



**COMAC CAL**

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

# **FLOW 32**

Ver. 4.0

*Installation and technical conditions*

**Date of issue 18/06/2019**

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## ***Description of the device***

The FLOW 32 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 32 induction meter is suitable exclusively for measurement of volumetric flow of electrically conductive liquid substances with a minimum conductivity of 20  $\mu\text{S}/\text{cm}$ .

The meters are designed for flow measurement within the corresponding range according to individual sizes, whereas it holds true that the higher velocity of the liquid flowing through the meter the higher measurement accuracy.

## **Scope of delivery**

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

### *Threaded connection design*

The electronic evaluation unit is incorporated right in the flow meter section in order to form its integral part, the respective flow rate sensor (grounding electrodes are formed by threaded connection), installation instructions.

### *Hose nipple connection design*

The electronic evaluation unit is incorporated right in the flow meter section in order to form its integral part, the respective flow rate sensor (grounding electrodes are made up of screw joints), hose nipples for threaded connection, installation instructions.

## ***Storage conditions***

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

## ***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**

#### *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 flow meter, the manufacturer recommends using a protective box or a roof to avoid direct solar exposure so that the meter 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.

#### *Actual location*

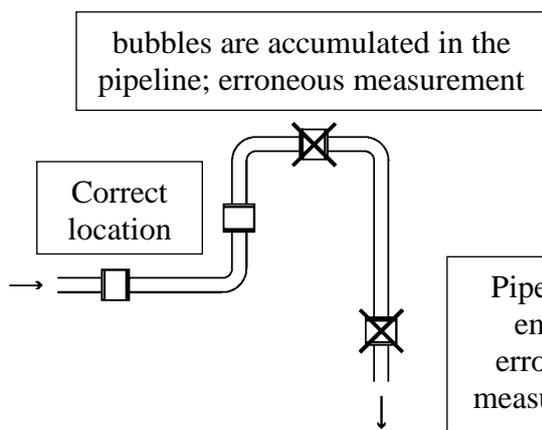
The flow sensor (detector) must not be at the top position of the pipe which may be airlocked, or in declining or even in horizontal pipelines with open ends in which air may penetrate. Impurities may accumulate during long-term measurement of very low flow rates  $Q < 0.1$  m/sec. There must be a sufficient 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.

For correct operation of the meter, the flow sensor should be constantly flooded with the measured fluid to avoid erroneous readout of the amount of the fluid supplied in case that the piping 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.

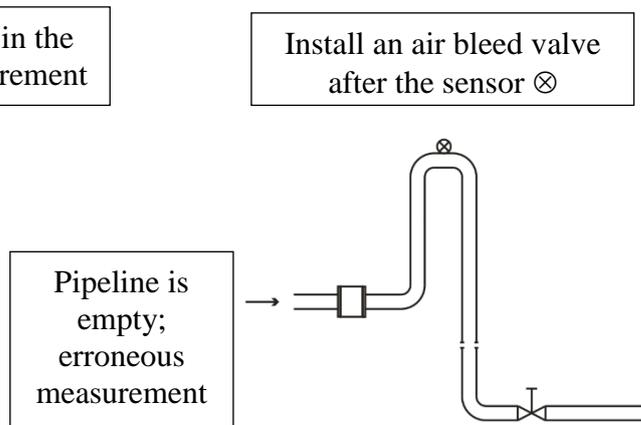
### Installation examples

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:

