Electromagnetic Flowmeter

FLONET FN20xx.1

Content

1. INTRODUCTION

The FLONET FN20xx.1 electromagnetic flowmeter has been designed to measure volume flow rates of electrically conductive liquids in closed piping systems. The flow measurement can be carried out bi-directionally, with a high measurement accuracy over a wide range of flow rates (0.1 to 10 m/s). The minimum required conductivity of the measured medium is 5 µS/cm.

The transmitter includes a two-line alphanumeric display to show the measured values where various operating parameters of the meter can be selected on a keypad. The flowmeter has two passive binary outputs, one active current output and an output to connect a digital communication line. All meter functions and output parameters can be reset during the meter operation. If the meter is to be used as an invoicing meter, some of its functions are blocked to prevent the user from interfering with the meter readings.

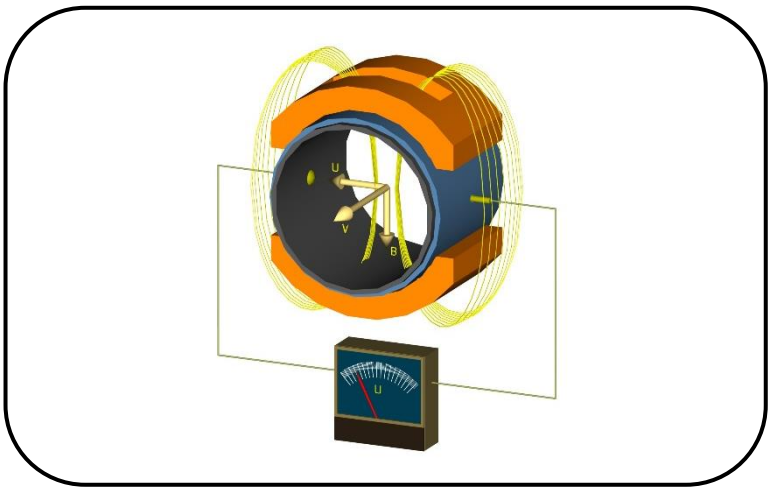
The user may combine any sensor of the IS X.xx type series with any transmitter (C 6.00 or C 7.00) without re-calibration of the meter on a test stand (however, such calibration is required for invoicing meters). The only thing that needs to be done is to enter the calibration constants and excitation frequency of the selected sensor into the transmitter memory. These data are mentioned on the rating plate of the sensor. The value of threshold flow rate shall be set between 0.5 and 1% of the specified maximum flow rate.

2. MEASUREMENT PRINCIPLE

The function of an electromagnetic flowmeter is based on Faraday's law of induction. The meter sensor consists of a non-magnetic and non-conductive tube with two embedded measuring electrodes detecting the induced voltage. The alternating magnetic field is created by two coils fitted onto the tube parallel to the plane of the measuring electrodes. When a conductive liquid moves in a magnetic field **B**, voltage **U** will be detected on the measuring electrodes. Such a voltage is 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 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 determined as a product of the flow velocity and square section of the tube, **Q = v** x **S.**

3. TECHNICAL DESCRIPTION

3.1. General description

The electromagnetic flowmeter consists of a sensor through which flows the measured liquid and an transmitter where the low-level signal from a sensor is modified to the standardised 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 induction flow meters is the requirement that the measured liquid must be conductive and non-magnetic. The induction flow meter can be designed either as a compact device or with the sensor separated from the associated transmitter. In the former case, the transmitter is fitted directly onto the meter sensor, in the latter case it is connected to the sensor by a special cable.

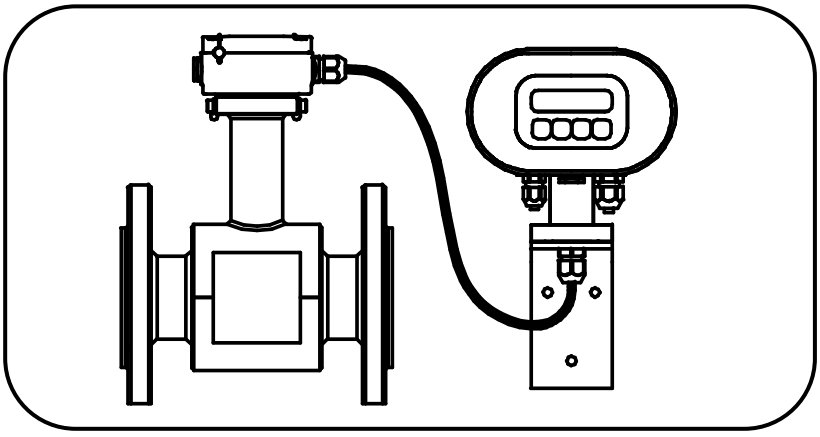
The sensor design shall take into consideration the type of the measured liquid and its operational parameters. To facilitate fitting into the liquid piping, the sensor can be provided with end flanges, screwing, or it may be of a sandwich design. The transmitter is supplied in two basic versions, COMFORT or ECONOMIC. The supply voltage, types of output signal and communication interface can be selected according to the customer requirements.

The basic configuration of the induction flow meter includes two insulated passive binary outputs (each with an optocoupler including a transistor output) and the USB communication interface. This interface is not insulated as it is used for calibration purposes only. Optional accessories to this basic configuration are insulated current output and insulated RS-485 communication interface, output relay, INPUT1 and OUTPUT3 for batching (all these electrically insulated from the transmitter circuitry).

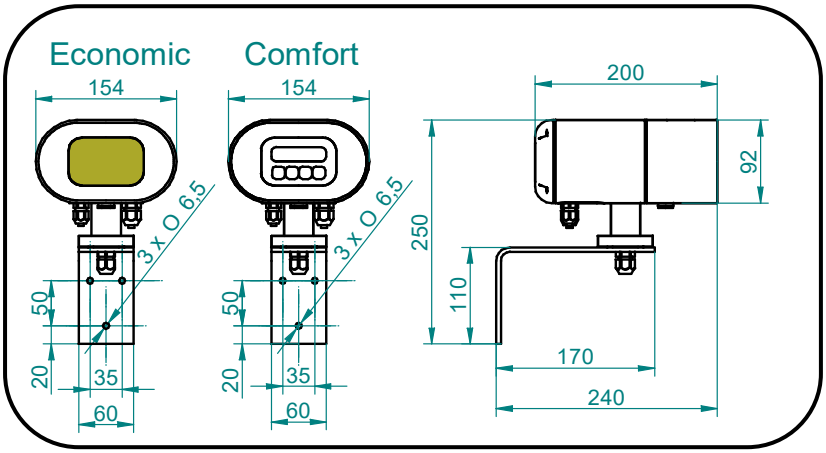
3.2. Meter design

3.2.1. Remote version

Flanged sensor connected by cable to the remote transmitter

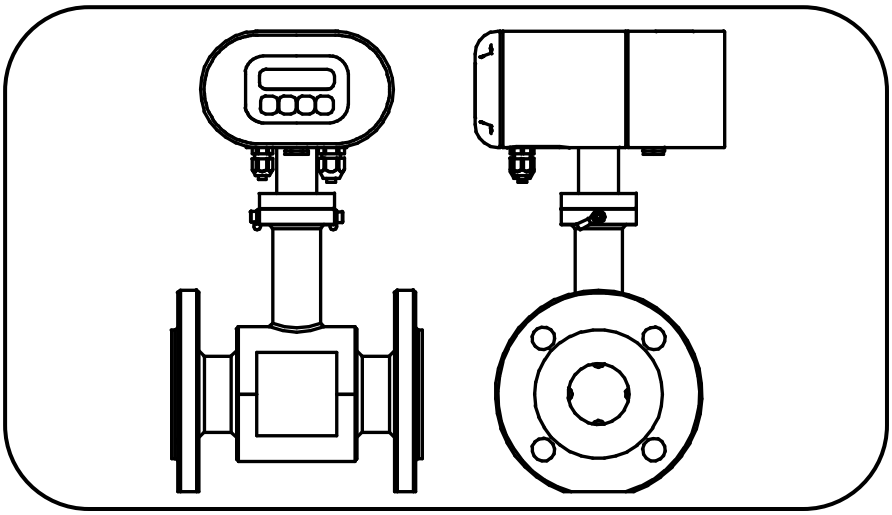


Dimensions of the box to accommodate remote transmitter and the mounting bracket

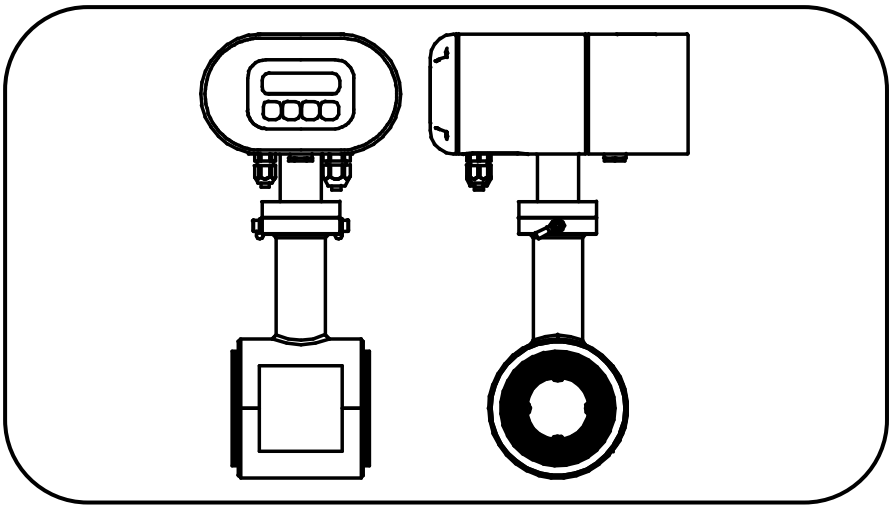


3.2.2. Compact version

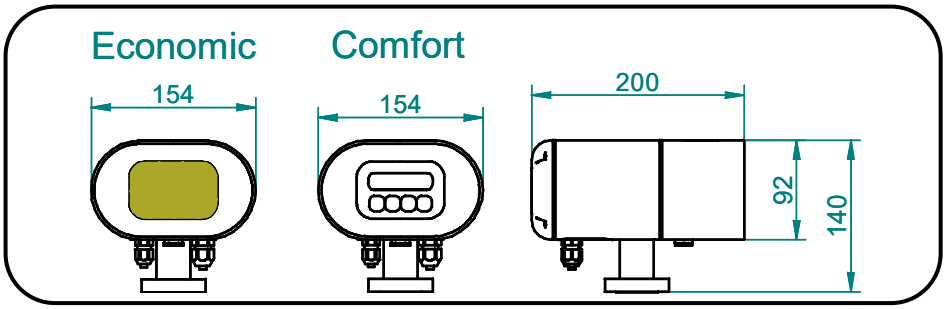
Compact version with flanged sensor and transmitter



Compact version with flangeless sensor and transmitter

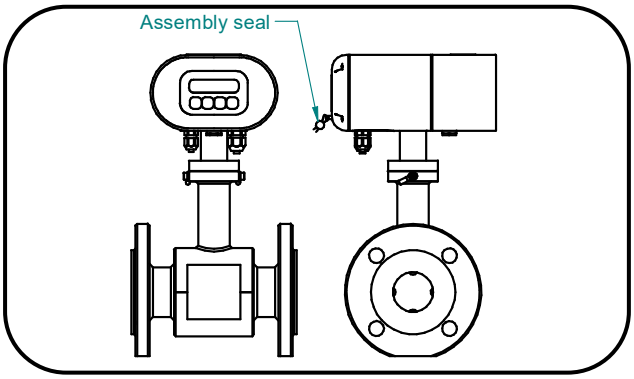


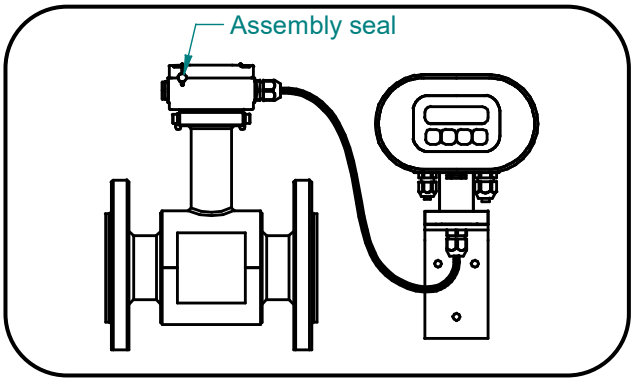
Housing dimensions in the compact version

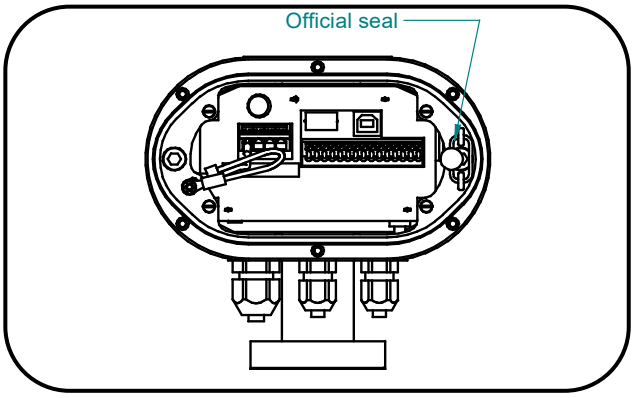


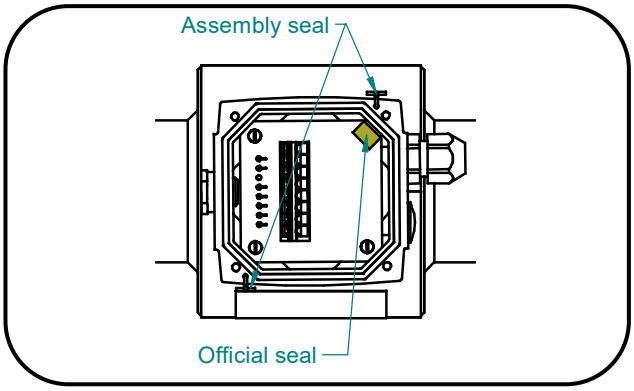
3.2.3. Protection of the flowmeters against unauthorised intervention

The flowmeter is delivered with official and assembly seals. Installation of commercial meters is reserved to duly authorised organisation(s).
Placement of official and assembly seals on meters in compact and remote versions.









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

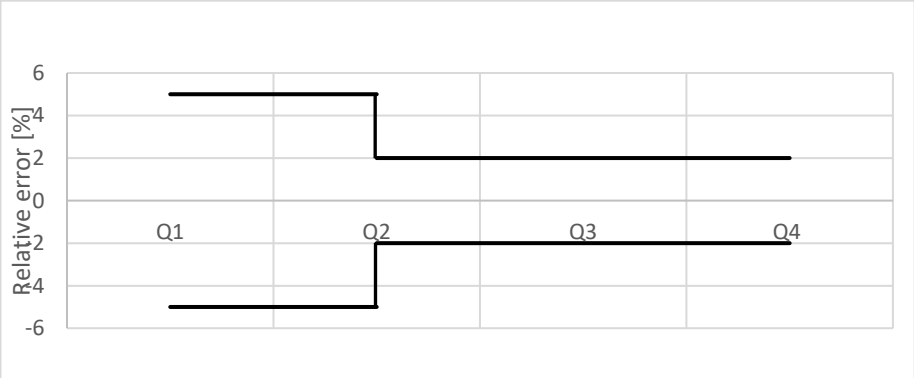
The following table shows minimum and maximum flow rates for various sensor sizes and flow velocities ranging from 0.1 to 10 m/s. The best operational properties will be achieved at the flow velocity range of 0.5 to 5 m/s. For lower flow velocities, the measurement accuracy is lower while at higher flow velocities the turbulences at contact edges may cause undesirable interference.

Minimum and maximum flow rates for various sensor sizes
Q_1 corresponds to flow velocity 0.1 m/s
Q_4 corresponds to flow velocity 10.0 m/s

Basic parameters of the flow meters are designed according to standard EN ISO 4064-1 (OIML R 49).
The ratio of following flows is shown below:

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

Flow meter precision rating in accordance with standard EN ISO 4064-1 (OIML R 49)



The figures in the table are based on standard EN ISO 4064-1 (OIML R 49).

The flow rate values Q_1, Q_2, Q_3 and Q_4 related to individual design versions and meter dimensions are shown below in the Table 1:

Table 1

DN	litre / s				m^3 / hour			
	Q_1	Q_2	Q_3	Q_4	Q_1	Q_2	Q_3	Q_4
6	0,003	0,004	0,22	0,278	0,010	0,016	0,80	1
8	0,005	0,008	0,4	0,5	0,018	0,029	1,44	1,8
10	0,008	0,012	0,622	0,778	0,028	0,045	2,24	2,8
15	0,018	0,029	1,444	1,806	0,065	0,104	5,2	6,5
20	0,033	0,053	2,667	3,333	0,120	0,192	9,6	12
25	0,05	0,08	4	5	0,180	0,288	14,40	18
32	0,0833	0,133	6,667	8,333	0,300	0,48	24	30
40	0,125	0,2	10,000	12,5	0,450	0,72	36	45
50	0,2	0,320	16	20	0,720	1,152	57,6	72
65	0,333	0,533	26,667	33,333	1,20	1,9	96	120
80	0,5	0,8	40	50	1,80	2,9	144	180
100	0,7778	1,244	62,222	77,778	2,80	4,5	224	280
125	1,1944	1,911	95,556	119,444	4,30	6,9	344	430
150	1,8056	2,889	144,444	180,556	6,50	10,4	520	650
200	3,194	5,111	255,556	319,444	11,50	18,4	920	1 150
250	5	8	400	500	18,00	28,8	1 440	1 800
300	7	11,2	560	700	25,20	40,3	2 016	2 520
350	9,72	15,56	777,78	972,22	35,00	56	2 800	3 500
400	12,5	20,00	1 000,00	1 250,00	45,00	72	3 600	4 500
500	20	32,00	1 600,00	2 000,00	72,00	115	5 760	7 200
600	27,78	44,44	2 222,22	2 777,78	100,00	160	8 000	10 000
700	38,89	62,22	3 111,11	3 888,89	140,00	224	11 200	14 000
800	50	80,00	4 000,00	5 000,00	180,00	288	14 400	18 000
900	63,89	102,22	5 111,11	6 388,89	230,00	368	18 400	23 000
1 000	77,78	124,44	6 222,22	7 777,78	280,00	448	22 400	28 000
1 200	111,11	177,78	8 888,89	11 111,1	400,00	640	32 000	40 000

Where

Q_4 is the overload (maximum) flow rate,

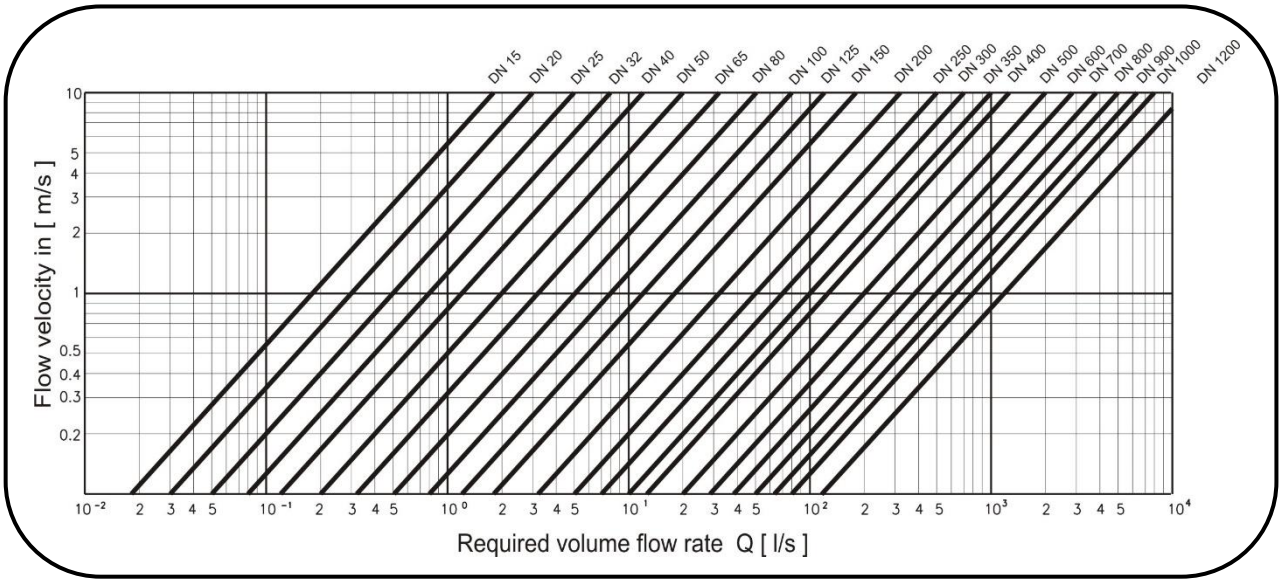
Q_3 is the permanent flow rate,

Q_2 is the minimum flow rate for specified measurement accuracy, and

Q_1 is the minimum flow rate

Q_{NEC} is the sensitivity threshold (flow rate) level of the sensor concerned.

