          | 45                     | 60                    |
| 100                    | 8 x M20  | 40                     | 55                    | 8 x M20  | 50                     | 75                    |
| 125                    | 8 x M24  | 50                     | 110                   | 8 x M24  | 70                     | 120                   |
| 150                    |          | 57                     | 115                   |          | 75                     | 136                   |
| 200                    | 12 x M24 | 68                     | 100                   | 12 x M27 | 85                     | 145                   |
| 250                    | 12 x M27 | 88                     | 120                   | 12 x M30 | 105                    | 220                   |
| 300                    | 16 x M27 | 95                     | 125                   | 16 x M30 | 115                    | 250                   |
| 350                    | 16 x M30 | 115                    | 200                   | 16 x M33 | 140                    | -                     |
| 400                    | 16 x M33 | 135                    | 255                   | 16 x M36 | 165                    | -                     |
| 500                    | 20 x M33 | 350                    | 430                   | 20 x M36 | -                      | -                     |
| 600                    | 20 x M36 | 600                    | 740                   | 20 x M45 | -                      | -                     |

In case of using a corundum or thermoplastic tube, the same torques apply as in case of using the PTFE tube according to the given pressure series.

*Threaded connection (EN 10226-1):*

| Diameter nominal<br>DN | Process connection<br>[inch] | Tightening torque<br>[Nm] |
|------------------------|------------------------------|---------------------------|
| 10                     | 3/8"                         | 8                         |
| 15                     | 1/2"                         | 10                        |
| 20                     | 3/4"                         | 21                        |
| 25                     | 1"                           | 31                        |
| 32                     | 1 1/4"                       | 60                        |
| 40                     | 1 1/2"                       | 80                        |
| 50                     | 2"                           | 5                         |
| 65                     | 2 1/2"                       | 6                         |
| 80                     | 3"                           | 15                        |
| 100                    | 4"                           | 14                        |

If you do not find your size or structure in the Torque Table, it is a special or non-standard design. In such a case, contact the manufacturer for more detailed information.



It is necessary to do the tightening three times, whereas for the first time, to 50% of the maximum torque according to the above given Table. For the second time, to 80% and for the third time, to 100% of the maximum torque. We recommend checking the screws/bolts for tightening some 24 hours after installation of the meter.

When installing the flow sensors over 200 mm, it is necessary to follow, except for the above mentioned rules, also simultaneous tightening of parallel screws on both opposite flanges to avoid possible damaging the electrodes or the measuring tube (symmetrical tensioning of the lining).

If the flanged joint is not tight, although all of the screws are tightened closely, **these must not be tightened more** but slackened on the opposite side to the untightness and tightened on the other side. If the untightness manifests itself even after that, it is necessary to check the sealing surfaces for scratches or mechanical impurities. If the scratches or any other damage are deeper than some 15% of the thickness of the flange, it is possible to remove them using fine emery paper.

In case of the threaded connection, it is necessary to check, while tightening, the screwed connection on the sensor so that torsional displacement is avoided.

### *Seal*

The turned up part of the lining does not carry out the function of sealing so it is necessary to insert the appropriate seal precisely centred between the sensor and the pipeline. If the sealing extends in some place into the flow profile, it makes whirls and reduces the measurement quality. Use the seals compatible with the liquid and 5mm thick. Do not use graphite or any other electrically conductive material to hold the sealing in place during installation. It could influence the measuring signal accuracy.

### *Earthing*

For reliable and correct operation of the induction sensor it is necessary to provide proper protective and working earthing. The earth line must not transmit interference voltages so the other electrical devices must not be earthed by means of this line.

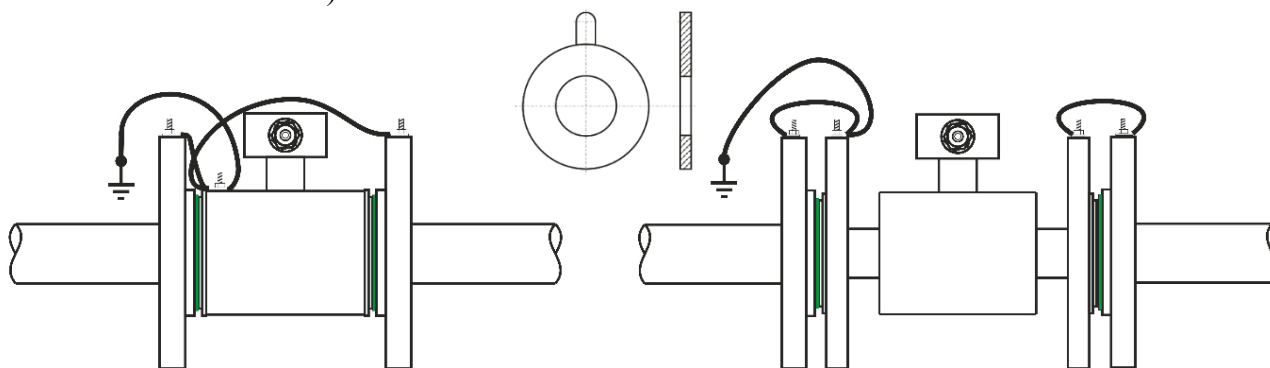
The flow sensor is provided with the M5 earthing screw of stainless steel with a washer and nut for proper connection of the sensor body with both counter-flanges of the metallic pipeline. The earthing cable lug is screwed there and it should be conductively connected with the counter-flanges. On the counter-flanges, it is recommended their connection to the welded crews or into a threaded hole. Connecting under the fixing screws of the flange is not suitable as they may corrode with time and cause failures in measurement.

However, if it is not ensured that the counter-flanges are in direct contact with the measured media and they are conductive, the earthing rings must be used, refer hereinafter.

### ***Earthing rings***

Using for a plastic pipeline or in case of metallic pipelines with internal plastic lining turned up or pulled out to the front faces of the pipeline flanges. Conductive earthing rings of stainless steel create conductive connection with the measured substance. Usually, potential equalization is carried out by means of the reference earthing electrode in the measuring tube. In exceptional cases, the equalizing currents may run through the reference electrode based on the device earthing conception. This may lead to deterioration of the sensor, e.g. by electrochemical disintegration of the electrodes. In such cases, it is **necessary** to use the earthing rings for potential equalization. This holds true for two-phase or two-component flows in which the medium is blended badly or its components cannot be blended. In general it can be said that using the earthing rings is always the protection against stray currents and the warranty of correct measurement at the same time.

The flow sensor is provided with the earthing screw of stainless steel for the earthing cable supplied with the mounting accessories. Then this cable must be conductively connected with the earthing rings. The earthing rings are not part of our standard package and must be ordered separately. Chemical durability of the material must correspond with the liquid to be measured; it is usually made of the same material as the sensor electrodes. While mounting, it is necessary to insert seals in both sides of the earthing ring and take care that no part extends to the internal profile of the sensor (whirling and turbulence of the medium).



### ***Electrodes***

The electrode material must be selected according to chemical resistance to the liquid to be measured. The purity of the electrodes may have an influence on measurement accuracy, their heavy foulness may cause even the interruption of the measuring function (isolation from the liquid). It is not necessary to clean the electrodes right after delivery before their installation in the pipeline. If the electrodes indicate signs of foulness, clean them with a soft cloth or use a chemical cleaning agent. Mind damaging to the lining! During routine operation, in case of a great majority of liquids, it is not necessary to clean the flow meter for the entire operation period of the flow sensor; self-cleaning by flow of the liquid is sufficient (recommended velocity is over 2 m/sec).

### ***PTFE, PFA and ETFE lining***

Meters with PTFE lining are equipped with protective covers to prevent the sealing surfaces from damaging during transportation or storage and from changing the shape (due to elastic memory of the PTFE material, it is restraightened to the tube). Protective covers may be removed only right before the installation. If these covers are removed due to a check, it is necessary to replace them immediately.

Carry out the installation at the lowest point of the pipeline to avoid the occurrence of vacuum. Never detach and damage the rim of the PTFE lining turned up to the of flow sensor faces. Remove the covers

from the inlet and outlet sides right before insertion of the sensor between the pipeline flanges and replace them with metal plates (0.3 ÷ 0.6 mm thick). After insertion of the sensor, remove the metal plates and install the screws/bolts.

### ***High temperature pipeline and High temperature medium***

At temperatures of the medium to be measured over 100°C, it is necessary to compensate the forces caused by thermal expansion of the pipeline due to its temperature rise. For short pipelines, it is necessary to use flexible seals, for long pipelines, use flexible pipe elements (e.g. bends).

The flow sensor must never be thermally insulated. In case that the sensor is placed in a thermally insulated pipeline, the thermal insulation must be interrupted and the flow sensor is installed without thermal insulation.

When a compact meter is used (evaluation unit placed on the sensor body), it is necessary to respect the temperature of medium up to 90 °C. In case of exceeding this temperature, the correct functionality of the electronic evaluation unit is not guaranteed, or there is a risk of its destruction.

### ***Installation check***

After installation of the flow sensor in the pipeline, the following must be checked:

- According to the name plate, if there is a relevant meter in the given measuring point (pressure, temperature, dimension, etc.).
- If the direction of the arrow on the device is in agreement with the direction of the flow in the pipeline.
- Correct position of the measuring electrodes (horizontally).
- Correct position of the electrode for empty pipeline detection (up).
- If all bolts (screws) are tightened properly.
- If earthing rings are used, then their correct installation and connection with the sensor.
- Accuracy of flow sensor earthing.
- Accuracy of execution of the pipeline calming section lengths
- If the sensor is protected against vibrations and mechanical damage.
- If the name plate (serial number) on the sensor corresponds to the one on the electronics.