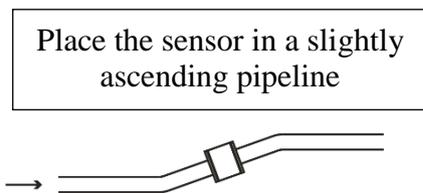
#### Recommended installation locations



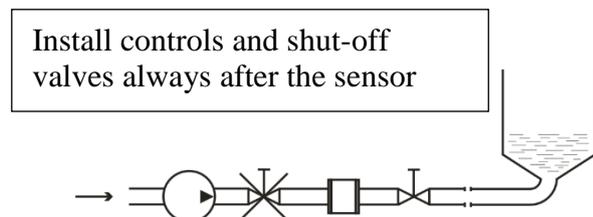
#### Downtake pipe



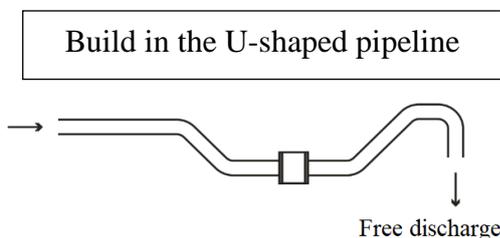
#### Horizontally laid pipeline



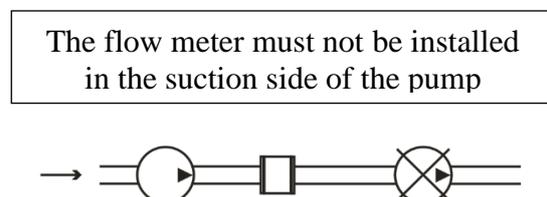
#### Long pipeline



#### 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 (min.  $30 \times d$  where  $d$  is the inside diameter of the meter in millimetres), otherwise it will result in instability of indication.
- 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

*In case of any intervention in the measuring circuit, it is necessary to consider the piping system as being filled up with medium regardless of the state of the test indicated by the empty tube on the meter!!!*

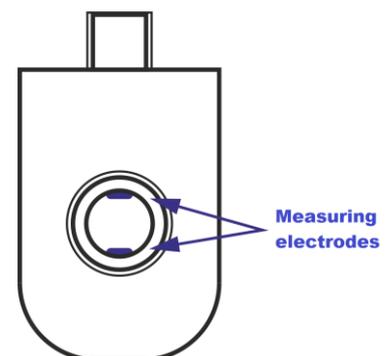
When preparing the piping, the **alignment** of both connecting ends must be followed so that the levelness of seating faces is ensured and that the flow meter body is not exposed to any excessive tensile and bending loading.

The welding current must not run through the flow sensor during electrical welding and power supply must always be disconnected. Welding equipment must not be used in the proximity of the flow meter due to possible thermal damage.

The installation itself is implemented by using adequate construction spanners according to the flow meter threaded connection and with the use of a gasket (not included in delivery). When tightening, use another key on the threaded connection of the meter to lock. Mind the correct angular position of the meter so that the liquid can flow through the flow meter in the direction **indicated** on the sensor plate with an **arrow**.

### Installation position

The flow meter is installed in vertical piping in any position. In case of horizontal piping, it is necessary to make sure that the sensor is installed with its measuring electrodes in horizontal position. If there is a horizontal piping and the meter is positioned with the connector upwards, it is necessary to put the meter in the U-profile in such a way that constant immersion of the electrodes is ensured.

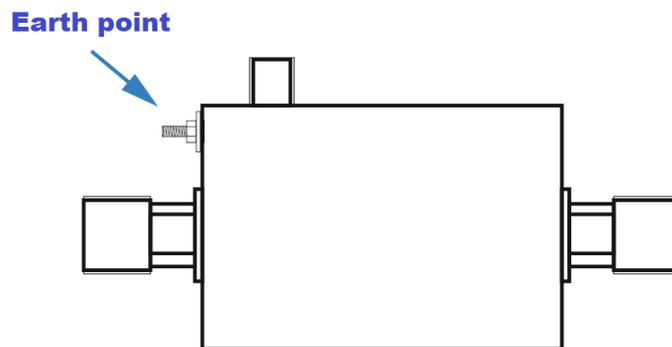


During installation, beware of:

- dropping the sensor on the ground and damaging
- 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

### *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. If a piping system is not earthed properly, it is necessary to connect the earth point of the meter with the electrical potential of the earth so that proper earthing is reached and the meter can operate reliably.



### *Electrodes*

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).

### *Temperature of medium*

For the meter, it is necessary to respect the temperature of medium up to 70 °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).
- Accuracy of flow sensor earthing.
- Accuracy of execution of the pipeline calming section lengths
- If the sensor is protected against vibrations and mechanical damage.