Operating flow rates and flow velocities for various sensor sizes



4.1.2. Operating pressure of measured liquid

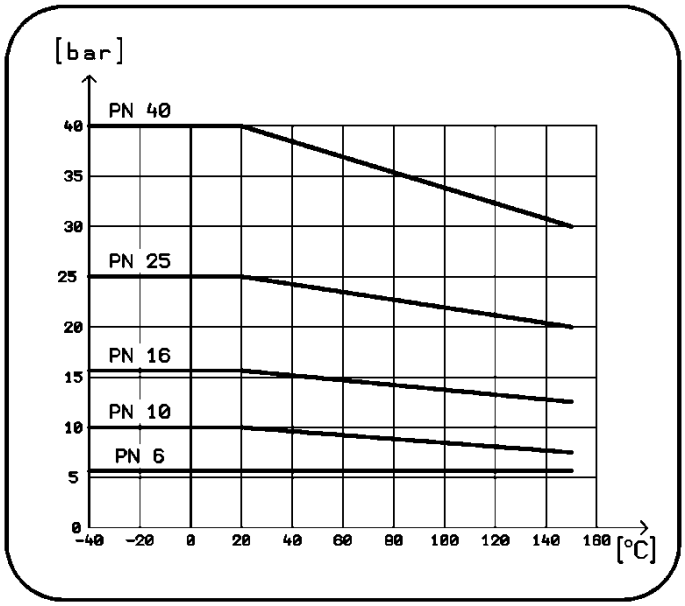
The standard sensor versions have the following pressure ratings:
Flanges according to EN1092-1

Nominal size of sensor	Pressure rating
DN 6 to DN10	PN 25
DN 15 to DN 50	PN 40
DN 65 to DN 200	PN 16
DN 250 to DN 300	PN 10

Flanges according to ASME B16.5

Nominal size of sensor	Pressure rating
NPS ½“ to 12“	Class 150

On request, any sensor can be supplied for pressure rating PN 6 to PN 40. The choice of pressure rating is primarily derived from the maximum admissible working pressure of the measured liquid, considering the nominal size and pressure rating of the flanges on the adjoining piping. Consideration shall also be given to the liquid temperature.
Relationship between operating pressure and temperature of the measured liquid.



4.1.3. Selection of electrode material

Measurement electrodes are made of stainless steel 1.4571 (316Ti) or Hastelloy C276. However, for special applications it may be necessary to select a material of higher quality. On request, the meter manufacturer may supply electrodes made of platinum-rhodium (PtRh10), tantalum and titanium.

4.1.4. Selection of sensor tube lining

The sensor lining material selection depends on the operational parameters of the measured liquid.

Hard rubber (HR)
Hard rubber is suitable for almost all applications in the water industry. It can be used also for acids and alkalis of medium concentration and with operating temperature +5 °C to 80 °C (41 °F to 176 °F).

Soft rubber (SR)
Soft rubber with a high abrasion resistance is suitable for less chemically aggressive and non-oxidation environments containing abrasive particles. It also withstands dilatation and rapid temperature changes in the range -35 °C to 80 °C (-31 °F to 176 °F).

Rubber for drinking water
Suitable for almost all applications in the water industry where a drinking water certificate is required. It can be used also for acids and alkalis of medium concentration and with operating temperature +5 °C to 80 °C (41 °F to 176 °F).

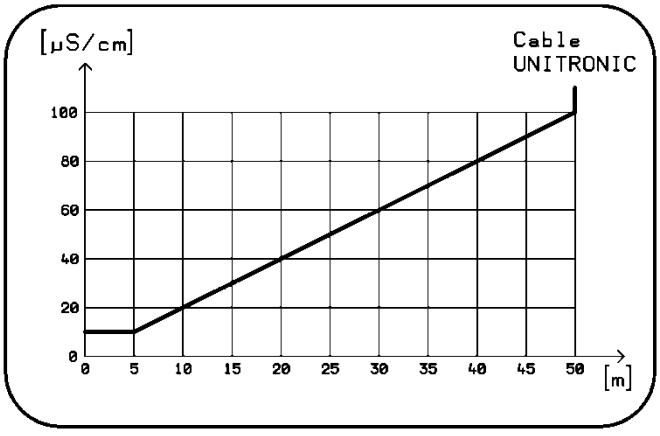
PTFE
PTFE lining is a universal solution for highly corrosive liquids and temperatures ranging from –20 °C to +110 °C (-4 °F to 230 °F), on request -35°C up to +150 °C (-31 °F to 302 °F). Typical application is in the chemical and food processing industry.

E-CTFE
E-CTFE lining is a universal solution for flowmeters from DN 300 and higher for corrosive liquids and temperatures ranging from -20 °C to +110 °C (-4 °F to 230 °F), on request from -35 °C up to 130 °C (-31 °F to 266 °F). Typical application is in the chemical processing industry.

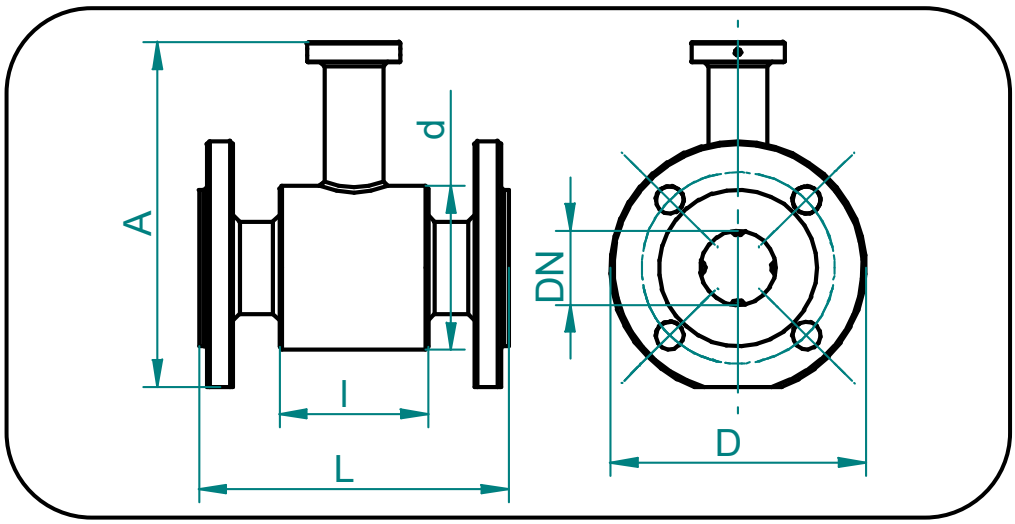
4.1.5. Compact and remote version

The remote version is used at locations where ambient temperature exceeds +50 °C. In such cases, the transmitter must be placed at a “remote” place where the ambient temperature never exceeds 50 °C. The remote transmitter is connected with the sensor by a connecting cable. For all places with ambient temperature below 50 °C is suitable the compact version.
It is important to mention that with an increasing ambient temperature decreases measurement accuracy.

To prevent electromagnetic interference in the connecting cable, the sensor and remote transmitter should be located as close as possible to one another. The maximum cable length depends on the conductivity of the measured liquid (see the following diagram).



4.1.6. Dimensions of flanged sensor



Dimensions of sensor with flanges according to EN1092-1.

Pressure rating	DN	D [mm]	D [mm]	A* [mm]	L [mm]	L [mm]	Weight [kg]
PN 25	6	90			170		
	8	90			170		
	10	90			170		
PN 40	15	95	62	164	200	66	2.9
	20	105	62	170	200	66	3
	25	115	72	180	200	96	3.9
	32	140	82	197	200	96	5.5
	40	150	92	207	200	96	6.1
	50	165	107	225	200	96	8.1
PN 16	65	185	127	245	200	96	10
	80	200	142	260	200	96	12.3
	100	220	162	280	250	96	15.3
	125	250	192	310	250	126	18.9
	150	285	218	344	300	126	26
	200	340	274	399	350	211	36
PN 10	250	395	370	475	450	211	60
	300	445	420	525	500	320	68
	350	505	480	584	550	320	92
	400	565	530	642	600	320	158
	450	615	581	695	600	320	150
	500	670	640	752	600	320	177
	600	780	760	870	600	320	288
	700	895	880	990	700	420	
PN 6	800	975	960	1100	800	420	427
	900	1075	1040	1185	900	520	
	1000	1175	1140	1290	1000	520	500
	1200	1405	1340	1510	1200	520	680

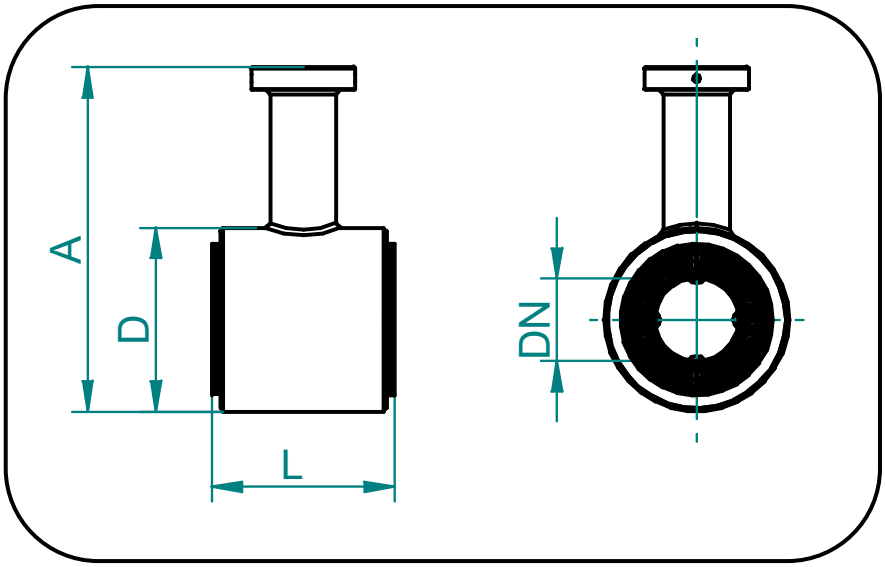
* Dimension A (sensor height) is without transmitter housing (or terminal box in the remote version).
The sensor weight is an indicative value.

Dimensions of sensor with flanges according to ASME (ANSI) B16.5 Class 150 (from 1/2” to 24”) and AWWA Class B (from 28” to 48”)

Pressure rating	NPS	D [mm]	D [mm]	A* [mm]	L [mm]	L [mm]	Weight [kg]
Class 150 (according to ASME)	1/2"	88.9	62	161	200	66	3
	3/4"	98.6	62	166	200	66	3
	1"	108	72	176	200	96	3
	1 1/4"	117.3	82	186	200	96	4
	1 1/2"	127	92	196	200	96	4
	2"	152.4	107	219	200	96	6
	2 1/2"	177.8	127	241	200	96	9
	3"	190.5	142	255	200	96	14
	4"	228.6	162	284	250	96	16
	5"	254	192	312	250	126	19
	6"	279.4	218	341	300	126	25
	8"	342.9	274	401	350	211	41
	10"	406.4	370	480	450	211	54
	12"	482.6	420	543	500	320	77
	14"	533.4	480	599	550	320	92
	16"	596.9	530	656	600	320	116
	18"	635	581	705	600	320	150
	20"	698.5	640	761	600	320	167
	24"	812.8	760	878	600	320	315
Class B (according to AWWA)	28"	927.1	863	1005	700	420	360
	32"	1060.45	957	1112	800	420	427
	36"	1168.4	1058	1216	900	520	510
	40"	1289.05	1156	1326	1000	520	580
	48"	1511.3	1373	1552	1200	520	680

* Dimension A (sensor height) is net of the electronic unit box (or terminal box in the remote meter version).
The sensor weight data are indicative only.

4.1.7. Dimensions of flangeless sensor



Dimensions of flangeless sensor

Pressure rating	DN / NPS	DN [mm]	D [mm]	A* [mm]	L [mm]	Weight [kg]
PN 40	20 / 3/4"	20	62	153	74	
	25 / 1"	25	72	163	104	1.5
	32 / 1 1/4"	32	82	173	104	1.8
	40 / 1 1/2"	40	93	184	104	2.4
	50 / 2"	50	107	201	104	2.5
PN 16	65 / 2 1/2"	65	127	221	104	3
	80 / 3"	80	142	236	104	3.7
	100 / 4"	100	162	256	104	5.5
	125 / 5"	125	192	286	134	6
	150 / 6"	150	218	315	134	7.8
	200 / 8"	200	274	371	219	13.5

* Dimension A (sensor height) is without transmitter housing (or terminal box).
The sensor weight is an indicative value.

Caution: Connection for counter flanges ASME (ANSI) for flangeless version is supplied starting with NPS 1" to NPS 8".
(Sensors are one dimension smaller due the installation between flanges from NPS 1" up to NPS 3"; for example: request from customer NPS 1" means sensor with internal diameter NPS 3/4", and it corresponds with a range of flow rates).
From NPS 4" to NPS 8" sensors are of the same diameters.

Note: The grounding rings for a flangeless version: size of the grounding rings should be the same size as a size of the existing pipe - valid for EN 1092-1 and ASME (ANSI) standards.

4.1.8. Sensor specifications

Sensor size	Flanged sensors, DN 6 to DN 1200 (NPS ½" to 48") Flangeless sensors, DN 20 to DN 200 (NPS 3/4" to 8")
Maximum admissible working pressure	with EN 1092-1 flanges 25 bar at RT* for DN 6 to10/ PN25 40 bar at RT* for DN 15 to 50/ PN40 16 bar at RT* for DN 65 to 200/ PN16 10 bar at RT* for DN 250 to 750/ PN10 6 bar at RT* for DN 800 to 1200/ PN6 *RT – reference temperature: -10 to +50°C with ASME(ANSI) B16.5 flanges 230 psig at -20° to +100°F (NPS ½" to 10" class 150) 150 psig at -20° to +100°F (NPS 12" to 24" class 150) with AWWA flanges 86 psig at -20° to +100°F (NPS 28" to 48" class B)
Mechanical connection	Flanges according to EN 1092-1, ASME (ANSI) B16.5, AWWA standards Flangeless Others
Grounding	on flanges Grounding rings Grounding electrode
Flow velocity of measured liquid	From 0.1 m/s to 10 m/s
Maximum temperature of measured liquid	up to 110 ºC (230 °F) up to 150 °C (302 °F) for request (for detailed information see article 4.1.4)
Minimum conductivity of measured liquid	20 µS/cm, 5 µS/cm in special applications
Empty pipe detection	a) with measurement electrodes from DN50 (2") b) for remote version max length of cable 6 m (19,6 ft)
Lining	Soft rubber Hard rubber Rubber for drinking water PTFE E-CTFE
Measuring electrodes	Stainless steel, grade 1.4571 (316Ti) Hastelloy C276 Titanium Tantalum Platinum-Rhodium (PtRh10) other materials on request
Protection class	IP 67 IP 68 (2 m/6,5 ft)
Storage temperature	-10 ºC to +70 ºC (14 °F to 158 °F) at max. relative air humidity 70 % (for PTFE, E-CTFE, Soft Rubber) +5 °C to +70 ºC (41 °F to 158 °F) at max. relative air humidity 70 % (for Hard Rubber and Rubber for drinking water)

4.2. Transmitter housing

The transmitter is accommodated in a cast aluminium box coated on the surface with paint of hue RAL 1017. The box is held by four M5 bolts with hexagonal socket heads. Upon loosening the bolts slightly, the box can be rotated around horizontal axis through ±180°. At the rear part of the box there is a terminal board under a lid held in position by six bolts with hexagonal socket heads. At the bottom of the box there are cable glands and a special valve preventing condensation of the air humidity inside the box.
The unused gland openings shall be blinded. The front panel of the box is either blinded (the ECONOMIC version) or fitted with a two-line background-illuminated display unit and a four-button membrane keypad (the COMFORT version of the meter).

Prior to putting the meter into operation, check the correct sealing of all active glands, blinding of the unused ones and tightening of the bolts holding the terminal box lid.

4.2.1. Transmitter specifications

Power supply	230V~ (+10 % / -15 %) / 50 to 60 Hz 115V~ (+10 % / -15 %) / 50 to 60 Hz 24V~ (+10 % / -15 %) / 50 to 60 Hz 24V = (± 20 %)
Power consumption	15 VA
Line fuse	T 250 mA, T 2.0 A (with power supply 24 V)
Electric shock protection according to standard CSN 332000-4-41	Automated disconnection from power source in TN-S network
Housing material	Aluminium casting
Weight	3.0 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	0.1 to 10 m/s
Accuracy class according to EN ISO 4064-1 (OIML R49) *)	2
Zero flow-rate setting	For COMFORT version only
Output 1 - passive output, isolated Output 2 - passive output, isolated Active current output, isolated Dosing: input 1 output 3 Output relay	Binary multi-function optocoupler 30 V / 50 mA Binary multi-function optocoupler 30 V / 50 mA Analog 0 (4) to 20mA, max. load 1,000 Ohm Input optocoupler diode 5 V, 10 mA Binary multi-function optocoupler 30 V / 50 mA Insulated switch contact 0.3 A, 30 VDC Mechanical lifetime 50,000,000 cycles
Serial communication ports	USB (not insulated) RS-485 (insulated)
Operator communication language	CZ – Czech, EN – English
Protection class	IP 67
ECONOMIC version / configuration	C 6.00 – no display or keypad
COMFORT version / configuration	C 7.00 – including display and keypad

Note: In case, that a flow meter shall be installed in non-standard climatic condition, it is necessary to consult this using with the producer (ELIS PLZEN a. s.).

*) in the above standard version, it is possible to supply the flowmeter with higher accuracy in the range and conditions agreed with the manufacturer
Example of above standard parameters:

Maximum measurement accuracy	0,2 % for 10 to 100 % of Q_4 0,5 % for 5 to 100 % of Q_4

5. METER APPLICATION RULES

The compact version of flowmeter is intended only for environments without occurrence of condensation and where media temperature does not exceed +60 °C.

5.1. Sensor placement in piping

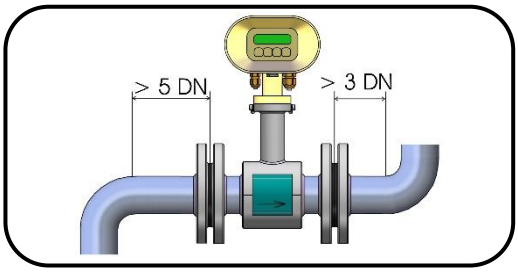
No chemical injection or batching unit (such as chlorine compound injector) should be located at sensor's inlet. The insufficient homogeneity of the flowing liquid may affect the flow rate values indicated by the meter.

The meter performance will be the best if the liquid flow in the piping is well stabilised; 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 shall 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 piping.

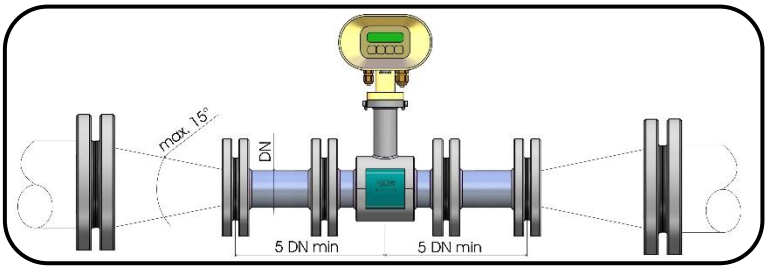
If more than one flow-disturbing element such as pipe bend or fitting are located near the sensor, the required length of straight piping section on the sensor side concerned should be multiplied by the quantity of such elements.

As required by clause 4.2.1 of standard EN 29104, the inner diameter of the connected pipe shall not differ by more than 3% from that of the sensor.

