Electromagnetic Flowmeter

FLONET FN50xx.2

Content

1. APPLICATION

The FLONET FN50xx.2 electromagnetic flowmeter has been designed to measure volume flow rates of electrically conductive liquids in closed piping systems. It enables flow measurement with high accuracy in a wide range of flow rates (0.05 to 10 m/s) unlike the previous type FLONET FN20xx.1 (range 1:100) in extended range 1:200.

It is supplied in a compact design (dismountable piece of flow sensor and electronic unit) as a “blind” (without a display) low-cost flowmeter for heat and cold measurement systems.

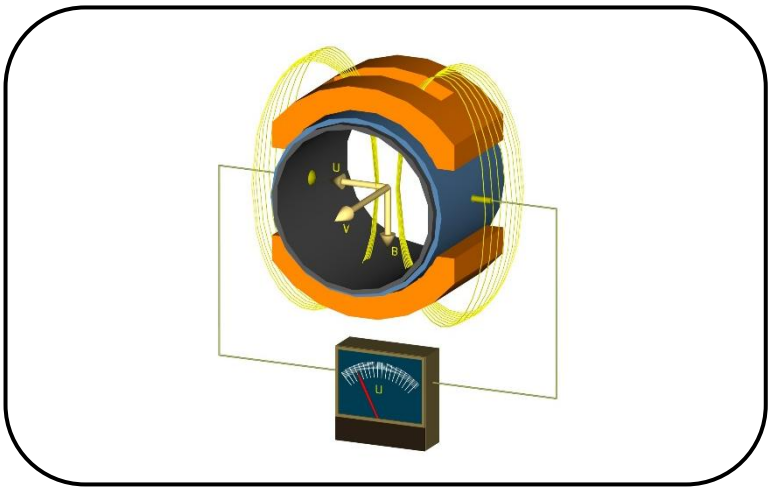
There is also a remote design of this flowmeter with a junction box on the top of chimney connected to a cable with an electronic unit fitted with L-shaped steel angle bracket at the other end of the cable.
Power supply range is 85 to 305 VAC or 24 VDC (24 VAC) The flowmeter has only one galvanic isolated passive pulse output OUT1.
The basic parameters can be set during activation process using special USB channel and sw FLOSET (it isn’t standard in a delivery) .

2. MEASUREMENT PRINCIPLE

The function of an electromagnetic flowmeter is based on Faraday’s induction law. The meter sensor consists of a non-magnetic and non-conductive tube with two embedded measuring electrodes to pick up the induced voltage. To create an alternating magnetic field, two coils are fitted onto the tube in parallel with the plane defined by the active parts of the measuring electrodes. Now if a conductive liquid flows across magnetic field **B**, voltage **U** will appear on the measuring electrodes proportional to the flow velocity v and the conductor length **l**.

U = B x l x v

U induced voltage
B magnetic flux density
l distance between the measuring electrodes
v liquid flow velocity



As the magnetic flux density and distance between the electrodes are constant, the induced voltage is proportional to the liquid flow velocity in the tube. The value of the volume flow rate can then be readily determined as a product of the flow velocity and square section of the tube, **Q = v x S.**

3. TECHNICAL DESCRIPTION

3.1. General

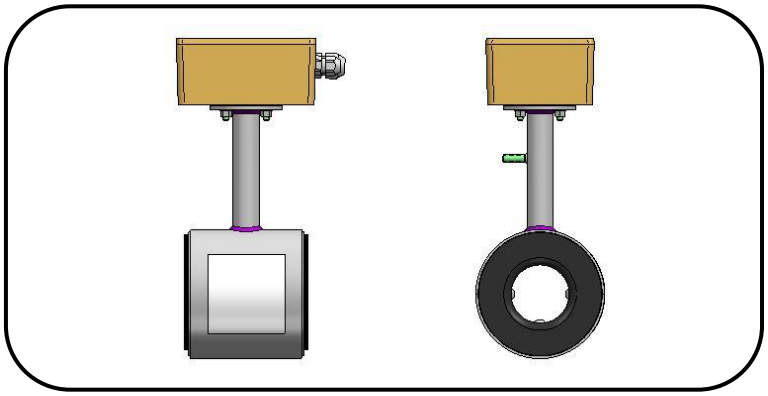
The electromagnetic flowmeter consists of a sensor through which the measured liquid flows and an electronic unit where the low-level signal from the sensor is modified to a standardized form suitable for further processing in various industrial electronic devices. The output signal is proportional to the volume flow rate of the measured liquid. The only factor limiting the application of electromagnetic flowmeters is the requirement that the measured liquid shall be conductive and non-magnetic. The electromagnetic flowmeter can be designed as a compact or remote device. The meter sensor is with different type of lining (hard rubber, soft rubber and special hard rubber for drinking water, PTFE or E-CTFE), with electrodes from different material and in flanged or wafer (flangeless) version.

Cold meters always must be in a remote design!
The reason is a risk of moisture condensation inside of the cooled electronic unit in a compact design that can be caused by drawing in a surrounding air.

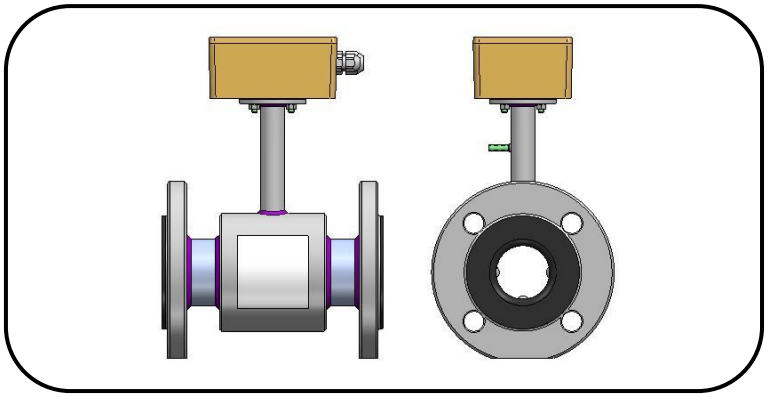
Flow meters for heat meters in a compact design may have a sensor with a prolonged chimney (made of stainless material). Such a sensor can measure media with temperatures up to 150ºC provided that the sensor and pipeline are thermally insulated and the ambient temperature doesn't exceed 60ºC.
When choosing a sensor for cold or heat measurement, physical parameters of lining must be taken into account – see 4.1.4 Selection of flow sensor lining

3.2. Meter design

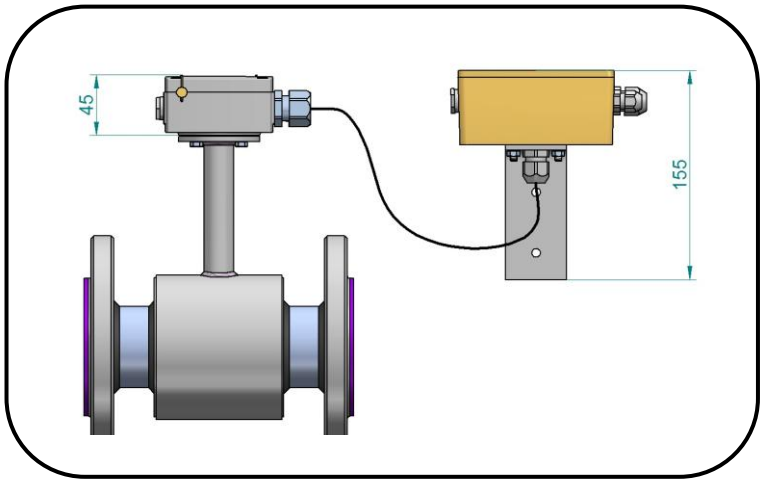
Compact design solution for a flangeless sensor and associated electronic unit