## Wiring system

*Workers performing wiring are subject to the requirements of Decree No. 50/1978 Coll. on activities on electrical equipment!!!*

*When the following operations are performed unprofessionally, the claim on warranty for the resulting errors becomes extinct!!!*

*Prior to any manipulation with the meter, switch off the power!!!*

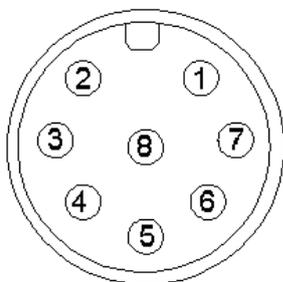
## Meter wiring

### Evaluation unit

As a standard, the evaluation unit is delivered for 24V DC $\pm$ 15% /250mA power supply.

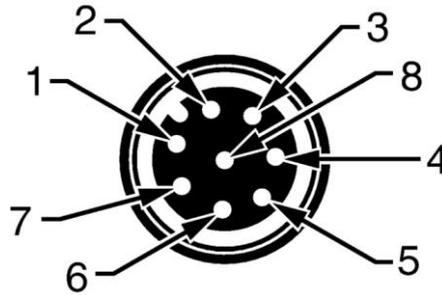
The flow meter signal outputs must only be connected to devices where accident protection is provided by safe low voltage and where generated voltages do not exceed the limits defined for safe low voltage.

Electrical connection of the meter is carried out by means of 8-pin M12x1 connector  
All signals are **active**.



- PIN 1 – Service communication (Txd)
- PIN 2 - OUT1 impulse (collector – positive potential)
- PIN 3 – OUT2 impulse/FlowSwitch/direction  
(collector – positive potential)
- PIN 4 – Service communication (Rxd)
- PIN 5 – OUT3 failure (collector – positive potential)
- PIN 6 - Analog output 4÷20mA +
- PIN 7 - GND
- PIN 8 - +Vdd (24VDC $\pm$ 15%)

Standard connection of the cable to the M12 connector against the socket on the meter's body:



### Impulse output OUT1/OUT2

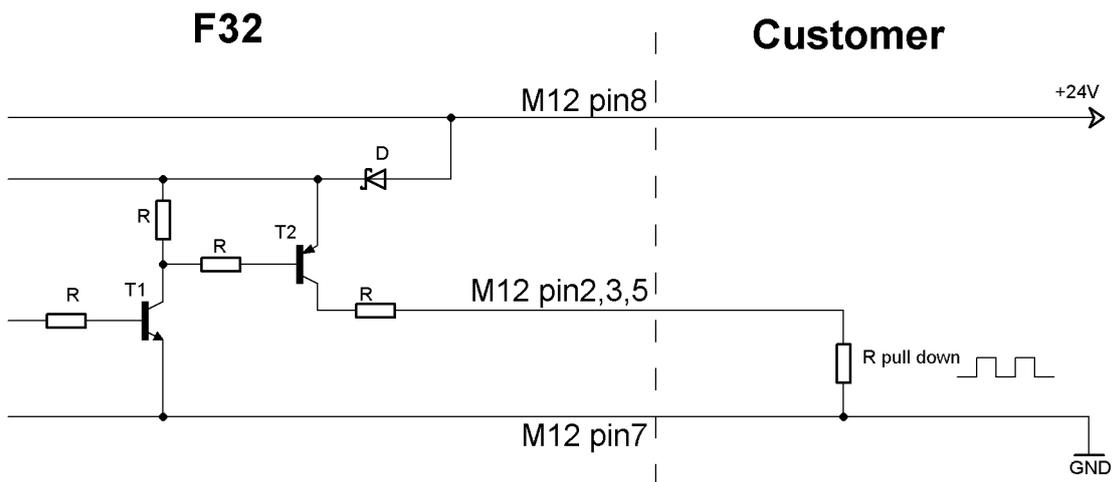
The OUT1 and OUT2 impulse outputs are implemented by a PNP transistor, the emitter of which is internally connected to VCC and with its collector connected to connector M12, whereas it is an **active** output.

The OUT1 is used for remote transmission of volumetric impulses and for metrological verification of the flow meter. Conversion constant and pulse width are set by the manufacturer during production.