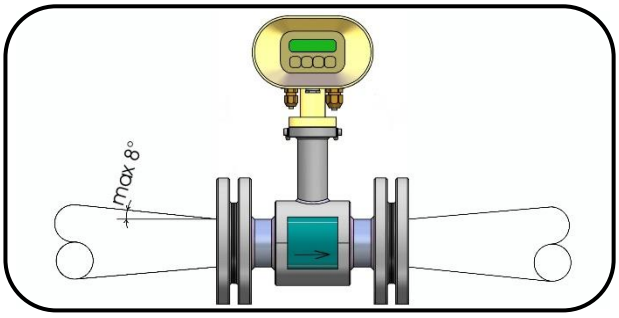
In the cases of bi-directional flow rate measurement, the same conditions concerning flow stability shall be met at sensor's input and output.



Required straight piping sections



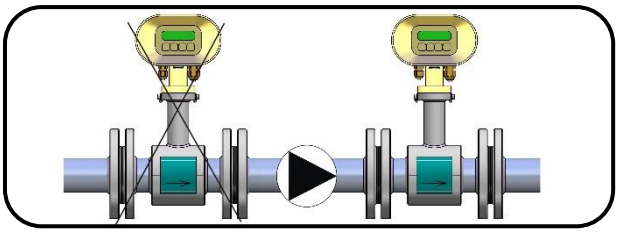
Pipe narrowing



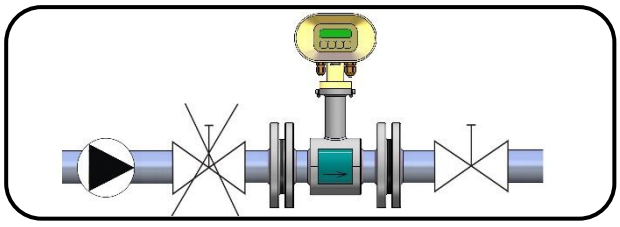
Where the pipe size is larger than that of the meter sensor, it is necessary to use conical reduction pieces with the angle of taper not exceeding 15° (see the picture). For a bi-directional flow measurement, the minimum length of straight piping sections on both sides is 5 DN. At horizontal sensor installations,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

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

Where the liquid is pumped into the piping, the flow sensor shall always be placed at the outlet 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 at least 25 DN.



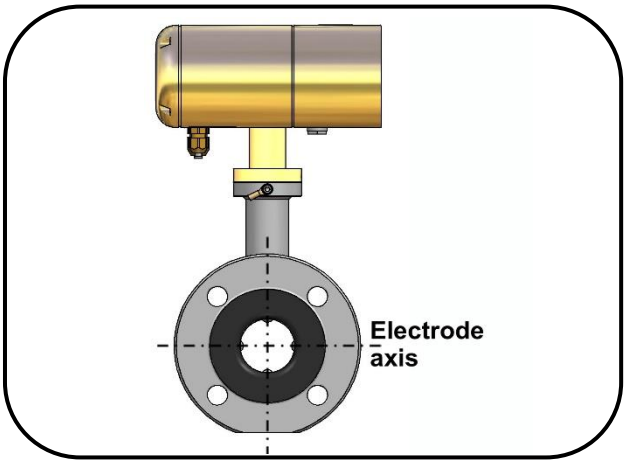
Pump in the piping



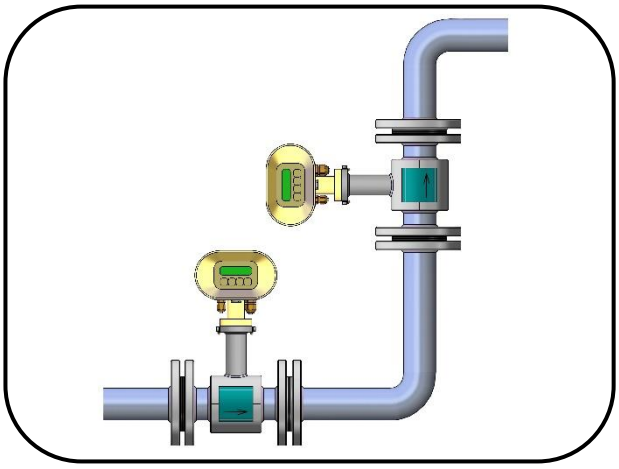
Closing valve in the piping

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. Make sure that the electrode axis is always horizontal and, if the sensor is mounted in a horizontal position, the chimney faces upwards.

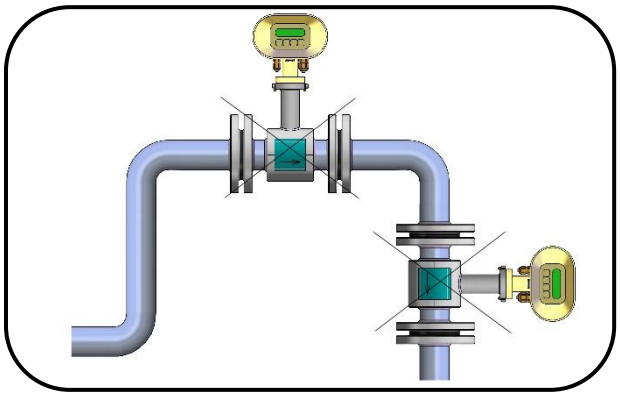


Electrode axis

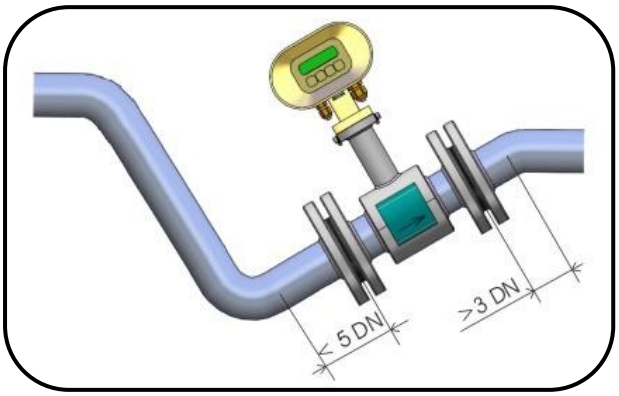


Sensor mounted in a vertical position

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

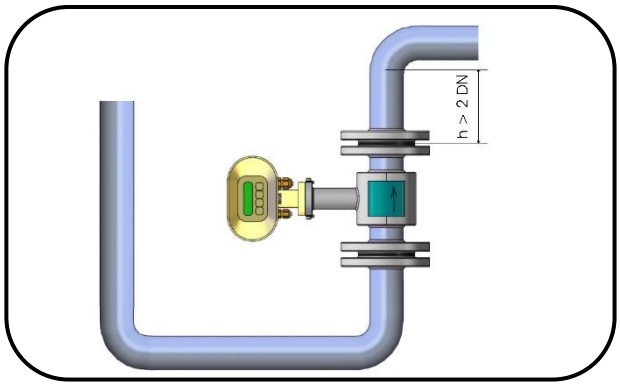


Risk of liquid aeration



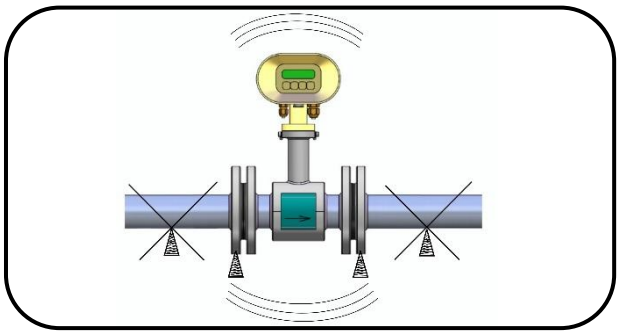
Permanent flooding of sensor

To ensure correct meter function at all times, the measured liquid must 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.

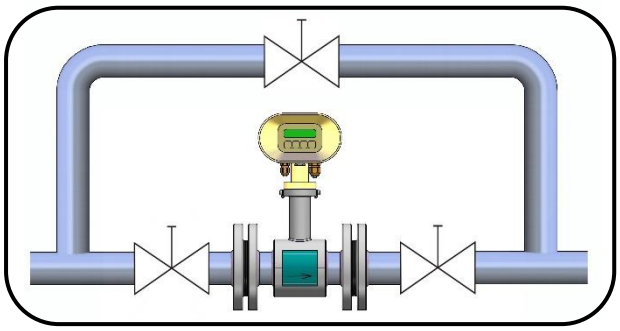


Sensor placement near free discharge point

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



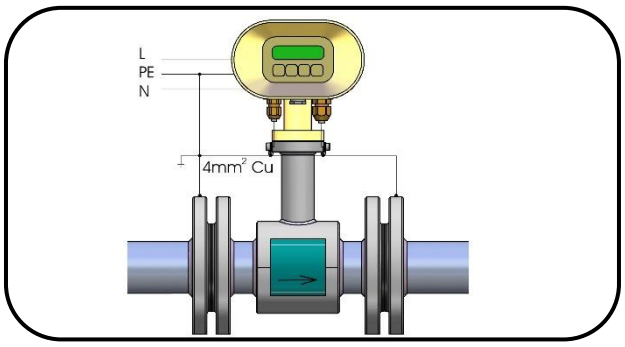
Sensor bypass

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 where dismantling the flow sensor would require an emptying of a very long section of piping.

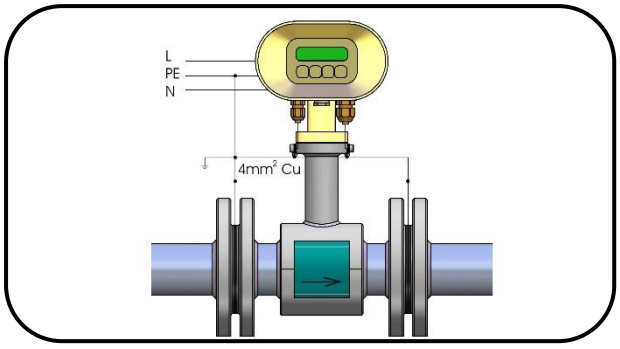
5.2. Sensor grounding

The correct meter function requires that both sensor and adjoining piping sections are duly interconnected to the ground potential by low-impedance grounding conductors and a protective conductor from a power supply. The overall arrangement shall be such that the potentials of the measured liquid at the sensor inlet and outlet sides are close to the ground.

With a flanged sensor installed in electrically conductive piping, the flanges shall be electrically connected with the piping and the piping connected to earth.



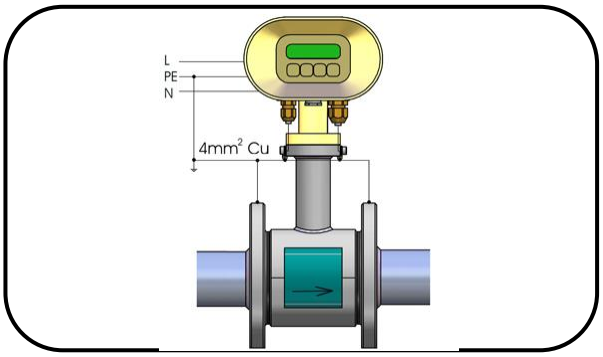
Flange grounding connection



Grounding rings

Should the adjoining piping sections be non-conductive, grounding rings or similar instruments shall be used to ensure that the electric potential of the measured liquid is properly grounded.

In case of a flangeless sensor, the piping flanges holding the sensor shall be electrically connected with the grounding point on the sensor.



Flangeless sensor

To ensure potential equalisation for remote version of flowmeter, it is recommended to interconnect the sensor body with the transmitter housing with a copper conductor of cross-section 4mm^2.

6. FLOWMETER INSTALLATION AND COMMISSIONING

The meter installation shall be performed in a strict observance of rules and procedures as described in this manual.

To prevent undesirable interference, the power cables shall be laid at least 25 cm away from all signal cables. The signal cables include the cable connecting the sensor with the transmitter (in case of a remote meter version), output signal cables and the cable of the RS-485 communication line. All cables shall be laid outside the thermal insulation layer on the piping (if any). Only shielded conductors shall be used to connect the output signals and the RS-485 line where the shielding shall be connected to the earth potential on the side of the master control system.

In applications where high levels of electromagnetic field interference at the measuring location can be expected (e.g. in the vicinity of power frequency converters), the remote meter version should be avoided. In these cases it is also recommended to include a filter in the power supply line to the transmitter.

Filter specification: The filter is intended to suppress dissemination of the undesirable high frequency disturbances from the power supply cable to the flowmeter system. Use any commercial filter of suitable parameters including protection class, and install it is close to the meter as possible. If need be, the filter can be placed in a special protection housing. When installing the filter, observe the applicable safety regulations.

Rated voltage:	250V/50Hz
Rated current:	0.5A and more
Suppression characteristic:	10kHz: 10 to 20dB
	10MHz: 40dB

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 flow meter 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, connecting flanges and the sensor tube shall be identical. The flange faces shall be perpendicular to the piping. The inlet and outlet piping sections including seals shall be perfectly aligned, with no protruding edges. In case of a non-conductive piping, use grounding rings on both sides of the sensor.

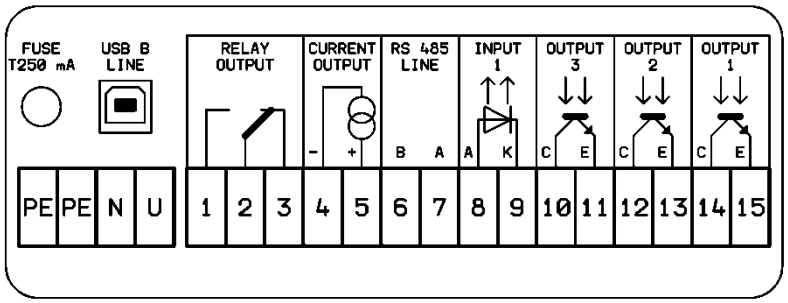
The arrow on the sensor body indicates the required liquid flow direction (positive flow direction).

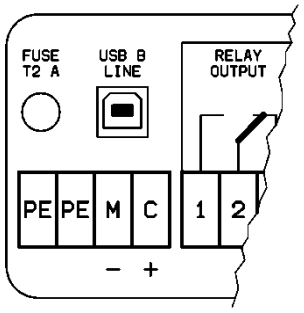
Upon loosening the four bolts holding the transmitter housing in position on the sensor body, the housing can be rotated through ±180°. The same system for the housing rotation can be used if the housing is mounted on a bracket attached to a vertical support plate or wall.

Do not expose the transmitter housing to direct sunlight; if installed outdoors, use a suitable protection shield.

6.2. Electric connection of flowmeter

The terminals for connecting the cables can be accessed upon removal of a cover at the rear part of the housing of transmitter. The cover is held by six socket-head bolts. A schematic diagram of connection is shown at the inner side of the cover.





Examples of labels showing power supply (line voltage or 24VDC source) and meter signal interconnection

6.2.1. Connection to power supply

Terminal	24V 115V 230V/AC/50 ÷ 60Hz
PE	PE grounding conductor
N	N neutral conductor
U	L phase conductor

Terminal	24VDC
PE	PE grounding conductor
M	M middle conductor
C	L+ +24V

To connect the power source, use a standard cable of three conductors of square section not exceeding 3 x 1.5mm^2. For ambient temperatures over 50°C, use a cable with rated operating temperature of at least 90°C. The housing's cable glands will only accommodate cables with outer diameter between 4 and 8mm. Use of any other cable would disturb the integrity of the IP 67 box.

The grounding 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 grounding conductor shall be the last to be disconnected from the terminal (see clause 6.10.2.2. of standard EN 61010-1).

The power supply line shall be protected by an overcurrent circuit breaker. A seal should be applied on the breaker to prevent unauthorised tampering. The transmitter 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	Switching contact	Change-over contact Output relay (optional)	Optocoupler insulated contact 0.3A, 30VDC
2	Central contact		
3	Break contact		
4	- pole	Current output (optional)	Active output, max. loading (Rz) 1,000Ω. No external power source needed.
5	+ pole		
6	Conductor B (-)	RS-485 (optional)	To be directly connected to communication line
7	Conductor A (+)		
8	Anode (+)	Dosing (optional) Binary input 1	Passive input 5VDC, 10mA
9	Cathode (-)		
10	Optocoupler collector (+)	Dosing (optional) Binary output 3	Passive output requires external power source and loading resistor
11	Optocoupler emitter (-)		
12	Optocoupler collector (+)	Binary output 2	Passive output requires external power source and loading resistor
13	Optocoupler emitter (-)		
14	Optocoupl. collector (+)	Binary output 1	Passive output requires external power source and loading resistor
15	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 and the communication line where the shielding shall be connected to the earth potential on the side of the master control system.

Upon connecting the conductors to the terminals, tighten the bolts holding the transmitter housing cover and check the gland sealing. The unused glands shall be blinded.

6.3. Interconnection of sensor and transmitter (remote version)

In the compact version of meter, the connection is internal. In the remote version, the transmitter shall be connected to the sensor be means of a special cable attached to the transmitter. On the sensor side, connect the cable wires paying attention to the wire insulation colours and the terminal identification labels.

Special cable UNITRONIC Cy PiDy 3x2x0.25 length up to 50 m, temperature up to 70 °C:

Brown BN	A
Blue BU	B
White WH	C
Green GN	D
Yellow YE	E
Yellow and green GNYE	Shielding
Pink PK	W2
Gray GY	W1

6.4. Interconnection of sensor and transmitter (remote version with IP 68)

In the IP 68 version of the flow sensor, the terminal box is sealed by cast plastic and the connecting cable is fixed on the sensor side. On the transmitter side, the cable is provided with a screw-on connector with its mating part mounted on the transmitter bracket. To prevent unauthorised handling, this connector can be sealed. The hole for the seal wire is provided in the bracket.

6.5. Commissioning

6.5.1. The ECONOMIC version

The electromagnetic flowmeter of either compact or remote design 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 stabilised. Information on the liquid flow parameters will start to be communicated from the meter outputs to the co-operating equipment (the plant control system) equipment.

The ECONOMIC version of the meter does not include any keypad or display unit. The meter configuration is always customized. Changes in the configuration and/or setting can be performed via the USB serial communication line using a computer with the FLOSET 2.0 software supplied by ELIS PLZEŇ a. s.

6.5.2. The COMFORT version

The electromagnetic flowmeter in compact or remote design must first installed in the piping and then the power supply and output terminals be interconnected. Then switch on the power supply voltage. For a while, the meter display will show a welcome message. Then the measured flow rate values will appear on the display.

6.5.3. Operating data

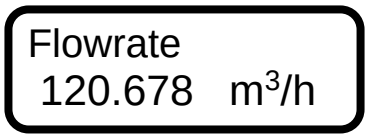
The COMFORT version includes a two-line alpha-numeric display of 2 x 16 characters with a background illumination. The display illumination function works in a power-saving mode where the illumination is automatically switched off 255 following the last keypad action. Pressing any key reactivates the display background illumination.

The keypad includes four keys labelled with the following symbols:
1. Symbol ⊙ is the “roller” key, indicates a downward movement
2. Symbol ⊙ means an upward movement, in the direction of arrow
3. Key ⊙, a password entry key
4. Key ⊙, referred to as the “Enter” key

The meter display makes possible reading of different types of data. To switch to the desired data display mode, use push-buttons ⊙ (direction downwards) and ⊙ (direction upwards).

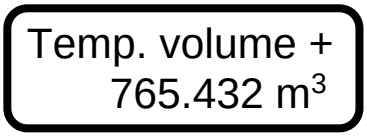
To display temporary data, press the ⊙ key. Press the ⊙ key again to return to the total data display mode.

1. Flow rate
Average flow rate determined from the specified number of sample readings. The value is also used for calculation of other measured quantities.



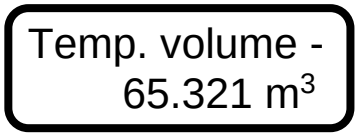
Display reading: Flow rate

2. Total volume +
The total volume of liquid passed through the meter sensor in the direction of arrow on the sensor body since the measurement start, or the temporary volume, i.e. the volume of liquid passed since the last resetting of the temporary volume + data.



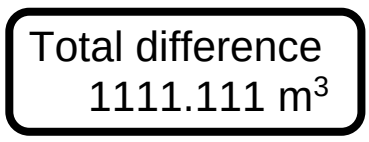
Display reading: Total volume +

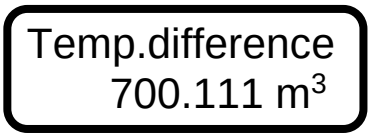
3. Total volume -
The total volume of liquid passed in the direction against arrow on the sensor body since the measurement started, or the temporary volume since the last resetting of the temporary volume – data.



