COMAC CAL

CZECH PRODUCER
AND DEVELOPER
OF MEASUREMENT
AND SENSOR TECHNOLOGY

FLOW 32

Ver. 4.1

Installation and technical conditions

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WWW.COMACCAL.COM

Contents:

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

In case of returning the meters for inspection or repair to the COMAC CAL s.r.o. factory, please enclose 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 $\alpha \leq 7°$ (where α 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.

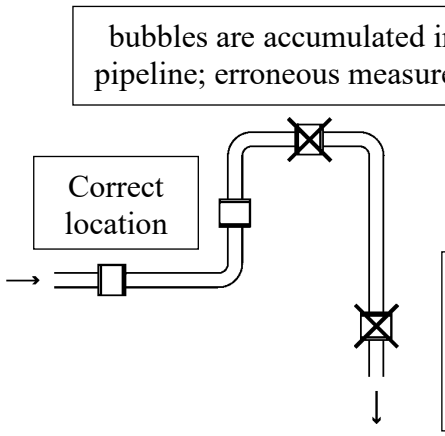
For correct operation of the meter, the flow sensor should be constantly flooded with the measured fluid to avoid erroneous readout of the amount of the fluid supplied in case that the piping is empty. It is necessary to select the location of the meter in such a way that the flow

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.

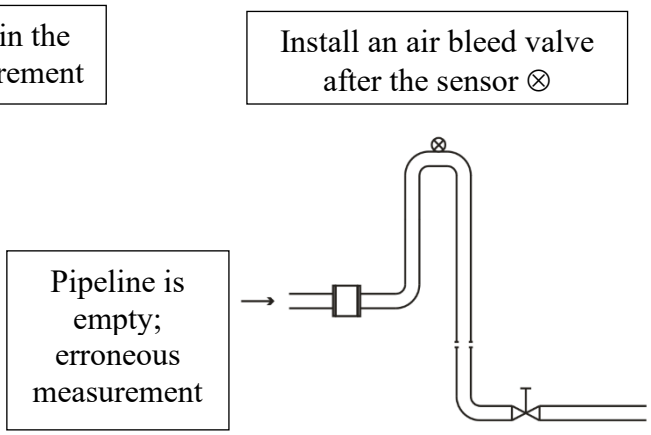
Installation examples

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:

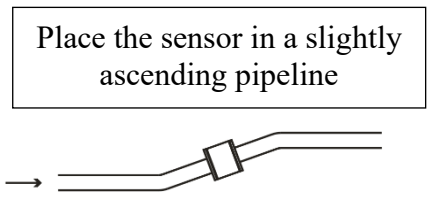
Recommended installation locations



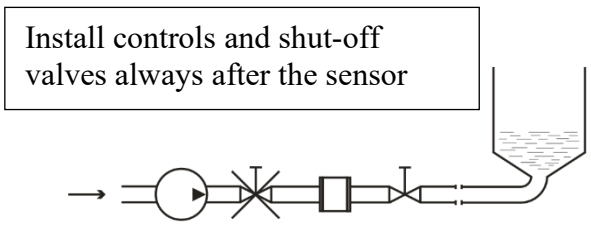
Downtake pipe



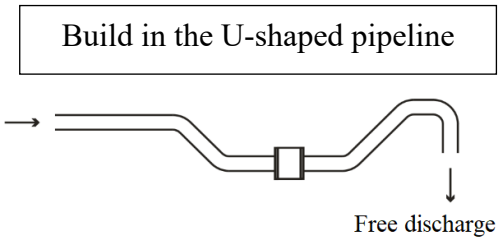
Horizontally laid pipeline



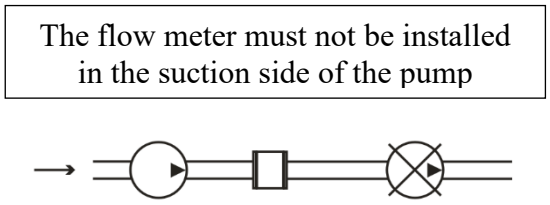
Long pipeline



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×d before the flow sensor and 3×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×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×d at least before the flow sensor. In case of a separate elbow or bend, the placement 10×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!!!

