KROHNE

measure the facts

OPTIFLUX 4000

Electromagnetic flow sensor

- Standard flow sensor for the process industry
- Special flow sensor for corrosive liquids and slurries
- For demanding applications:

  High temperatures, high pressures, low conductivity, corrosive liquids, hazardous areas
- Robust and reliable

HART COMMUNICATION PROTOCOL

Fieldbus Foundation

PROFIBUS PROCESS FIELD BUS

Standard solution for the process industry

The Optiflux 4000 electromagnetic flow sensor is the standard in the process industry and suitable for demanding applications.

Highlights

- Robust and reliable
- Works reliably under demanding conditions: High temperatures (up to 180°C / 356°F) and low conductivity
- Quick and easy to install and operate
- Chemically resistant to alkaline solutions and acids

Industries

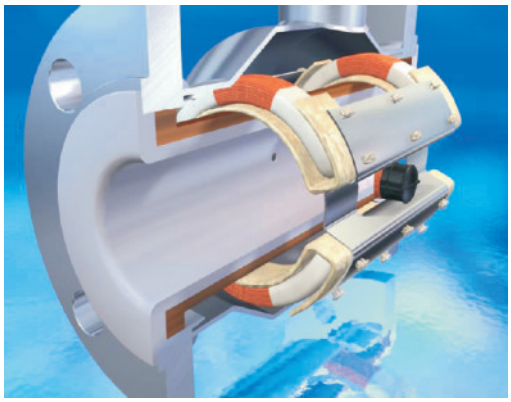
- Chemicals
- Pulp and Paper
- Minerals and Mining
- Iron, Steel and Metals
- Water and Wastewater
- Petrochemicals / Oil and Gas
- Food and Beverages

Applications

- Measurement of aggressive chemicals, acids and alkalies etc
- Measurement of pulps and pastes etc
- Measurement of abrasive slurries, pastes with high solid content etc
- Measurement of abrasive slurries, water etc
- Measurement of water, effluent etc
- Measurement of milk, juices, concentrates, water etc

The Optiflux 4000 has been designed for measuring any application in any industry. Furthermore the modular concept allows tailor-made solutions for challenging applications. Every meter that leaves our factory is wet-calibrated on our calibration rigs (ISO/IEC 17025 standards)

Construction



The measuring tube of the sensor has a smooth, cylindrical shape. This design, consisting of a circular cross section (no moving parts) and a homogeneous magnetic field, forms the basis for a flow-optimised pipe cross section, thereby providing reliable measurements that are largely independent of the flow profile. This design allows the sensor to measure the flow bi-directional. As an additional benefit, there is no pressure drop. The liner of the measuring tube is made of PTFE, PFA, soft rubber or polyurethane and is resistant to vacuum, corrosion, aging and abrasion. The surface and shape of the measuring tube also minimise mineral deposits, resulting in exemplary measurement quality - even over the long term.

Electromagnetic flowmeters have many important advantages over mechanical flowmeters like outstanding long-term stability, maximum process reliability, no maintenance - to name just a few. As a result, these meters can deliver precise and reliable measurements for many years.

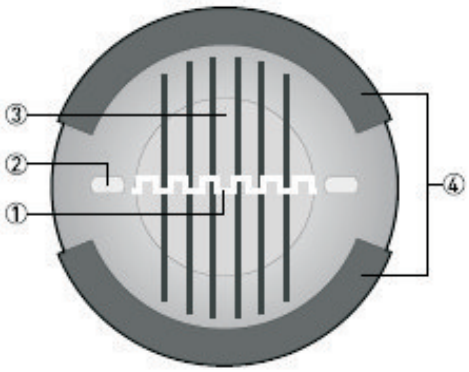
Measuring Principle – Faraday's law

An electrically conductive fluid flows inside an electrically insulated pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils. Inside of the fluid, a voltage U is generated:

U = V * K* B * D

Where
V = Mean flow velocity
K = Meter constant / correction factor for geometry
B = Magnetic field strength
D = Inner diameter of flowmeter

The signal voltage U is picked up by electrodes and is directly proportional to the mean flow velocity V and thus the flow rate Q. The generated signal voltage is very low.
Signal converter is used to amplify this signal voltage, filter it (separate from noise) and convert it into signals for totalising, recording and output processing.