### ***Wiring***

*It is necessary that the installation worker has the owner of a valid certification for the installation of electrical equipment according to the legislation in the country where the installation is performed. When the operations described below are performed unprofessionally, the claim on warranty becomes extinct!!! Prior to any opening of the evaluation unit, switch off the power!!! It is necessary to bear in mind that in case of detached design, the electronic evaluation unit and the flow sensor form an integral unit which is calibrated and matched uniquely. In consequence, make sure that **the serial numbers of both parts are always identical!!!***

## ***Important information***

### ***Flow sensor connecting cable***

The signal cable of the detached induction flow sensor cannot be led in parallel (even partly) with the cables for power distribution voltage or in the proximity to electric motors, electromagnets, contactors, frequency converters and similar sources of electromagnetic interference. In unavoidable situations, it is necessary to put the cable in an earthed iron tube. Primarily in media with a low conductivity, cable movements and interference may result in distortion of the measured signal. The maximum length of the cable between the sensor and the evaluation unit is 30 metres provided that the conductivity is over 50 $\mu$ S/cm. In case of lower conductivities, it is recommended to use the shortest possible cable length, however, 10m max.

In case of detached designs, it is possible to interconnect only the sensor and the transducer with the same serial numbers. The special cable for connection of the detached meter design must not be extended or cut short. In case of infringement of these requirements, measurement failures and significant inaccuracies may occur once the meters are connected.

If it is possible to expect an increased level of unwanted electromagnetic field, we do not recommend using the detached design. In places with strong electromagnetic interference (in the proximity of frequency converters, electric motors, transformers, etc.), we recommend putting a line filter before the meter in the power supply circuit.

### ***Evaluation unit***

As standard, the evaluation unit is delivered for mains power supply 230V / 50÷60Hz. It is possible to specify also DC power (as standard, 24V AC/DC / 250mA).

For securing the tightness of the evaluation unit cover, it is necessary to keep the seal intact and clean (replace the damaged seal immediately). If the holes for cable entries are not occupied, it is necessary to do it.

The flow meter signal outputs may only be connected to devices where accident protection is provided by a safe low voltage and where generated voltages do not exceed the limits defined for safe low voltage.

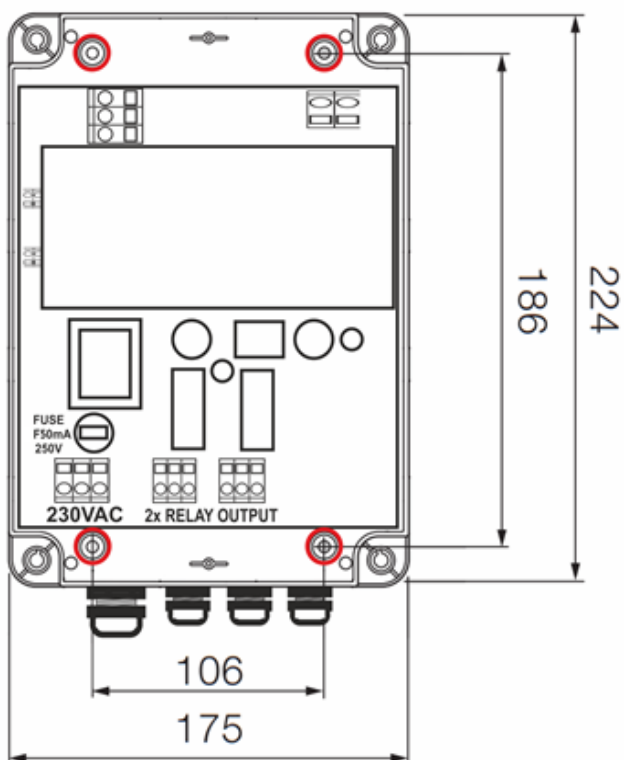
In case of mains power 230V / 50÷60Hz, the meter is fed by a switched power supply which may contain beats in acoustic spectre whereas this symptom does not indicate a failure of the meter.

Never make kinks on the cable and on individual conductors and do not let them cross mutually in the terminal board area and always use a separate cable grommet for power supply. Cover the unoccupied grommets with a piece of cable or a plastic plug (securing of tightness).

## *Installation of the meter's detached evaluation unit*

### *Wall mounting*

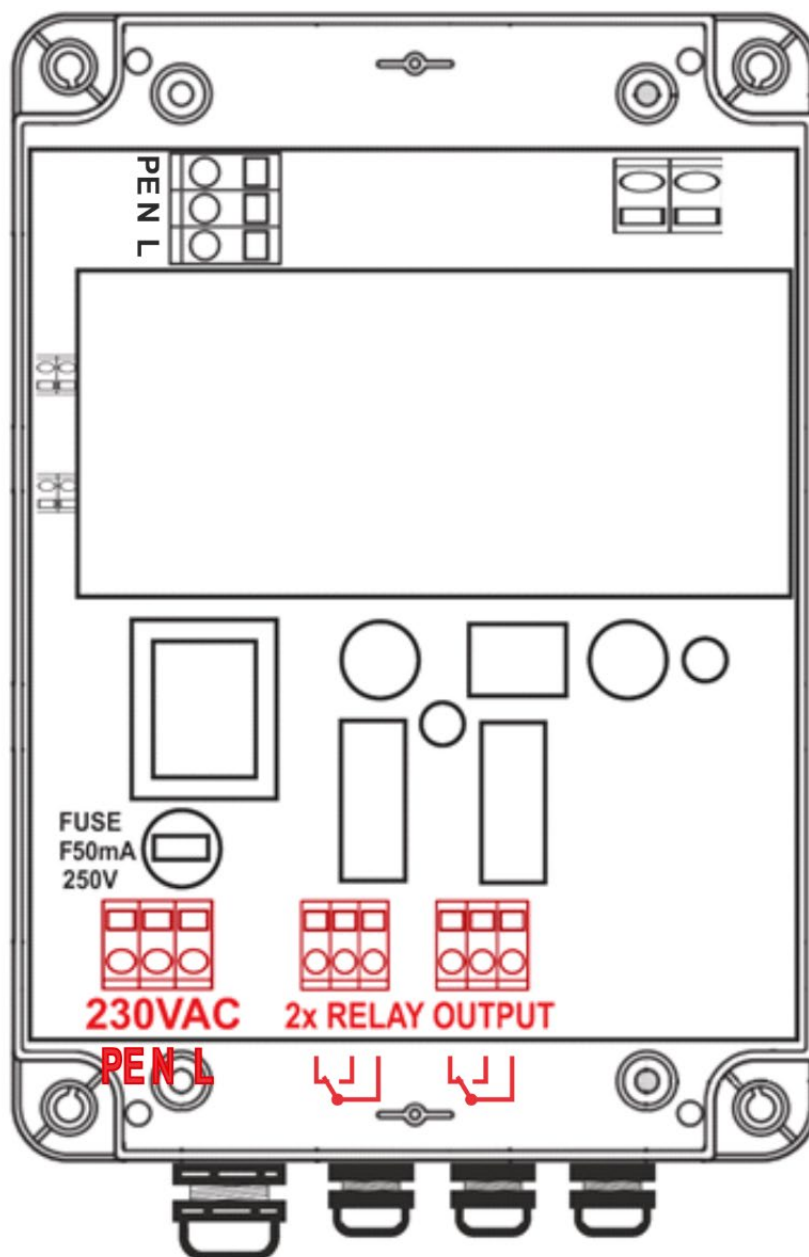
For mounting on the wall are at the device indicated four mounting points forming a rectangle with dimension 106x186mm (total box height is 200 mm). These points then drill and place with the dowels, screws, install the unit to the wall and do the wiring. After completion, close the unit and tighten all screws.



**Total depth of box is 200mm!!**

### *Meter wiring of batching unit*

The actual wiring is done by bringing electrical power supply wires 230VAC and controlling wire for the valve of one of two relay outputs (it is double output in case of damage to the first relay, or when there is a need to control two devices). Once the wiring is done, close the box and by fastening of the corner screws secure the cover against opening. Next use the connectors to connect the flow sensor cable. Fix the cable to the wall or structure so that it does not "hang" off the connector. Below the connector create a "drip loop" facing down so that any dripping water would not wet the connector. Similarly, fasten the wires for supply voltage and control outputs. At this stage the device is ready to operate. The internal control board is already connected with a measuring device – this has been done inside the COMAC CAL factory. If this is not desirable, do not interfere with the wiring.

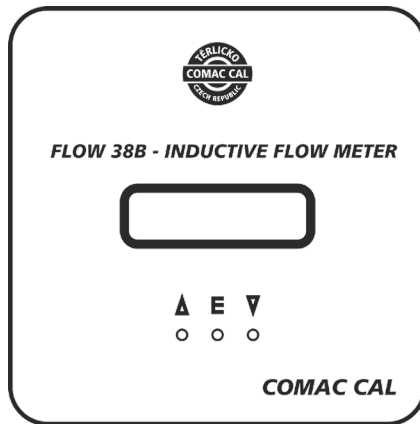


### ***Electrical connection of the meter***

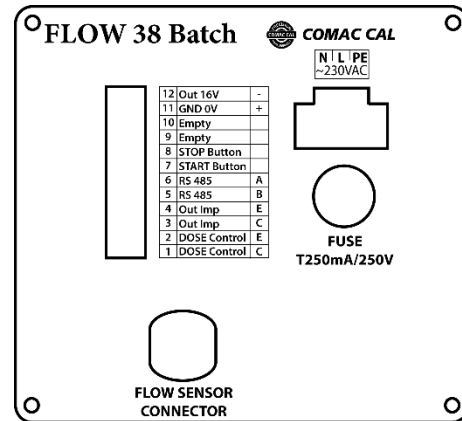
(It is connected in the factory by default)

Evaluating unit is consists of two units:

*Front panel with display unit*



*Back panel with outputs, inputs and power*



*Terminal connection of the evaluation unit:*

- Terminal 1 – controlling of batching valve C
- Terminal 2 – controlling of batching valve E
- Terminal 3, 4 – puls output OUT IMP
- Terminal 5, 6 – communication RS485
- Terminal 7 – START button
- Terminal 8 – STOP button
- Terminal 9,10 – none
- Terminal 11,12 – auxiliary voltage

Terminal L, N, PE – power 230 VAC

These terminals are in the batching device already connected to the control supply plate.

Terminal connection and jumpers is always described on the cover sheet of power supply and back cover..