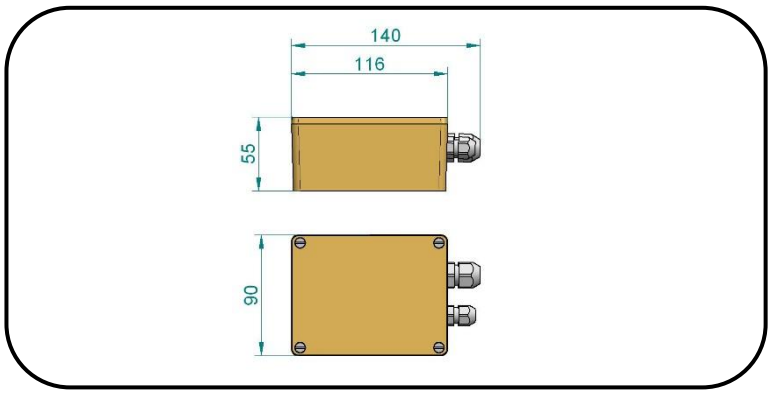
Compact design solution for a flanged sensor with associated electronic unit



Example of flowmeter assembly in the remote design version



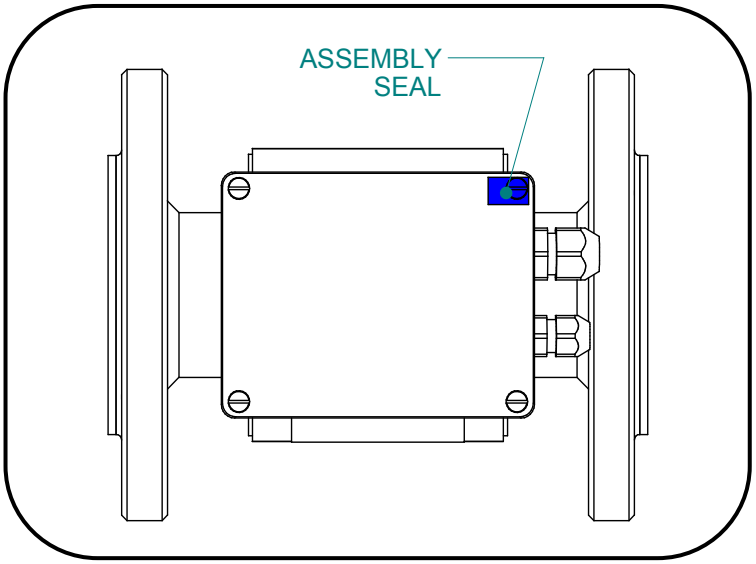
Dimensions of the box to accommodate the flowmeter in the compact design version



3.3. Protection of meters against unprofessional handling

The meter shall be provided with an assembly seals after installation, which can do duly authorized organization, which is trained from the producer.

Placement of official and assembly seals on meters.



4. TECHNICAL PARAMETERS

4.1. Flow sensor

The sensor environment must be free of any strong magnetic fields.

4.1.1. Selection of correct sensor size

The following table shows minimum and maximum flow rates for various sensor sizes and flow velocities ranging from 0,05 to10 m/s. The best operational properties will be achieved at the flow-velocity range of 0.5 to 5 m/s. For lower flow velocities, the measurement accuracy is worse while at higher flow velocities the turbulences at contact edges may cause undesirable interference.

Minimum and maximum flow rates for various sensor sizes
Q_{min} corresponds to flow velocity 0.05 m/s
Q_{max} corresponds to flow velocity 10.0 m/s

DN	l / s		m3 / h	
	Q_{min}	Q_{max}	Q_{min}	Q_{max}
15	0.0072	1,8	0,026	6,5
20	0,013	3,3	0,048	12
25	0,025	5	0,09	18
32	0,04165	8,33	0,15	30
40	0,0625	12,5	0,225	45
50	0,1	20	0,36	72
65	0,16665	33,33	0,6	120
80	0,25	50	0,9	180
100	0,38885	77,77	1,4	280
125	0,5972	119,44	2,15	430
150	0,90275	180,55	3,25	650
200	1,597	319,4	5,75	1150
250	2,5	500	9	1800
300	3,5	700	12,6	2520
350	4,86	972	17,5	3500
400	6,25	1250	22,5	4500
500	10	2000	36	7200
600	11,1	2778	40	10000
700	15,5	3889	56	14000
800	20,0	5000	72	18000

The basic parameters of flow meters for heat/cold meters are designed in compliance of standard EN1434 (OIML R 75).

Below is issued ratio of following flow rates:

$$\frac{q_s}{q_p} = 2$$

Size DN	Overload flow q_s [m3/h]	Permanent flow q_p [m3/h]	Min. flow q_i [m3/h]	Ratio qp/pi
15	6,5	3	0,0163	200
20	12	6	0,0300	
25	18	9	0,0450	
32	30	15	0,0750	
40	45	23	0,1125	
50	72	36	0,1800	
65	150	75	0,3750	
80	180	90	0,4500	
100	280	140	0,70	
125	430	215	1,08	
150	650	325	1,6	
200	1 150	575	2,9	
250	1 800	900	4,5	
300	2 520	1 260	6,30	
350	3 500	1 750	9	
400	4 500	2 250	11	
500	7 200	3 600	18,0	
600	10 000	5 000	25	
700	14 000	7 000	35	
800	18 000	9 000	45	

Data in the table are valid for accuracy higher than ±2% in range q_{min} x% ≤ q_i ≤ q_s

Legend:

q_s = overload (maximum) flow rate of a measured liquid

q_p = permanent (nominal) flow rate of a measured liquid

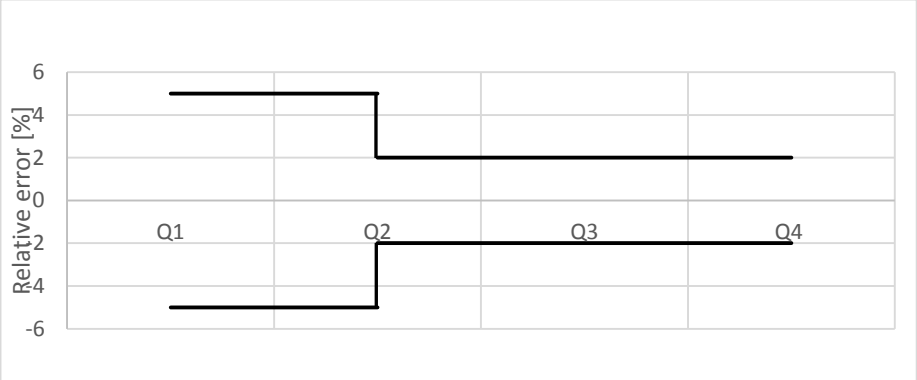
q_i = min flow rate for an accuracy of measurement

The basic parameters of flow meters are designed in compliance of standard ISO 4064 (OIML R 49).

Below is issued ratio of following flow rates:

$$\frac{Q_4}{Q_3} = 1.25 \qquad \frac{Q_2}{Q_1} = 1.6$$

An accuracy complies of standard EN ISO 4064-1 (OIML R 49)



Values in the table are acc to standard ISO 4064-1 (OIML R 49).

Values of flow Q_1, Q_2, Q_3 a Q_4 , which apply to individual design variants and to dimensions, are written in the table 2 below:

Table 2

Size DN	NPS	Over load flow Q4 [m3/h]	Permanent flow Q3 [m3/h]	Transition flow Q2 [m3/h]	Min. flow Q1 [m3/h]	Ratio Q3/Q1
15	½“	7,88	6,3	0,050	0,032	
20	¾“	12,5	10,0	0,080	0,050	
25	1“	20,0	16,0	0,128	0,080	
32	1 ¼“	31,3	25,0	0,200	0,125	
40	1 ½“	50,0	40,0	0,320	0,200	
50	2“	78,8	63,0	0,504	0,315	
65	2 ½“	125,0	100,0	0,800	0,500	
80	3“	200,0	160,0	1,280	0,800	
100	4“	280,0	250,0	2,00	1,25	
125	5“	500,0	400,0	3,20	2,00	
150	6“	787,5	630,0	5,04	3,2	200
200	8“	1 250	1 000	8	5,0	
250	10“	2 000	1 600	12,8	8,0	
300	12“	3 125	2 500	20	12,5	
350	14“	3 125	2 500	20	12,5	
400	16“	5 000	4 000	32	20	
450	18“	5 000	4 000	32	20	
500	20“	7 875	6 300	50,4	31,5	
600	24“	7 875	6 300	50,4	32	
700		12 500	10 000	80	50	
800		12 500	10 000	80	50	

