

OPTIFLUX 2000 Technical Datasheet

Electromagnetic flow sensor

- Engineered and manufactured for the water and wastewater industry
- Wide range of approvals for potable water
- Long-term reliability and negligible maintenance

The documentation is only complete when used in combination with the relevant documentation for the converter.

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1.1 Solution for the water and wastewater industry

The **OPTIFLUX 2000** electromagnetic flow sensor is the optimum solution for water and wastewater applications. Its long-term reliability and durability make it the standard flow sensor for the water industry for measuring abstraction water, drinking water, wastewater, sewage and effluent.



① Flanged design
② Installation length to ISO 13359
③ PP and hard rubber liners

Highlights

- Drinking water approvals including KTW, WRc, KIWA, ACS
- Suitable for underground installation and constant flooding (IP 68)
- Bidirectional flow metering
- Compliant with requirements for custody transfer (MID MI-001, OIML R49, ISO 4064, EN 14154)
- Standard in house wet calibration of sensors up to diameter DN3000
- Easy installation and commissioning
- With virtual reference option grounding rings can be omitted and installation is simplified
- Rugged liners suitable for all water and wastewater applications
- In-situ verification with MagCheck
- Extensive diagnostic capabilities
- Maintenance-free
- Proven and unsurpassed lifetime

Industries

- Water
- Wastewater
- Pulp & Paper
- Minerals & Mining
- Iron, Steel & Metals
- Power

Applications

- Water abstraction
- Water purification and desalination
- Drinking water distribution networks
- Revenue metering or billing
- Leakage detection
- Irrigation
- Industry water
- Cooling water
- Wastewater
- Sewage and sludges
- Seawater

1.2 Options

The solution for the water and wastewater industry



Robust construction
The OPTIFLUX 2000 has been designed for measuring all water and wastewater applications including groundwater, potable water, wastewater, sludges and sewage, industry water and salt water.
The sensor is available for a wide diameter range of DN25 up to DN3000 for flow rates up to 300.000 m3/hr.
The robust polypropylene or hard rubber liner have been approved for drinking water applications according to ACS, KIWA, KTW and WRc.
The OPTIFLUX 2000 causes no pressure loss and allows for bi-directional flow metering. Filters or straighteners are not required. The installation can be further eased by choosing for the virtual reference option. Grounding rings can then be omitted (only in combination with the IFC 300 converter).



Buriable and maintenance-free
The OPTIFLUX 2000 can be installed underground and allows for constant flooding (IP 68).
A measurement chamber is not necessary, saving substantial costs.
The condition for this is a robust flowmeter that does not require regular maintenance. The OPTIFLUX 2000 provides years or reliable measurements as it has no internal moving parts and nothing can wear.
The OPTIFLUX 2000 has a field proven and unsurpassed lifetime.
In addition, the OPTIFLUX 2000 in combination with the IFC 300 converter offers extensive diagnostic capabilities such as continuous monitoring of the converter, the sensor electrodes, the flow profile and electronic functions.



Custody transfer

Optionally the OPTIFLUX 2000 can be used for custody transfer applications when combined with the IFC 300 converter. It meets the requirements of the OIML R49 and can be verified according to Annex MI-001 of the Measuring Instruments Directive (MID). All water meters that are to be used for legal metrology purposes in Europe require certification under the MID. The EC type examination certificate for the OPTIFLUX 2300 is valid for the compact and the remote version and applies for forward and reverse flow.
Every flowmeter leaving the factory is standard wet calibrated by direct volume comparison at KROHNE's certified calibration facilities. The performance of the OPTIFLUX 2000 is defined and documented in a calibration certificate.



Communication

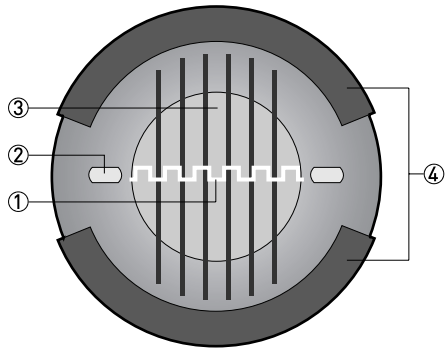
The OPTIFLUX 2000 can be provided with state-of-the-art fieldbus communication systems. Data is transmitted by HART®, Profibus, Fieldbus Foundation or Modbus and then forwarded to a management system.