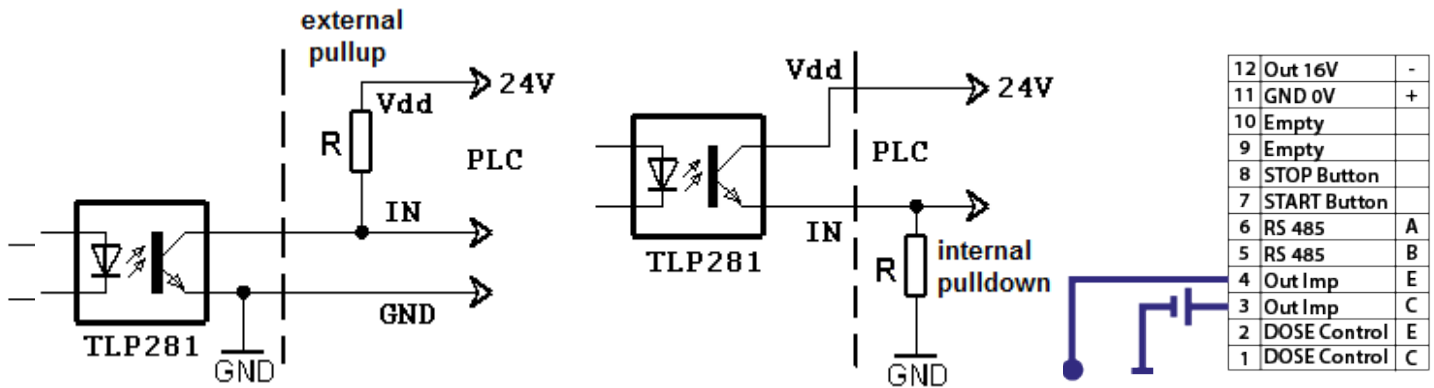
### ***Impulse output***

The **Impulse** output is used for remote transmission of volumetric impulses. The conversion constant is arbitrarily variable using buttons or user software. The adjustment must be carried in such a manner that the frequency at maximum flow rate  $f_{out} < 400\text{Hz}$ .

Impulse output is implemented by the optocoupler with an NPN switching transistor. Limit parameters of this optocoupler are 80V/50mA/100mW max. The output can be connected as a passive one or active one when terminals 11 and 12 are used. In active mode, the meter makes use of its internal galvanically separated 16V power supply. In this case, the switch voltage for logical high is 16V with the recommended current consumption of approx. 2mA with regard to optocoupler transfer. The output in off-state is found in high impedance state and so it is necessary to use a pull down or pull up resistors for defining the steady-state level.

Wiring connection examples – **passive** impulse output:

Terminals



Due to  $CR \approx 100\%$  and  $I_f = 2.5 \text{ mA}$  it is advisable to choose the collector current up to  $2.5 \text{ mA}$ .

### Buttons START, STOP

Applying a signal to the GND terminal 7 or 8 you can start or stop the batch. These terminals are in batching devices already connected to the control buttons.

### Controlling of the batching valve

Terminals 1 and 2 are used to control the relay valve batching device. These terminals are in batching devices already connected to the control board with relay outputs.

### Data output

The Flow 38 Batch meter can be provided with RS485 communication interface with M-Bus protocol according to EN 1434-3 or ModBus RTU.

### Protection degree

The meters meet all the requirements for IP 65 protection degree.

### Replacement of tube fuse in the meter

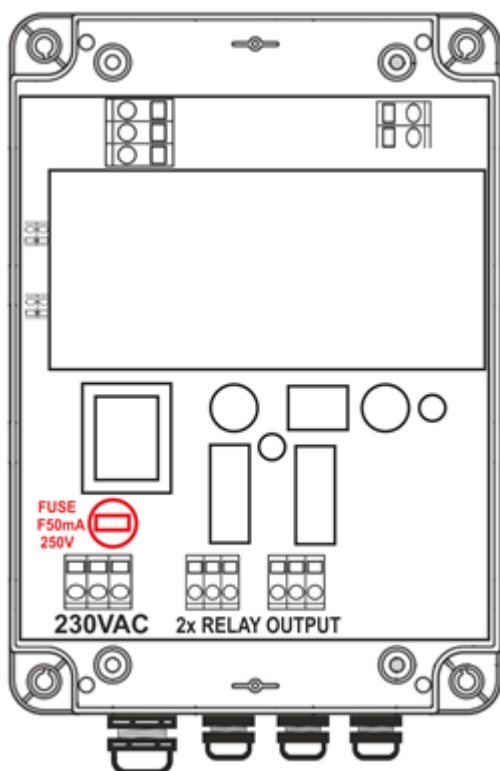
**!!! Risk of electric shock! Uncovered components generate dangerous voltages. Before removing the cover from the electronics area, make sure that the meter is not under voltage!!!**

The instrument fuse is on the power supply PCB and it is replaced as follows:

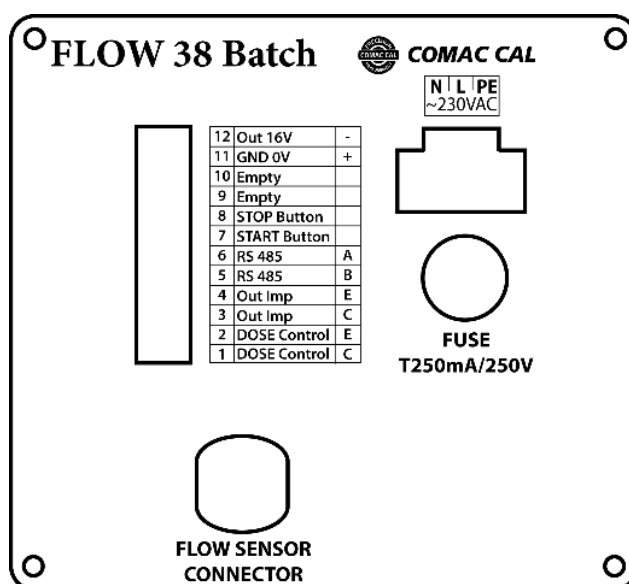
1. Switch off power.
2. Unlock the corner screws and remove the cover instrument boxes

3. Remove the protective cover and replace the instrument fuse (use solely F50mA/250V tube fuses for power source part and F250mA/250V for measuring part)
4. Proceed in reverse order to recover the function of the meter.

Power source part



Measurment part



### ***Wiring check***

After completion of wiring, it is necessary to check:

- Connecting cables for damage.
- If the cables used are suitable for given cable entries.
- Cables for pull relief.
- Correct tightening of cable entries.
- Correct connection of cables to terminals.
- Whether the supply voltage corresponds with the nameplate data.
- After closing the device properly tightening the lid

### ***Putting into operation***

Prior to connection to power supply, check the device installation accuracy in accordance with “Installation in pipeline” and “Wiring” chapters.

***If you wish the meter to take measurement as precisely as possible right after powering up, it is a good idea to fill the flow sensor with water, one or two days before its installation, so that all of its***

***electrodes are flooded. Just before the installation, the water is discharged and the sensor is installed into piping. Right after installation, piping is filled with a medium so that the electrodes cannot dry off.***

If the meter has no electrode for empty tube detection, do not connect the meter to power before filling the system with the fluid to be measured and power off the meter before system discharge.

Once the meter is powered up, the green LED on the front glazed panel is lit, confirming the supply voltage on the control PCB and stabilization of parameters of the meter takes place subsequently. The stabilization is indicated on the meter's display. After that period of time, the meter starts measuring.

### ***Meter status***

It is displayed continuously on the screen as one of the main menu items and in case of a non-standard state or a failure, this is displayed by alternating indication of the status and main menu basic data and the operator is warned by a text. The meter status is divided into 4 basic groups:

- |               |                                                                         |
|---------------|-------------------------------------------------------------------------|
| 1) OK         | everything is all right                                                 |
| 2) Warning    | the meter takes measurement but some of the parameters are out of range |
| 3) Error      | critical error – the meter does not take measurement                    |
| 4) Empty tube | if the EMPTY TUBE TEST function is activated                            |

### ***Flow direction:***

***The arrow indicates the direction liquid flow inside the sensor and thus the correct orientation of the meter's sensor for installation in piping. In case of inversely performed installation, it is possible to toggle the direction in electronics between positive/negative and thus avoid incorrect value imaging and reading out .***

### ***Basic parameter settings***

The meter or flow meter parameters are set by the manufacturer in accordance with the purchase order. If these values are not indicated in your purchase order, the meter will be set up using the default parameters in accordance with the meter's range. The operator can make modifications by means of three buttons on the meter's panel or through the RS485 interface.

### ***Safety rules for operator***

Any interventions in the inductive flow sensor and evaluation unit itself are illegal on the part of operator and they may lead to direct scalding by medium. Perform electrical connection always after powering off.

## ***Flow 38 Batch operating instructions***

The meter is provided with two external buttons on the side of the electronics housing and with three internal buttons on the bottom of the measuring electronics PCB which is accessible after unscrewing the front glazed cover.

### ***Functions of control (lower) buttons:***

|                      |                                                                                                                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Potenciometer        | Setting the batch size, the minimum setting value of the potentiometer corresponds to the limit for the minimal batch and maximum value of the potentiometer then the maximal batch (see p. 26). |
| Green "START" button | Start the set dose from the beginning, or its restart, if the previous stop red button.                                                                                                          |
| Red "STOP" button    | Stop ongoing dose. In the case the batch is stopped yet, than this unfinished dose is cancelled and the unit is ready to be restarted dose again from the beginning of the green button.         |

### *Function of setting buttons ( under display)*

Before pressing **E** and entering the password

|              |                                                        |                                                                                           |
|--------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------|
| ▲            | short press                                            | movement in current menu up<br>or modification of the value at the cursor up              |
| ▼            | short press                                            | movement in current menu down or<br>modification of the value at the cursor down          |
| ▲ / <b>E</b> | long press (>3sec)                                     | entry to PARAMETERS menu                                                                  |
| ▼            | long press (>3sec)                                     | exit from PARAMETERS menu                                                                 |
| ◆            | simultaneously ▲ and ▼<br>(short press approx. 0.5sec) | resetting user rV counter<br>in PARAMETERS menu while entering<br>values by an order back |
| ◆            | simultaneously ▲ and ▼<br>(long press >3sec)           | in PARAMETERS menu, end of modification<br>of values without writing                      |
| ◆            | simultaneously ▲ and ▼<br>(long press >8sec)           | total restart of the meter                                                                |
| <b>E</b>     | short press                                            | confirmation (Enter) or modification of a value (setting)                                 |



***Basic display menu contains the following items:***

|                                                                          |            |
|--------------------------------------------------------------------------|------------|
| Date and Time                                                            | D/T        |
| Current flow                                                             | Q          |
| Dose setting                                                             | Vrun/stop  |
| Volume in positive direction against the arrow on the meter's name plate | + V        |
| Volume in negative direction against the arrow on the meter's name plate | - V        |
| Total volume (summary in both directions)                                | $\Sigma$ V |
| Dose volume (in positive direction only)                                 | r V        |
| Status                                                                   | OK         |

The order may vary as per meter's settings. The customers may select the data to be displayed on the first two lines (or change the order) in such a manner that corresponds to their requirements.