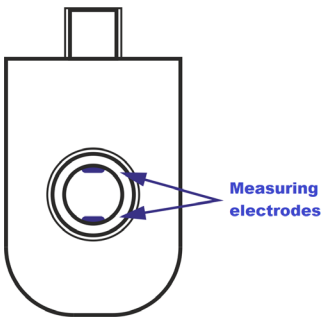
When preparing the piping, the **alignment** of both connecting ends must be followed so that the levelness of seating faces is ensured and that the flow meter body is not exposed to any excessive tensile and bending loading.

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.

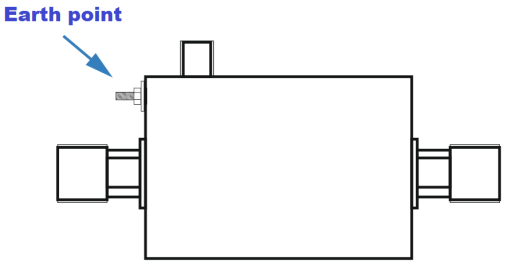


During installation, beware of:

- 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 inducion 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 earthd 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, resulting errors are not covered by the warranty!!!
Prior to any manipulation with the meter, switch off the power!!!

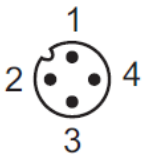
Meter wiring

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

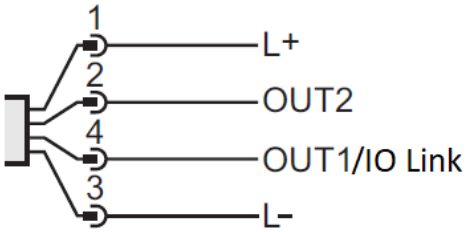
The flow meter signal outputs must only be connected to devices where accident protection is provided by safe low voltage and where generated voltages do not exceed the limits defined for safe low voltage.

Electrical connection of the meter is carried out by means of 4-pin M12x1 connector
All signals are **active**.

Standard cable connection



PIN 1 - +Vdd (24VDC±15%)
PIN 2 – configurable output OUT2
(PNP open collector- Positive potential)
PIN 3 - GND
PIN 4 - IO-LINK/ configurable output OUT1



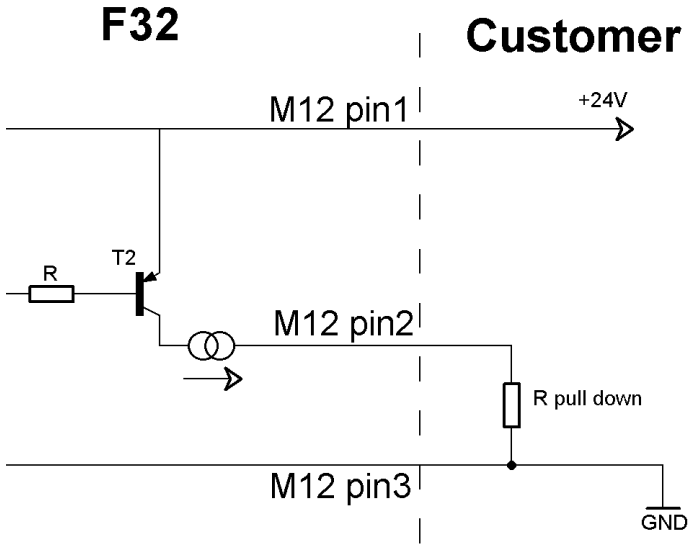
Configurable Output OUT1

Output OUT1 can be configured as an impuls output, status output, FlowSwitch or alternatively Fault. Simultaneously this output is used for C/Q communication through IO-Link protocol.
Active output with a current overload protection.