Legend:

Q_4 overload (maximum) low (maximum)

Q_3 permanent (nominal) flow

Q_2 transition flow

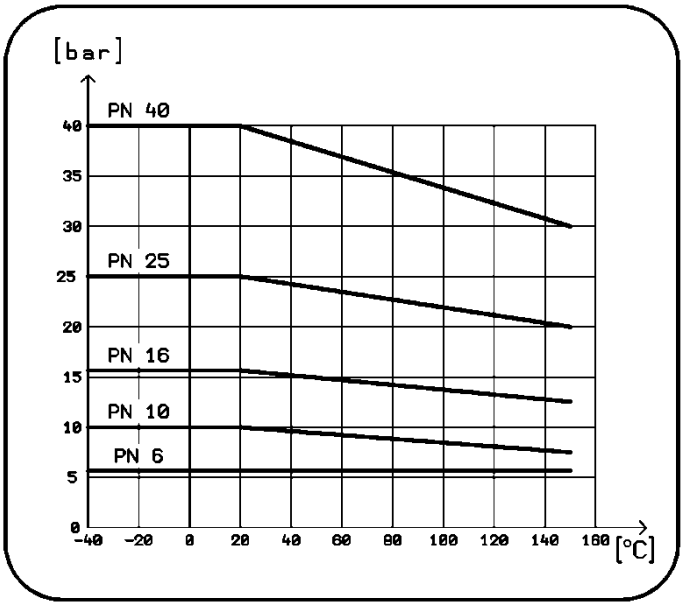
Q_1 min. flow for specific accuracy

4.1.2. Operational pressure of measured liquid

The standard flow-sensor versions have the following pressure ratings:

Sensor size	Pressure rating
DN 15 to DN 50	PN 40 (4,0 MPa)
DN 65 to DN 200	PN 16 (1,6 MPa)
DN 250 to DN 800	PN 10 (1,0 MPa)

Relationship between operational pressure and temperature of the measured liquid.



4.1.3. Material of electrodes

Measurement electrodes are made of stainless steel 1.4571 (316Ti). Some special applications require use of higher-quality and more resilient materials. We provide electrodes made of Hastelloy C276, Tantalum, Titanium and Platinum-Rhodium (PtRh10).

4.1.4. Selection of sensor lining

The sensors are produced with linings of different materials. Selection of lining material depends on properties of measured liquid.

Soft rubber, low aggressive liquids, -35°C to 80ºC, higher content of abrasive particles

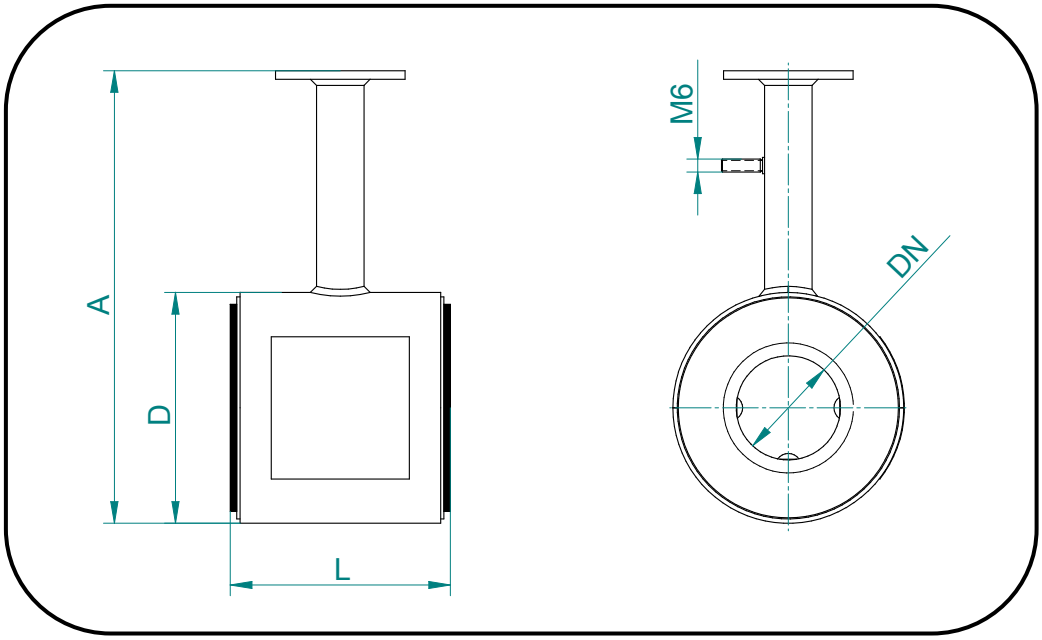
Hard rubber, low aggressive liquids, +5 to 80ºC

Special rubber for potable water, +5 to 80ºC

Teflon PTFE, aggressive liquids with operating temperature –20 to +110ºC, on request –35 to +150ºC

E-CTFE, operating temperature -20 to +110ºC, for dimensions over DN300, on request –35 to +130ºC

4.1.5. Dimensions of flangeless sensor ISX.Mxx (for heat meters)

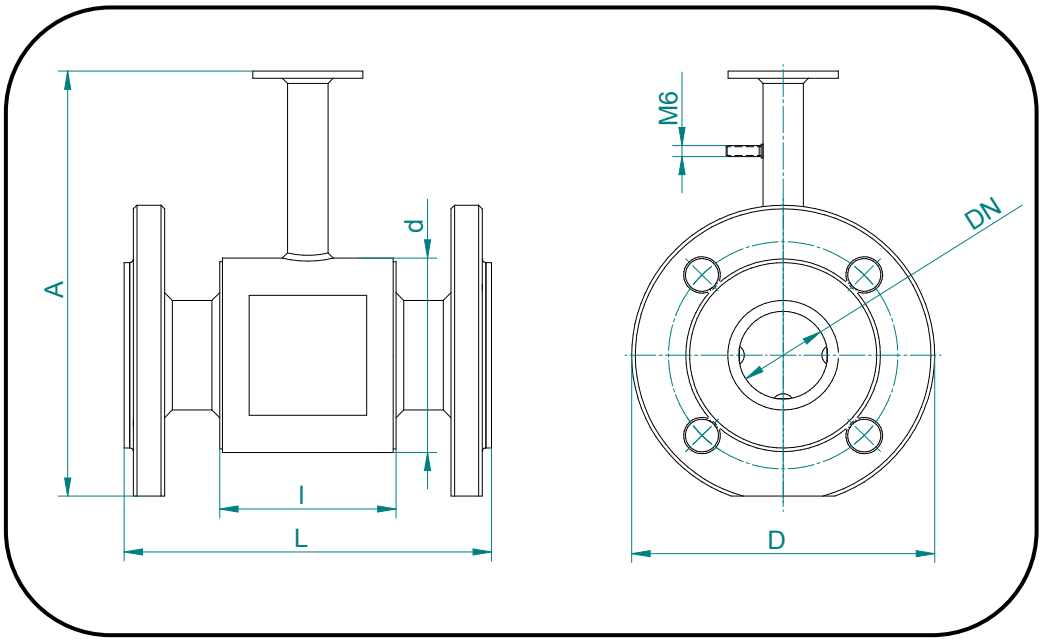


Flangeless sensor dimensions for various rated diameters (DN)

	DN	D	A*	L	Hmotnost [kg]
PN40	25	72	165	104	2
	32	82	175	104	2
	40	92	186	104	2
	50	107	199	104	3
PN16	65	127	219	104	3
	80	142	234	104	4
	100	162	254	104	4
	125	192	284	134	6
	150	218	310	134	8
	200	274	366	219	10

* Height is considered without the electronic unit, without the junction box respectively. Weight of sensor has an indicative character.