Display reading – Total volume –

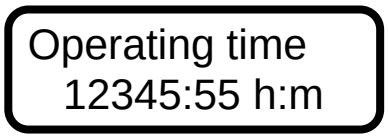
4. Total difference
The difference between liquid volumes passed in the positive (+) and negative (-) directions since the measurement start, or temporary difference from the last resetting of the temporary difference data.

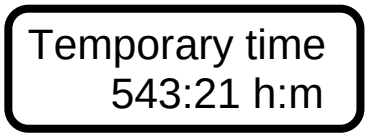




Display reading: Total difference

5. Operating time
The length of the time period, in hours and minutes, counted from the first meter start, or the length of the temporary time period measured since the last resetting of the temporary time data.

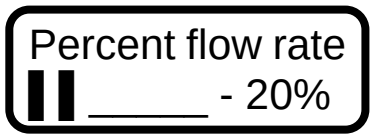




Display reading: Operating time

Upon switching off the induction flow meter, the data readings under items 2, 3, 4 and 5 are stored at the EEPROM unit and restored upon each new meter start.

6. Percentage flow rate
Flow rate information in the form of a horizontal bar whose length corresponds to the flow rate value in per cent of a selected 100% value (need not necessarily be the same as the maximum flow rate for the given sensor). The figure on the right side offers the digital form of the same information. The minus sign before the figure indicates negative flow data.



Display reading: Per cent flow rate

7. Last error
Abbreviated text of the last error message.

Display reading: Last error

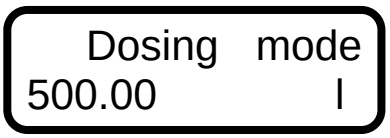
In case of a meter error, provided the error-indication mode has been enabled, the display will immediately show a message including a short description of the error concerned. Upon pressing the ⟲ key, the meter will return to the data display mode, while the abbreviated error message and error code are stored in the "previous errors" register. While an error is indicated, the measurement functions continue undisturbed. In cases of errors E6 or E7, zero flow rate is indicated throughout the error condition duration.

The user may review earlier error codes and messages up to 255 previous error messages stored in the error register. To access this function, press the ⟲ key (previous error display). In the data format E-XXX YYY/ZZZ are: XXX the error code, YYY error ordinal number, and ZZZ the total number of error codes stored in the register. To page through the list use the ⟲ key. To return to the data display mode, press the ⟲ key. Error register is reset with switching power on.

The error messages are:
E0: No error.
E1: Error in CRC EEPROM. Incorrect data check sum in the EEPROM unit. This error may occur when the processor, following a power failure, does not manage to store all data in the EEPROM unit.
E2: OUT1 (multi-functional output) is in the pulse mode of operation and the memory block storing the unsent pulses overflows.
E3: OUT2 (multi-functional output) is in the pulse mode of operation and the memory block storing the unsent pulses overflows.
E4: Multifunctional output RELAY is set for pulse output and the memory block storing the unsent pulses overflows.
E5: WDOG: the processor reset condition due to the overflow in the timer controlling the length of the programming loop.
E6: Not fully flooded piping.
E7: Open current loop in the pulse generation circuitry of the meter sensor.
E8: Error in +5V power supply.
E9: Error in +24V power supply.
E10: Error in -5V power supply.
E11: Actual flow rate exceeded the selected Imax value.
E12: Failure in frame receipt confirmation while communicating via a serial line.
E13: Error no processed

Error indication mode enabled: error information is displayed and entered into the error register. Some errors result in setting the indicated flow rate at zero.
Error indication mode disabled: the error information is entered into the error register.

8. Dosing (B
Dosing is visible and functional provided this data display mode has been selected.
The selected liquid volume (dose) will wait for the active initiation signal to be brought to terminals 8-9. As soon as such signal is received, a countdown towards zero will commence. Upon reaching zero, OUT3 will close. The dosing action can be repeated by pressing the ↵ key. To interrupt dosing, use the ↵ key. To set the required dose, follow the respective procedure in the configuration menu.



Display reading: Dosing mode

6.5.3.1. Display formats of aggregate values

If the displayed value occupies more than 11 digit places including the decimal point, the calculated value will be displayed alternately with the selected measurement unit.

6.5.3.2. Data reset

The user is not permitted to reset the aggregate values under items 2, 3, 4 and 5. Resetting is only possible with running (“temporary”) values associated with items 2, 3, 4 and 5 accessible via the ↵ key (another pressing of the ↵ key will return the display to the total value display mode). When a temporary value is displayed, press the ⟲ key to discontinue the temporary value mode, and press the ↵ key to reset the temporary value. By pressing any of the ⟲ → ↑ keys and after that the ↵ key, return to the total value display mode. If you stop the temporary mode and wish not to reset the temporary value, press any of the → ↑ keys, whereby the count continues. To return to the total value mode, press the ↵ key. This procedure will reset the edited temporary value only, the other temporary values will be unaffected.

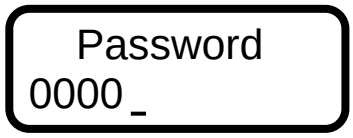
7. CONFIGURATION

The electromagnetic flowmeter can be configured in two ways: using a computer connected to the serial meter interface or using its own keypad. The following description relates to the keypad configuration procedure.

The keypad includes four keys labelled with the following symbols:
1. Symbol ⟲, the "roller" key, indicates a downward movement
2. Symbol →, a movement to the right in the direction of arrow; an upward direction
3. Symbol ↑, a password entry key, an upward movement in the direction of arrow; movement back to the menu;
4. Symbol ↵, the "Enter" key (command confirmation).

In any menu, the selected line is on the first line with the first character blinking.

Entering the configuration mode, movement within a menu and data saving
To enter the **configuration** mode, press the ↑ key and then the ↵ key. The **configuration** mode is protected against unauthorised access by a password (a four-digit number) that needs to be entered before accessing the basic **configuration** menu. Upon delivery from the manufacturing plant, every new meter has a default password of 0000.

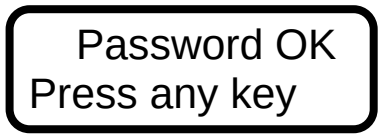


Display reading: Password
With a new meter, enter password 0000 and confirm by pressing the ↵ key. If you have already chosen your own password, enter the same and confirm by pressing the ↵ key. Prior to leaving the **configuration** mode, the password can be changed without any limitation.

Use the → key to move the cursor to the right. Upon reaching the rightmost position, the cursor will return to the left side of the line. The cursor is a short horizontal line located under the character we wish to edit/change.

Use the ↑ key to change the selected character in the upward direction, or the ⟲ key in the downward direction. Upon reaching the last character available, the first eligible character will reappear.

After completing the editing action, confirm your choice of password by the ↵ button. Should you enter an incorrect password, the display will read "Incorrect password Try again" while the program will return to the data display mode.



Display reading: confirmation of correct password entry: Password OK. Press any key.

With the display reading "Password OK Press any key", press any key (preferably ↵) to enter the basic **configuration** menu.

The two-line display will always show two of the following basic menu options:

Displayed data
Samples
Analog output
Output functions
Electrode clean
Serial line
Production data
Dose setting
Zero setting
100 percent
Exit

Display reading: the basic menu options

Use the → and ↻ keys to move upwards and downwards in the menu. As in any meter menu, the selected item is on the first display line with the initial character blinking.

Press the ↵ key to enter a lower level menu, or to edit a menu item. When in the lower level menu, press the ↑ key to return to the higher level menu (the "Escape" function). When in the basic menu, the Escape command will bring forth the possibility to terminate the **configuration** mode via the selection of the "Exit" item of the basic menu.

7.1. Basic menu configuration

7.1.1. Displayed data

The "Displayed data" menu allows the operator to choose which parameters are to be displayed. Using the ↻ and → keys, select parameters from the following list. The "Flow Rate" display cannot be cancelled.

Menu: Displayed data, press the ↵ key
The two-line display unit will always show two of the items from the following menu. Use the ↻ and → keys to browse upwards and downwards through the menu items.

Flow rate
Total volume +
Total volume -
Total difference
Operating time
Percent flow rate
Last error
Dosing mode

Menu: Displayed data, press the ↵ key / Total volume press the ↵ key
Display line 1 will read "Do not display", line 2 "l/s …. l". Use the ↻ and → keys to go up and down in the menu items. If you choose "Do not display", press the ↵ key to return to the "Displayed data" menu. If you wish to display "Total Volume +", select the "Total Volume +" item on the menu, press the ↵ key, skip line 1 (Do not display) and select line 2, "l/s …. l" (flow-rate unit … volume unit). Using the ↻ (downwards) and → keys (upwards), select the desired flow rate and volume units and confirm the selection by pressing the ↵ key. The display line 1 will then show "0" and line 2 "0.0". Using the ↻ (downwards) and → keys (upwards), select the desired number of decimal positions, confirm the selection by pressing the ↵ key and return to the "Displayed Data" menu.

Note:
The measurement unit selected for “Flow Rate” is automatically set for all other flow rate quantities referred to in the **Configuration** menu.
The measurement unit selected for “Total Volume +” is automatically set for all other flow-volume quantities in the **Configuration** menu.
The measurement units for the “Total Volume –“ and “Volume Difference” quantities can be selected as need be, and their selection will not affect any other measured quantities to be set within the **Configuration** menu.

Table of flow rate and volume units		
l/s	….	l
l/min	….	l
l/h	….	l
m^3/s	….	m^3
m^3/min	….	m^3
m^3/h	….	m^3
GPS	….	G
GPM	….	G
GPH	….	G

Table of decimal positions
0
0.0
0.00
0.000
0.0000
0.00000
0.000000

User-specified units
When defining a user-specific unit, it is necessary to enter a conversion constant (a multiple of the standard flow-rate or volume units – “l/s” or “l”, then press the ↵ key, define the unit name (six characters), press the ↵ key, define number of decimal positions, press the ↵ key and return to the “Displayed Data” menu.

Example: the desired flow rate unit is US barrel per second; the conversion constant is **0.006283811**; unit name bl/s; number of decimal positions **0.000**.

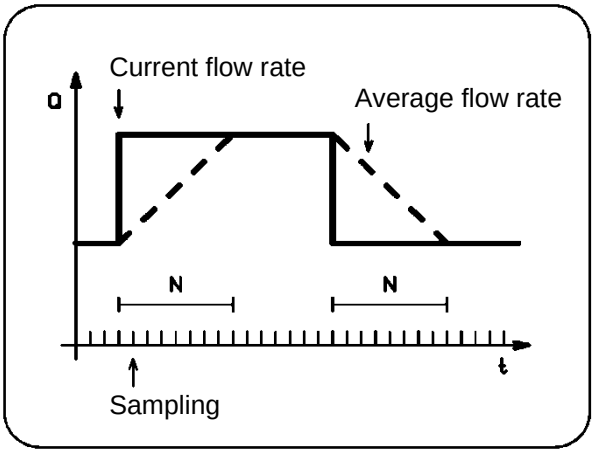
The same procedures apply to parameter setting with Flow Rate, Total Volume +, Total Volume – and Total Difference.

While setting the parameters of Operating Time, Per Cent Flow Rate, Last Error and Dosing, the options to select from are only “Display” and “Do Not Display”.

To leave the “Displayed Data” mode and return to the basic configuration menu, press the ↑ key.

7.1.2. Number of samples

The number of samples N, based on which the average flow rate value is calculated, can be set within the range of 1 to 255. While the measurement frequency is 6.25Hz (or 3.125, 1 or 0.5Hz), fast (step) changes in the flow rate will be smoothened within the interval of 0.08 to 20.40s (0.16 to 40.80s, 0.5 to 127.5s or 1 to 255s). The averaging feature is useful where the flow through the meter sensor is unstable, the liquid is turbulent or where there are air bubbles in the liquid flow.
The averaging function helps suppress fast changes in the liquid flow rate. Average flow rate as measured and displayed is the parameter used to calculate other meter outputs.



Suppression of step changes in flow rate

Menu: Number of samples, press the ↵ key.
The display will read “Number of samples xxx“. Replace xxx by a number from the range of 1 to 255 (usually 25 is chosen). Move the cursor using the → key and increase/decrease this number using the ↑ or ↻ keys , respectively. Confirm the selection by pressing the ↵ key. The display will then read “Value entered Press any key”. Press the ↵ key or any other key. This action will take you back to the basic menu.

7.1.3. Analog output

Setting options
Connected to terminals 4 and 5 is a programmable current output. It is an active current output, galvanically isolated from other meter parts. The maximum output load is 1,000Ω. Depending on the liquid-flow characteristics, the output can be used in four different modes of operation (see graphics below) and in two selectable measurement ranges.
When the flowmeter is used for measurement of flow in both directions (bi-directional measurement), we recommend to use current output mode |Q| and use one of the binary outputs (OUT1, OUT2 or relay output) for indicating the flow direction.
Please contact the producer if is necessary to use mode –Q .. +Q and get information about the flow rate and direction of flow at the same time (when using –Q .. +Q mode, there is no error indication for exceeding analog range in negative flow direction).
The two-line display unit will always show two of the items from the following menu. Use the ↻ and → keys to browse downwards and upwards through the menu items.

Menu: Analog output, press the ↵ key

0…+Q Output
0...-Q Output
|Q| Output
–Q...+Q Output
Fixed current 0…20

In all operating modes except the “Fixed Current” mode, the current output range can be user defined.

Menu: Analog output, press the ↵ key / Output 0...+Q, press the ↵ key

Output 0…20mA
Output 4…20mA

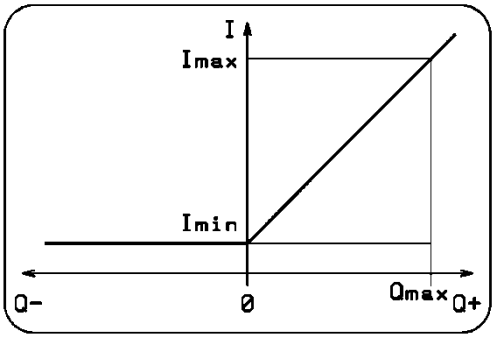
Selection of current output

Menu: Analog output, press the ↵ key / Output 0...+Q, press the ↵ key / Output 0…20mA, press the ↵ key / Flow rate for Imax
The current output setting consists of defining flow rate Q_4 corresponding to Imax. Move the cursor using the → key, and increase/decrease the Q_4 value using the ↑ and ↻ keys. Select the desired Q_4 and confirm the setting by pressing the ↵ key. The display will then read “Value Entered Press Any Key”. Press any key, preferable the ↵ key. This action will take you back to the main configuration menu, item “Analog output”.

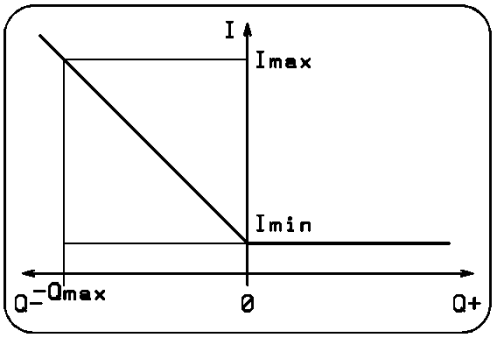
In the “Fixed current” mode, the output current can be set within the range of 0 to 20 mA. This mode is used for meter servicing purposes.

Menu: Analog output, press the ↵ key / Fixed current 0…20, press the ↵ key / Fixed current 0…20 mA
Move the cursor using the → key, and increase/decrease the current value using the ↑ and ↻ keys. Select the desired current value and confirm the setting by pressing the ↵ key. The display will then read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. This action will take you back to the main menu, item “Analog Output”. At the same time, the defined current will start to flow through the output circuit.

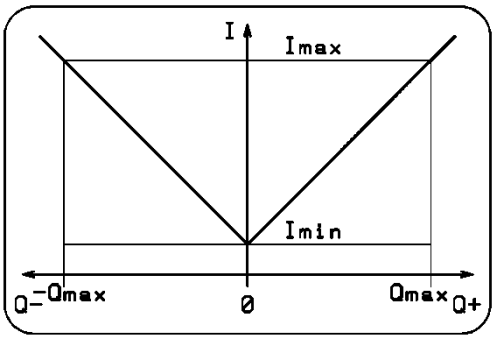
The following graphics show the relationships between current I and flow rate Q for various operating modes.



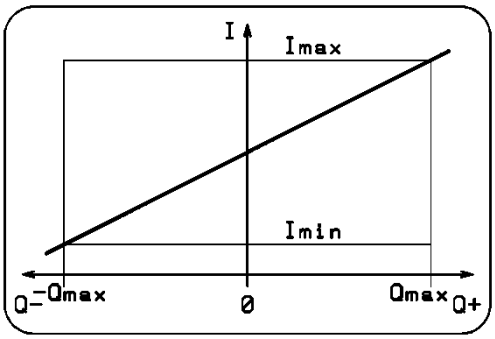
Output current for 0 ...+Q



Output current for 0 ...-Q

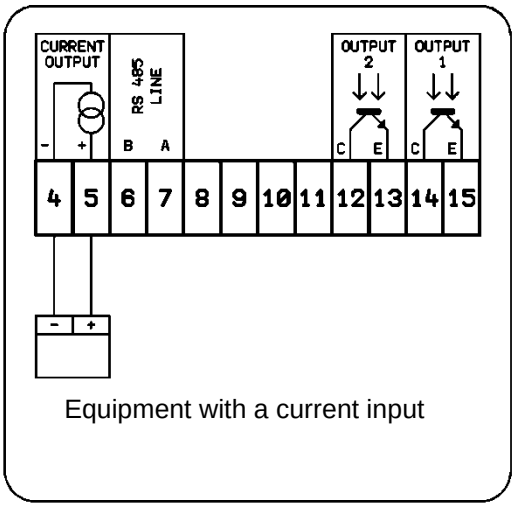


Output current for |Q|

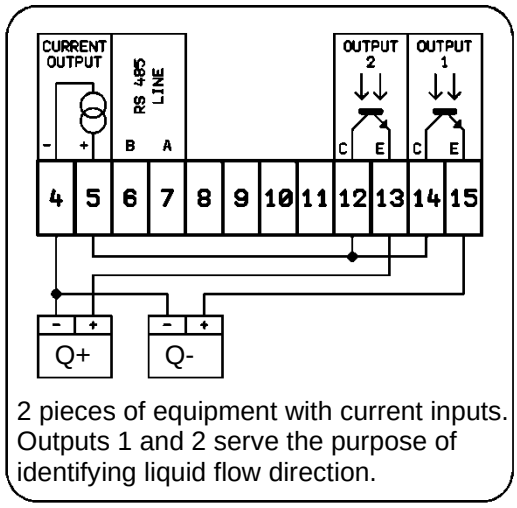


Output current for –Q ...+Q

Examples of analog output interconnections

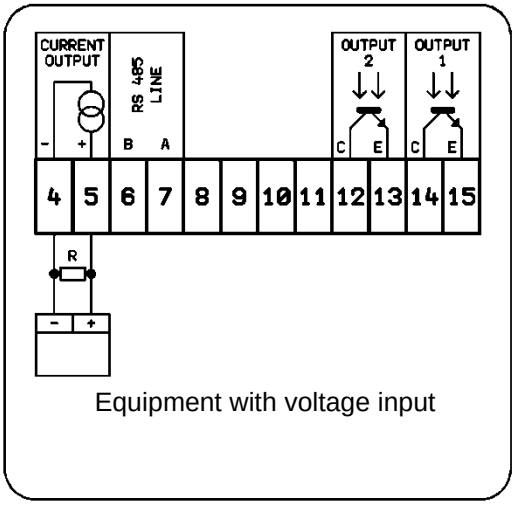


Equipment with a current input

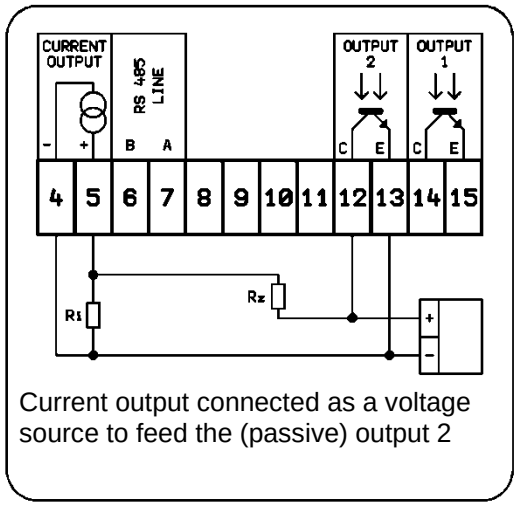


2 pieces of equipment with current inputs. Outputs 1 and 2 serve the purpose of identifying liquid flow direction.