In case that the meter's status is found in a different than normal and correct (OK) status, measurement failure indication alternates with the normal display indication. As a consequence, it is not necessary to check the status all the time; in case of trouble, it is indicated on the display unit automatically.

Using both external and internal ▲ and ▼ buttons, you can list in basic menu, reset the user volumetric counter (by simultaneous pressing both buttons), enter PARAMETERS menu, list in it and exit from it.

***Meter settings via the display***

*Parameter settings menu contains these following items:*

DATE AND TIME  
OPERATION TIME COUNTER  
POWER LOSS COUNTER  
IMPULSE OUTPUT OR FLOW SWITCH  
SETTING OF THE RANGE OF DOSE  
COMMUNICATION  
BASIC INDICATIONS ON DISPLAY  
DISPLAY DIMMING  
DISPLAY BACKLIGHT  
SERIAL NUMBER  
CALIBRATION CONSTANTS  
EMPTY TUBE TEST  
FIRMWARE VERSION  
DEAD BAND – MEASUREMENT START SUPPRESSION\*  
ZERO CALIBRATION\*  
FLOW SIMULATION  
LANGUAGE  
COUNTER RESETTING\*

NOMINAL DIAMETER (DN)  
 FLOW DIRECTION\*  
 FLOW UNITS DISPLAYED [Q]  
 VOLUME UNITS DISPLAYED [V]\*  
 PASSWORD CHANGE  
 DEFAULT SETTINGS (ORIGINAL FACTORY SETTINGS)

*\* If the meter is delivered for billing purposes, then these parameters marked with an asterisk cannot be changed (in case of restoration of factory settings, the volumetric counter is not reset).*

For editing items in PARAMETERS menu, the central **E** button is used, once it is pressed down, the operator is asked for authorization of access by password (by default, it is **0000**). Consequently, it is possible to use the **▲** and **▼** buttons to change the value upwards or downwards and confirm the modification by the central **E** button. In case that the parameter to be changed is not a numerical one, the entire parameter is changed by means of a "scroll bar". The password is required only at the first entry and it will become invalid after returning to basic display or within two and a half minutes of inactivity when the meter returns again to its basic display automatically

*Examples of representation in normal status according to user settings:*



*Note: The order of representation of menu items can be modified by user according to the customer's needs.*

### ***Flow meter settings***

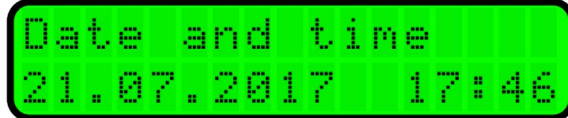
The meter can be reconfigured in Settings menu. In the case of first requirement for reconfiguration (E-button is pressed), the user is asked for password insertion. If the password is valid, it is possible to reconfigure individual items until the user exits Settings menu. The default value for user password is 0000. All modifications need to be confirmed prior to new saving.



*\*Note: Some modifications may not be valid right after saving but these will become valid after reinitialization of the meter - refer to special button functions – REBOOT*

### *Date and time*

This menu item is in DD/MM/YYYY HH/MM formats.



Date and time  
21.07.2017 17:46

Use the ▲ and ▼ buttons to set the menu item on the display and press the **E** to edit. Implement settings in a standard way, using the setting buttons and confirm by pressing the **E** button.

It is necessary again to confirm the change.



Confirm changes  
Parameter? YES

### *Operation time counter*

The counter registers the operation time of the meter (switching on). The first line indicates the date when the last counter reset was performed and the second line indicates the length of operation in days, hours and minutes.

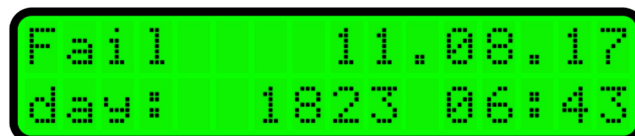


Run 11.08.17  
day: 0 07:22

This counter can be reset by pressing the **E** button when necessary.

### *Power loss counter*

The counter registers the time of loss of power time for the meter. The first line indicates the date when the last reset of power loss counter was performed and the second line indicates the length of time when the meter was out of operation in days, hours and minutes. The counter can be reset again by pressing the **E** button.



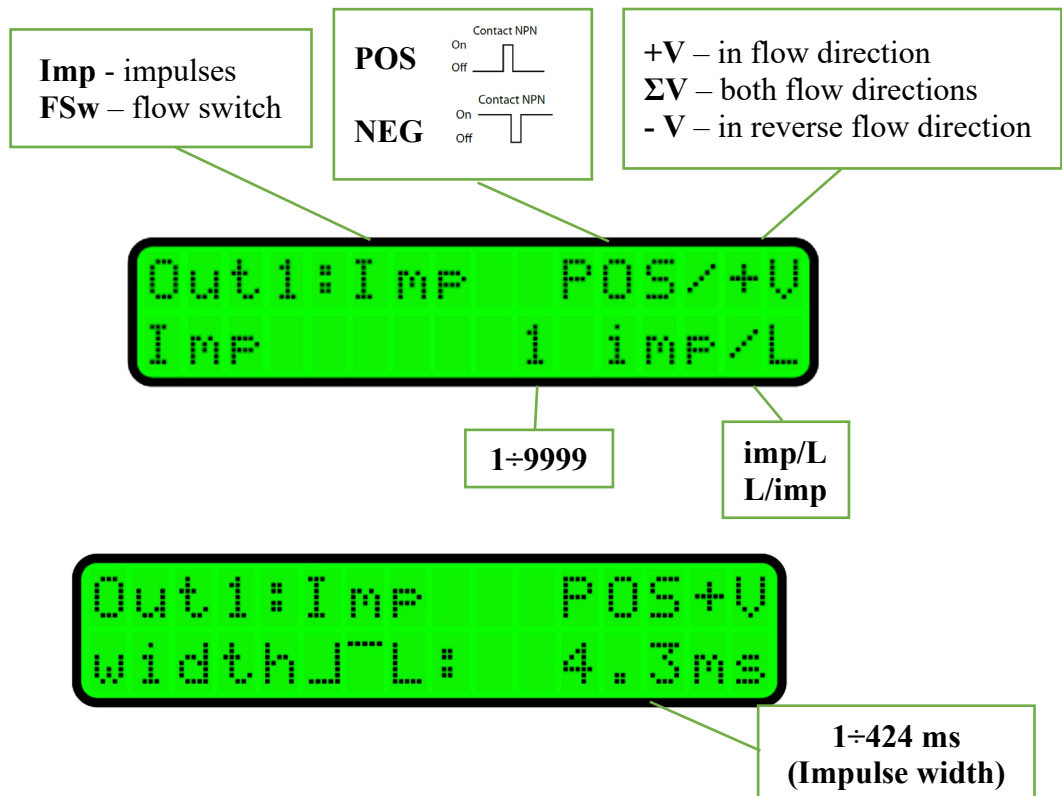
Fail 11.08.17  
day: 1823 06:43

## OUT1 setting

OUT1 can be configured as the impulse output or Flow Switch contact.

### Impulse output

In impulse output parameter setting, it is possible to change the logics (polarity) of the electrical signal (on-state/off-state), furthermore, to set the impulse output to which direction the volumetric counter will respond (volume run in positive direction, in opposite direction and in both directions) as well as your own impulse constant, including its indication (imp/L or L/imp) and impulse width.



\*Note

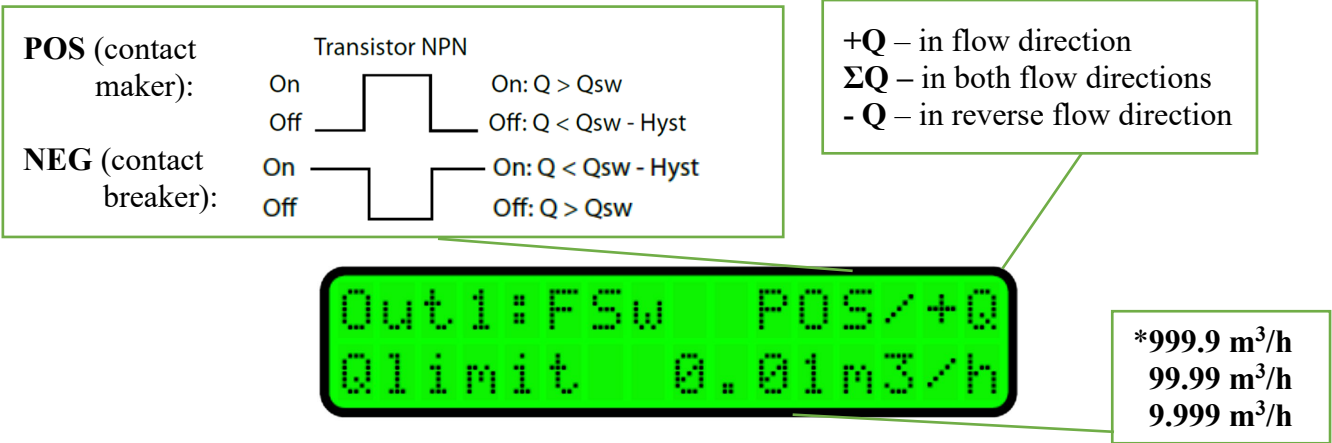
Period [ms] = pulse width [ms] + inter-pulse gap [ms] where gap ≥ width

The pulse width is selected in steps by scrolling through predefined values with ▲ or ▼ buttons.