OUT1 Configuration options:
- Volume impulses in a positive flow direction **+ IMP**
- Volume impulses in a negative flow direction **- IMP**
- Bidirectional volume impulses **± IMP**
- FlowSwitch Status output with hysteresis **+FS**
- Status output Fault **Err**

Configurable output OUT2

Output OUT2 can be configured as Impulse output, Status output, FlowSwitch, alternatively Fault or 4-20mA analog output.
Active output with an open collector (PNP) and current overload protection



* wiring example

OUT2 configuration options:

- 4-20mA output in the positive direction +**AO**
- Bidirectional 4-20mA output ±**AO**
- Volume impulse in positive direction + **IMP**
- Volume impulse in negative direction **- IMP**
- Bidirectional volume impulse ± **IMP**
- FlowSwitch Status output with hysteresis +**FS**
- Status output Fault **Err**

Wiring check

After completion of wiring, it is necessary to check:

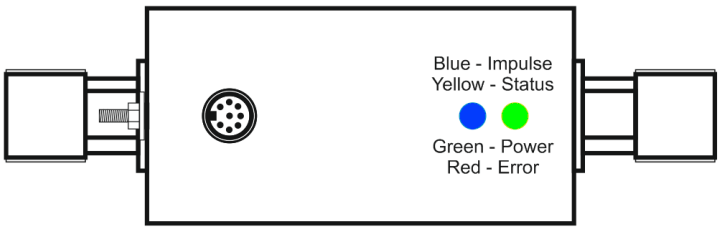
- Connecting cables for damage.
- Cables for pull relief.
- Correct connection of cables to terminals.
- Whether the supply voltage corresponds with the nameplate data.

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 „Factory settings (p.18)“ or by order and basic data are indicated on the flow meter. Changes can be done based on the flow meter specifications through IO Link, or buttons and LCD display

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 d the device.

IOLINK parameters

Serial number	Serial number
Calibration constant	Nominal Flow rate calibration constant
Calibration offset	Minimum flow rate calibration constant (non-linear)
Direction flow	Flow direction
Transient time	Transient time (insensitivity) after excitation commutation
Excitation time	½ excitation period [ms]
Excitation current limit	Limit value for current detection by excitation coils
Low Flow Cut-off	Start of measurement – Low flow cut-off
Flow switch point	Trigger point of the flow Switch function
Hysteresis switch point	Hysteresis of Flow Switch in % of trigger point
Pulse output [imp/L]	Impulse output Constant
Pulse width	Impulse output – impulse width/Gap
Flow 4mA	4mA current loop flow rate
Flow 20mA	20mA current loop flow rate
Calibration constant 4mA	4mA current loop calibration constant
Calibration constant 20mA	20mA current loop calibration constant
Out1 - CQ (IO-Link) **- Pulse output - forward flow (+Imp)** **- Pulse output - reverse flow (-Imp)** **- Pulse output - forward/reverse flow (±Imp)** **- Flow switch (+FS)** **- Error state output (Err)**	Out1 output configuration (CQ IOLink)
Out2 **- Current loop - forward flow (+AO)** **- Current loop - forward/reverse flow (±AO)** **- Pulse output - forward flow (+Imp)** **- Pulse output - reverse flow (-Imp)** **- Pulse output - forward/reverse flow (±Imp)** **- Flow switch (+FS)** **- Error state output (Err)**	Out2 output configuration
Test empty tube	Empty pipe test ON/OFF
Empty tube noise detection limit	Noise amplitude for empty tube test evaluation
Empty tube noise detection count	Number of overlap repetitions to evaluate the empty tube test
Correction process data	The measured values for the IOLink data display / process and the pulse output use a different calculation algorithm. The difference correction of the measurement methods is set to -4. The value is in tenths of a percent (default = -0.4%)
Out1 high speed pulse width	Pulse width in fast pulse mode when "Pulse width = 0" is set In this case, the pulses have a width in tens of µs. The exact width depends on the CPU usage. Default value = 2 (50µs in version without LCD)
Flow raw data	Digital value from the AD converter, which is directly proportional to the flow