Multifunctional outputs programmed to identify the liquid flow direction and to negate the flow direction, will divide the analog output operated in the "Absolute Flow-Rate Value" mode into two outputs, one for each flow direction.



Equipment with voltage input



Current output connected as a voltage source to feed the (passive) output 2

The output voltage for the equipment to be connected is defined as the voltage drop on resistor R. It holds: U = I R.

For the voltage range of 0…10V, select R = 500Ω and the analog current output range 0…20mA. Resistor R shall be placed as close to the input terminals of the equipment as possible. The maximum voltage (voltage drop on the resistor) is 10V. The input impedance of the controlled equipment shall be at least 100 times higher than that of resistor R.

The interconnection of the current output as an auxiliary power source for the binary outputs is shown in the picture above. This arrangement assumes that the current output is not used for the purposes of flow rate indicator. Here the current output needs to be set in the "Fixed Current" mode of operation. The voltage drop on resistor Ri is used as supply voltage for the binary output (via resistor Rz). The input impedance of the equipment shall be at least 10 times higher than that of a resistor Rz, while Rz shall be at least 10 times higher than Ri. It holds: Ri < Rz < input impedance for the equipment to be connected.

Analog output specifications

The analog output signal is controlled by a 12-bit DA converter. The operational range 0 to 20mA is divided into 4,096 steps. One step (1LSB) corresponds to about 0.005mA (0.025% of 20mA). This resolution applies to all output ranges. The current range 4 ... 20mA is software-defined with the converter steps reduced accordingly. The maximum voltage at the current output is 20V; the maximum resistance of the current loop is therefore 1,000Ω.

7.1.4. Output functions

The configuration includes the option of two binary multifunctional outputs, electrically isolated by means of optocouplers. The output transistors of the optocouplers are accessible via terminals 12-13 and 14-15. These are passive outputs that need external power source. Alternatively, they can be powered by an analog output in the fixed-current mode as described above. The binary outputs can switch on and off the 1 to 50mA current continuously.

Default settings: Output 1: frequency output, Output 2: pulse output.

The flowmeter can be equipped with an output relay, in the menu to be found under "Relay Functions". Electrically isolated relay contacts are accessible via terminals 1-2-3. For pulse output, both the pulse width and the minimum gap length are set at 0.5s. To ensure correct operation of the pulse function, it is necessary to set the pulse constant with a regard to Q_4 so that the memory block of unsent pulses never overflows. If the pulse constant is set to too low, data will be irreversibly lost.

Menu: Output functions, press the ↵ key.
The display will offer the following selection:

OUT1 function
OUT2 function
RELAY function

The two-line display unit will always show two of the items from the above menu. Use the ↻ and → keys to browse downwards and upwards through the menu items.

Menu: Output functions, press the ↵ key / Output 1 function, press the ↵ key.
The two-line display unit will always show two of the items from the respective menu. Use the ↻ and → keys to browse downwards and upwards through the menu items.

The output functions available are shown in the following table:

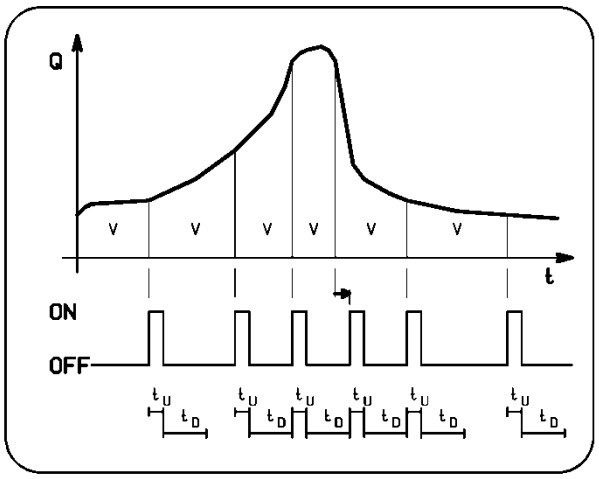
Permanently open Perm. closed	
|Q| pulses Q+ pulses Q- pulses	
Q+ frequency Q- frequency |Q| frequency Fixed frequency	**Frequency cannot be used for relay output!**
Negative flow Non-neg. flow	
Error occurred No error occurred	
Q>Qlim. Q<Qlim. |Q|>Qlim. |Q|<Qlim.	
Cleaning Not cleaning	

Permanently closed (open)
These modes are only used for servicing purposes.

Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key /Permanently closed (open), press the ↵ key.
This will return the display to the menu item "Output 1 Function" or "Output 2 Function".
To return to the basic configuration menu, press the ↑ key.

Pulse outputs

In any of the pulse modes, a pulse will be generated as soon as defined (pre-set) liquid volume passes through the meter sensor. The pulse mode requires specification of the following three parameters: pulse width "t_u", minimum time gap between two successive pulses "t_d" and liquid volume per pulse "V".



Pulse generation principle

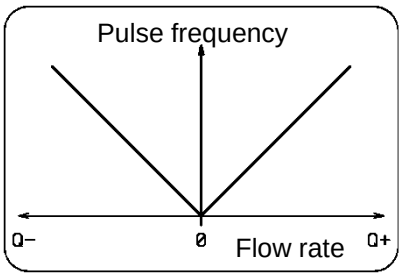
This mode provides for integration of the flow rate values in time. As soon as pre-set liquid volume V passes through the meter, an pulse of width t_u is generated. After each pulse, a gap of at least t_d follows. If, after elapsing of the t_d period, liquid volume V has not yet passed through the sensor, the output remains inactive. If the volume passed is equal to or greater than V, another pulse plus gap are immediately generated. Should the pre-set volume V pass before the end of the previous pulse, the non-generated pulse will be stored in an accumulator with the capacity of 255 pulses. Should the pulse accumulator overflow, an error message will be generated. To ensure correct operation of the meter pulse function, it is necessary to set the pulse output parameters so that the expected pulse frequency shall correspond to the pulse width and gap length selected.

It holds: maximum pulse frequency = 1 / (t_u + t_d)

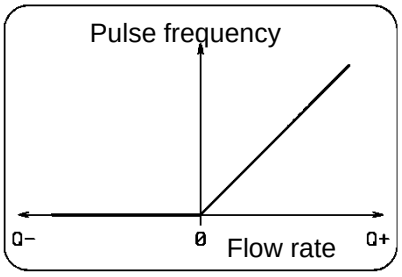
The volume per pulse parameter can be set within the range of 0.001 to 1,000,000 litres. The pulse width and gap length can be set at 10 to 2,550 ms in steps of 10 ms. The setting procedure consists of selecting numbers from 1 to 255 on the meter display. Multiplied by 10, the figure shows the pulse width or gap length in milliseconds.

From the above it follows that the maximum pulse frequency is 50 per second.

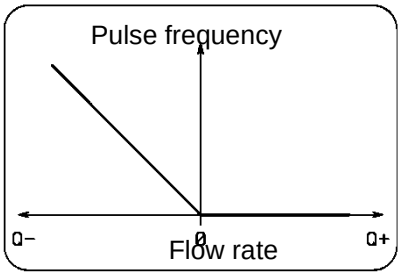
Regarding the flow rate conditions (see below), pulses can be generated in three different modes. During the t_u periods, the output is closed.



Pulses for |Q|



Pulses for Q+



Pulses for Q-

Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key / Pulses for |Q|, press the ↵ key. The display will read "Pulse Width [1] xxx". Move the cursor using the → key, and increase/decrease the values at various "x" positions using the ↑ or ↻ keys, respectively. Replace xxx by a figure which, when

multiplied by 10, will give the pulse width in ms. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. The display will then show the message “Gap Length [1] xxx“. Move the cursor using the → key, and increase/decrease the values using the ↑ or ↻ keys, respectively. Replace xxx by a figure which, when multiplied by 10, will give the gap length in ms. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. The display will then show the message “Volume Per Pulse [1] xxxxxxx“. Move the cursor using the → key, and increase/decrease the “x” values using the ↑ or ↻ keys, respectively. Replace xxxxxxx by a figure equal to the desired liquid volume per pulse. This figure is elsewhere referred to as the pulse constant or pulse number. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. This will return the display to the menu items “Output 1 Function” or Output 2 Function”. To return to the basic menu, press the ↑ key.

Pulse number selection for FLONET FN20xx.1

Dimension	Q_4	Pulse number	Q_4	Pulse number
DN	l/s	l/pulse	gall./s	gall./pulse
6	0.28	1	0.073968	1
8	0.5	1	0.132086	1
10	0.777	1	0.205262	1
15	1.8	1	0.475509	1
20	3.33	1	0.879693	1
25	5	1	1.320860	1
32	8.33	5	2.200553	1
40	12.5	5	3.302150	1
50	20	5	5.283441	5
65	33.33	10	8.804854	5
80	50	10	13.20860	5
100	77.77	50	20.54466	5
125	119.44	50	31.55271	10
150	180.55	50	47.69626	10
200	319.4	100	84.37655	50
250	500	100	132.0860	50
300	700	500	184.9204	50
350	972	500	256.7752	100
400	1250	500	330.2150	100
500	2000	500	528.3441	500
600	2778	1000	733.8699	500
700	3889	1000	1027.365	500
800	5000	1000	1320.860	500
900	6389	5000	1687.795	500
1000	7778	5000	2054.730	500
1200	11111	5000	2935.216	1000

1 US gallon = 3.785412 l
Pulse width = 100 ms
Minimum gap length = 100 ms
f <= 5 Hz

0.264172037 gall = 1 l
15.85032224 gall/min = 60 l/min

Uniform output pulses

The flowmeters with a "Series 5" electronics (including boards FNA5, FNP5, FNS5 and FNZ5), the user may select the so-called uniform output pulses. These can only be set at the OUT2 output. The standard OUT2 setting on board FNA5 is facilitated by jumper W1 1-2. To set uniform output pulses, remove jumper W1 1-2 and install jumper W1 2-3. Further configuration steps are carried out by means of keypad and display.

To set the uniform output pulse mode:

1. Enter the configuration menu, select "Production Data" and check the sensor size – e.g. DN40. Return to the basic menu.
2. Select "Output Functions", press Enter. Select "Output 2 Function", press the Enter. Select "Frequency for Q+" (or Frequency for Q-" or "Frequency for |Q|"), press the Enter. Set the value of flow rate per 1 kHz with respect to the sensor dimension. In our case, for DN40, Q_4 is 12.5 l/s (see the table below). Return to the basic menu.
3. Select "Production Data", press the Enter. Select "Base Frequency", press the Enter. Enter the value shown in the table. In the case of DN40, the base-frequency value is 8,192. Return to the basic menu and leave the configuration menu by selecting "Exit".
4. Install jumper W2 3-4 on analog board FNA5 (see the table). The position of jumper W2 determines the output voltage-divider parameters.
5. This is all you need to do to set uniform output pulses.

Note:
If the actual flow-rate unit is other than litres per second (l/s), the value of 12.5 l/s needs be recalculated. For example, if the actual unit is m^3/h, multiply 12.5 by 3.6 = 45 m^3/h; enter this value as the "Flow Rate Per 1 kHz" parameter.

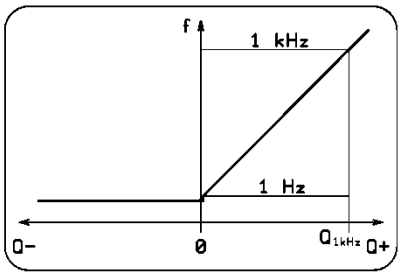
Uniform output pulse setting table

Calorimeter pulse constant [litres per pulse]	Flow sensor DN	Q_4 [l/s]	Q_4 [m^3/h]	Output frequency [Hz]	Base frequency [Hz]	Jumper position on board FNA5
100	15	1,8	6.5	0,018	4718,592	W2 5-6
100	20	3,33	12	0,0333	8729,395	W2 5-6
100	25	5	18	0,05	3276,8	W2 3-4
100	32	8,33	30	0,0833	5459,1488	W2 3-4
100	40	12,5	45	0,125	8192	W2 3-4
100	50	20	72	0,2	1638,4	W2 1-2
100	65	33,33	120	0,3333	2730,394	W2 1-2
100	80	50	180	0,5	4096	W2 1-2
100	100	77,77	280	0,7777	6370,918	W2 1-2
1000	125	119,44	430	0,11944	7827,6198	W2 3-4
1000	150	180,55	650	0,18055	1479,066	W2 1-2
1000	200	319,4	1150	0,3194	2616,525	W2 1-2
1000	250	500	1800	0,5	4096	W2 1-2
1000	300	700	2520	0,7	5734,4	W2 1-2
1000	350	972	3500	0,972	7962,624	W2 1-2

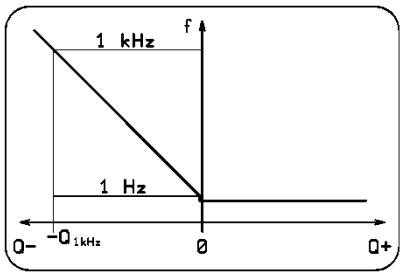
Frequency outputs

In the frequency modes, the output signals will be pulses of pulse-to-gap ratio 1:1. The frequency range available is from 1Hz to 10kHz.

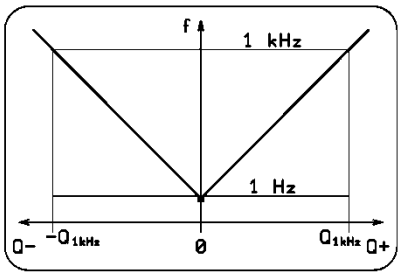
Note: The transmitter includes only one frequency generator. It is therefore impossible to select different frequencies for each output or combine the fixed-frequency mode at one output with frequency related to flow rate mode at the other output. On the other hand, the operator may select the frequency related to flow rate mode in the positive direction at one output with that in the negative direction at the other output, with the same frequency-to-flow-rate ratios.
Regarding the flow rate conditions, the frequency outputs can be operated in three different modes (see below).



Frequency for Q+



Frequency for Q-



Frequency for |Q|

Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key / Frequency for Q+, press the ↵ key.
The display will read “Flow Rate Per 1kHz xxxx”. Move the cursor using the → key, and increase/decrease the values at various “x” positions using the ↑ or ↻ key, respectively. Replace xxxx by a figure representing the maximum flow rate. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. This will return the display to the menu items “Output 1 Function” or “Output 2 Function”.

The fixed-frequency mode is used for servicing purposes only. The required frequency is set in Hz within the range of 1 to 10,000 in steps of 1Hz.

Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key / Fixed frequency, press the ↵ key
The display will read “Fixed Frequency xxxxx“. Move the cursor using the → key, and increase/decrease the “x” values using the ↑ or ↻ keys, respectively. Replace xxxxx by a figure equal to the desired frequency in Hz. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. This action will return the display to the menu items “Output 1 Function” or “Output 2 Function”.
To return to the basic menu, press the ↑ key.

Negative (non-negative) flow direction

This mode is used to identify the liquid flow direction. In the case of negative flow direction, the output is closed (open).

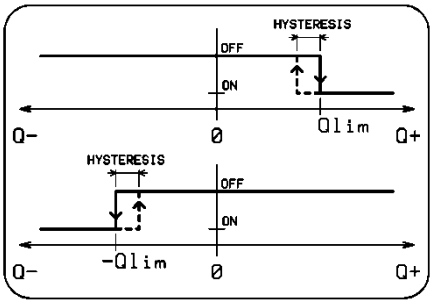
Menu: Output functions, press the ↵ keys / Output 1 (2) function, press the ↵ keys / Negative (Non-negative) flow direction, press the ↵ key.
The display will return to the menu items “Output 1 Function” or “Output 2 Function”.
To return to the basic configuration menu, press the ↑ key.

Error (no error) condition
In case of a meter error, the output will close (open) and stay so as long as the error condition exists.

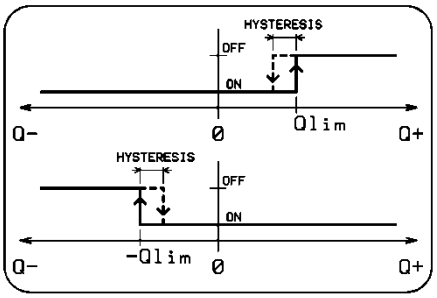
Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key / Error (No error) condition, press the ↵ key.
The display will return to the menu items “Output 1 Function” or “Output 2 Function”.
To return to the basic menu, press the ↑ key.

Exceeding (dropping below) the limit values of flow rate

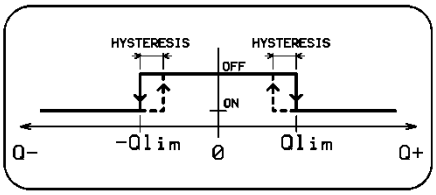
In cases of exceeding (dropping below) the pre-set flow rate limit values, the output will close (open). Upon returning into the normal operating range, the output will open (close) again with a pre-set hysteresis. Regarding the flow rate conditions, there are four different modes of operation:



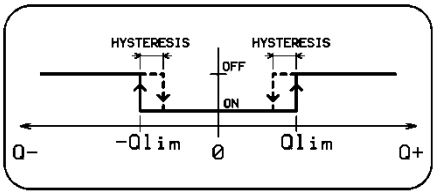
Q > Q lim.



Q < Q lim.



IQI > Q lim.



IQI < Q lim.

Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key / Q > Q lim., press the ↵ key. The display will read "Flow Rate Limit [1] xxxxxx". Move the cursor using the → key, and increase/decrease the values at various "x" positions using the ↑ or ↻ keys, respectively. Replace xxxxxx by a figure equal to the flow rate which, when exceeded, should cause the output to close. Press the ↵ key. The display will read "Value Entered Press Any Key". Press any key, preferably the ↵ key. The display will then show the message "Hysteresis [1] xxxx". Move the cursor using the → key, and increase/decrease the "x" values using the ↑ or ↻ key, respectively. Replace xxxx by a figure representing hysteresis, between the closing and opening output functions. Press the ↵ key. The display will read "Value Entered Press Any Key". Press any key, preferably the ↵ key. The display will return to the menu items "Output 1 Function" or "Output 2 Function".
To return to the basic menu, press the ↑ key.

Electrode cleaning in progress (No cleaning)

While the electrode cleaning process is in progress, the output is closed (open).

Menu: Output functions, press the ↵ key / Output 1 (2) function, press the ↵ key / Cleaning in progress (No cleaning), press the ↵ key.
The display will return to the menu items "Output 1 Function" or "Output 2 Function".
To return to the basic menu, press the ↑ key.

7.1.5. Electrode cleaning

During the meter operation, non-conducting substances may accumulate in the form of a sediment on the sensor electrodes. This increases the contact resistance between the electrode and the measured liquid and results in decreased measurement accuracy. The FLONET FN20xx.1 flowmeter offers a sensor electrode cleaning function without sensor dismantling. The cleaning method is based on the electro-chemical phenomenon where the electrodes are connected to an AC voltage source causing the accumulated layer to dissolve in the measured liquid. It is recommended that the cleaning process be repeated in regular intervals.

The cleaning cycle lasts 1 minute. Measurement is discontinued during the cleaning process. Nonetheless the last flow rate being measured before the cleaning process is being simulated. The cleaning action can be indicated using the multifunctional outputs. While the cleaning process is in progress, the message "Cleaning Electrodes" can be seen on the top display line. The bottom line shows the last value of the selected measured quantity. As soon as the cleaning action is over, the meter resumes normal measurements.

There are several ways of initiating the electrode cleaning cycle:

Menu: Electrode cleaning, press the ↵

Cleaning OFF
Single cycle
During Power ON
Periodic [day]

The two-line display unit will always show only two of the four menu items. Use the ↻ and → keys to browse downwards and upwards through the menu items. Select the desired item by pressing the ↵ key. The display will return to the basic menu, item “Electrode Cleaning”.
Upon selecting the “Single cycle” option, the cleaning process will start immediately. On completion of the cleaning cycle, the meter will return to the “Cleaning OFF” status.
The selection of “During Power ON” implies that a cleaning process will be initiated wherever line voltage is switched on. In the “Periodic [Day]” mode of operation, cleaning processes will be initiated automatically in regular intervals to be chosen by the user from the range 1 to 255 days. The time counting process will always start upon setting a new cleaning period.