4.1.6. Dimensions of flanged sensor IS0.Mxx (for heat meters)

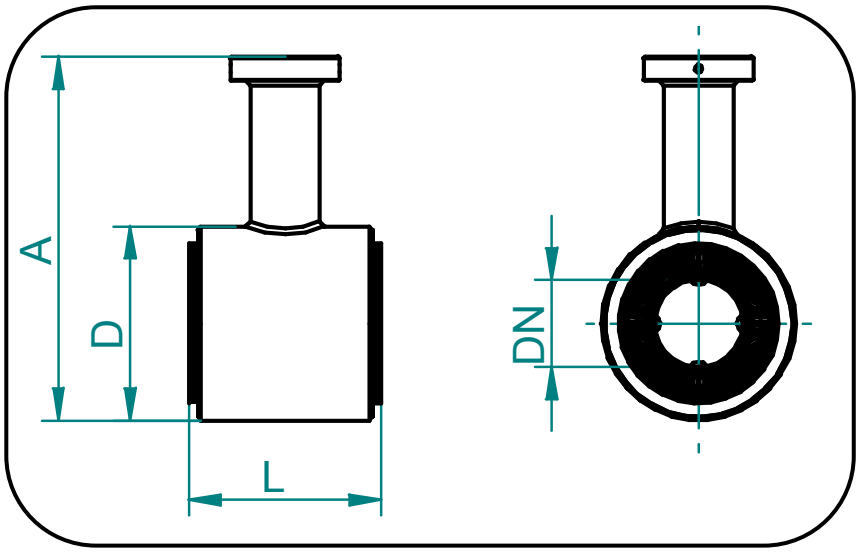


Dimensions of flanged sensor according to DN
Flanges according to the norm EN 1092-1

	DN	D	d	A*	L	l	Weight [kg]
	15	95	62	x	200	66	2
	20	105	62	x	200	66	2,5
	25	115	72	187	200	96	3
PN40	32	140	82	206	200	96	4
	40	150	92	216	200	96	4
	50	165	107	230	200	96	6
	65	185	127	251	200	96	9
	80	200	142	267	200	96	14
PN16	100	220	162	287	250	96	16
	125	250	192	317	250	126	19
	150	285	218	347	300	126	25
	200	340	274	405	350	211	41
PN10	250	395	370	487	450	211	54
	300	445	420	542	500	320	77
	350	505	480	591	550	320	92
	400	565	530	649	600	320	116
	500	670	640	759	600	320	167
	600	780	760	877	600	320	288
	700	895	880	997	700	420	356
PN6	800	975	960	1107	800	420	427

* Height is considered without the electronic unit, without the junction box respectively. Weight of flow sensor has an indicative character.

4.1.7. Dimensions of flangeless sensor ISX.1xx

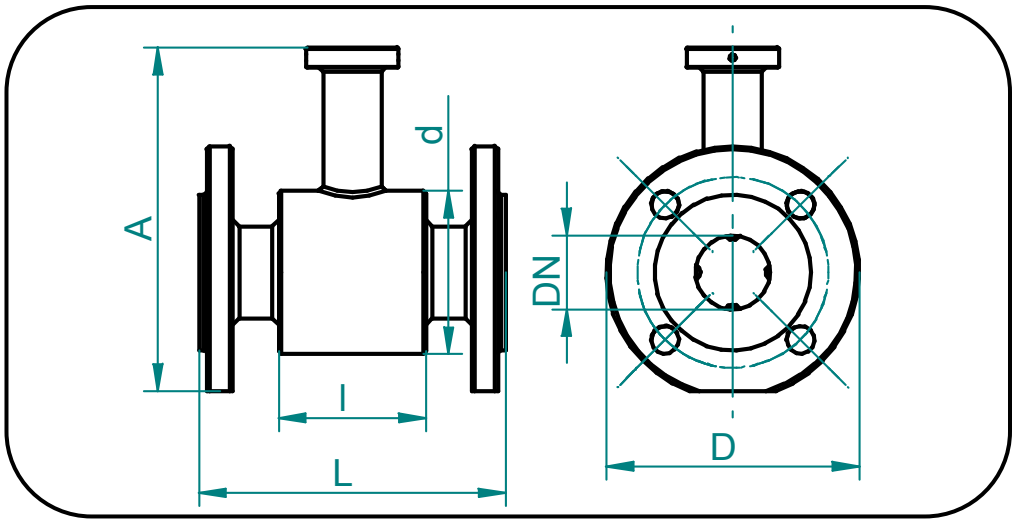


Dimensions of flangeless sensor according to DN

	DN	D	A*	L	Hmotnost [kg]
PN40	25	72	158	104	2
	32	82	168	104	2
	40	92	179	104	2
	50	107	192	104	3
PN16	65	127	212	104	3
	80	142	227	104	4
	100	162	247	104	4
	125	192	277	134	6
	150	218	303	134	8
	200	274	359	219	10

* Height is considered without the electronic unit, without the junction box respectively. Weight of flow sensor has an indicative character.

4.1.8. Dimensions of flanged sensor ISX.1xx



Dimensions of flanged flow sensor according to DN
Flanges according to the norm ČSN EN 1092-1

	DN	D	d	A*	L	l	Weight [kg]
PN40	15	95	62	x	200	66	2,5
	20	105	62	170	200	66	3
	25	115	72	180	200	96	3
	32	140	82	199	200	96	4
	40	150	92	209	200	96	4
	50	165	107	223	200	96	6
PN16	65	185	127	244	200	96	9
	80	200	142	260	200	96	14
	100	220	162	280	250	96	16
	125	250	192	310	250	126	19
	150	285	218	340	300	126	25
	200	340	274	398	350	211	41
PN10	250	395	370	480	450	211	54
	300	445	420	535	500	320	77
	350	505	480	584	550	320	92
	400	565	530	642	600	320	116
	500	670	640	752	600	320	167
	600	780	760	x	600	320	288
	700	895	880	x	700	420	x
PN6	800	975	960	x	800	420	427

* Height is considered without the electronic unit, without the junction box respectively. Weight of flow sensor has an indicative character.

4.1.9. Technical data of sensor

Dimensions of sensor	Flangeless DN 25 to DN 200 Flanged DN 15 to DN 800
Operating pressure	PN 40 (4,0 MPa) for DN 15 to DN 50 PN 16 (1,6 MPa) for DN 65to DN 200 PN 10 (1,0 MPa) for DN 250to DN 800
Connection of sensor	Flangeless Flanged
Earthing	Earthing electrode
Flow rate of measured liquid	0,05 m/s to 10 m/s (range 1:200)
Temperature of measured liquid	110^{o} C Up to 150ºC on a request (based on lining type and when using sensor with prolonged chimney made of stainless material) – see article 4.1.4
Minimum conductivity of measured liquid	20 µS/cm, based on agreement with manufacturer up to 5 µS/cm
Lining	Soft rubber Hard rubber Rubber for potable water Teflon PTFE E - CTFE
Electrodes	Stainless steel 1.4571 (316Ti) Hastelloy C276 Tantalum Titanium Platinum-Rhodium (PtRh10)
Ingress protection	IP 65
Storage temperature	-10ºC to +70ºC, at the max. relative humidity 70 %

4.2. Electronic unit box

The signal-processing electronic unit is accommodated in a cast aluminum box coated on the surface with paint of hue RAL 1017. The box is held by four (2x hexagonal head and 2x countersunk head) M5 bolts with hexagonal socket heads. Inside the box is the terminal board accessible by removing the cover fastened by 4 bolts. The side of the box is equipped by cable glands. Prior to putting the meter in service, check the correct sealing of all active glands, and tightening of the bolts holding the cover of the box.
The remote version of electronic unit is equipped with L- shaped angle bracket for wall mounting. Through the cable bushing fitted at the angle bracket, the connecting cable connects electronic unit and junction box of sensor.