OUT2 can be configured by the manufacturer during production to the following options:

- Volumetric impulses in positive direction of flow **IMP +**
- Volumetric impulses in negative direction of flow **IMP -**
- Indication of the direction in which the medium flows
- Flow switch functions
- Shift phase

The transistor rating should be selected so that its limit parameters cannot be exceeded (200mA/100mW max.).



Wiring example:

Maximum frequency of the impulse output is 16kHz.

### Status output OUT3

The status output OUT3 is specified for sending the **FAULTY STATE** information, whereas the faulty state is one of the two states:

- Defective flow sensor
- Measured signal is beyond limits (signal cannot be measured)

This failure output is **active** and it is implemented identically as OUT1/OUT2, on connector pin 5.

*Note: - The failure status is indicated by open outputs!*

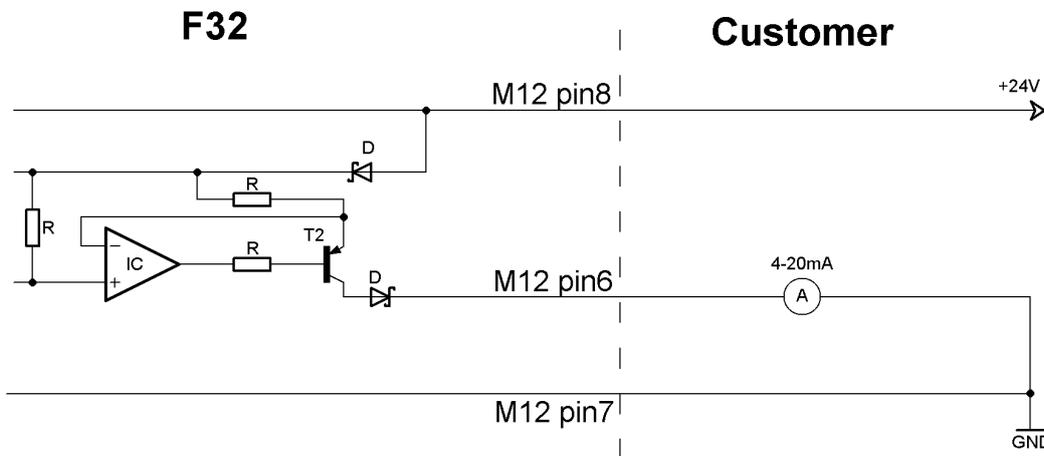
### Current output

The current output is also **active**. The positive output of the current loop is connected to 5. The loop resistance must not be higher than  $600\Omega$ . As standard, it is set in such a way that with the maximum flow  $Q_{max}$  the loop current is 20mA and with the zero or negative flow, the loop current is 4mA. The current value is directly proportional to that of the flow in the sample.

The flow limits of the current output are arbitrarily adjustable by the manufacturer during production (float data type) by means of the service communication interface.

In case of a failure or due to the loss of power, the current output falls under 4mA (usually to 3mA) and thereby a higher-level system can detect the error state.

*Active current loop example:*



*Feasible output configurations*

OUT1 (impulse)	OUT2 (status/impulse)	Analog OUT
impulses in flow direction	impulses in flow direction	4-20mA in flow direction
impulses in flow direction	impulses in reverse flow direction	4-20mA in flow direction
impulses in both flow directions	flow direction	4-20mA in both flow directions
impulses in flow direction	impulses in flow direction, phase-shifted	4-20mA in flow direction
impulses in flow direction	flow monitoring (in flow direction only)	4-20mA in flow direction

## Wiring check

After completion of wiring, it is necessary to check:

- Connecting cables for damage.
- Cables for pull relief.
- Correct connection of cables to terminals.
- Whether the supply voltage corresponds with the nameplate data.