Note: The electrode cleaning function cannot be used when power is supplied from 24V AC/DC.

Menu: Electrode cleaning, press the ↵ key / Periodic [day], press the ↵ key.
The display will read “Cleaning [Day] xxx“. Move the cursor using the → key, and increase/decrease the “x” values using the ↑ or ↻ key, respectively. Replace xxx by a number from 1 to 255 (days). Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. This action will return the display to the basic configuration menu, item “Electrode Cleaning”.

Note: In case of measuring the salt water, it is not recommended to use the cleaning electrode function.

7.1.6. Serial line

The meter is equipped with a serial communication interface intended for servicing purposes. In the standard configuration, the USB port is implemented. On request, the flowmeter can be equipped with galvanically isolated RS-485 port.

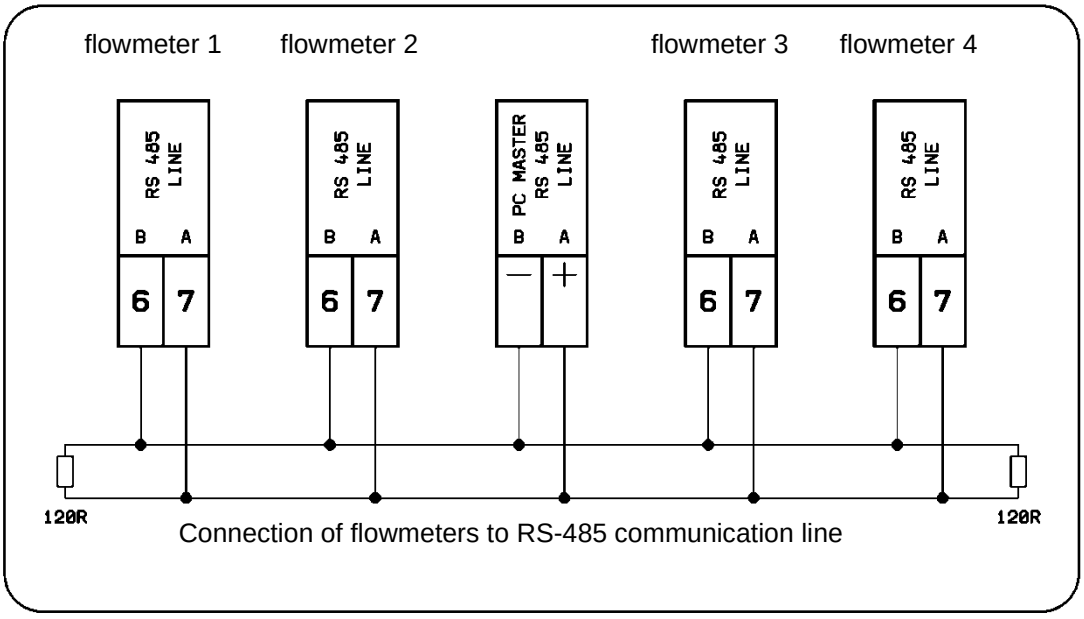
Serial port USB

This port is accessible through USB type B connector. Connection to the computer is facilitated by means of a USB cable type A connector at one end and USB type B connector at the other end.
The USB port is not galvanically isolated from the other meter circuits. It is primarily intended for servicing purposes, not for a permanent operation.

Serial port RS-485

The RS-485 is an optional port of the flowmeter. It is galvanically isolated from the other meter circuitry and allows for a connection of up to 31 flowmeters to a common communication network. The maximum length of the connecting two-wire twisted cable is 1,200 m. If repeaters are used, the number of meter stations and cable length can further be increased. The cable wires are to be connected to terminals 6 and 7.

The flowmeter found at the end of the communication network shall be provided with jumper W1 with a terminal resistor 120 R. Jumper W1 is located on the terminal board FNS5 between the terminal strip and lightning arrestor



Connection of flowmeters to RS-485 communication line

Communication

Communication consists of transmission of individual data packets. To ensure correct function of a communication network, each station must have a different address. On delivery, all electromagnetic flowmeters will have the following setting of communication parameters: Address 1, Group 1, Speed 9600Bd, Parity SL. Communication uses the FLOSET 2.0 program package.
The communication protocol is not included in this brochure; it can be obtained from the meter manufacturer on request.

Menu: Serial line, press the ↵ key

Address
Group
Baud rate
Parity

The two-line display will always show two of the menu items. To browse through the menu, use the ↻ (direction upwards) and ↦ keys (downwards). Select the desired item and press the ↵ key.

Menu: Serial line, press the ↵ key / Address, press the ↵ key
The display will read “Address xxx”. Replace “xxx” by a number from 1 to 255, being the meter address. Press the ↵ key. The display will show the message “Value Entered Press Any Key”. Press any key, preferably the ↵ key. This command will take you back to the Serial Line menu.

Menu: Serial line, press the ↵ key / Group, press the ↵ key
The display will read “Group xxx”. Replace “xxx” by a number from 1 to 255, being the designation of a group of electromagnetic meters. Press the ↵ key. The display will show the message “Value Entered Press Any Key” Press any key, preferably the ↵ key. This command will take you back to the Serial Line menu.

Menu: Serial line, press the ↵ key / Baud rate, press the ↵ key
All equipment connected to a particular communication line branch shall use the same communication speed. There are six optional selections of speed:

1200Bd
2400Bd
4800Bd
9600Bd
19200Bd
38400Bd

The two-line display will always show two of the menu items. To browse through the menu, use the ↺ key (direction upwards) and ↦ (downwards). Select the desired item and press the ↵ key. This action will bring the display to the Serial Line menu.

Menu: Serial line, press the ↵ key / Parity, press the ↵ key

Parity --
Parity SL
Parity SS
Parity LS
Parity LL

The two-line display will always show two of the menu items. To browse through the menu, use the ↻ (direction upwards) and ↦ key (downwards). Select the desired item and press the ↵ key. This action will bring the Serial Line menu on the display.
To return to the basic configuration menu, item Serial Line, press the ↑ key.

7.1.7. Production data

The first three menu items, i.e. Production Data, Serial Number and Software, give basic information about the electromagnetic flowmeter and as such cannot be edited. The other items, i.e. Sensor Constants, Excitation Frequency, Suppressed Flow Rate, Language, Sensor Number, Sensor DN, Errors, Dose Correction, Flow Direction and Base Frequency can be changed by the user unless the flowmeter is certified and used as an invoicing meter; in such cases the sensor constants, excitation frequency and suppressed flow rate are protected against unauthorised modification.

Menu: Production data, press the ↵ key.

Production date
Serial number
Software
Sensor constants
Excitation freq.
Suppressed flow
Language
Sensor number
Sensor DN
Errors
Dose correction
Flow direction
Base frequency

The two-line display will always show two selected menu items. To browse through the menu items, press repeatedly the ↓ (direction downwards) and → keys (upwards). To select a particular menu item, press the ↵ key.

Menu: Production data, press the ↵ key / Production date, press the ↵ key
The display will read “Production Date dd mm yyyy”. This information cannot be edited. To return to the Production data menu, press any key, for example the ↵ key. The menu will reappear on the display.

Menu: Production data, press the ↵ key / Serial number, press the ↵ key
The display will read “Serial Number xxxxxrr”. This information cannot be edited. To return to the Production data menu, press any key, for example the ↵ key. The menu will reappear on the display.

Menu: Production data, press the ↵ key / Software, press the ↵ key
The display will read “Software v.xxxxx/xx”. This information cannot be edited. To return to the Production data menu, press any key, for example the ↵ key. The menu will reappear on the display.

Menu: Production data, press the ↵ key / Sensor constants, press the ↵ key

Constant 1
Constant 2

To browse through the menu items, use the ↓ (direction downwards) and → key (upwards). Select the desired item and press the ↵ key. The constant value will appear on the display. Should you wish to change this value, use the → key to place the cursor under the selected figure and increase/decrease the same using the ↑ and ↓ keys, respectively. The sensor constants shall be set at the values indicated on the sensor nameplate. Any difference in the values of constants results in the incorrect calibration of flowmeter.

Menu: Production data, press the ↵ key / Sensor constants, press the ↵ key / Constant 1, press the ↵ key
The display will read "Sensor Constant 1 xxxxxxxxx". The value was set during the meter calibration at the manufacturing plant and it should not be changed. Press the ↵ key. The display will read "Value Entered Press Any Key". Press any key, preferably the ↵ key. This command will cause the menu Constant 1 / Constant 2 to reappear on the display. The same procedure applies to value setting of Constant 2. To return to the Production data menu, press the ↑ key.

Menu: Production data, press the ↵ key / Excitation frequency, press the ↵ key

1 – 6.25 Hz
2 – 3.125 Hz
3 – 1.0 Hz
4 – 0.5 Hz

To browse through the menu items, use the ↓ (direction downwards) and → keys (upwards). Select the desired frequency and press the ↵ key.

Menu: Production data, press the ↵ key / Excitation frequency, press the ↵ key / 2 – 3.125 Hz, press the ↵ key. The Manufacturing data menu will reappear on the display with the item "Excitation Frequency" on the first line.

Menu: Production data, press the ↵ key / Suppressed flow, press the ↵ key.
The display will read "Suppressed Flow xxxxx". This parameter is usually set at 0.5% Q_4 and may be increased in cases where it can be demonstrated that while no liquid flows through the meter sensor, the meter indicates a non-zero flow rate. Using the → key move the cursor to the desired position and increase/decrease the selected figure by pressing the ↑ and ↓ keys, respectively. Replace xxxx by a number equal to the desired value of suppressed flow rate. Press the ↵ key. The display will read "Value Entered Press Any Key". Press any key, preferably the ↵ key. The Production Data menu will reappear on the display with the item "Suppressed Flow Rate" selected.

Menu: Production data, press the ↵ key / Language, press the ↵ key
The display will read "[CZ] Czech / [EN] English". To browse through the menu items, use the ↓ (direction downwards) and → keys (upwards). Select the desired language and press the ↵ key. The Production Data menu will appear on the display with the Language option on the first line.

Menu: Production data, press the ↵ key / Sensor number, press the ↵ key
The display will read "Sensor Number". Using the → key, move the cursor to the desired digital position and increase/decrease the selected figure by pressing the ↑ and ↓ keys, respectively. Enter the sensor production series number (maximum 10 digits). Press the ↵ key. The display will read "Value Entered Press Any Key". Press any key, preferably the ↵ key. The Production data menu will reappear on the display with the Sensor Number item selected.

Menu: Production data, press the ↵ key / Sensor DN, press the ↵ key
The display will read "Sensor DN". Using the → key, move the cursor to the desired position and increase/decrease the selected figure by pressing the ↑ and ↓ keys, respectively. Enter the sensor dimension (maximum 10 digits). Press the ↵ key. The display will read "Value Entered Press Any Key". Press the ↵ key. The Production Data menu will reappear on the display with the Sensor DN item selected.

Menu: Production data, press the ↵ key / Errors, press the ↵ key
The display will read „1: Error EEPROM, 2: Overflow OUT1". Scrolling in menu is possible using the ↓ (down) and → keys (up). Scroll to desired error and press the ↵ key. Display will read „Active, Non-Active". With the ↓ and → keys set the desired error characteristics and press the ↵ . Then you can continue with setting of another error. When finished, press the ↑ key and return to item "Errors".

Menu: Production data, press the ↵ key, Dose correction, press the ↵ key
The display will read “Dose Correction xxxxx”. The value specified here will be added or subtracted from the earlier specified dose size. Move the cursor by repeated pressing of the → key and set the desired value by pressing the ↑ and ↻ keys (increase/decrease). The five “x” should be replaced by a figure representing the dose correction in the given volume units. Confirm your selection by pressing the ↵ key. The display will read “Value Entered Press Any Key”. Press the ↵ key. This takes you back to the Production Data menu, item “Dose Correction”.

Menu: Production data, press the ↵ key / Flow direction, press the ↵ key
The first display line will show “A → B”, the second line “A ↔ B”. The first line applies. Select the correct information by pressing the ↻ key, then press the ↵ key. The display will read “Value Entered Press Any Key”. Press the ↵ key. The Production Data menu will appear on the display with the “Flow Direction” item selected.

Menu: Production data, press the ↵ key / Base frequency, press the ↵ key
The display will read “Base Frequency LXXX”. Move the cursor by repeatedly pressing the → key and set the desired value by pressing the ↑ and ↻ keys (increase/decrease). The X-es should be replaced by a figure equal to the base frequency in Hz specified in the table shown in section 7.1.4. Then press the ↵ key. The display will read “Value Entered Press Any Key”. Press the ↵ keys. This takes you back to the Production Data menu, item “Base frequency”.
To return to the basic menu, item “Production data”, press the ↑ key.

7.1.8. Dose setting

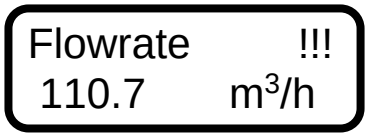
The dosing mode is active when the Display item is selected from the “Displayed Data” menu. The dosing mode allows for measurement of the pre-set liquid volume (dose). The external initiation command shall be brought to the input of optocoupler IN1. As soon as the pre-set dose has passed through the meter probe, the output optocoupler (OUT3) will close. The dosing process will be repeated with every new external initiation signal brought to the input of optocoupler IN1. Press the ↵ key to discontinue the dosing process currently in progress. Following that, the next dosing process can be initiated at any time.

Menu: Dose setting, press the ↵ key
The display will read “Dose Size xxxxx“. Using the → key move the cursor to the desired decimal position and increase/decrease the selected figure by pressing the ↑ and ↻ keys, respectively. Replace xxxx by a number equal to the dose size. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. The basic configuration menu will reappear on the display with the “Dose Setting” item selected.

7.1.9. Zero setting

The zero-setting function is useful in cases where the actual flow rate is very small (e.g. due to leakage in closed valves) and for all practical purposes equal to zero. This function can only be used with meters in a single flow-direction application. Should you open the zero-setting configuration mode by mistake (not wishing to change the zero setting), proceed using the Cancel-Zero setting sequence of commands.

Menu: Zero setting, press the ↵ key
The display will read “Setting Completed” and show the flow rate as indicated by the meter prior to entry to the configuration mode. Take a note of this value as it cannot be otherwise reconstructed once the new zero setting has been completed. Press the ↵ key. The basic configuration menu will reappear on the display with the “Zero Setting” item selected.
The new zero setting will become effective upon leaving the meter configuration mode. At the same time, three flashing exclamation marks will appear on the display showing the actual flow rate values.



The flow rate display image with the zero-setting effective
The actual zero setting can be changed at any time by repeating the above “Zero Setting” procedure.

Cancellation of the actual zero flow rate setting:

Menu: Zero setting, press the ↵ key
The display will read “Setting Completed” and show the flow rate as indicated by the meter prior to entry to the configuration mode. Press the ↻ key . The display will read “Setting Cancelled” while the flow rate value will remain unchanged. Press the ↵ key. The basic configuration menu will reappear on the display with the “Zero Setting” item selected. The cancellation of zero setting will take effect upon leaving the meter configuration mode. The three flashing exclamation marks on the flow rate display will disappear.

7.1.10. 100 per cent

Default value of the “100 Percent” quantity is Q_4 as specified for the sensor DN (see the table of minimum and maximum flow rates in section 4.1.1.). This default value can be reset, in particular in cases where the actual maximum flow rate is lower than Q_4.

Menu: 100 percent, press the ↵ key
The display will read “100 Percent xxxx“. Using the → key, move the cursor to the desired decimal position and increase/decrease the selected figure by pressing the ↑ and ↻ keys, respectively. Replace xxxx by a number equal to the flow rate identified with 100%. Press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. The basic configuration menu will reappear on the display.

7.1.11. Exit

Select “Exit” to leave the configuration mode and protect the meter from any unauthorised configuration action.

Menu: Exit, press the ↵ key

EXIT New password

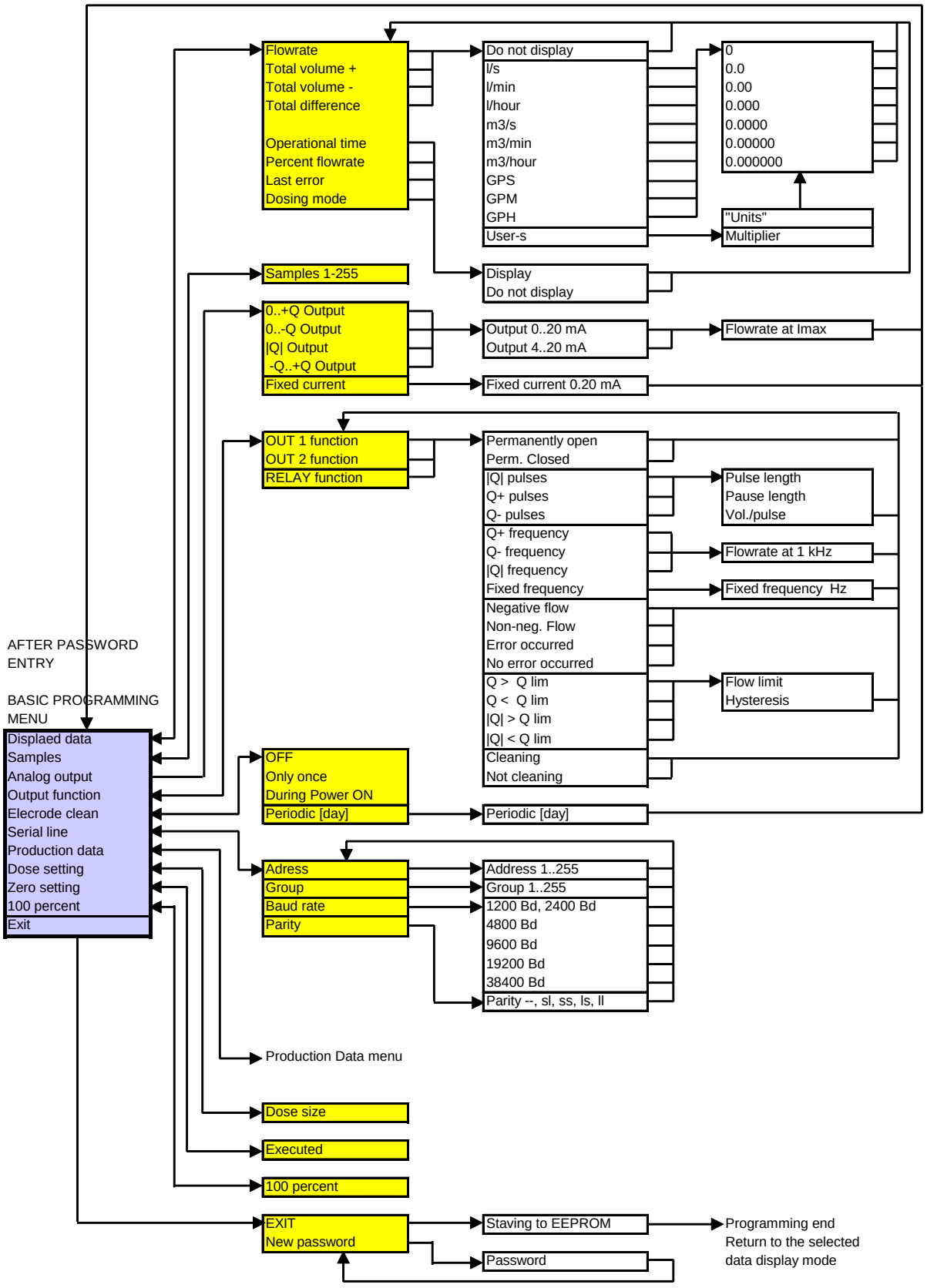
Browse through the menu using the ↻ (direction downwards) and → keys (upwards). The selected menu item appears on the first line with the first character blinking. Select “Exit” and press the ↵ key. The display will read “Write To EEPROM Press Any Key“. Press any key, preferably the ↵ key. The meter configuration mode will be terminated, and the data display menu will appear on the display. Use the ↻ and ↻ keys to browse downwards and upwards through the menu items.

Select “New password” to cancel the existing password and define a new password enabling entry into the Parameter Setting mode.