Satur. level ratio	The value of the signal from the AD converter that is closest to the saturation limits of the amplifier. Allows you to estimate whether the signal is moving at safe levels from saturation. The saturation limits at which an alarm is issued are <-973677; +973677>. The saturation limits at which the meter stops measuring are <-1048576; +1048576>

„Event“ list IOLINK

Event type	*Description*
Warning	Warning - Amplifier saturation!
Warning	Warning - Empty tube!
Notification	Warning - Simulation active!
Warning	Warning - Imp Out overflow!

Device hardware fault (Current coil fail)

Process Data IOLINK

Flow rate	2B integer
Volume	4B float

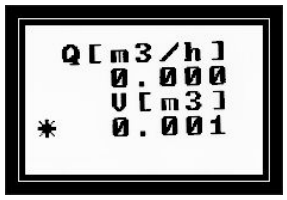
Display and settings

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 ↑ changes parameters and button E confirm values.

Basic display view

- Current flow rate Q [m^3/h]
- Volumetric counter V [m^3]

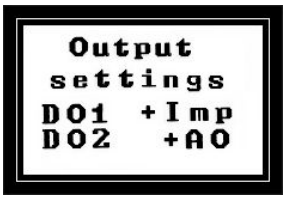
  Both values are shown in 3 decimal places.



Display settings

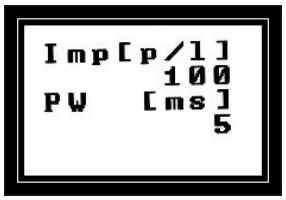
- Out1 and Out2 output configuration

  configuration
  +AO 4-20mA output in the positive direction
  ±AO Bidirectional 4-20mA output
  + **Imp** Volume impulse in positive direction
  - Imp Volume impulse in negative direction
  ± IMP Bidirectional Volume impulse
  +FS FlowSwith Status output with hysteresis
  Err Status output Fault



- Impulse output constant

  Allows for impulse constant (**Imp**) setting and the impulse width/spacing (**PW**)

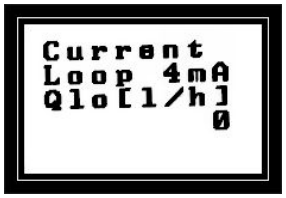


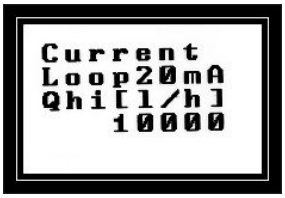
- Status flow control output (FlowSwitch)

  Allows for trigger point setting **FS** with hysteresis **Hyst**

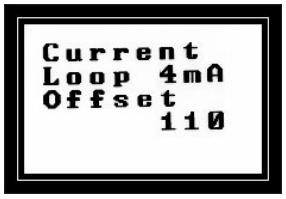
- Current loop setting

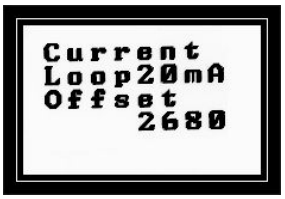
  Qlo Lower flow limit for 4mA current
  Qhi Higher flow limit for 20mA current





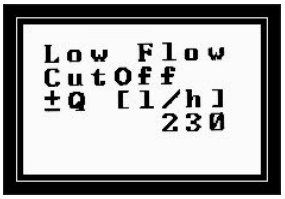
  Offset:
  4mA Calibration constant for current 4mA
  20mA Calibration constant for current 20mA





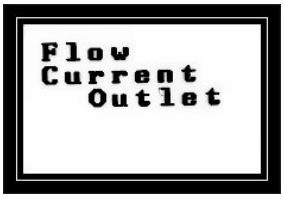
- Low flow cut off settings

  Allows for the minimum flow rate measure settings.
  Flow rate below the set value shows as 0.