1.3 Measuring principle

An electrically conductive fluid flows inside an electrically insulating 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

in which:
v = mean flow velocity
k = factor correcting for geometry
B = magnetic field strength
D = inner diameter of flow meter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate q. A signal converter is used to amplify the signal voltage, filter it and convert it into signals for totalising, recording and output processing.



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

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

Measuring system

Measuring principle	Faraday's law
Application range	Electrically conductive fluids
Measured value	
Primary measured value	Flow velocity
Secondary measured value	Volume flow

Design

Features	Fully welded maintenance-free sensor
	Flange version with full bore flow tube
	Standard as well as higher pressure ratings
	Large diameter range from DN25...3000 with rugged liners approved for drinking water
	Industry specific insertion lengths
Modular construction	The measurement system consists of a flow sensor and a signal converter. It is available as compact and as separate version.
Compact version	With IFC 040 converter: OPTIFLUX 2040 C
	With IFC 100 converter: OPTIFLUX 2100 C
	With IFC 300 converter: OPTIFLUX 2300 C
Remote version	In wall (W) mount version with IFC 100 converter: OPTIFLUX 2100 W
	In field (F), wall (W) or rack (R) mount version with IFC 300 converter: OPTIFLUX 2300 F, W or R
Nominal diameter	With IFC 040 converter: DN25...150 / 1... 6"
	With IFC 100 converter: DN25...1200 / 1...48"
	With IFC 300 converter: DN25...3000 / 1...120"
Measurement range	-12...+12 m/s / -40...+40 ft/s

Measuring accuracy

Reference conditions	Flow conditions similar to EN 29104
	Medium: Water
	Electrical conductivity: ≥ 300 µS/cm
	Temperature: +10...+30°C / +50...+86°F
	Inlet section: ≥ 5 DN
	Operating pressure: 1 bar / 14.5 psig
	Wet calibrated on EN 17025 accredited calibration rig by direct volume comparison

Accuracy curves	Option: verification to MI-001
	(Only in combination with IFC 300)
	Option: calibration according to OIML R49
	(Only in combination with IFC 300)
	For detailed information on the measuring accuracy, see chapter "Measuring accuracy".

Operating conditions

Temperature	
Process temperature	Hard rubber liner: -5...+80°C / 23...+176°F
	Polypropylene liner: -5...+90°C / 23...+194°F
	For Ex versions different temperatures are valid. Please check the relevant Ex documentation for details.
	For detailed information see chapter "Temperatures".
Ambient temperature (all versions)	**Standard** (with aluminium converter housing):
	-40…+65°C / -40…+149°F (Protect electronics against self-heating with ambient temperatures above 55°C)
	Option (with stainless steel converter housing):
	-40...+55°C / -40…+130°F
	For Ex versions different temperatures are valid. Please check the relevant Ex documentation for details .
Storage temperature	-50...+70° / -58...+158°F
Pressure	
EN 1092-1	DN2200...3000: PN 2.5
	DN1200...2000: PN 6
	DN200...1000: PN 10
	DN65 and DN100...150: PN 16
	DN25...50 and DN80: PN 40
	Other pressures on request
ISO insertion length	Optional for DN15...600
ASME B16.5	1...24": 150 lb RF
	Other pressures on request
AWWA (class B or D FF)	**Option**
	DN700...1000 / 28...40": ≤ 10 bar / 145 psi
	DN1200...2000 : ≤ 6 bar / 87 psi
JIS	DN50...1000 / 2...40": 10 K
	DN25...40 / 1...1½": 20 K
	Other pressures on request
Vacuum load	For information on pressure limits depending on liner material see chapter "Vacuum load".
Pressure ranges for secondary containment	For DN25...150:
	Pressure resistant up to 40 bar / 580 psi
	Burst pressure up to approx. 160 bar / 2320 psi
Pressure drop	Negligible

Chemical properties	
Physical condition	Conductive liquids
Electrical conductivity	≥ 20 µS/cm
Permissible gas content (volume)	≤ 5%
Permissible solid content (volume)	≤ 70%

Installation conditions

Installation	Take care that flow sensor is always fully filled
	For detailed information see chapter "Installation"
Flow direction	Forward and reverse
	Arrow on flow sensor indicates positive flow direction.
Inlet run	≥ 5 DN
Outlet run	≥ 2 DN
Dimensions and weights	For detailed information see chapter "Dimensions and weights".