## *Putting into operation*

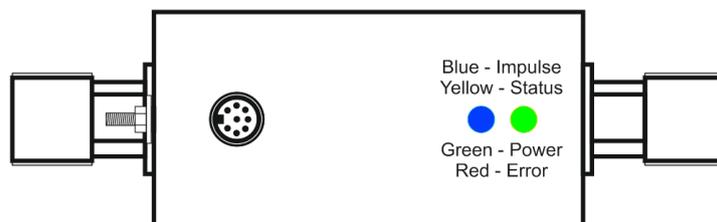
Prior to connection to power supply, check the device installation accuracy in accordance with “Installation in pipeline“ and “Wiring” chapters.

Do not power up the meter during installation before the system is filled with the measured medium and power off the meter before the system is discharged. After the meter is powered up, the green LED on the top cover next to the M12 connector is lit, confirming the supply voltage on the control PCB and stabilization of parameters of the meter takes place afterwards (approx. 5 sec). After that period of time, the meter starts measuring.

### *Meter status:*

It is continuously displayed by two indicator LEDs located in the evaluation unit top cover. The meter status indicated by the LEDs can be as follows:

LED1	LED2	Description	Current output
● green	-	The meter is in good order and the flow is null or negative	4mA
● green	● blue LED is flashing	The meter is in good order and the flow is positive where the blue LED is indicating the transmission of volumetric pulses	4÷20mA
● red LED	-	Meter is out of order, service necessary	<4mA
● red LED	● yellow LED	Meter is temporarily beyond parameters	<4mA
-	-	Supply voltage error	-



### *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.*

### *Basic parameter settings*

The parameters of the meter or those of the flow meter are set by the manufacturer according to order and basic data are indicated on the flow meter.

### *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. In case of a high temperature of the medium, the flow meter itself can be heated up so you must be careful and avoid contacting the device.

## ***Technical data***

### *Evaluation electronics technical parameters*

Power	24VDC±15 % / 250mA with polarity reversal protection
Input power	3 VA
Electrical connection	M12x1, 8-pin
Display	4× LED, LCD display (4x8)
Construction	compact
Maximum temperature of medium	70 °C (as per lining), at a higher temperature, upon agreement with manufacturer
Size	DN 4 ÷ 20
Lining material	PVDF
Electrode material	CrNi steel DIN 1.4571
Material coming in contact with medium	stainless steel EPDM and Silicone seals PVDF
Measuring range (Qmin/Qmax)	unidirectional/bidirectional for 0.2÷12 m/s (1/60)
Accuracy:	1% for 1 ÷ 10 m/s 2% for 0.2 ÷ 1 m/s
Repeatability	up to 0.4 % (for 0.1 ÷ 10 m/sec)
Min. medium conductivity (manufacturer)	20 µS (at a lower conductivity, upon agreement with manufacturer)
Controls	2x button
Outputs (active):	OUT1 – impulse (max. 16kHz) OUT2 – impulse/status (max. 16kHz) OUT3 - status Analog 4÷20 mA
Communication	IO-LINK or Bluetooth
Design:	IO-LINK Bluetooth and IO-LINK LCD display and IO-LINK
I/O response:	70ms (current loop)
Process connection	threaded (EN ISO 228-1)
Sampling:	900 samples per second (standard)
Max. ambient temperature	55°C
Ambient humidity:	max. 90%
Pressure	PN25
Pressure loss	negligible
Meter IP code	IP65

*Factory configuration of outputs*

OUT1 (impulse)	OUT2	OUT3	Analogue OUT
impulses in flow direction	impulses in reverse flow direction	status output – Failure	4-20mA in flow direction

*Table with flow ranges for individual DN sizes*

Diameter nominal [mm]	Qmin [m3/h]	Qmax [m3/h]
DN 4	0.02	0.5
DN 6	0.03	1
DN 8	0.04	2
DN 10	0.06	3
DN 15	0.2	7
DN 20	0.25	10