- Flow Direction

  Allows to change flow direction (positive/negative) without installation change.

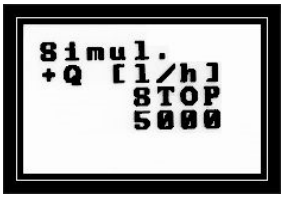


- Empty pipe test

  Allows for the "empty pipe test" to be turned ON/OFF .
  When "Empty pipe test" is turned on the registry of „**Empty tube noise detection limit"** and „**Empty tube noise detection count"** need to be configured
  Values in the registry represent type of liquid, Factory setting values are for water
  Empty tube noise detection limit = 2700
  Empty tube noise detection count = 7

- Flow Simulation

  Allows for Flow simulation needed for superior system testing



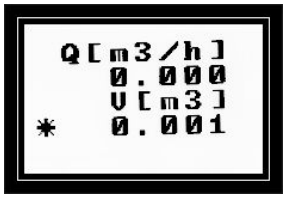
- Factory reset
  Resets all the input data into factory setting

Warnings or errors display notifications

- „e“ Error – Servis necessary
- „w“ Warning – Sensor is outside its parameters
- „*“ Empty pipe

Flow meter status visual is in the lower left corner of the display

Empty pipe detected example:



Technical data

Evaluation electronics technical parameters

Power	24VDC±15 % / 250mA with polarity reversal protection
Input power	3 VA
Electrical connection	M12x1, 4-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 ÷ 32
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
Controls	2x button (LCD Version only)
Outputs (active, 24V):	impulse status Analog 4÷20 mA
Max. frekvence imp. výstupu	ver. A1,A2 (IOLINK / BlueThooth) – 10kHz ver. A3 (LCD display and IOLINK) – 8kHz
Current carrying capacity:	OUT1 - 50mA OUT2 - 30mA
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
impulses in flow direction	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
DN 25	0,35	15
DN 32	0,6	25

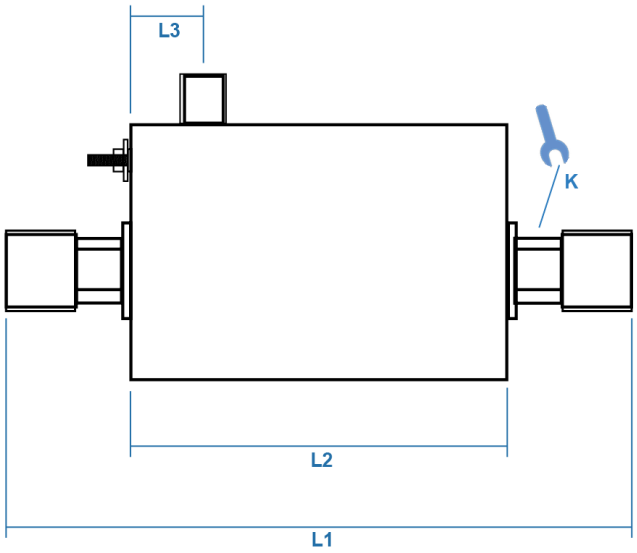
Factory settings

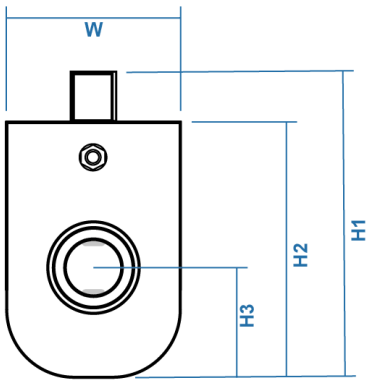
Impulse constants and current loop – factory settings