1. Voltage (Induced voltage is directly proportional to flow velocity)
2. Electrodes
3. Magnetic field
4. Field coils

Technical Data

Measuring System

Measuring principle	Faraday's law of electromagnetic induction
Application range	Electrically conductive fluids
Measured value	Volumetric flow and velocity

Design

Features	Fully welded maintenance free sensor
	Flange version with full bore flow tube
	Standard as well as higher pressure rating up to 2500 lbs
Modular construction	The measurement system, consisting of a flow sensor and a signal converter, is available in compact or separate version. More information about the signal converter can be found in the technical data sheet of the signal converter.
Nominal diameter	3/8" .... 120" / DN 10 .... DN 3000
Measurement range	-12...12 m/s / -40...40 ft/s

Measuring accuracy

Measuring error (with signal converter)	IFC 050 converter – DN 10 ... DN 1200 / 3/8" ... 48" ±0.5% of mv
	IFC 100 converter – DN 10 ... DN 1200 / 3/8" ... 48" ±0.3% of mv
	IFC 300 converter – DN 10 ... DN 3000 / 3/8" ... 120" ±0.2% of mv + 1mm/s
Special calibration	Higher accuracy available on request
Repeatability	±0.1% of mv

Operating conditions

Temperature	
Process temperature	PTFE / PFA : -40...+180°C / -40...+356°F for remote version
	PTFE / PFA: -40...+90°C / -46...+194°F for compact version
	Soft rubber: -5...+80°C / 23...+176°F for remote / compact version
	Polyurethane: -5...+60°C / 23...+140°F for remote / compact version

Pressure	
ASME B16.5	Standard: 150 lbs RF for ASME / 3/8" .... 24"
	300lbs, 600lbs, 900lbs, 1500lbs, 2500lbs available on request
DIN	Standard:
	PN 40 for DN 10 .... DN 50 and DN 80
	PN 16 for DN 65 and DN 100 ... DN 150
	PN 10 for DN 200 .... DN 600
	Higher pressure rating available on request.
JIS & AWWA	Available on request
Hygienic connection	SMS union & Triclamp connection available on request for 1" .... 6" / DN 25 .... DN 150
Pressure loss	Negligible

Chemical properties

Physical condition	Liquids
Electrical conductivity	Water ≥ 20 µS/cm
	Process fluids ≥ 1 µS/cm
Permissible gas content	≤ 5% by volume
Permissible solid content	≤ 70% by volume

Installation conditions

Installation	Take care that flow sensor is fully filled
Flow direction	Forward and reverse
	Arrow on flow sensor indicates positive flow direction
Inlet straight run	≥ 5 DN
Outlet straight run	≥ 2 DN
Specials	0 x DN (upstream) & 0 x DN (downstream) available on request

Materials

Measuring tube	Standard: SS 304
	Optional: SS 316, SS 316L, SS 304L
Liner	PTFE for 3/8" ... 24" / DN 10 ... DN 600
	PFA for 1" .... 16" / DN 25 .... DN 400
	Soft Rubber for 1" .... 120" / DN 50 .... DN 3000
	Polyurethane for 1" .... 48" / DN 25 .... DN 1200
	Other liners (ETFE and specials) available on request
Sensor housing	Standard: Sheet Steel PU coated
	Optional: SS 304, SS 316, SS 304L, SS 316L
Flanges	Standard: Carbon Steel PU coated
	Optional: SS 304, SS 316, SS 304L, SS 316L
Process connection size	Meter size: 3/8" / DN 10 – Connection size: ½" / DN 15
	Meter size: 1/2" .... 120" / DN 15 .... DN 3000 –
	Connection size same as meter size
Measuring electrodes	Standard: Hastelloy C
	Optional: Platinum, Tantalum, Nickel, Titanium, Monel,
	Low noise, SS 316, SS 316L etc
Grounding rings	Standard: SS 316
	Optional: SS 316L, Hastelloy C, Titanium, Tantalum, Nickel, Graphite
	Optional: Grounding rings with neck for slurry applications
Grounding electrodes	Available optionally in above materials
Connection box (only for remote versions)	Standard: Die-cast Aluminum PU coated
	Optional: Stainless steel
Cable entry	M 20 x 1.5, others available on request