4.2.1. Electronic unit specifications

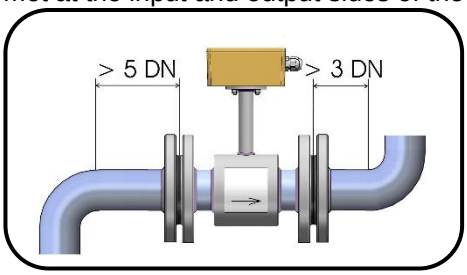
Power supply standard	85 to 305 VAC
Power supply optional	24V ± 20% (10 to 25 VAC) 24V ± 20% (11 to 36 DC)
Power consumption	3 VA max.
Line fuse	T 2A
Magnetic field	Pulse unidirectional field Selectable frequencies 1.56Hz; 3.125Hz; 6.25Hz;12.5Hz
Back-up battery	CR2032
Electric shock protection according to standard ČSN 332000-4-41	Automated disconnection from power source in TN-S network
Cable bushing Pg9	For power supply cable with a diameter of 5 to 10 mm
Box material	Aluminum casting
Weight	0,4 kg
Ambient temperature	-5 °C to 55 °C (protected from direct sun light)
Storage temperature	-10 °C to 70 °C at relative air humidity not exceeding 70%
Flow velocity range	0,05 to 10 m/s
Maximum flow error	Acc to standard EN1434 or ISO4064-1 class 2 (standard) 0,2 % for 10 to 100 % Q_{max} (on request) 0,5 % for 5 to 100 % Q_{max} (on request)
Output 1 - passive output, insulated	Passive: electrically insulated from the ground and other outputs; Uextmax = 30V, Imax = 50mA Open collector Operational modes: Frequency: frequency range 0 to 10kHz, duty cycle 1:1 Pulse: Maximum frequency 100Hz Pulse length 1 to 999ms Selectable pulse number Output negation Binary: Exceeding limit values of measured quantities Error messages Output negation
Communication interfaces	RS-485 MODBUS RTU, electrically insulated from the ground and other outputs
Serial communication ports	USB not insulated, only for service
Protection class	IP 65

*) A variant must be specified by an order. The calibration is done for a chosen output!

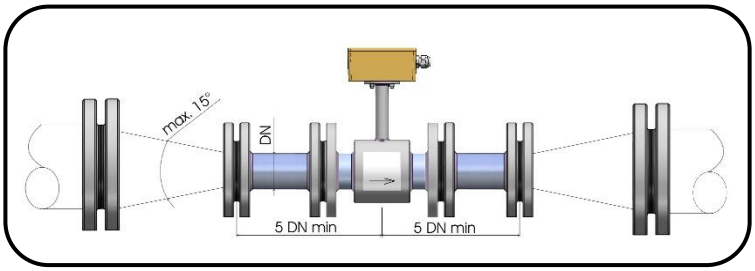
5. METER APPLICATION RULES

5.1. Sensor placement in piping

No chemical injection or batching unit (such as chlorine compound injector) should be located at the input side of the sensor. The insufficient homogeneity of the flowing liquid may affect the flow-rate values indicated by the meter.
The meter performance will be the best if the liquid flow in the piping is well stabilized; therefore it is necessary to observe specific rules for the sensor placement in piping. In the contact planes between the sensor and the adjoining piping sections should be no edges as these would cause flow turbulence. Make sure that straight piping sections are provided before and after the sensor; their required length is proportional to the inner diameter of the piping concerned.
As required by clause 4.2.1 of standard EN 29104, the inner diameter of the connected pipe should not differ by more than 3% from that of the sensor.
If more than one flow-disturbing element such as pipe bend or fitting are located near the sensor, the required length of straight piping section on the sensor side concerned should be multiplied by the quantity of such elements.
In the cases of bi-directional flow-rate measurement, the same conditions concerning flow stability shall be met at the input and output sides of the sensor.

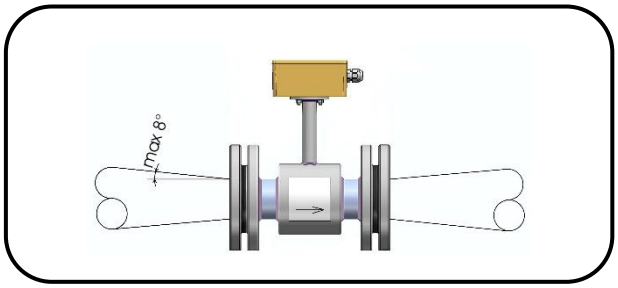


Required straight piping sections



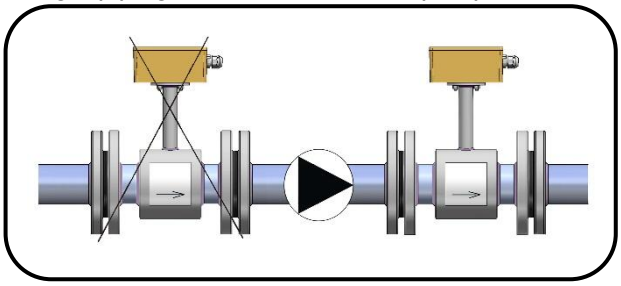
Pipe narrowing

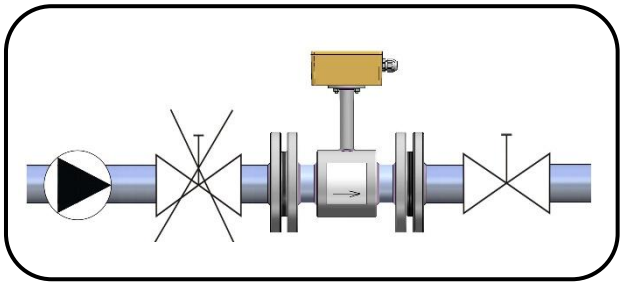
In the cases where the pipe size larger than that of the meter sensor, it is necessary to use conical reduction pieces with the angle of taper not exceeding 15° (see the picture). In the cases of bi-directional flow measurement, the minimum length of straight piping sections on both sides is 5 DN. In horizontal sensor installations, to prevent bubbling, use eccentrically-fitted reduction pieces (see standard EN ISO 6817).



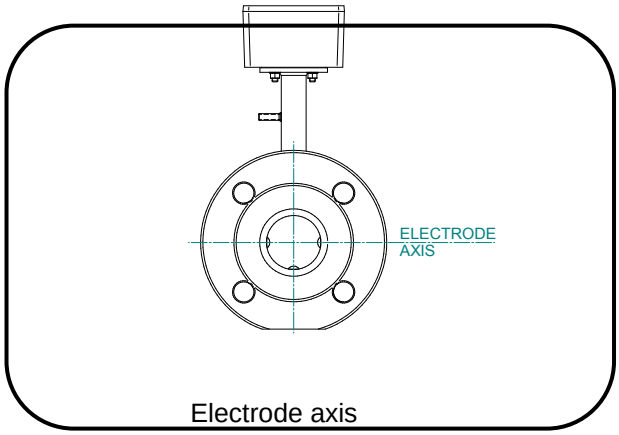
Pipe narrowing sections with angles not exceeding 8° can be taken for straight sections.

In the cases where the liquid is pumped, the flow sensor shall always be placed at the output side of the pump to prevent under pressure in the piping which might damage the sensor. The required length of the straight piping section between the pump and sensor is then at least 25 DN.

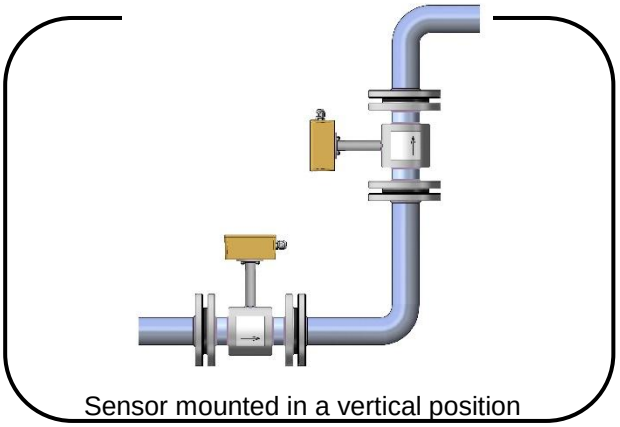

Pump in the piping


Closing valve in the piping

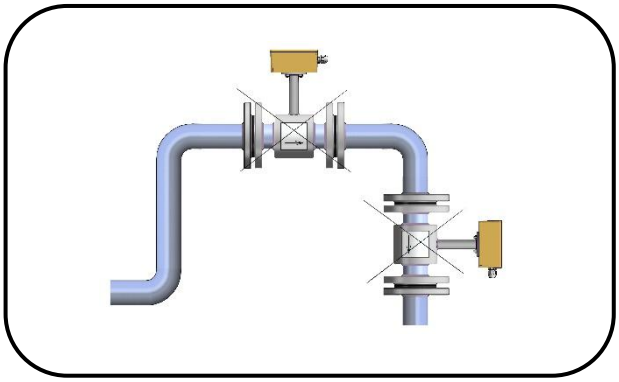
For the same reason, the sensor shall be always placed before the closing valve in the piping.
The sensor can be fitted in the piping in either horizontal or vertical position. However, make sure that the electrode axis is always horizontal and, if the sensor is mounted in a horizontal position, the flange section for attachment of the electronic unit box faces upwards.