Materials

Sensor housing	Sheet steel, polyurethane coated
	Other materials on request
Measuring tube	Austenitic stainless steel
Flanges	Carbon steel, polyurethane coated
	Other materials on request
Liner	**Standard**
	DN25...150 / 1...6": Polypropylene
	DN200...3000 / 8...120": Hard rubber
	Option
	DN25...150 / 1...6": Hard rubber
	See pressure and temperature limits for various liners in the relevant chapter.
Connection box (only remote versions)	Standard: polyurethane coated die-cast aluminium
	Option: stainless steel
Measuring electrodes	Standard:Hastelloy® C
	Option: Stainless steel, titanium
	Other materials on request
Grounding rings	Standard: Stainless steel
	Option: Hastelloy® C, titanium, tantalum
	Grounding rings can be omitted with virtual reference option for the IFC 300 converter.
Grounding electrodes (option)	Same material as measuring electrodes.

Process connections

Flange	
EN 1092-1	DN25...3000 in PN 6...40
ASME	1...120" in 150 lb RF
AWWA	DN700...2000 in 6...10 bar
JIS	25...1000 in 10...20K
Design of gasket surface	RF
	Other sizes or pressure ratings on request

Electrical connections

Signal cable	
Type A (DS)	Standard cable, double shielded. Max. length: 600 m / 1950 ft (dep. on electrical conductivity and measuring sensor). See documentation of the converter for more information.
Type B (BTS)	Optional cable, triple shielded. Max. length: 600 m / 1950 ft (dep. on electrical conductivity and measuring sensor). See documentation of the converter for more information.

Approvals and Certificates

CE	
	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.
Electromagnetic compatibility	Directive: 2004/108/EC, NAMUR NE21/04
	Harmonized standard: EN 61326-1: 2006
Low voltage directive	Directive: 2006/95/EC
	Harmonized standard: EN 61010: 2001
Pressure equipment directive	Directive: 97/23/EC
	Category I, II or SEP
	Fluid group 1
	Production module H

Hazardous areas	
ATEX	Please check the relevant Ex documentation for details.
	Compact version with IFC 040 C converter
	II 2 GD
	Compact version with IFC 100 C converter
	II 2 GD
	Compact version with IFC 300 C converter
	II 2 GD or II 2(1) GD
	Remote version
	II 2 GD
FM	**In combination with IFC 300 converter**
	Class I, Div. 2, Groups A, B, C and D
	Class II, Div. 2, Groups F and G
	Class III, Div. 2, Groups F and G
CSA	**In combination with IFC 300 converter**
	Class I, Div. 2, Groups A, B, C and D
	Class II, Div. 2, Groups F and G
NEPSI	GYJ05234 / GYJ05237
	Ex me ia IIC T6...T3
	Ex de ia II T6...T3
	Ex qe ia IIC T6...T3
	Ex e ia IIC T6...T3
Other approvals and standards	
Custody transfer	DN25...500 (other materials on request)
	Standard: without verification
	only in combination with IFC 300 converter
	Cold water
	MI-001 type examination certificate
	OIML R49 certificate of conformity
	Conformity with ISO 4064 and EN 14154
Drinking water approvals	Hard rubber liner: ACS, WRc, NSF
	Polypropylene liner: ACS, KIWA, KTW, WRc, NSF
Protection category acc. to IEC 529 / EN 60529	Standard: IP 66 / 67 (NEMA 4/4X/6)
	Option: IP 68 (NEMA 6P)
	IP 68 is only available for separate design and with a stainless steel connection box
Shock test	IEC 68-2-27
Vibration test	IEC 68-2-34