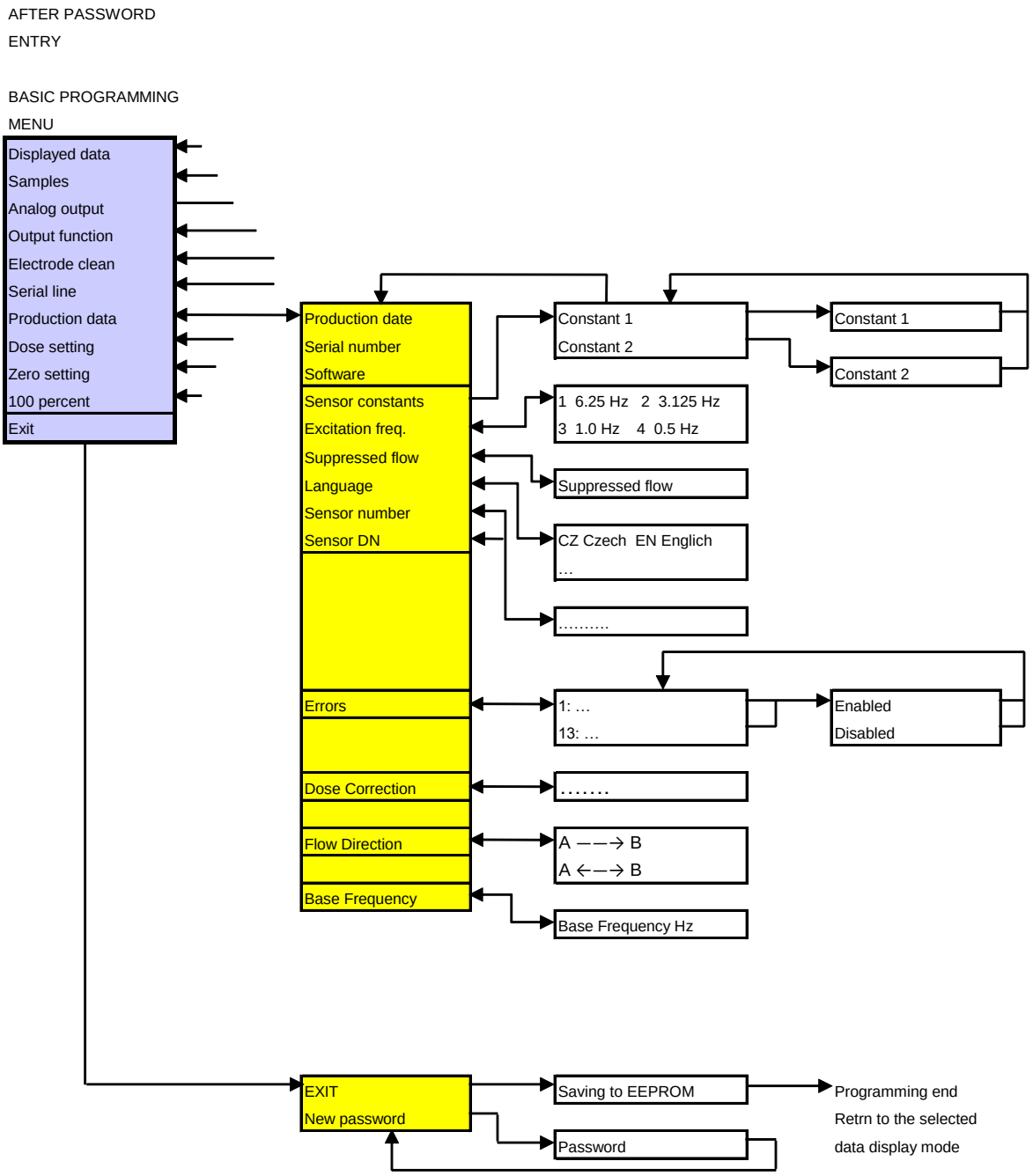
Menu: Exit, press the ↵ key / New password, press the ↵ key
The display will read “Password 0000“. Using the → key, move the cursor to the desired decimal position and increase/decrease the selected figure by pressing the ↑ and ↻ keys, respectively. Enter the new password and press the ↵ key. The display will read “Value Entered Press Any Key”. Press any key, preferably the ↵ key. The Exit menu will reappear on the display. Select the Exit item and press the ↵ ley. The display will read “Write To EEPROM Press Any Key”. Press any key, preferably the ↵ key. This command will terminate the configuration mode and bring the data display menu on the meter display. Unless the configuration procedure is terminated in this way, the flowmeter parameters will not be protected by a password. Browse through the menu items using the ↻ (direction downwards) and → keys (upwards).

Warning! After downloading of any new data to EEPROM, the flow meter mustn’t be turn off min for time 5 min!!!

7.2. The Parameter Setting menu



7.3. The Production Data menu



8. ERROR REMOVAL AND METER REPAIR PROCEDURES

Error removal and meter repair activities should be reserved to duly qualified staff skilled in maintenance of electronic equipment and acquainted with the labour 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, dismantling of the display unit, keypad etc., make sure that the supply voltage is disconnected. At all times, be aware of the danger of electric shock.

8.1. REPLACEMENT PC BOARDS

Processor board including FNP5 display unit
Analog board FNA5
Power source board FNZ5
Terminal board FNS5
Keypad
Display unit

8.2. PROGRAM AND SIMULATION SOFTWARE

Project design, assembly and service manual FLONET FN20xx.1
SF 1.0 sensor simulator plus connecting cable to FLONET FN20xx.1 meter (Es90254K/a)
FLOSET 2.0 program (distributor Es90503D, customer Es90504D)
Personal computer with Windows 2000 or a higher upgrade thereof
USB 2.0 communication cable (with connector USB, type A at one end and connector USB, type B at the other end)
Fixture for checking outputs of FLONET KV 1.0 including flat connecting cable (Es90355K/a)

8.3. FLOWMETER REPAIR PROCEDURE

Prior to any maintenance or repair action on the internal parts of the meter control unit including the power source, PC boards, display unit, keypad etc. make sure that the supply voltage is disconnected.

WARNING: disregarding this instruction implies risk of electric shock.

The meter in the ECONOMIC configuration can be tested using a computer connected to the meter by means of an USB serial communication line and using the FLOSET program. Alternatively, connect a display unit and keypad to the FNP5 processor board of the meter to be checked or repaired and carry out the test as with the COMFORT configuration.

The meter in the COMFORT configuration includes a keypad and display unit. The procedures described in this manual are focused on identification of a defective board or system component. The serviceman shall have available replacement boards tested and pre-set by the meter manufacturer. The repair procedure consists of replacement and checks on the condition of each system component (PC board) in turns. To exclude the possibility of a defect in the flow sensor, it should be disconnected and a sensor simulator SF 1.0 put in its place.

Under normal meter operation, the display backlight is off. To turn it on, press the any key. The display will show the latest selection of the measured parameter.

The self-diagnostic feature of the transmitter concerns errors E0 through to E13. The indicated error is accompanied by a brief error description. More detailed description of the error conditions is included in section 6.5.3 of this Manual. The operator may acknowledge the error indication by pressing ⟲ key, whereby the error message will disappear and the previous image/message return to the display. Should the error be of a lasting nature, the error message will eventually reappear. Then proceed with repair, taking into account the error type concerned.

Remove the cover at the rear side of the transmitter housing. The cover is held in position by means of six socket screws. With the cover removed, loosen and remove two RSK pin nuts using size 5 Alien wrench. Then the front panel can be lifted off (mind the flat keypad cable). Disconnect the keypad. Pull out the electronic circuit block including the FNA5, FNP5 and FNZ5 boards by some 20mm, disconnect the connector of the flow sensor on the analog board FNA5 and remove the block from the housing. When re-assembling the unit, proceed in reverse order of the above steps.

When replacing the processor (FNP5) board, set the flowmeter configuration with respect to the flow sensor used.

Upon replacement of the analog (FNA5) board, the current output calibration at 4.00 mA and 20.00 mA will be lost.

When replacing the terminal (FNS5) board, mind the L165V integrated circuit mounted on an insulation plate and attached onto the housing body.

The power source (FNZ5) board in fitted onto the analog (FNA5) board with its position secured by nuts M3. The keypad replacement shall be done at the manufacturer’s plant. The keypad shall be tight-fitted onto the front unit panel to ensure the overall system protection class IP 67.

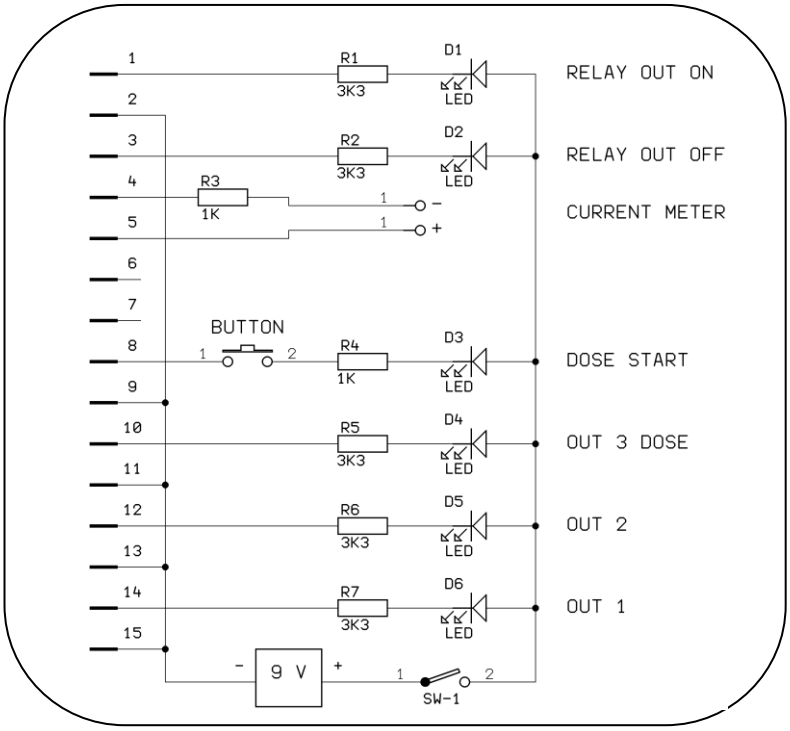
Flowmeter error	Error removal/rectification
No text on display, no back light, no reaction to keypad commands	Unscrew bolts and remove cover lid on terminal board. Check the power source voltage on FNS5 and the condition of fuse on FNS5; if necessary, replace power board FNZ5 and/or terminal board FNS5.
Nonsensical reading appearing on display	Turn off and on power source, perform the initial meter setting procedure (see below); if needed, replace processor board FNP5 and/or keypad.
Display shows flow rate values and does not react to keypad commands	Replace processor board FNP5 and/or keypad.
Upon press the ing a key on keypad, display backlight fails to appear	Replace processor board FNP5.
Meter diagnostics system reports error E-000	No error.
E-001	Replace power supply board (FNP5).
E-002, E-003, E-004	Incorrectly set output parameters (OUT1, OUT2, OUT3).
E-005	Electromagnetic interference from external sources too high.
E-006	Not fully flooded piping or defective electrode(s) indicating this condition Replace analog board FNA5.
E-007	Check sensor connection (coil feeding lines), replace analog board FNA5, replace terminal board L165V.
E-008	Replace power source board FNZ5, processor board FNP5 and/or analog board FNA5.
E-009	Replace power source board FNZ5, processor board FNP5 and/or analog board FNA5.
E-010	Replace analog board FNA5 and/or processor board FNP5.
E-011	Incorrect setting of current output.
E-012	Replace analog board FNA5, processor board FNP5 and/or terminal board FNS5.
E-013 – not used, has no influence on the flowmeter operation	Check sensor connection (electrodes), replace analog board FNA5 and/or processor board FNP5.
Irregular function of analog output	Check analog output using the “fixed-current” mode with Amp-meter connected at the output; replace analog board FNA5, terminal board FNS5 and/or processor board FNP5.
Irregular function of outputs OUT1 and/or OUT2.	Check outputs using the “open” and “closed” modes with power source on and loading resistor connected to the output; replace analog board FNA5, terminal board FNS5 and/or processor board FNP5.
Irregular function of output relay	Check output relay using the “open” and “short-circuit” modes with Ohm-meter connected at the output; replace terminal board FNS5, analog board FNA5 and/or processor board FNP5
Unstable flow rate readings on display	In reference to meter manual, check the sensor and measured liquid grounding connections; in case of remote meter version, check signal interference via cable connecting meter sensor and transmitter (connect sensor simulator at cable end), and interference via power supply cable (use line-voltage filter).

The initial flowmeter setting procedure: With the meter power supply turned off, press simultaneously and keep pressed the ⟲ and ⇥ keys, turn on the power, and wait till the display starts showing the flowrate values. This operation is used to activate the meter transmitter in production. The initialisation procedure cancels previous meter calibration and output settings and replaces these by factory-preset parameters. Therefore, in the next step, the customised meter setting needs to be performed. There are two possible methods available to do that:

1) Parameter setting via the meter keypad. Enter the configuration menu using password “0000” (see the Project design, assembly and service manual FLONET FN20xx.1). Enter the parameters specified on the sensor rating plate: excitation frequency, threshold (suppressed) flow rate, language, sensor number and DN. Further it is necessary to define liquid volume units to be displayed and to set up the output configuration.

2) Parameter setting using a computer and the USB serial communication line. The configuration software (FLOSET 2.0) is supplied by the manufacturer, ELIS PLZEŇ. Fill in the meter specific data into the respective FLOSET 2.0 tables and store them into the meter memory unit. A more practical way of parameter setting is re-writing the pre-set values by the meter configuration file (system production series number.fln). Feed the configuration file into the FLOSET 2.0 program and store it into the meter memory. The configuration file can be obtained from the meter manufacturer.

8.3.1. KV 1.0 Fixture for checking the meter outputs



Schematic drawing KV 1.0 Fixture

Fixture application

Disconnect external equipment from the meter terminal board. Connect fixture KV 1.0 to the terminal board of the FLONET FN20xx.1 flow meter under test using a flat cable. Make sure that the fixture terminals are connected to corresponding meter terminals. Switch on the fixture battery. Enter the configuration menu (see the meter manual).

Checking the analog (current) output: Set fixed current at specific value, e.g. 10.0 mA. Connect Amp meter into the respective socket contacts on the fixture and check the current value.

Checking output OUT1: Select the “short-circuit (Closed)” mode and check that signal light OUT1 will light up. Select the “open-circuit (Open)” mode and the same signal light should go out.

Checking output OUT2: Select the “Closed” mode and check that signal light OUT2 will light up. Select the “Open” mode and the same signal light should go out.

Checking the relay function: Select the “Closed” mode and the signal light associated with the contact indicating the energised relay status (RELAY OUT CLOSED) will light up. Select the “Open” mode and the signal light indicating the energised relay status should go out and the signal light associated with the normally closed contact (RELAY OUT OPEN) will light up.

Checking the dosing function (DOSE START and OUTPUT3): Select the “Dosing Display” mode. The dose size may be set at 500 liters or otherwise. Return to the “Dosing Display” mode of operation. Press the DOSE START on the verification fixture. While the key is pressed, the DOSE START signal light will be up and DOSE OUTPUT3 signal light will be off. Provided the liquid flows or it is simulated by Simulator SF 1.0, dosing starts immediately. Signal light OUTPUT3 DOSE will light up following completion of the dosing operation.

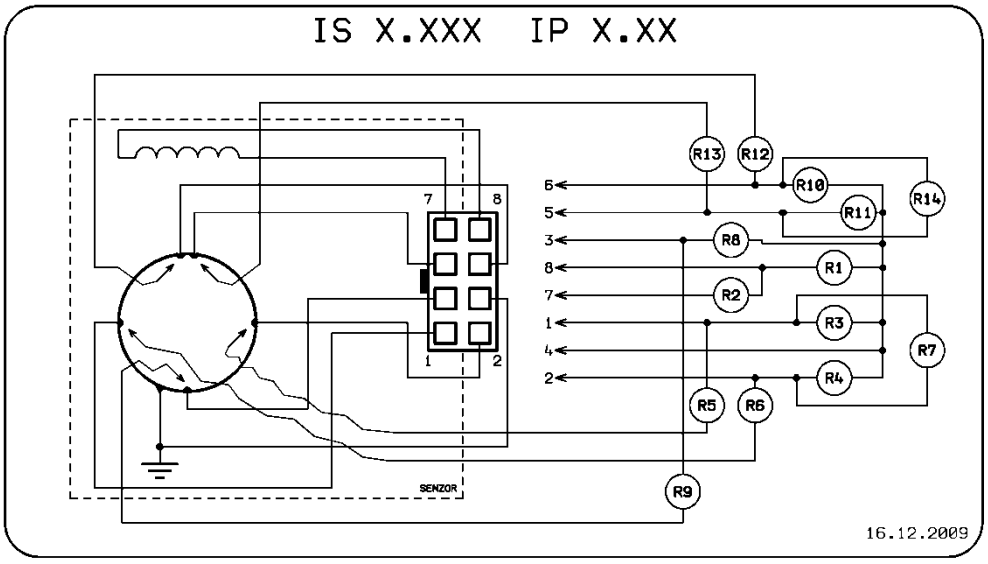
Turn the battery switch into the OFF position.
Upon completion of the above checks, disconnect the KV 1.0 fixture from the meter terminal board. Then connect all co-operating devices and equipment to the unit as they were before. **It is also of utmost importance to restore completely the original settings of all outputs.**

8.3.2. Checking the sensor condition (compact version)

To check the sensor condition, dismantle the transmitter so as to gain access to the sensor connector. Proceed as follows:
Remove the cover at the rear side of the transmitter housing. The cover is held in position by means of six socket screws. With the cover removed, loosen and remove two RSK pin nuts using size 5 Alien wrench. Then the front panel can be lifted off (mind the flat keypad cable). Disconnect the keypad. Pull out the electronic block including the FNA5, FNP5 and FNZ5 boards by some 20mm, disconnect the connector of the flow sensor from the analog board FNA5 and remove the block from the unit box. When reassembling the unit, proceed in reverse order of the above steps.

8.3.2.1. Measurements to be performed on sensor with no liquid inside (the lining is dry)

Schematic diagram: a particular sensor need not include all the depicted electrodes



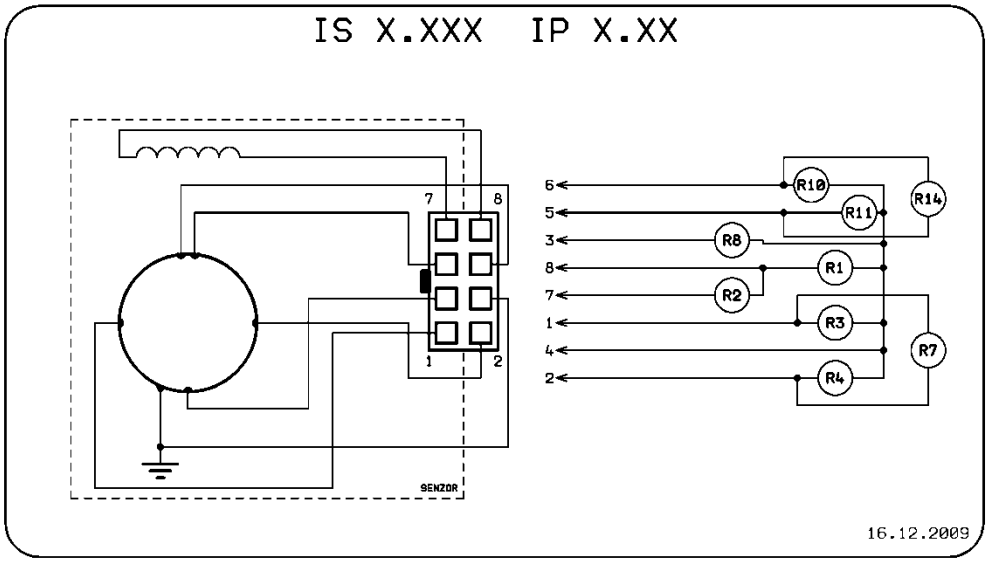
Example: Measurement of R1. Connect Ohm-meter to connector pins 8 and 4 and measure resistance. Then exchange the Ohm-meter leads and measure resistance again. Calculate the average value of the two measurements and enter it as “Measured Value” into the table below.