Electrical connections

Signal Cable	Only for remote versions
Type DS	Standard cable: Double shielded (Standard length: 10 m) Maximum: 600 m / 1968 ft (depending on electrical conductivity)

Approvals and Certifications

Protection category according to IEC 529 / EN 60529	Standard: IP 66 / 67 (NEMA 4 / 4X) Optional: IP 68 / NEMA 6P
Hazardous area	CCOE approval
Drinking water	Available on request

Technical information

Selection of meter size

Meter size		Full scale range Q 100% m³/h
DN mm	inch	v = 1 m/s
2.5	1/10	0.017674
4	1/8	0.045239
6	1/4	0.101790
10	3/8	0.2827
15	1/2	0.6362
20	3/4	1.131
25	1	1.767
32	-	2.895
40	1½	4.524
50	2	7.069
65	-	11.95
80	3	18.10
100	4	28.27
125	-	44.18
150	6	63.62
200	8	113.1
250	10	176.7
300	12	254.5
350	14	346.4
400	16	452.4
450	18	572.56
500	20	706.9
600	24	1018
700	28	1385
800	32	1810
900	36	2290
1000	40	2827
1200	48	4072
1400	56	5542
1600	64	7238
1800	72	9161
2000	80	11310
2200	88	13685
2400	96	16286
2600	104	19113
2800	112	22167
3000	120	25447

The optimum flow velocity should be 2-3 m/s or 6-9 ft/s, for products with solids contents between 3 and 5 m/s or 9 and 15 ft/s. The exact flow velocity can be determined from the columns in the tables for v=1m/s as shown in the following examples

Example for m³/h

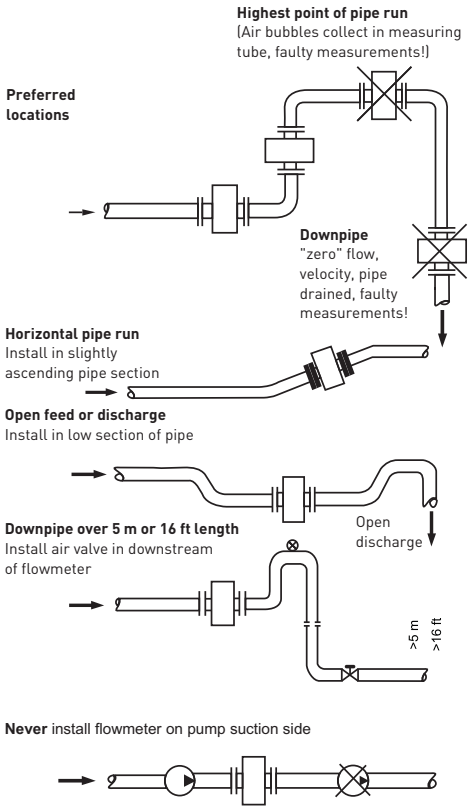
- Meter size: DN 80
- Desired measuring range: 55m³/h

From the table obtain for v = 1 m/s the flow rate of 18.10 m³/h at DN 80.