Diameter nominal	**Impulse output**		**4 – 20mA (in Qmin/Qmax 1/100 range)**	
DN	Vout[imp/l]	Vout - pulse width [ms]	Q[l/h] for 4mA	Q[l/h] for 20mA
4	100	4	0	500
6	100	4	0	1 000
8	10	4	0	2 000
10	10	4	0	3 000
15	10	4	0	7 000
20	10	4	0	10 000
25	10	4	0	15 000
32	10	4	0	25 000

Basic device sizes

Threaded design





Diameter nominal [mm]	Threaded connection	L1	L2	L3	W	H1	H2	H3	K	Compact flow meter weight (kg)
4	½“	161	97	16.5	49	80	70	32	17	1.2
6	½“	161	97	16.5	49	80	70	32	17	1.2
8	½“	161	97	16.5	49	80	70	32	17	1.2
10	½“	161	97	16.5	49	80	70	32	17	1.1
15	½“	161	97	16.5	49	80	70	32	17	1
20	¾“	161	97	16.5	49	80	70	32	22	1
25	1“	209	117	26,5	60	97	83	40	27	1,5
32	1 ¼“	209	117	26,5	70	97	83	40	36	2

Diameter nominal [mm]	DN 15…DN 20	DN 25…DN 32
Outside dimension of CLAMP [mm]	34	50,5

Functional checks

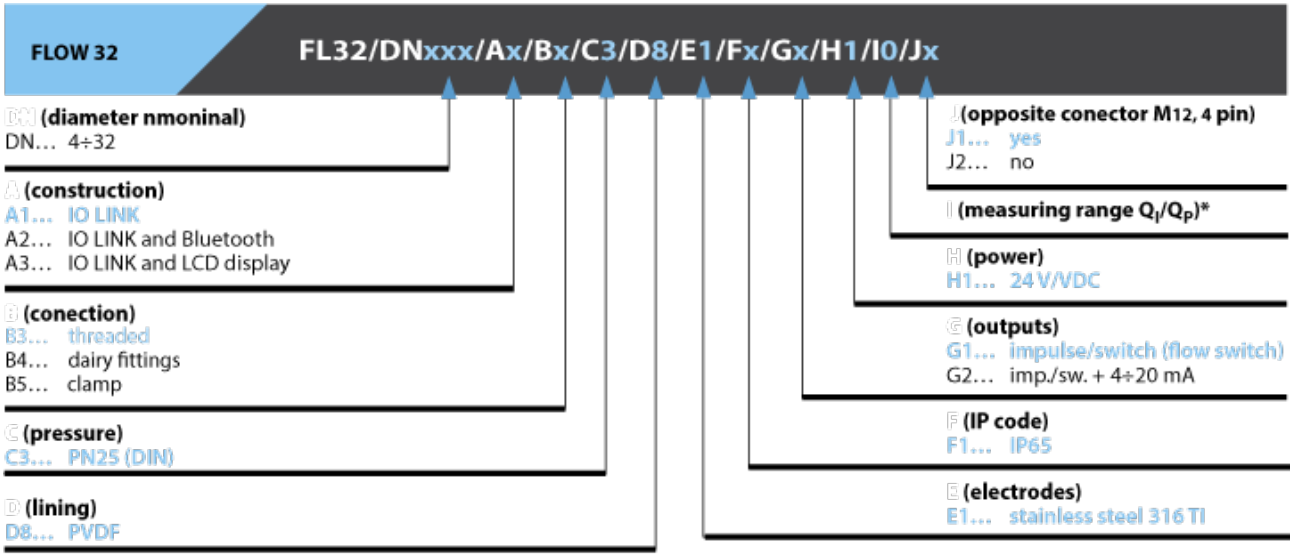
When the operations described below are performed unprofessionally, the claim on warranty becomes extinct!!!
Before starting any work on the meter, power supply must always be turned off!!!

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: contains installation manual. In case of other requirements, contact the manufacturer.
* The measuring range is determined by the meter dimensions according to the "Flow ranges" table.

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.