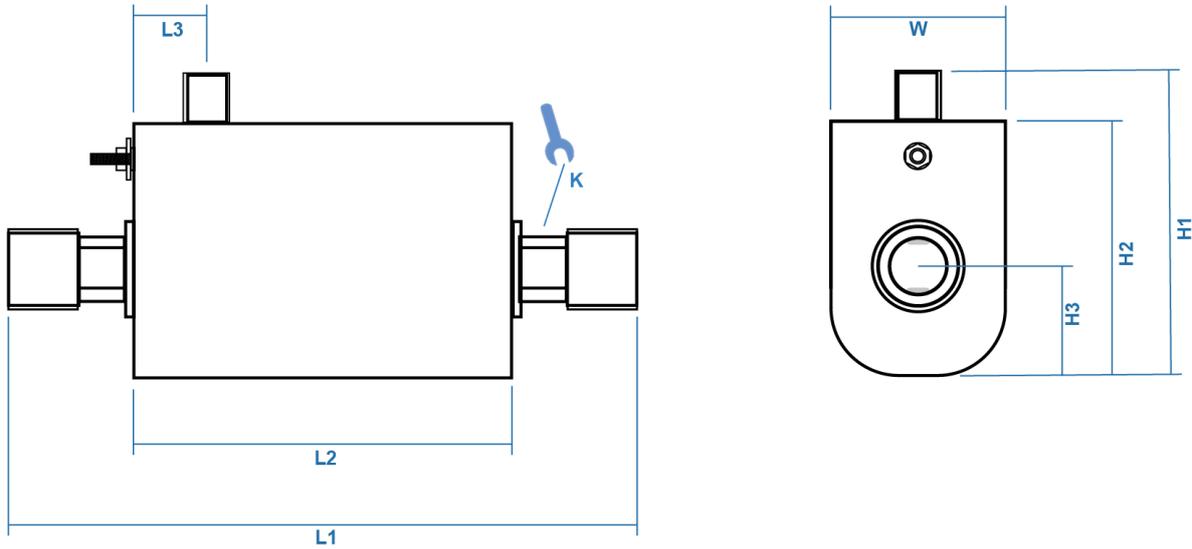
*Factory settings*

*Impulse constants and current loop – factory settings*

Diameter nominal 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	100	4	0	540
6	100	4	0	1200
8	10	4	0	2200
10	10	4	0	3 400
15	10	4	0	7 600
20	10	4	0	14 200

## *Basic detector sizes*

### *Threaded design*



Diameter nominal [mm]	Threaded connection	L1	L2	L3	W	H1	H2	H3	K	Compact flow meter weight (kg)
4	1/2"	161	97	16.5	49	80	70	32	17	1.2
6	1/2"	161	97	16.5	49	80	70	32	17	1.2
8	1/2"	161	97	16.5	49	80	70	32	17	1.2
10	1/2"	161	97	16.5	49	80	70	32	17	1.1
15	1/2"	161	97	16.5	49	80	70	32	17	1
20	3/4"	161	97	16.5	49	80	70	32	22	1

## Display

### Basic display view

- Current flow rate  $Q$  [ $m^3/h$ ]
  - Volumetric counter  $V$  [ $m^3$ ]
- Both values are shown in 3 decimal places.

### Display setting view

- DO1 digital output:  $\pm Imp$  /  $+Imp$  (bidirectional/unidirectional)
- DO2 digital output: Pos/Neg /  $+FS$  / Pha /  $+Imp$  /  $-Imp$  (direction of flow/monitor of flow in positive direction/phase-shifted DO1 /impulses in positive direction/impulses in negative direction where the impulse constant is always equal as in DO1)
- Flow monitor  $+FS$  [ $l/h$ ] (at DO2 output): switching point in positive direction of flow / hysteresis in per cents
- AO analogue output:  $\pm Loop/+Loop$  (Current loop active during the flow in both directions / in positive direction whereas the setting is specified by DO1 mode)
- Limit of current output [ $l/h$ ]: for 4mA / for 20mA / offset for 4mA / offset for 20mA
- Starting flow rate measurement:  $\pm Q$  [ $l/h$ ]
- Flow direction: Inlet/Outlet (in the direction of the arrow on the meter's name-plate)
- Flow rate simulation:  $+Q$  [ $l/h$ ] (for verification of the flow meter functionality and connection to a higher-level system, after 3 minutes, the flow meter goes back automatically to measurement mode)
- Factory reset: (restoring the meter to factory default state)

Corresponding set point values are displayed according to output pre-selections. Possible output combinations correspond to the previous Possible output configurations Table.