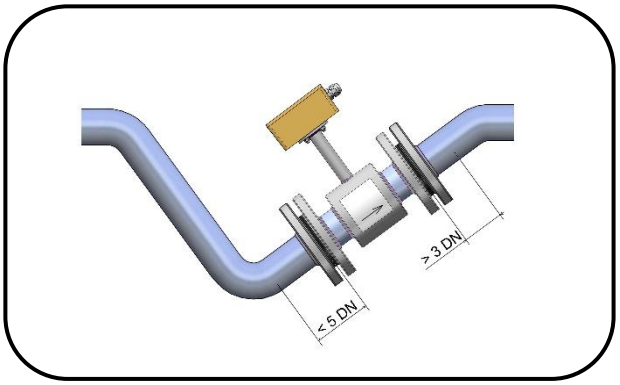


Electrode axis


Sensor mounted in a vertical position

In the cases where the sensor is mounted in a vertical position, the flow direction shall always be upwards.

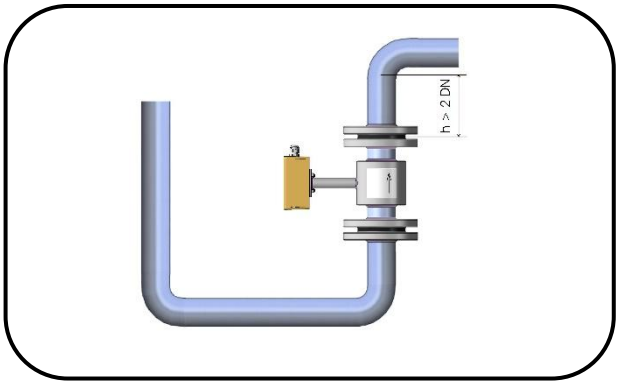

Risk of liquid aeration



Permanent flooding of sensor

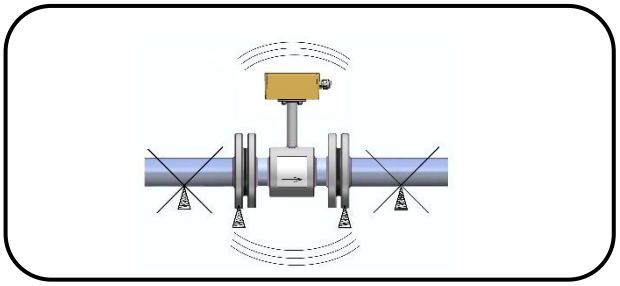
To ensure correct meter function at all times, the measured liquid shall completely fill up the sensor and no air bubbles shall be permitted to accumulate or develop in the sensor tube. Therefore the sensor shall never be placed in the upper pocket of the piping or in a vertical piping section where the flow direction is downwards.
In piping systems where complete flooding of the piping cannot always be guaranteed, consider placing the sensor in a bottom pocket where full flooding is ensured.

If the sensor is located near a free discharge point, such point shall be by at least 2 DN higher than the top part of the sensor.

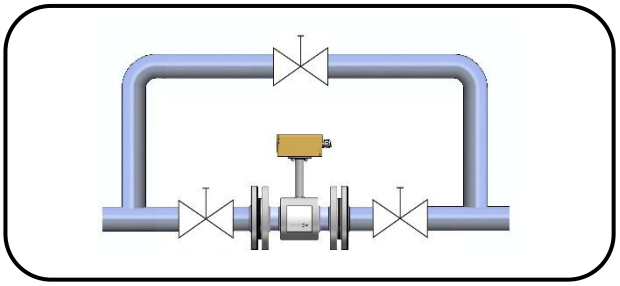


Sensor placement near free discharge point

Make sure that the adjoining piping is clamped/supported as close to the sensor as possible, to prevent vibrations and damage to the sensor.



Undesirable sensor vibrations

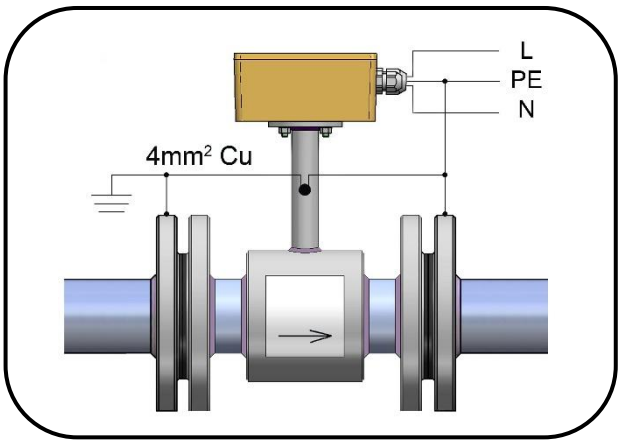


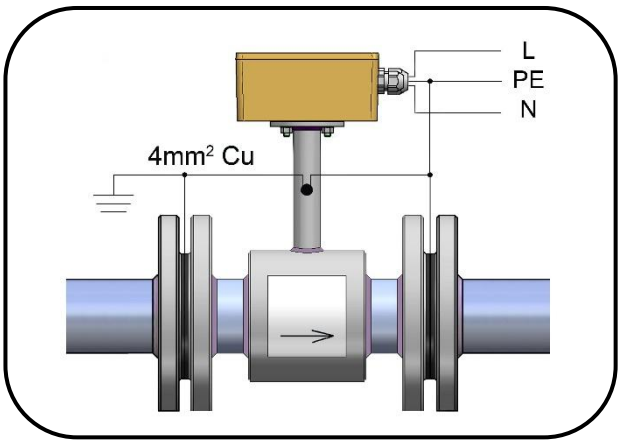
Sensor bypass

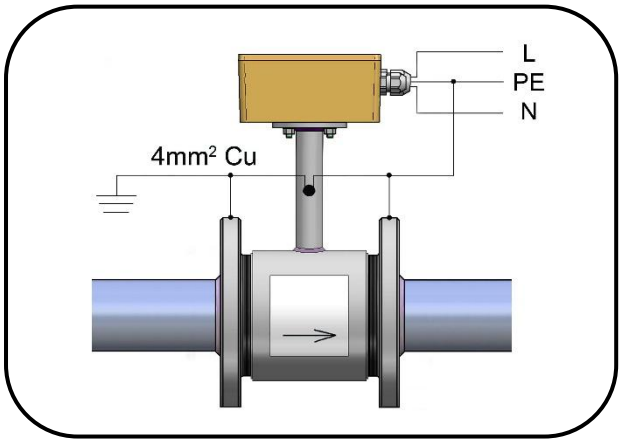
In applications where continuous liquid flow is essential, a bypass shall be provided to allow for sensor servicing. A sensor bypass may also be a reasonable solution in the cases where, to dismantle the flow sensor from the piping, liquid from a very long piping section would have to be discharged.

5.2. Sensor earthing

The correct meter function requires that the sensor and adjoining piping sections be connected by low-impedance earthing conductors to the earth potential and the protection conductor of the power source. Measured liquid is earthed using a earthing electrode embedded in the sensor. If the sensor is not equipped with a earthing electrode is in terms of measurement the required electrical wiring between the screw on the chimney and flanges or earthing rings as shown in the pictures bellow.
This connection is recommended even if the sensor with earthing electrode (indeed fulfills the contact hazard protection and stray currents).