### Flow switch operation

In “flow switch” status output parameter setting, it is possible to change the logics (polarity) of the electrical signal (on-state/off-state), furthermore, to set the output to which direction the output will respond (flow in positive direction, in opposite direction and in both directions) as well as your own switching point value.

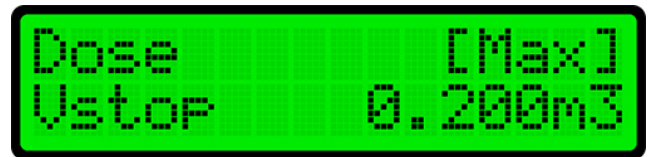
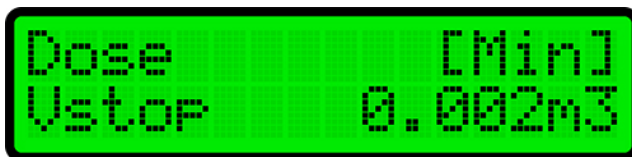
\*Qlimit - the number of decimal places is given by DN of the given meter and cannot be changed.



### Settings of dose range

There are two parameters for setting the dose range. According to these parameters, we can then determine the dose size with a rotary potentiometer on the body of the device. The choice of the maximum limit automatically affects the resolution in which the dose can be set so that the value set by the rotary element is stable - usually the value can be set to 3 valid digits (999 positions of the rotary switch). E.g. at a dose of 1000 liters, it will be possible to set the dose only in steps of 10 liters, etc.

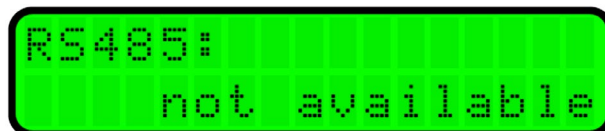
The setting is then carried out in the usual way by changing the dose value in m<sup>3</sup> for the minimum limit and then the maximum limit.



### Communication

If the flow meter is ordered with communication, it is possible to choose either MODBUS-RTU or MBUS protocols. RS485 is the physical layer of both protocols. In MODBUS-RTU protocol, it is possible to set parity and the number of stop bits. The parity of MBUS protocol is fixed to EVEN and the number of stop bits to 1. Due to the existing requirements for MBUS protocol and MBUS physical layer, it is necessary to use an interior expansion card. In this case, besides parity and stop bits, the transfer rate is fixed to 2400Bd as well.

The flow meter address can be in the range of 0 – 255. The MBUS protocol supports the broadcast address 254.



*If communication was not ordered.*



Address 0 - 255

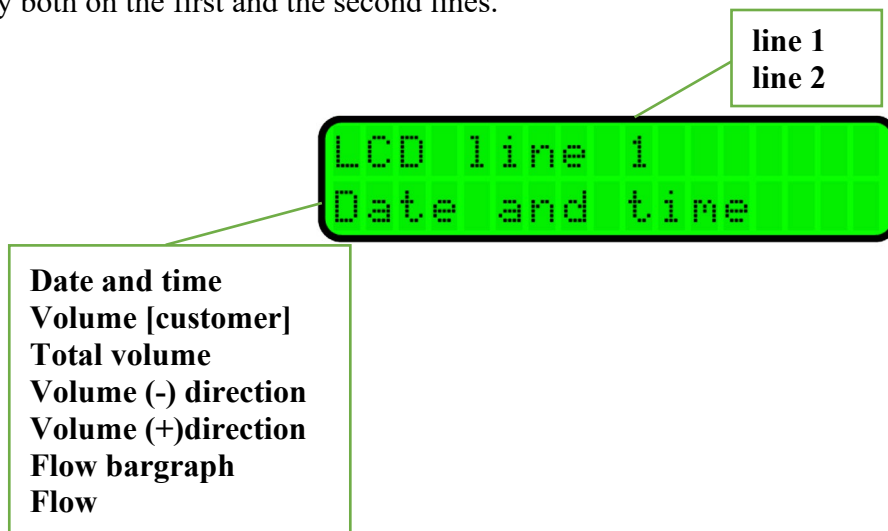
Transfer rate 1200Bd –  
9600Bd

parity: N – no parity  
E – even  
O – odd

Number of stop  
bits 1/2

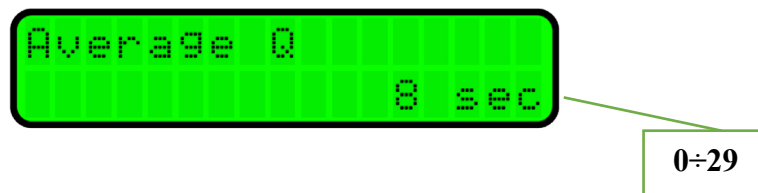
### *Idle state basic indications on display*

Basic indications in idle state can be influenced and modified in such a manner that the data needed by the user can be found on the first two lines on the display. Whereas the order of the other items is retained. If you want to change a setting, press the **E** and **▲** or **▼** buttons and select the data on the line which is then confirmed by the **E** button. The customer can select from these indications, namely both on the first and the second lines.



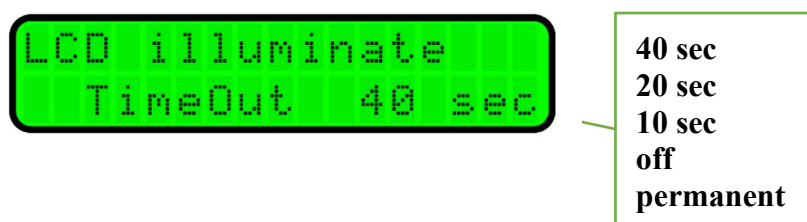
### *Flow rate damping*

Time averaging of flow rate values within the range is set here. Averaging is used both for the display unit and the current loop.



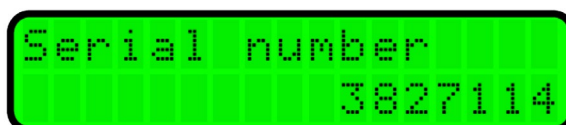
### *Display backlight*

Here, you can set the period during which the display backlight is turned off after the last activation of a button. Use the **▲** and **▼** buttons to select the desired settings from menu.



### *Serial number*

The serial number is registered in the factory and cannot be changed by user. Modifications can only be carried out by an authorized person under production password.



Serial number 3827114

### *Calibration constants*

Calibration constants are registered during the production and cannot be changed by user. Modifications can only be carried out by an authorized person under production password.



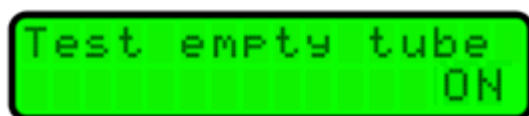
Constant k1 69548



Constant n1 -1

### *Empty tube test*

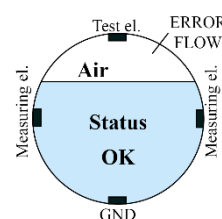
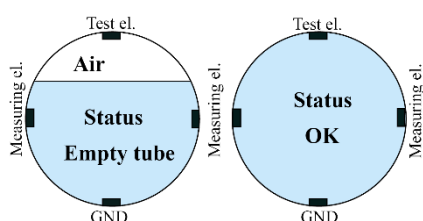
Activates and deactivates monitoring of measuring tube filling. If the meter was ordered without the testing electrode, the flooding test cannot be activated.



Test empty tube ON



Test empty tube OFF



### *Firmware version*

The firmware version is registered in the factory and cannot be changed by user.



FIRMWARE v8.22  
CRC32: 4D12A654

### ***Dead band – measurement of start suppression***

Star of measurement is registered in the factory and cannot be changed by user. Modifications can only be carried out by an authorized person under production password.

CutOff Q  
0.42m3/h

### ***Zero calibration***

The date under "Zero calibration" heading indicates the date when zero flow calibration was performed.

Adjust null Q  
-----

If you want to recalibrate the zero flow, press the **E** button. The flow meter evaluates the measured data automatically and if YES is set, upon confirmation of the selection by the **E** button, a new value for zero flow will be set and the date of the last recalibration is updated (when NO is selected, the value for recalibration is not registered and everything remains in original setting).

*Note: Before recalibration is performed, do not forget to close the valves first and secure a real zero flow (stationary medium) in the system.*

### ***Flow simulation***

Flow simulation serves for comfortable setting and checking the systems in which the flow meter is installed without necessity to use realistic flow of medium through the meter and without necessary installation of the meter in the pipeline. The display shows the simulated flow and current and impulse outputs of the meter correspond to this data. Such a simulated flow is not recorded in volume invoice registers, the control can be carried out in user resettable volume register **rV**.

**WARNING!** *If the meter runs in simulation flow mode, it does not return automatically after two and a half minutes as it is typical for all other modes and representations. After termination of flow simulation mode, it is necessary to exit Parameters menu by the (▼ long press >3sec) button!!!*

The customer can set the value of the simulated flow. If you want to activate or deactivate the simulation, press the **E** button.

Simulation Q OFF  
Qsim 0.00m3/h

ON  
OFF

Number of significant digits: 6

### *Language*

If you want to change the meter's language, press **E** and then select a desired language from menu.



**cz** – Czech  
**de** – German  
**en** – English  
**pl** – Polish  
**fr** – French  
**es** – Spanish

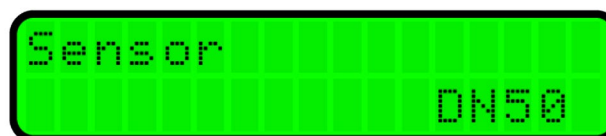
### *Counter resetting*

Here, it is possible to reset all or only certain volumetric counters. If you want to perform resetting, press **E** and select which counter you wish to reset ( $\Sigma V$ , -V, +V or all). After resetting, the date when the last reset was performed is displayed and which counter was reset (again,  $\Sigma V$ , -V, +V or all).



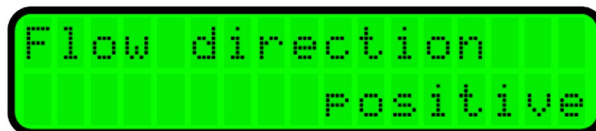
### *Nominal diameter (DN)*

This parameter is set in the factory and cannot be changed. DN modification can only be carried out by an authorized person under production password.