$$v = \frac{55 m^3/h \times 1 m/s}{18.10 m^3/h}$$

v = 3.04 m/s

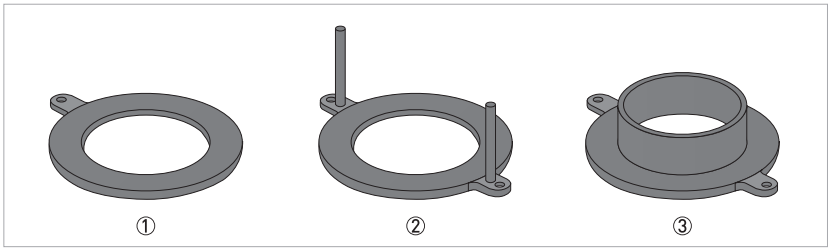
Suggestions for installation



Grounding rings

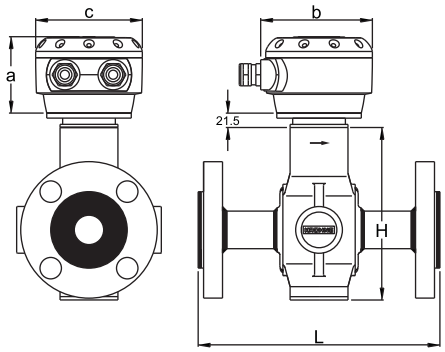
The instrument must be grounded for proper functioning as well as to provide safety against electric shocks.
Such a grounding system is lacking in the pipes with internal lining / coating or plastic pipes. In such cases, grounding rings must be fitted on both sides of the primary head.

Grounding rings also function as liner protectors and available below types in various material of construction.

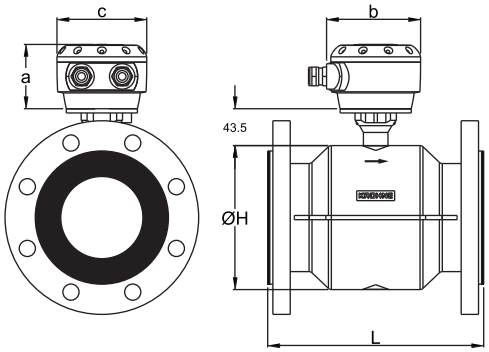


1. Grounding ring type 1
2. Grounding ring type 2: Prevents damage to liner during transportation and installation
3. Grounding ring type 3: With cylindrical neck, prevents damage to liner when handling abrasive media

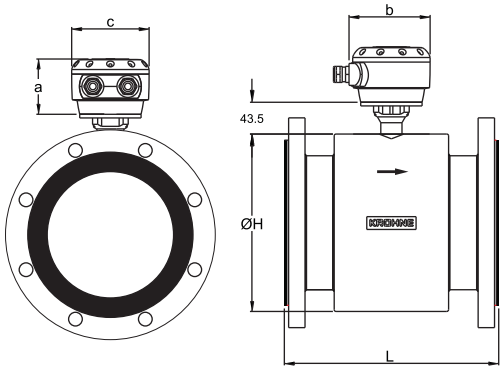
Dimensions and Weights



DN10 ... DN20 / 3/8" ... ¾"



DN25 ... DN150 / 1" ... 6"



DN25 ... DN2000 / 1" ... 80"

- All data given in the following tables are based on standard versions of flow sensor only.
- For other pressure rating, flange standards and flow meters with hazardous area approvals, the dimensions may be different.
- For information on signal converter dimensions see relevant catalogue.

a = 88 mm / 3.5"
b = 113 mm / 4.5"
c = 106 mm / 4.2"

Dimensions for flow sensors with 150 lbs flanges

Meter Size (ANSI / DIN)	Standard Length [L]	Dimensions [mm] ISO Length [L]	ØH / H	Approx. Weight [Kg]
3/8" / 10	150		150	6
1/2" / 15	150	200	150	6
3/4" / 20	150	200	150	7
1" / 25	150	200	78	3
1 1/4" / 32	150	200	86	4
1 1/2" / 40	150	200	95	5
2" / 50	200	200	119	8
2 1/2" / 65	200	200	126	10
3" / 80	200	200	137	12
4" / 100	250	250	166	20
5" / 125	250	250	194	22
6" / 150	300	300	226	29
8" / 200	350	350	292	43
10" / 250	400	450	332	65
12" / 300	500	500	382	94
14" / 350	500	550	446	129
16" / 400	600	600	495	165
18" / 450	600	—	546	186
20" / 500	600	—	597	224
24" / 600	600	—	709	307

Note: The subject flow meters cannot be used as a weight or measures under the Legal Metrology Act. Specifications subject to changes without prior notice DOC#FMKRH/1216/2311/V3.R1-B

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