6. FLOWMETER INSTALLATION AND OPERATIONAL START

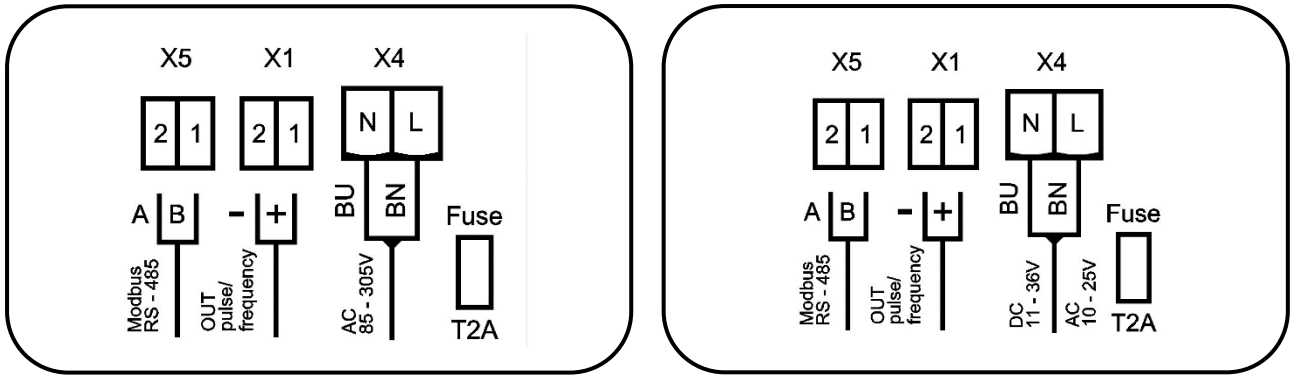
The meter installation work shall be performed in strict observance of the procedures and rules described in this manual.
To prevent undesirable interference, the power cables shall be laid at least 25cm away from all signal cables. All cables shall be laid outside the thermal insulation layer on the piping (if any). Only shielded conductors shall be used and shielding shall be connected to the earth potential on the side of the plant control system.

6.1. Sensor installation

The measurement point chosen for the sensor installation should ensure that the internal part of the sensor is fully flooded with the measured liquid at all times. If the sensor is mounted in vertical position, the only permitted liquid flow direction is upwards.
No thermal insulation shall be used on the sensor body. If the flowmeter is to be installed in a pipeline with thermal insulation, the insulation shall be removed at the sensor insulation point.
The internal diameters of the piping and the sensor tube shall be identical. The input and output piping sections including seals shall be perfectly aligned, with no protruding edges. The arrow on the sensor body indicates the required fluid flow direction (positive flow direction).
Do not expose the electronic unit box to direct sunlight; in the cases of outdoor installation, use a suitable protection shield.

6.2. Electric connections of electromagnetic flowmeter

The terminals for connecting cables can be accessed upon removal of the upper lid of the electronics box. The lid is screwed by four bolts. A schematic diagram of the connecting is shown on the bottom side of the lid.
Examples of labels showing power supply and impulse output



6.2.1. Connection to power source

Terminal	
BU	N neutral conductor
BN	L phase conductor (DC +)

To connect the power source, use a standard cable of three conductors of square section not exceeding 2 x 1.5mm^2. For ambient temperatures, over 50°C, use a cable with rated operating temperature of at least 90°C. The box grommets will only accommodate cables with outer diameter between 4 and 8mm. Use of any other cable would disturb the protection of the IP 65 box.
The earthing conductor shall be longer than both the phase and neutral conductors. This is a safety requirement as in the case of loosening the cable clamping in the gland, the earthing conductor shall be the last to be disconnected from the terminal.
The power supply line shall be protected by an overcurrent circuit breaker. A seal should be applied on the breaker to prevent unauthorized handling. The electronic unit has no independent power switch. The recommended rating of the overcurrent circuit breaker is 4 to 6A.

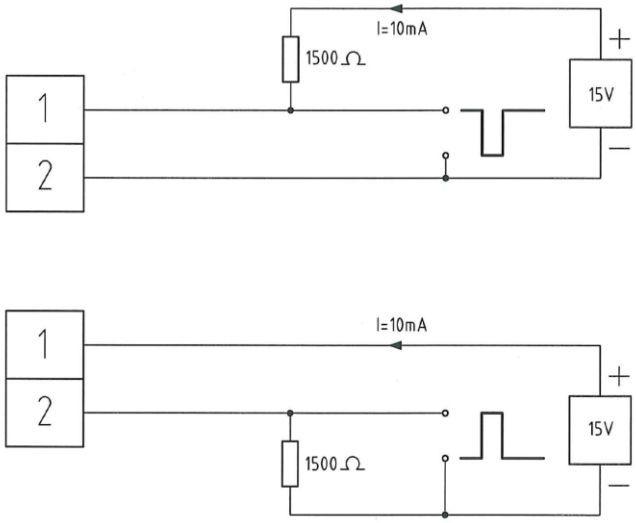
6.2.2. Output signal connections

Terminal	Polarity	Function	Comments
1	Optocoupler collector (+)	Binary output OUT1 Pulse output	Passive output, required external power source and loading resistor
2	Optocoupler emitter (-)		

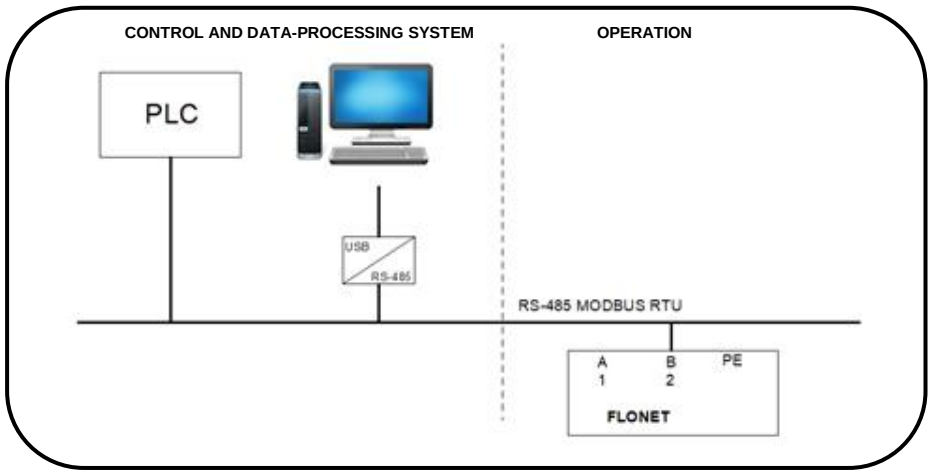
The output terminals can be connected to co-operating electronic equipment using standard shielded signal cables of external diameter 3 to 6.5mm and conductor cross-section 0.5 to 1.5mm^2. Shielded conductors shall also be used to connect all output signals where the shielding shall be connected to the earth potential on the side of the plant control system.

Upon connecting the conductors to the terminals, tighten the bolts holding the electronic box cover and check the grommet sealing.

Example of output OUT1 interconnection



6.2.3. Communication interface RS-485 MODBUS RTU



Communication interface: RS-485 MODBUS RTU according to standard EN 61158, electrically insulated
PC requirements: Windows 7 or higher OS upgrade (Linux, iOS) with JAVA 8u40 or higher,
the FLOSET 4.0 communication software installed
* .Flo configuration file
USB / RS-485 converter with connection cables

Connecting cable: Type A according to EN 61158-2 (a twisted pair of conductors, 90% shielding)

Interconnection:

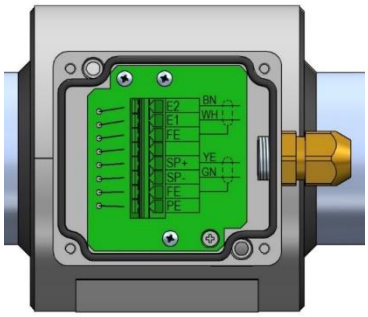
FH FN50xx.2	Bus conductor
1	A
2	B
PE	Shielding

Detailed instructions regarding application of the RS-485 MODBUS RTU communication interface can be found the manual:

Es 90684K **Communication interface RS-485 MODBUS RTU**
Electromagnetic flowmeters FLONET FH30xx and FLONEX FXx11x

6.2.4. Connection of sensor in remote design

The sensor in remote design has a junction box mounted on the top of a chimney. The connecting cable goes from the electronic unit through the cable bushing into the junction box. The cable shall be connected with the junction box as shown in the table below. The bushing has to be well tightened.