### Display warning or error views

- Excitation circuit error
- Impulse output flooding
- Unstable measuring signal
- Signal out of measuring window

Warning or error messages displayed are flashing in regular intervals and a LED indicator according to message type is also lit (Error — red LED, warning — amber LED) and the D03 digital status output is activated at the same time.

If you wish to change parameters, you need to initiate the setup mode within 3 minutes after powering of the meter (the command to modify setting is sent via the communication interface, or E-button is pressed and held for approx. 4 seconds). After this period is over, it is only possible to view the current settings, the modification of parameters is blocked). Button  $\uparrow$  changes parameters and button E confirm values.

## Functional checks

When the operations described below are performed unprofessionally, the claim on warranty becomes extinct!!!

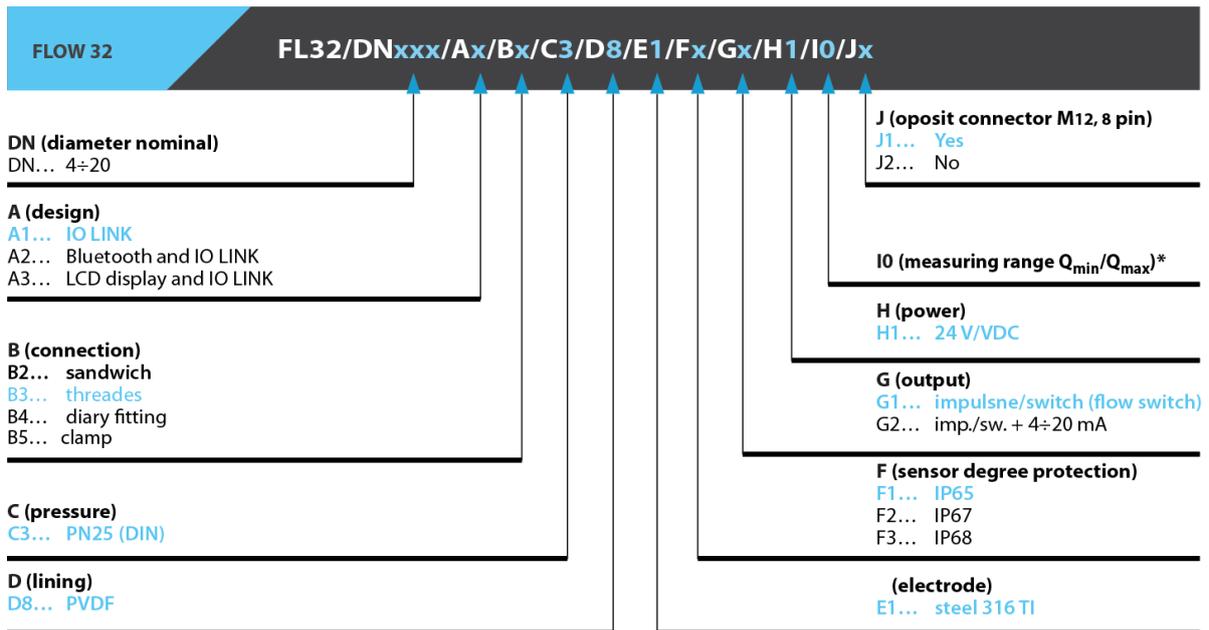
Before starting any work on the meter, power supply must always be turned off!!!

### Failures and their symptoms during measurement

Unstable indication and outputs may occur upon:

- high proportion of solids
- latent non-homogeneities
- dislocation of mixing
- ongoing chemical reactions within the measured substance
- use of diaphragm pumps or piston-type pumps

### Order code



Standard set include installation manual. For other requirements, please contact the manufacturer directly.

\*Measuring range corresponds to the dimensions according to table „Flow range“.

## ***Servicing***

All warranty and after-warranty repairs are carried out by the manufacturer, **COMAC CAL S. r.o.**

*Unprofessional implementation of the operations described herein will void your warranty claims for failures that may occur as a result!!!*

### ***Returning the meter 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.

Please attach full description of the fault. COMAC CAL s.r.o. will not be able to process your request promptly and correctly without this form.