2.2 Vacuum load

Diameter	Vacuum load in mbar abs. at a process temperature of			
[mm]	20°C	40°C	60°C	80°C
Liner in Polypropylene				
DN25...150	250	250	400	400
Liner in Hard rubber				
DN200...300	250	250	400	400
DN350...1000	500	500	600	600
DN1200...3000	600	600	750	750

Diameter	Vacuum load in psia at process temperature of			
[inches]	68°F	104°F	140°F	176°F
Liner in Polypropylene				
1...6"	3.6	3.6	5.8	5.8
Liner in Hard rubber				
8...12"	3.6	3.6	5.8	5.8
14...40"	7.3	7.3	8.7	8.7
48...120"	8.7	8.7	10.9	10.9

2.3 Metrological performance

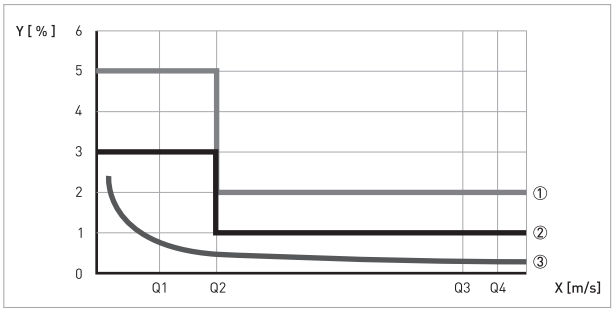


Figure 2-1: Maximum deviation Y [%] vs flow velocity X [m/s]

① Demands according to EN 14154 OIML R49 class 2
② Demands according to EN 14154 OIML R49 class 1
③ OPTIFLUX 2300

DN	Q1	Q2	Q3	R	Q4
	(Q3 / R)	(Q1 * 1.6)		(Q3 / Q1)	(Q3 * 1.25)
[mm]	[m^3/h]	[m^3/h]	[m^3/h]		[m^3/h]
25	0.04	0.064	16	400	20
32…40	0.063	0.1	25	400	31.3
50	0.1	0.16	40	400	50
65	0.16	0.25	100	630	125
80	0.25	0.41	160	630	200
100	0.4	0.63	250	630	313
125…150	0.63	1.02	400	630	500
200	1	1.6	1000	1000	1250
250	1.6	2.56	1600	1000	2000
300	2.5	4	2500	1000	3125
350	5	8	2500	500	3125
400…450	8	12.8	4000	500	5000
500…600	12.6	20.2	6300	500	7875
650…750	20	32	10000	500	12500
800…950	32	51.2	16000	500	20000
1000…1200	50	80	25000	500	31250
1300…1500	80	128	40000	500	50000
1600…1700	100	160	40000	400	50000
1800…2100	160	256	40000	250	50000
2200…2500	250	400	40000	160	50000
2600…3000	400	640	40000	100	50000

2.4 OIML R49

The OIML R49 recommendation (2006) concerns water meters intended for the metering of cold potable water and hot water. OPTIFLUX 2300 has a certificate of compliance with OIML R49, issued by NMi.
The OIML R49 recommendation sets out the conditions to which water meters shall comply to meet the requirements of the services of legal metrology in countries where these instruments are subject to state controls.
The measuring range of the water meter is determined by Q3 (nominal flow rate) and "R" (ratio).
The OPTIFLUX 2300 meets the requirements for water meters of accuracy class 1 and 2.
For accuracy class 1, the maximum permissible error for water meters is ±1% for the upper flow rate zone and ±3% for the lower flow rate zones.
For accuracy class 2, the maximum permissible error for water meters is ±2% for the upper flow rate zone and ±5% for the lower flow rate zones.