Parameter	Description	Measured value
R1	Coil to sensor body insulation resistance (>2MΩ)	
R2	Excitation coil resistance (36 to 44Ω)	
R3	Measuring electrode to sensor body insulation resistance (>2MΩ)	
R4	Measuring electrode to sensor body insulation resistance (>2MΩ)	
R5	Measuring electrode to connector connection (short circuit)	
R6	Measuring electrode to connector connection (short circuit)	
R7	Insulation resistance between measuring electrodes (>2MΩ)	
R8	Grounding electrode to sensor body insulation resistance (>2MΩ)	
R9	Grounding electrode to connector connection (short circuit)	
R10	Dry-condition electrode to sensor body insulation resistance (>2MΩ)	
R11	Dry-condition electrode to sensor body insulation resistance (>2MΩ)	
R12	Dry-condition electrode to connector connection (short circuit)	
R13	Dry-condition electrode to connector connection (short circuit)	
R14	Insulation resistance between dry-condition electrodes (>2MΩ)	

Note:
If the electrodes indicating the not fully flooded (dry) piping condition are not included in the sensor configuration, connector pins 5 and 6 are shorted and parameters R10 through to R13 need not be measured. The R14 measurement will indicate a short-circuit condition.
If the grounding electrode is missing, connector pin 3 remains unconnected and parameters R8 and R9 need not be measured.

8.3.2.2. Checking the sensor condition fitted into piping and flooded with a measured liquid

The sensor grounding electrode is connected to the piping or grounding rings.
Schematic diagram: a particular sensor need not include all the depicted electrodes



Example: Measurement of R1. Connect Ohm-meter to connector pins 8 and 4 and measure resistance. Then exchange the Ohm-meter leads and measure resistance again. Calculate the average value of the two measurements and enter it as “Measured Value” into the table below.

Parameter	Description	Measured value
R1	Coil to sensor body insulation resistance (>2MΩ)	
R2	Excitation coil resistance (36 to 44Ω)	
R3	Liquid resistance between measuring electrode and sensor body	
R4	Liquid resistance between measuring electrode and sensor body	
R7	Liquid resistance between measuring electrodes	
R8	Liquid resistance between grounding electrode and sensor body	
R10	Liquid resistance between dry-condition electrode and sensor body	
R11	Liquid resistance between dry-condition electrode and sensor body	
R14	Liquid resistance between dry-condition electrodes	

Comments:
If the electrodes indicating the not fully flooded (dry) piping condition are not included in the sensor configuration, connector pins 5 and 6 are shorted and parameters R10 and R11 need not be measured. The R14 measurement shall indicate a short-circuit condition.

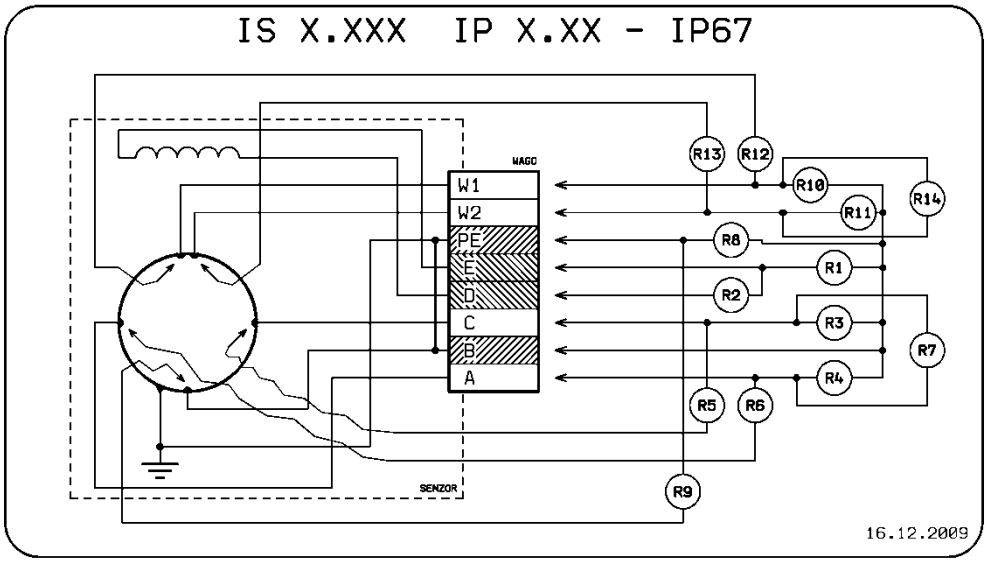
If the grounding electrode is missing, connector pin 3 remains unconnected and parameters R8 need not be measured.

8.3.3. Checking the sensor condition (remote transmitter with IP67 housing)

To check the condition of the meter sensor, remove the lid on the sensor terminal housing. Disconnect the cable to the associated transmitter and perform the required sensor parameter measurements. In case of the IP67 design version, the terminals are readily accessible. With IP68 design, the terminals including the cable end are sealed with packaging compound and cannot be accessed.

8.3.3.1. Measurements to be performed on sensor with no liquid inside (the lining is dry)

Schematic diagram: a particular sensor need not include all the depicted electrodes



Example: Measurement of R1. Connect Ohm-meter to the terminals E a B and measure resistance. Then exchange the Ohm-meter leads and measure resistance again. Calculate the average value of the two measurements and enter it as “Measured Value” into the table below.

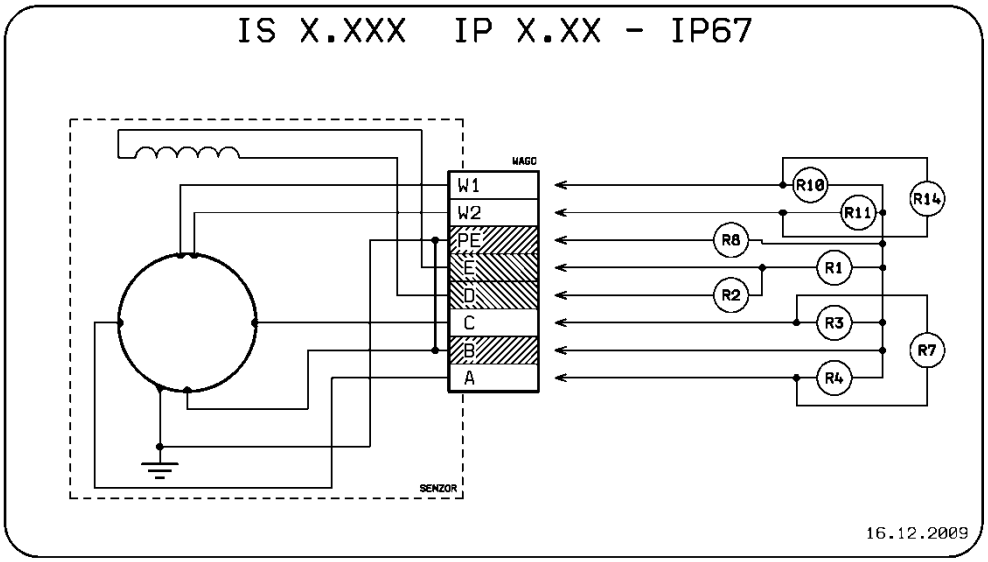
Parameter	Description	Measured value
R1	Coil to sensor body insulation resistance (>2MΩ)	
R2	Excitation coil resistance (36 to 44Ω)	
R3	Measuring electrode to sensor body insulation resistance (>2MΩ)	
R4	Measuring electrode to sensor body insulation resistance (>2MΩ)	
R5	Measuring electrode to Terminals connection (short circuit)	
R6	Measuring electrode to Terminals connection (short circuit)	
R7	Insulation resistance between measuring electrodes (>2MΩ)	
R8	Interconnection between Terminals points PE and B (short circuit)	
R9	Grounding electrode to sensor body connection (short circuit)	
R10	Dry-condition electrode to sensor body insulation resistance (>2MΩ)	
R11	Dry-condition electrode to sensor body insulation resistance (>2MΩ)	
R12	Dry-condition electrode to Terminals connection (short circuit)	
R13	Dry-condition electrode to Terminals connection (short circuit)	
R14	Insulation resistance between dry-condition electrodes (>2MΩ)	

Note:

If the electrodes indicating the not fully flooded (dry) piping condition are not included in the sensor configuration, terminal pins W1 and W2 are free and resistances R10 through to R14 need not be measured. If the grounding electrode is missing, parameter R9 need not be measured.

8.3.3.2. Checking the sensor condition fitted into piping and flooded with a measured liquid

The sensor grounding electrode is connected to the piping or grounding rings.
Schematic diagram: a particular sensor need not include all the depicted electrodes



Example: Measurement of R1. Connect Ohm-meter to the terminals E a B and measure resistance. Then exchange the Ohm-meter leads and measure resistance again. Calculate the average value of the two measurements and enter it as “Measured Value” into the table below.

Parameter	Description	Measured value
R1	Coil to sensor body insulation resistance (>2MΩ)	
R2	Excitation coil resistance (36 to 44Ω)	
R3	Liquid resistance between measuring electrode and sensor body	
R4	Liquid resistance between measuring electrode and sensor body	
R7	Liquid resistance between measuring electrodes	
R8	Interconnection between points PE and B (short circuit)	
R10	Liquid resistance between dry-condition electrode and sensor body	
R11	Liquid resistance between dry-condition electrode and sensor body	
R14	Liquid resistance between dry-condition electrodes	

Note:

If the electrodes indicating the not fully flooded (dry) piping condition are not included in the sensor configuration, terminals pins W1 and W2 are free and resistances R10, R11 and R14 need not be measured.

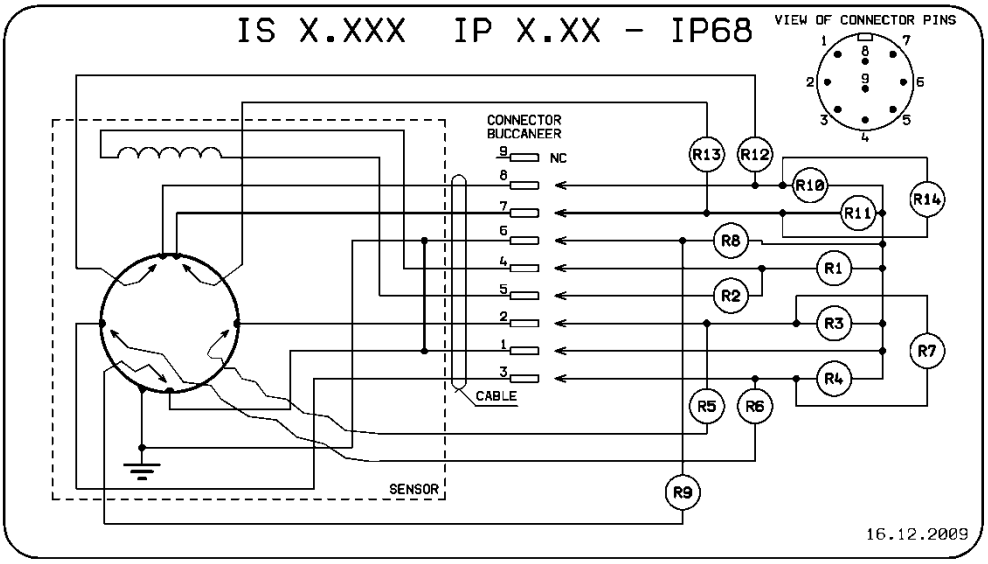
8.3.3.3. Checking the condition of the cable connecting sensor and associated transmitter

Important notice: Prior to checking the condition of the connecting cable, disconnect the flat connector on the side of the transmitter. After the check, plug the connector in again.
Remove the cover at the rear side of the transmitter housing. The cover is held in position by means of six socked screws. With the cover removed, loosen and remove two RSK pin nuts using size 5 Alien wrench. Then the front panel can be lifted off (mind the flat keypad cable). Disconnect the keypad. Pull out the electronic block including the FNA5, FNP5 and FNZ5 boards by some 20mm, disconnect the connector of the flow sensor from the analog board FNA5 and remove the block from the unit box. When reassembling the unit, proceed in reverse order of the above steps.

During the inspection, the connecting cable shall be disconnected from both the meter sensor and the transmitter. Check the integrity of individual cable conductors, insulation resistance between the cable conductors and insulation resistance between each cable conductor and shielding. The shielding connection is on the side of the meter sensor only.

8.3.4. Checking the sensor condition (remote transmitter with IP68 housing)

The sensor and connecting cable are to be checked simultaneously. On the side of the transmitter, the cable is terminated by a 9-pin Buccaneer connector via which all measurements shall be done.



Example: Measurement of R1. Connect Ohm-meter to connector pins 4 and 1 and measure resistance. Then exchange the Ohm-meter leads and measure resistance again. Calculate the average value of the two measurements and enter it as “Measured Value” into the table below.

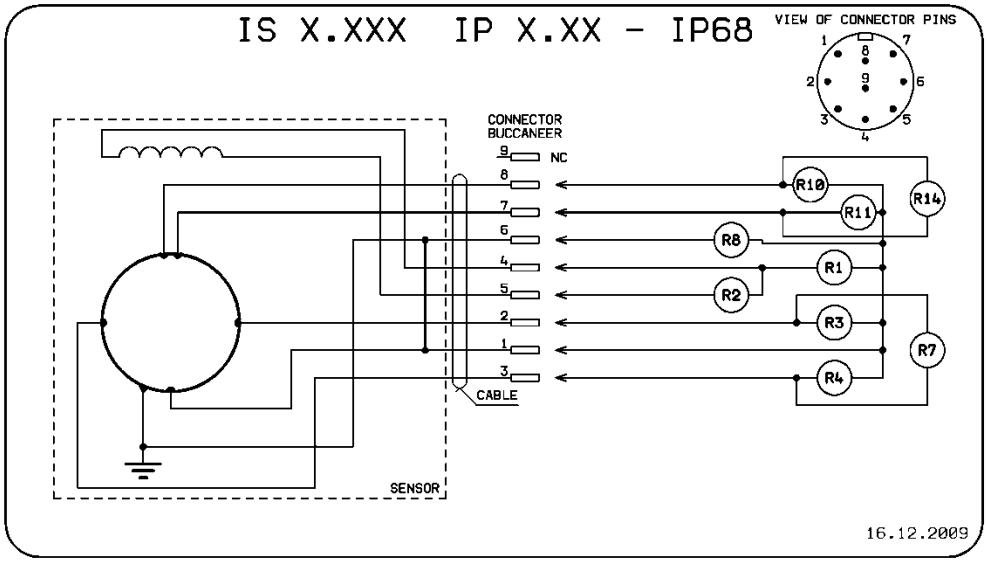
Parameter	Description	Measured value
R1	Coil to sensor body insulation resistance (>2MΩ)	
R2	Excitation coil resistance (36 to 44Ω)	
R3	Measuring electrode to sensor body insulation resistance (>2MΩ)	
R4	Measuring electrode to sensor body insulation resistance (>2MΩ)	
R5	Measuring electrode to connector pin connection (short circuit)	
R6	Measuring electrode to connector pin connection (short circuit)	
R7	Insulation resistance between measuring electrodes (>2MΩ)	
R8	Interconnection of connector pins 1 and 6 (short circuit)	
R9	Grounding electrode to sensor body connection (short circuit)	
R10	Dry-condition electrode to sensor body insulation resistance (>2MΩ)	
R11	Dry-condition electrode to sensor body insulation resistance (>2MΩ)	
R12	Dry-condition electrode to connector pin connection (short circuit)	
R13	Dry-condition electrode to connector pin connection (short circuit)	
R14	Insulation resistance between dry-condition electrodes (>2MΩ)	

Note:
If the electrodes indicating the not fully flooded (dry) piping condition are not included in the sensor configuration, connector pins 7 and 8 are free and resistances R10 through to R14 need not be measured.

If the grounding electrode is missing, parameter R9 need not be measured either.

8.3.4.1. Checking the sensor condition fitted into piping and flooded with a measured liquid

The sensor grounding electrode is connected to the piping or grounding rings.
Schematic diagram: a particular sensor need not include all the depicted electrodes



Example: Measurement of R1. Connect Ohm-meter to connector pins 4 and 1 and measure resistance. Then exchange the Ohm-meter leads and measure resistance again. Calculate the average value of the two measurements and enter it as “Measured value” into the table below.

Parameter	Description	Measured value
R1	Coil to sensor body insulation resistance (>2MΩ)	
R2	Excitation coil resistance (36 to 44Ω)	
R3	Liquid resistance between measuring electrode and sensor body	
R4	Liquid resistance between measuring electrode and sensor body	
R7	Liquid resistance between measuring electrodes	
R8	Interconnection of connector pins 1 and 6 (short circuit)	
R10	Liquid resistance between dry-condition electrode and sensor body	
R11	Liquid resistance between dry-condition electrode and sensor body	
R14	Liquid resistance between dry-condition electrodes	

Note:
If the electrodes indicating the not fully flooded (dry) piping condition are not included in the sensor configuration, connector pins 7 and 8 are free and resistances R10, R11 and R14 need not be measured.

8.3.5. Checking the flowmeter condition with a diagnostic module of FLOSET 2.0 program

Connect your computer via an USB communication cable to the FLONET flowmeter. Start the FLOSET 2.0 program and verify the connection to the flowmeter under test. Select the Diagnostics module and initialise it.
Module functions:

- reading of all measured flow rate and volume values and indicated errors
- recording of repeated value readings into specified files
- visualisation of meter manufacturing information
- system diagnostics and printout of the diagnostic report

For more detailed information, see Guide to FLOSET 2.0 application.

Note: If the meter configuration includes RS-485 communication line interface, the diagnostic operations can be carried out via this line (provided, of course, that your computer has the necessary interface or an RS-485 converter).

9. SERVICE ACTIVITIES

9.1. Warranty service

The product warranty service is understood to include any repair work executed free of charge either on site or at the manufacturer's premises during the product warranty period. Warranty repair shall be executed within the terms agreed between the customer and manufacturer (service provider). Warranty repair concerns product defects due to the use of non-standard materials, parts or incorrect manufacturing procedures. Should such defects prove irreparable, the product shall be replaced at no costs to the customer.

Warranty repair shall be performed either by the manufacturer (ELIS PLZEŇ a.s.) or duly authorized service centres or distribution agents. However, these need to have the manufacturer's authorisation in writing and have a staff properly trained to execute flowmeter repairs.

The manufacturer's warranty shall not cover
- products where the installation and/or metrological seals have been removed
- product defects due to incorrect installation
- product defects due to non-standard product use
- product pilferage
- product defects due to circumstances classified as force majeure.

Any requirement for warranty repair shall be submitted in writing (using fax, electronic mail or registered letter) to the official address of the manufacturer. Should the manufacturer establish that the subject product repair does not fall within the warranty conditions, this fact will be made known to the customer in writing and the respective repair costs will be invoiced to the same. In case of invoicing meters, the parameters of a repaired product shall be verified at a duly authorized metrological centre.

9.2. Post-warranty service

The post-warranty service is understood to include any repair work needed due to the product defects or deficiencies identified after the warranty period. All such repair work, whether executed at the manufacturer's plant or on site, shall be invoiced and paid for by the customer. In case of invoicing meters, the parameters of a repaired product shall be verified at a duly authorised metrological centre. Any requirement for a post-warranty repair shall be delivered in writing (using fax, electronic mail or registered letter) to the official address of the manufacturer.

10. STANDARD TESTS

Each finished product is thoroughly checked to establish the product completeness and compliance with the manufacturer's quality assurance standards. Subsequently the product functions are verified according to specifications of the approved test procedures and the meter is subject to at least 15-hour trial test.

11. CALIBRATION

The FLONET electromagnetic flowmeters are supplied from the manufacturing plant calibrated with a three-point calibration. Upon agreement with the customer, the number of calibration points can be extended to 5 or 9 on a request of a customer. The meter calibration services can also be carried out by duly authorized contracting parties equipped with adequate measuring equipment.

Warning:

If not agreed otherwise with the customer, flowmeters are calibrated with the 0 to 1 kHz frequency output. Upon agreement with the manufacturer, flowmeters can be calibrated by means of other outputs, i.e. pulse or current.
Guaranteed parameters of measurement accuracy always apply only to the electrical output used for the flowmeter calibration. The other outputs, not use for calibration purposes, are recommended to be used only for measurements with the permissible accuracy that is 1 to 2 % lower than the accuracy achieved when calibrated with the frequency output.

During a control measurement or metrological verification carried out by the customer it is necessary to use the same electrical output that was used for calibration by manufacturer.

12. PRODUCT ORDERING

When ordering the FLONET FN20xx.1 electromagnetic flowmeters, use a specific order number to be determined based on the following table.

For ordering and specification of electromagnetic flow meters, the order number is available on the Internet at www.elis.cz/en, if the order number is not found here please, contact us.

13. PACKAGING

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

14. 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. Together with the flowmeter FLONET FN20xx.1, the customer shall receive a delivery note, operation and maintenance manual and a statement on the product compliance with the respective standards.

15. 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 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.

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