### *Flow direction*

Specifies the direction of flow in the flow sensor with respect to the data in electronics. Positive direction is the flow in the sensor identical to the arrow indicated on the meter's name plate. If the medium flows through the sensor against the arrow on the sensor, select the NEGATIVE direction. If you wish to make the change, press **E**.



### *Signal saturation filter*

The setting determines the behaviour of the input amplifier during saturation. Saturation can occur if the properties of the medium change abruptly or if there are impurities in the medium.



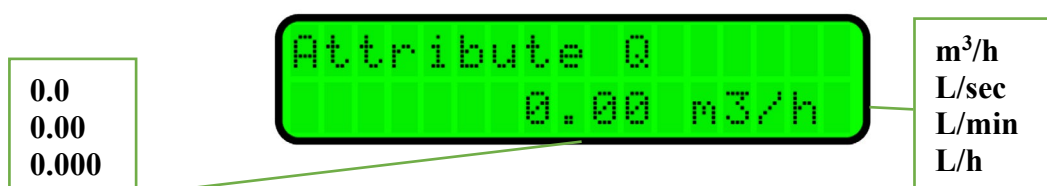
**OFF** – the meter will declare an error as soon as the input amplifier becomes saturated

**10sec** – the meter will replace the erroneous flow rate value due to saturation by the one right before saturation; this flow rate value is held for 10sec max. If the amplifier fails to return to normal state within 10sec, the error – Amp. signal limit is declared.

Instead of the flow index Q indicated on the display, the symbol “H” - hold is indicated.

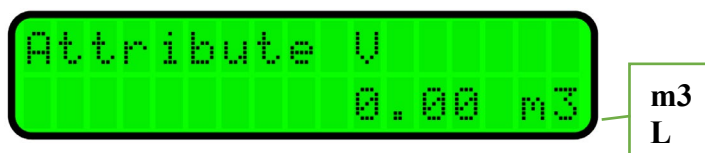
### *Flow units displayed [Q]*

If you wish to change the way of flow indication, press **E**. Use the  $\blacktriangle$  and  $\blacktriangledown$  buttons to set the required number of decimal places and by confirming with **E**, go to setting the flow unit representation.



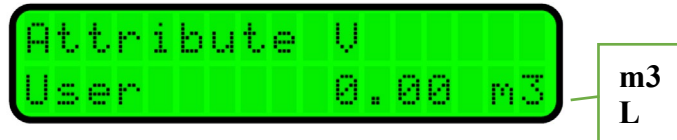
### *Volume units displayed [V]*

To change the way of volumetric indication (+V, -V and  $\Sigma V$ ), press **E**. The number of decimal places for the volumetric counters can be selected from 3 to none. Furthermore, the selection of units is here (L, m³). If these parameters are changed, the respective measured value will be changed as well. In consequence, we recommend resetting of the counters changed in this way after reconfiguration.



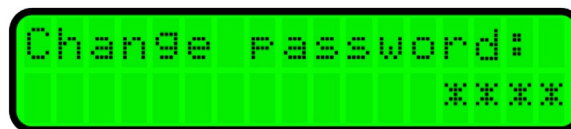
### *User counter with reset option*

It is the volumetric counter (rV) available to user who can reset it using external control buttons (simultaneously ▲ and ▼). The number of decimal places can be selected from 3 to none. Furthermore, the selection of units is here (L, m<sup>3</sup>). If these parameters are changed, the respective measured value will be changed in this counter as well – the value is not recalculated. In consequence, we recommend resetting of the counter changed in this way after reconfiguration.



### *Password change*

The password for modification of the customer parameters is set by default to **0000**. However, the user can change it in this window by pressing **E**. The access code must have 4 digits.



### *Default settings (original factory settings)*

During activation of this function, the configuration of the meter will be restored to the factory default state in which it was shipped. All settings carried out by the user will be cancelled and all volumetric counters will be reset.

The user password is cancelled and the access password is reset to original (0000). At the same time, the calibration constants will be set to the factory values. Before activating this function, it is useful to record or make a data backup of all counters.

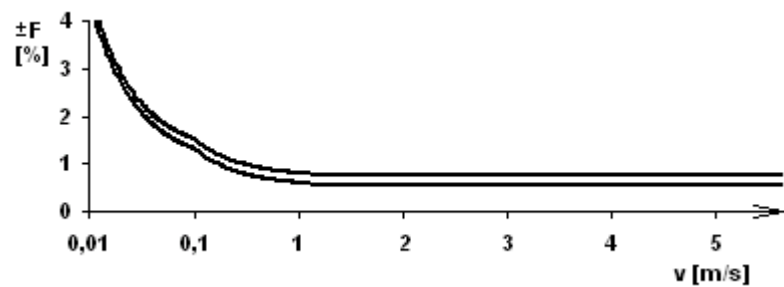


## *Technical data*

|                             |                                                                                                                                                                                                |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supply voltage:             | 230V AC (+10; -20%) 50 ÷ 60Hz                                                                                                                                                                  |
| Input power:                | 4.6VA                                                                                                                                                                                          |
| Display:                    | LCD 2 x 16 characters, backlit                                                                                                                                                                 |
| Size                        | DN 10÷400                                                                                                                                                                                      |
| Lining material             | rubber (hard, soft, certif. for potable water): DN25÷400 (up to 80°C)<br>PTFE: DN 15÷DN 250 (up to 150°C)<br>E-CTFE, FEP, PFA: DN 300÷DN 400 (do 130°C)<br>ceramics: DN 15÷DN80 (up to 170 °C) |
| Electrode material          | CrNi steel DIN 1.4571, Hastelloy C4, Titanium, Tantalum                                                                                                                                        |
| Construction                | all-welded frame                                                                                                                                                                               |
| Sensor material             | flanged – stainless steel and structural steel with polyurethane coating<br>sandwich, threaded, food processing – stainless steel                                                              |
| Process connection          | sandwich<br>flanged (EN1092)<br>threaded (EN ISO 228-1)<br>food processing (fittings DIN 11851, clamp)                                                                                         |
| Measuring range (Qmin/Qmax) | 0.2÷12 m/s (1/60); 0.12÷12 m/s (1/100); 0.06÷12 m/s (1/200)                                                                                                                                    |
| Flow meter accuracy         | up to 0.5 % (for 0.1 ÷ 10 m/s)                                                                                                                                                                 |
| Repeatability               | up to 0.2 % (for 0.1 ÷ 10 m/s)                                                                                                                                                                 |
| Additional electrodes       | reference, earthing and detection for empty pipeline (DN 15÷DN 400)                                                                                                                            |
| Empty pipeline detection    | DN 15÷DN 400                                                                                                                                                                                   |
| Min. conductivity of medium | 20 µS/cm (at a lower conductivity upon agreement with manufacturer)                                                                                                                            |
| Displayed values:           | flow – m <sup>3</sup> /h; L/h; L/min; L/s; positive, negative<br>volume – m <sup>3</sup> ; L; positive, negative, sum in both directions                                                       |
| Controls                    | 2× external button (START / STOP)<br>3× internal button (viewing + parameter modification)                                                                                                     |
| Inputs:                     | buttons START / STOP                                                                                                                                                                           |
| Outputs                     | impulse/flowswitch (max. 400 Hz, passive)                                                                                                                                                      |
| Communication:              | RS485 (M-BUS/Mod-Bus protocol)                                                                                                                                                                 |
| Sampling:                   | 12.5 samples per second                                                                                                                                                                        |
| Display response:           | 1.28 s                                                                                                                                                                                         |
| Design                      | separate (minimal cable length 3 m)                                                                                                                                                            |
| Pressure loss               | negligible                                                                                                                                                                                     |
| Pressure                    | PN10, PN16, PN25, PN40                                                                                                                                                                         |
| Cable entries               | LH (mains) 1 x cable max.φ 9 mm<br>RH (outputs) 1 x cable max.φ 7 mm                                                                                                                           |
| Ambient temperature         | 5 ÷ 55°C                                                                                                                                                                                       |
| Ambient humidity            | max. 90%                                                                                                                                                                                       |
| Head size                   | 220 x 170 x 80 mm (H x W x D),                                                                                                                                                                 |
| Weight                      | 2540 g (evaluation unit in detached version)                                                                                                                                                   |
| Material                    | ABS plastic                                                                                                                                                                                    |
| Max. ambient temperature    | 55 °C                                                                                                                                                                                          |
| Flow sensor protection      | IP65, IP67, IP68                                                                                                                                                                               |
| Electronics protection      | IP65                                                                                                                                                                                           |

If you do not find your size or structure in the Flow sensor technical parameters Table, it is a special or non-standard design. In this case, find the information on the sensor nameplate where this information is always indicated, or please contact the manufacturer for more detailed information.

Error limits at reference conditions (range 1:1000)



| Diameter nominal | Measured value maximum error |                      |                    | Curve |
|------------------|------------------------------|----------------------|--------------------|-------|
|                  | v >= 1 m/s                   | 1 m/s > v >= 0.1 m/s | v < 0.1 m/s        |       |
| DN [mm]          |                              |                      |                    |       |
| <= DN 10         | 0.8 % z M*                   | 0.72 % + 0.8 mm/s    | 1.52 % + 0.35 mm/s | 1     |
| >= DN 15         | 0.5 % of M*                  | 0.52 % + 0.8 mm/s    | 1.22 % + 0.35 mm/s | 2     |

\* Of M – of the measured value

## ***Factory settings***

The current loop is set in such a manner that 4 mA corresponds to zero flow and 20 mA corresponds to its maximum value.

The address of the meter is set to 1 by default and communication parameters to 2400Bd,8db,1sb,parity EVEN (Mbus) or 9600Bd,8db,1sb, no parity (Modbus).

Access password (PIN) for parameter changing is always set to **0000** and this value will be reset in case of restoring to factory default settings.