Junction box	Meaning	Color of conductor
	Electrode E1	Brown BN
	Electrode E2	White WH
	Earthing electrode	Blue BU (shielding of couple BN, WH)
	Excitation winding	Yellow YE
	Excitation winding	Green GN
	Earthing electrode	Blue BU (shielding of couple GN, YE)
	Protective conductor	Yellow-green GNYE (cable shielding)

6.3. Operational start

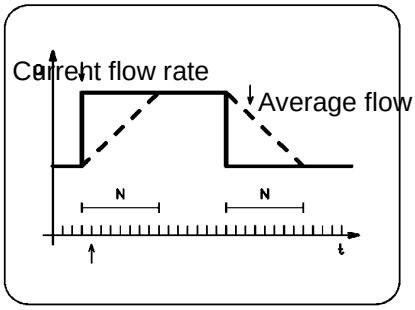
The electromagnetic flowmeter must first be fitted mechanically and then the power supply and output terminals be interconnected. Then switch on the supply voltage. Within a short time, the meter will be initialized and its operational conditions stabilized. This version of the flowmeter contains neither display nor buttons.
The meter configuration is always customized. Changes in the configuration and/or setting can be performed via special serial communication line USB (ELIS PLZEŇ a. s. delivers as a producer)

7. OPTIONAL SETTINGS

The electromagnetic flowmeter is standardly set at the factory. If the customer needs the parameters of optional settings, it must be specified in the order.

7.1. Samples

The number of samples “N”, on the basis of which the average flow rate value is determined, can be set within the range of 1 to 255. The averaging feature is useful in the cases where the flow through the meter sensor is unstable, the fluid is turbulent or where there air bubbles are trapped in the fluid flow.
Average flow rage as measured and displayed is the parameter used to calculated impulse output OUT1. The averaging function helps suppress fast changes in the fluid flow rate.



Sampling

Suppression of step changes in flow rate

7.2. Pulse output OUT1

In any of the impulse modes, an impulse will be generated as soon as a defined (preset) fluid volume passes through the meter sensor. Pulse width is fixed at 100 ms. For the duration of the impulse output is closed. The following table shows the optimal choice of impulse numbers depending on the dimension of the flowmeter.

DN	Q_{max} l/s	Pulse number l/pulse
15	1,6	1
20	3	1
25	5	1
32	8,33	1
40	12,5	10
50	20	10
65	33,33	10
80	50	10
100	77,77	10
125	119,44	100
150	180,55	100
200	319,4	100
250	500	100
300	700	100
350	972	100
400	1250	1000
500	2000	1000
600	2778	1000
700	3889	1000
800	5000	1000

7.3. Production data

The production label consist all the parameters that are set at the factory.

Constant K1
Pulse number
Numbers of samples
Suppressed flow

Constant of a sensor K1 and K2 – defines a basic calibration factor of a sensor
Pulse number
Numbers of samples for averaging – it stabilizes a flow value by flow drifting. It is possible to set it by production on values 25, 50, 100, 150, 200, 250 of samples.
Suppressed flow – it defines a flow area (symmetric around zero), where all outputs values are set on zero.

8. ERROR REMOVAL AND METER REPAIR PROCEDURES FN50xx.2

Error removal and meter repair activities should be reserved to duly qualified staff skilled is maintenance of electronic equipment and acquainted with the labor safety rules applicable to the plant concerned. On request, the meter manufacturer will provide training for such staff. The manufacturer's responsibility for any meter damage due to incorrect handling is precluded. Prior to any work on the meter such as disconnection or removal of printed circuit boards, sensor disconnection, etc., make sure that the supply voltage is disconnected. At all times, be aware of the danger of electric shock.

8.1. FLOW-METER REPAIR PROCEDURE

Prior to any maintenance or repair action on the internal parts of the meter control unit including the power source, sensor disconnection, PC boards, etc. make sure that the supply voltage is disconnected. Warning: disregarding this instruction implies risk of electric shock. The self-diagnostic feature of the electronic unit concerns basic errors indicated via LED diode – lighting (lightless), flashing (not flashing), flashing regularly (irregularly). On the basis of these conditions possible to check status of the flowmeter. Correct status is that when the LED is flashing regularly about 3 times per second for small sizes, for bigger sizes is flashing slowly. A velocity of flushing matches with velocity of excitation of coils. The second LED is red and it must flush 1 per second. If a fault occurs it will appear by changing LEDs flashing. Of course, it can't be evaluated all possible faults, that even when the LED lighting correctly number of output pulses and their frequency may not correspond to the measured flow. Because the flowmeter has no display, it is the only visual check of status of the meter via LED on the circuit board (after removing the cover and cover plates electronics). It is necessary to connect PC with diagnostic software and in the section "ERRORS" to check, which error is signalized:

Code error	Description of error	Possible reason/removing of an error
E00	No error	–
E01	Overload of a range AD	Over limit flow rate (Short time of step change of flow in the range from 0 to Q_4) If this error lasts, the PC board is in defect.
E02	Step change of flow	See code error E01
E03	Error of reading /recording to memory	In case of big error of time RTC it is necessary to change of backup battery on the processor board. If this error lasts still, it is necessary to change the block of a transmitter.
E04	Other error of the transmitter block	If this error lasts, it is necessary to change the block of a transmitter (processor board, board of outputs, board of measurement).
E05	Alert -it is not possible to calibrate zero flow.	To repeat a calibration of zero flow after several seconds. If this error lasts, it is necessary to change the block of a transmitter (processor board, board of outputs, board of measurement).
E06	Low of current of excitation	Open circuit of excitation = defect of a sensor or interrupted connection between a transmitter and a sensor Defected board of measurement If this error lasts, it is necessary to change the block of a transmitter (processor board, board of outputs, board of measurement).
E07	Short circuit of excitation coils	Short circuit of excitation = defected sensor or shorted connection between a transmitter and a sensor Checking of signal cables Check a sensor by Simulator SF1.0.
E08	Information – zeroing is doing, any measurement	A flowmeter does not measure for time of 1 min. This information is missing after finishing of zeroing and a measure again normally.
E09	Hight resistance of measured medium	Indication of empty pipe.
E10	Error of output OUT1	Frequency output over 10 kHz. Frequency of pulse output over 100 Hz. Gap between pulses is shorten than duration of pulse.
E14	Exceeded over flow Q4	Checking of Q_4 (100%) If this error lasts, it is necessary to change the block of a transmitter (processor board, board of outputs, board of measurement).

9. PACKAGING

The product packaging shall meet the requirements regarding safe domestic and international transport or other conditions agreed to with the customer. In that, the manufacturer uses its own in-company packaging directives and standards.

10. PRODUCT ACCEPTANCE

The product acceptance procedure consists of visual inspection and check on the completeness of the delivered items with reference to the delivery note. On delivery to the customer, enclosed to the flowmeter FLONET FN50xx.2 shall be a delivery note, operation and maintenance manual and a statement on the product compliance with the respective standards.

11. WARRANTY CONDITIONS

Unless agreed otherwise between the manufacturer and the customer, the warranty period for electromagnetic flowmeters is 12 months counted from the delivery date. Within the warranty period, the manufacturer shall repair, free of charge, any product defects due to faulty materials or parts. In the case of a warranty repair, the warranty period shall be extended by the time the flowmeter was inoperative because of such repair. Manufacturer's warranty shall not cover product defects or malfunctions due to incorrect product installation, operation, intentional damage, pilferage or damage due to force majeure circumstances.

12. PRODUCT ORDERING

To order and specify the flowmeters, you can use the Order Number generated by the Specification Table after entering the required technical parameters.
This Specification Table for the required type of flow meter can be found on the website www.elis.cz/en in the "download" section.

If you need help, please contact us.

Manufacturer's address:

ELIS PLZEŇ a. s.
Luční 425/15,
301 00 Plzeň
Czech Republic
Tel.: +420 377 517 711
Fax: +420 377 517 722
E-mail: sales@elis.cz
http://www.elis.cz

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