### *Impulse constants and current loop – factory settings*

| Diameter nominal<br>DN | Impulse output |                         | 4 – 20mA (in Qmin/Qmax 1/100 range) |                 |
|------------------------|----------------|-------------------------|-------------------------------------|-----------------|
|                        | Vout[imp/l]    | Vout - pulse width [ms] | Q[l/h] for 4mA                      | Q[l/h] for 20mA |
| 4                      | 10             | 4                       | 0                                   | 600             |
| 6                      | 10             | 4                       | 0                                   | 1,200           |
| 8                      | 10             | 4                       | 0                                   | 2,200           |
| 10                     | 10             | 4                       | 0                                   | 3,400           |
| 15                     | 10             | 4                       | 0                                   | 7,600           |
| 20                     | 10             | 4                       | 0                                   | 14,200          |
| 25                     | 10             | 4                       | 0                                   | 21,000          |
| 32                     | 1              | 4                       | 0                                   | 34,000          |
| 40                     | 1              | 4                       | 0                                   | 54,000          |
| 50                     | 1              | 4                       | 0                                   | 84,000          |
| 65                     | 1              | 4                       | 0                                   | 144,000         |
| 80                     | 1              | 4                       | 0                                   | 220,000         |
| 100                    | 0.1            | 4                       | 0                                   | 340,000         |
| 125                    | 0.1            | 4                       | 0                                   | 534,000         |
| 150                    | 0.1            | 4                       | 0                                   | 760,000         |
| 200                    | 0.1            | 4                       | 0                                   | 1,350,000       |
| 300                    | 0.1            | 4                       | 0                                   | 3,052,000       |
| 400                    | 0.1            | 2.5                     | 0                                   | 5,400,000       |
| 500                    | 0.1            | 2.5                     | 0                                   | 8,480,000       |
| 600                    | 0.01           | 2.5                     | 0                                   | 12,200,000      |

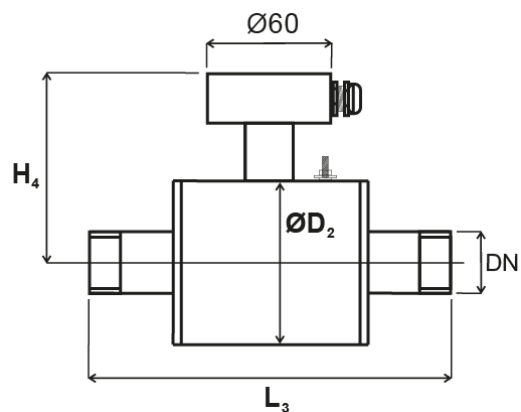
| Diameter nominal | Resolution V | Resolution Q   |
|------------------|--------------|----------------|
| DN≤25            | V [0.001 m3] | Q [0.001 m3/h] |
| 80≥DN>25         | V [0.01 m3]  | Q [0.01 m3/h]  |
| DN>80            | V [0.1 m3]   | Q [0.1 m3/h]   |

***Table with flow ranges for individual DN sizes***

| Diameter nominal<br>[mm] | Qmin [m3/h] as per Qmin /Qmax |                  |                  | Qmax [m3/h]<br>(12 m/s) |
|--------------------------|-------------------------------|------------------|------------------|-------------------------|
|                          | 1/60 (0.2 m/s)                | 1/100 (0.12 m/s) | 1/200 (0.06 m/s) |                         |
| DN 4                     | 0.01                          | —                | —                | 0.6                     |
| DN 6                     | 0.02                          | —                | —                | 1.2                     |
| DN 8                     | 0.04                          | —                | —                | 2.2                     |
| DN 10                    | 0.06                          | 0.034            | —                | 3.4                     |
| DN 15                    | 0.13                          | 0.076            | —                | 7.6                     |
| DN 20                    | 0.24                          | 0.142            | 0.071            | 14.2                    |
| DN 25                    | 0.35                          | 0.21             | 0.105            | 21                      |
| DN 32                    | 0.6                           | 0.34             | 0.17             | 34                      |
| DN 40                    | 0.9                           | 0.54             | 0.27             | 54                      |
| DN 50                    | 1.4                           | 0.84             | 0.42             | 84                      |
| DN 65                    | 2.4                           | 1.44             | 0.72             | 144                     |
| DN 80                    | 3.6                           | 2.2              | 1.1              | 220                     |
| DN 100                   | 5.6                           | 3.4              | 1.7              | 340                     |
| DN 125                   | 8.9                           | 5.34             | 2.67             | 534                     |
| DN 150                   | 13                            | 7.6              | 3.8              | 760                     |
| DN 200                   | 23                            | 13.5             | 6.75             | 1350                    |
| DN 250                   | 35                            | 21.1             | —                | 2115                    |
| DN 300                   | 51                            | 30               | —                | 3050                    |
| DN 350                   | 70                            | 41               | —                | 4150                    |
| DN 400                   | 90                            | 54               | —                | 5426                    |
| DN 500                   | 141                           | —                | —                | 8480                    |
| DN 600                   | 203                           | —                | —                | 12200                   |

## Basic sensor sizes

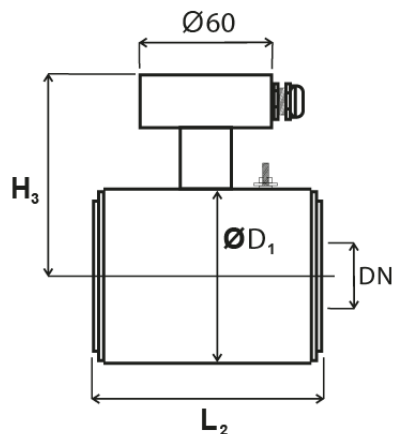
### Threaded design



| Diameter nominal [mm] | Threaded connection | D <sub>2</sub> Outside diameter of sensor | L <sub>3</sub> Building length of sensor | H <sub>4</sub> Building height of sensor | Weight of detached flow sensor (kg) |
|-----------------------|---------------------|-------------------------------------------|------------------------------------------|------------------------------------------|-------------------------------------|
| 4                     | ½"                  | 70                                        | 157                                      | 92                                       | 4                                   |
| 6                     | ½"                  | 70                                        | 157                                      | 92                                       | 4                                   |
| 8                     | ½"                  | 70                                        | 157                                      | 92                                       | 4                                   |
| 10                    | 3/8"                | 70                                        | 186                                      | 90                                       | 4                                   |
| 15                    | ½"                  | 70                                        | 190                                      | 90                                       | 4                                   |
| 20                    | ¾"                  | 80                                        | 200                                      | 95                                       | 4                                   |
| 25                    | 1"                  | 90                                        | 200                                      | 100                                      | 5                                   |
| 32                    | 1 ¼"                | 100                                       | 228                                      | 105                                      | 5                                   |
| 40                    | 1 ½"                | 116                                       | 248                                      | 113                                      | 6                                   |
| 50                    | 2"                  | 136                                       | 258                                      | 123                                      | 6                                   |

The Table is for PN25.

### *Sandwich (Inter-flanged) design*

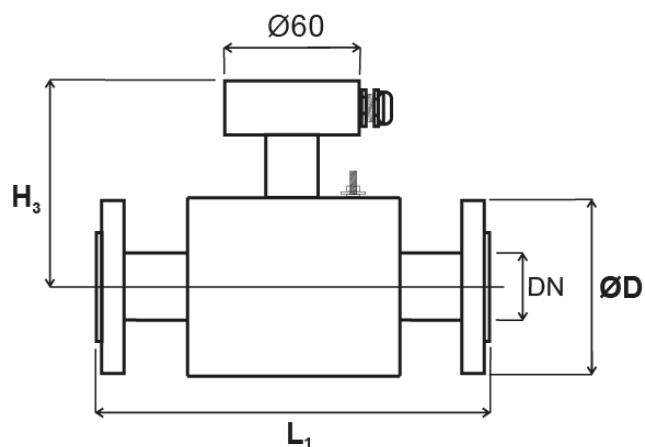


| Diameter nominal [mm] | D <sub>1</sub><br>Outside diameter of sensor | L <sub>2</sub><br>Building length of sensor | H <sub>3</sub><br>Building height of sensor | Weight of detached flow sensor (kg) |
|-----------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------|
| 10*,15                | 51                                           | 90                                          | 110                                         | 2                                   |
| 20                    | 61                                           | 90                                          | 120                                         | 2                                   |
| 25                    | 71                                           | 90                                          | 130                                         | 3                                   |
| 32                    | 82                                           | 90                                          | 140                                         | 3                                   |
| 40                    | 92                                           | 110                                         | 150                                         | 4                                   |
| 50                    | 107                                          | 110                                         | 165                                         | 4                                   |
| 65                    | 127                                          | 130                                         | 185                                         | 5                                   |
| 80                    | 142                                          | 130                                         | 200                                         | 6                                   |
| 100                   | 168                                          | 200                                         | 226                                         | 7                                   |
| 125                   | 194                                          | 200                                         | 253                                         | 9                                   |
| 150                   | 224                                          | 200                                         | 283                                         | 11                                  |
| 200                   | 284                                          | 200                                         | 340                                         | 14                                  |

*The Table is for PN25.*

*\* Process connection is performed through DN 15 flange*

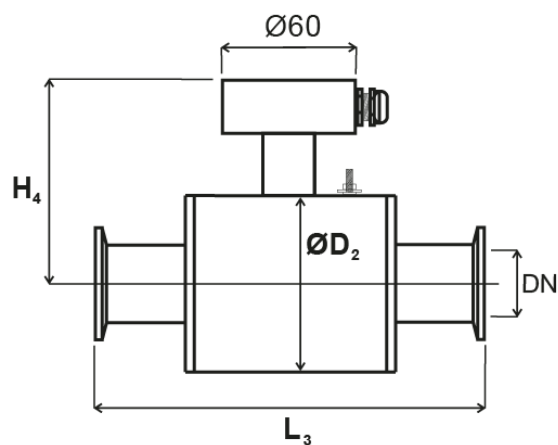
## Flanged design



| Diameter nominal [mm] | D Outside diameter of flanges                                                  | L <sub>1</sub> Building length of sensor | H <sub>3</sub> Building height of sensor | Weight of detached flow sensor (kg) |
|-----------------------|--------------------------------------------------------------------------------|------------------------------------------|------------------------------------------|-------------------------------------|
| 10*,15                | The outside diameter corresponds to the required pressure class and standards. | 200                                      | 86                                       | 4                                   |
| 20                    |                                                                                | 200                                      | 86                                       | 4                                   |
| 25                    |                                                                                | 200                                      | 91                                       | 5                                   |
| 32                    |                                                                                | 200                                      | 96                                       | 6                                   |
| 40                    |                                                                                | 200                                      | 101                                      | 7                                   |
| 50                    |                                                                                | 200                                      | 109                                      | 9                                   |
| 65                    |                                                                                | 200                                      | 119                                      | 11                                  |
| 80                    |                                                                                | 200                                      | 126                                      | 12                                  |
| 100                   |                                                                                | 250                                      | 139                                      | 19                                  |
| 125                   |                                                                                | 250                                      | 152                                      | 26                                  |
| 150                   |                                                                                | 300                                      | 167                                      | 37                                  |
| 200                   |                                                                                | 350                                      | 197                                      | 44                                  |
| 250                   |                                                                                | 450                                      | 240                                      | 65                                  |
| 300                   |                                                                                | 500                                      | 265                                      | 78                                  |
| 350                   |                                                                                | 550                                      | 295                                      | 88                                  |
| 400                   |                                                                                | 600                                      | 325                                      | 106                                 |
| 500                   |                                                                                | 600                                      | 797                                      | 115                                 |
| 600                   |                                                                                | 600                                      | 930                                      | 125                                 |

The Table is up to DN 200 for PN25, DN250 and DN300 for PN16, DN350 to DN600 for PN10.

\* Process connection is performed through DN 15 flange

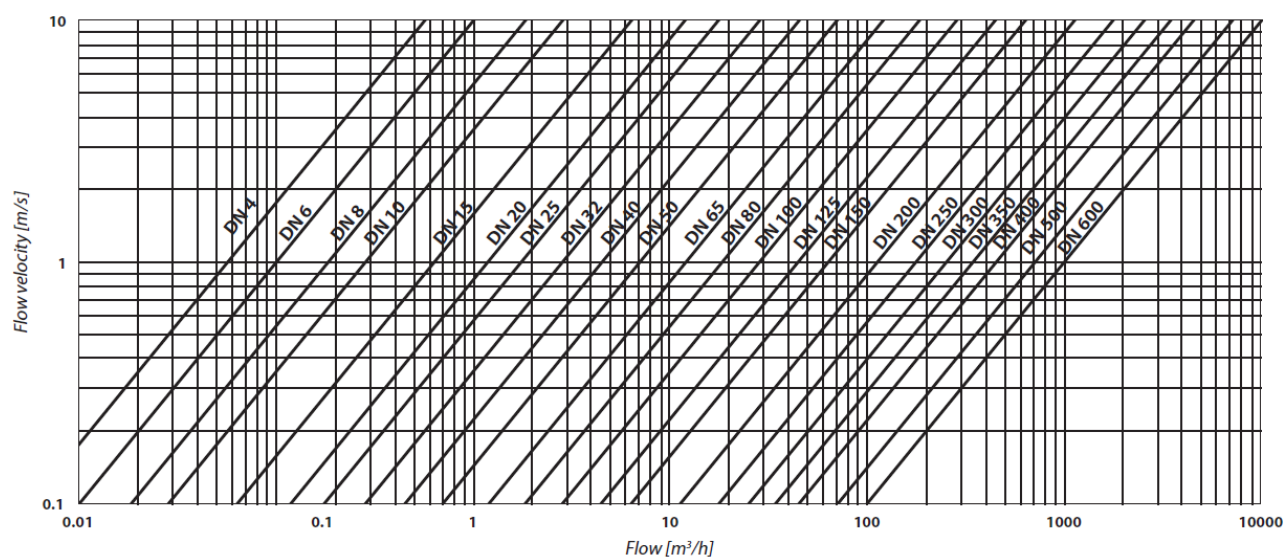


| Diameter nominal [mm] | Food grade connection CLAMP/Screwed fitting | D <sub>2</sub> Outside diameter of sensor | L <sub>3</sub> Building length of CLAMP | L <sub>3</sub> Building length of food grade screwed fitting | H <sub>4</sub> Building height of sensor | Weight of detached flow sensor (kg) |
|-----------------------|---------------------------------------------|-------------------------------------------|-----------------------------------------|--------------------------------------------------------------|------------------------------------------|-------------------------------------|
| 10                    | DN 10                                       | 70                                        | 180                                     | 173                                                          | 90                                       | 4                                   |
| 15                    | DN 15                                       | 70                                        | 175                                     | 165                                                          | 90                                       | 4                                   |
| 20                    | DN 20                                       | 80                                        | 175                                     | 170                                                          | 95                                       | 4                                   |
| 25                    | DN 25                                       | 90                                        | 175                                     | 180                                                          | 100                                      | 5                                   |
| 32                    | DN 32                                       | 100                                       | 175                                     | 192                                                          | 105                                      | 5                                   |
| 40                    | DN 40                                       | 116                                       | 203                                     | 215                                                          | 113                                      | 6                                   |
| 50                    | DN 50                                       | 136                                       | 211                                     | 228                                                          | 123                                      | 7                                   |
| 65                    | DN 65                                       | 151                                       | upon agreement                          | upon agreement                                               | 131                                      | 7                                   |
| 80                    | DN 80                                       | 177                                       | upon agreement                          | upon agreement                                               | 144                                      | 8                                   |

The Table is for PN25.

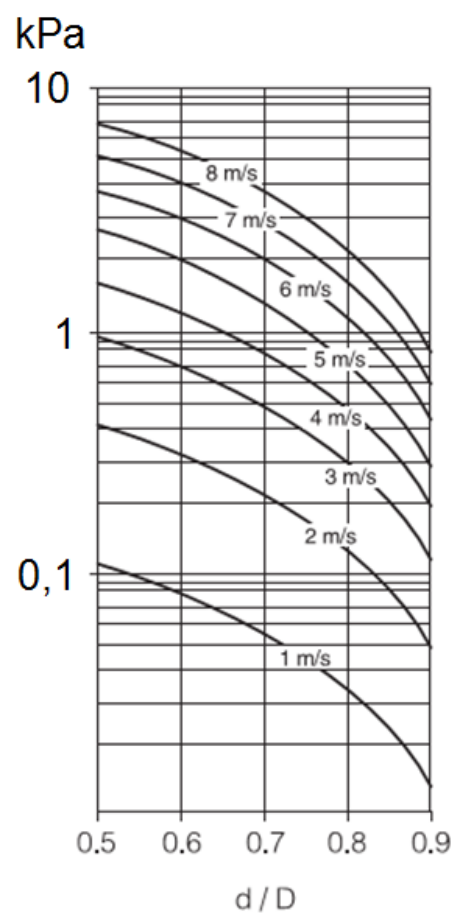
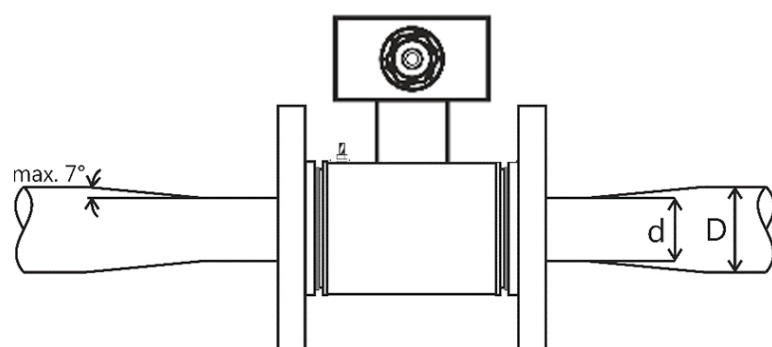
| Diameter nominal [mm]           | DN 15...DN 20 | DN 25...DN 40 | DN 50 | DN 65 | DN 80 |
|---------------------------------|---------------|---------------|-------|-------|-------|
| Outside dimension of CLAMP [mm] | 34            | 50,5          | 64    | 91    | 106   |

## Nomogram for quick proposal of the measured place



## Reduction in DN pipe

If the pipe's DN is higher than that of the meter selected



## ***Faults and their symptoms during measurement***

Unstable indications and readouts may appear due to:

- big portion of solids
- in homogeneities as a result of the state of matter
- turning point of immixture
- continuous chemical reactions in the measured fluid
- use of diaphragm pumps or plunger pumps
- poor grounding

## ***Flow sensor cleaning***

Some measured liquids contain substances and chemicals that tend to form layers inside the pipes including the measuring pipe, which may affect the measurement accuracy. In this case it is necessary to clean the flow sensor from time to time. Ceramic pipes can be cleaned mechanically with a steel brush and then the cleaning can be completed using diluted hydrochloride acid or citric acid solution. The acid removes calcareous layers or black layers of iron complex. If the contamination is greasy, it must be cleaned by caustic soda or potassium hydroxide solution. Flow sensors with teflon, plastic and rubber measuring pipe cannot be cleaned mechanically with a brush, it is only possible to clean them chemically. After cleaning, the pipe must be properly rinsed with water.

## ***Servicing***

All repairs within warranty and after warranty period are only conducted by the manufacturer, **COMAC CAL s. r.o.**

*When the operations described below are carried out incompetently, the claim for warranty for errors resulting from this becomes null and void !!!*

*Turn off the power every time the evaluation unit is opened!!!*

## ***Form for shipment of the meter back to COMAC CAL s.r.o.***

The meter you have was made with the maximum precision and it has been checked many times and wet calibrated.

If the meter is used in agreement with this manual, the occurrence of faults is very rare. Should they ever occur, contact our service department. If you return the meter to the manufacturing plant, adhere to the conditions stated below:

- Clear the meter of contaminations stuck to the sensor and measuring tube (eventually to the Evaluation Unit).
- If the meter was run with poisonous, etching, combustible liquids or with fluids dangerous to water, check it and if appropriate, flush and neutralize the cavities inside the sensor.

Fill in the following data please and the form duly completed attach to your consignment. COMAC CAL s.r.o. will not be able to process your request promptly and correctly without this form.

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### *Customer*

Company..... City.....  
Department..... Name.....  
Phone no.....

### *Enclosed meter*

Type..... Serial number.....  
Measured liquid.....

Description of a fault or modifications required.....  
.....  
.....  
.....

We confirm that the meter was duly cleaned, and if required, it was flushed out and neutralized. Therefore, this consignment does not constitute any risk to humans and environment due to remnants of the measured fluid.

Date..... Signature and stamp.....