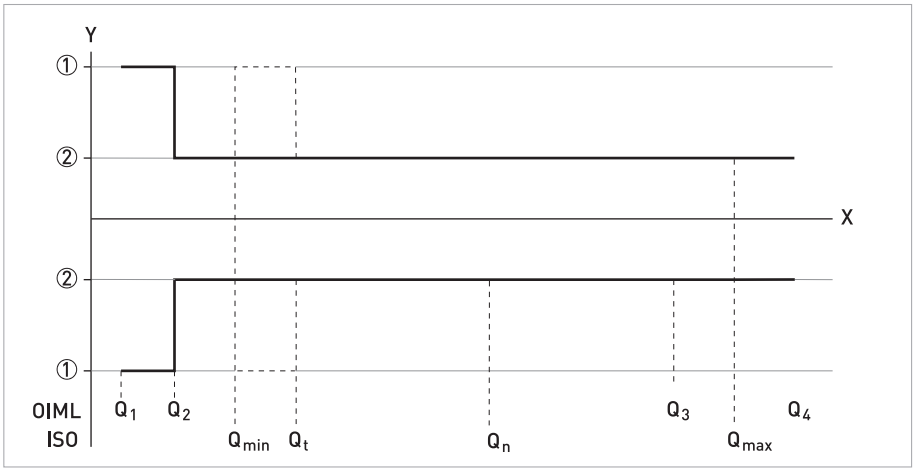


Figure 2-2: ISO flow rates added to figure as comparison towards OIML
X: Flow rate; Y: Maximum measuring error [%]

① ±3% for class 1, ±5% for class 2 devices
② ±1% for class 1, ±2% for class 2 devices

Q1 = Q3 / R
Q2 = Q1 * 1.6
Q3 = Q1 * R
Q4 = Q3 * 1.25

OIML R49 Class 1

DN	Span (R)	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
80	640	0.25	0.40	160	200.0
100	625	0.40	0.60	250	312.5
150	667	0.60	1.00	400	500.0
250	1000	1.60	2.60	1600	2000.0
500	500	12.60	20.20	6300	7875.0

OIML R49 Class 2

DN	Span (R)	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
25	400	0.040	0.064	16	20.0
50	400	0.100	0.160	40	50.0

2.5 MI-001

All new designs of water meters that are to be used for legal purposes in Europe require certification under the Measuring Instruments Directive (MID) 2004/22/EC. Annex MI-001 of the MID applies to: water meters intended for the measurement of volume of clean, cold or heated water in residential, commercial and light industrial use. A type examination certificate to the MID certificate is valid in all the countries of the European Union.
OPTIFLUX 2300 has a type examination certificate to the MID MI-001 for DN25...300.
The EC type examination certificate for OPTIFLUX 2300 is valid for the compact and the remote version and applies for forward and reverse flow.
According to MI-001 the maximum permissible error on volumes delivered between Q2 (transitional) flow rate and Q4 (overload) flow rate is ±2%. The maximum permissible error on volumes delivered between Q1 (minimum) flow rate and Q2 (transitional) flow rate is ±5%.

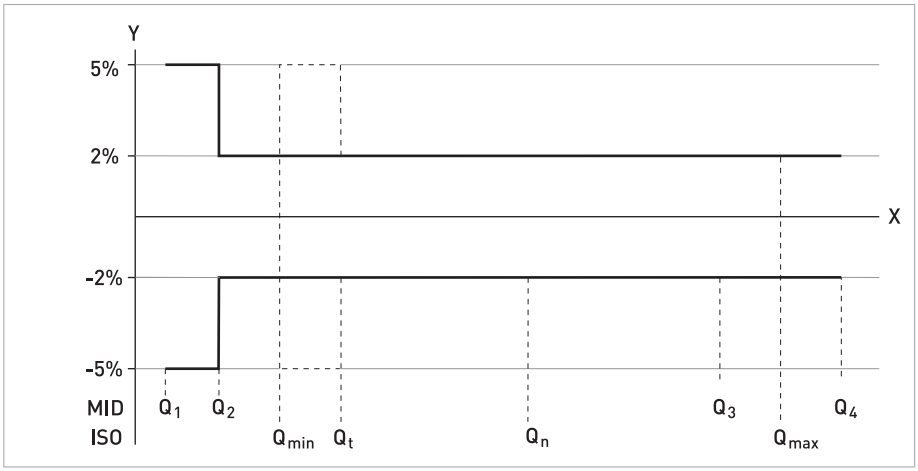
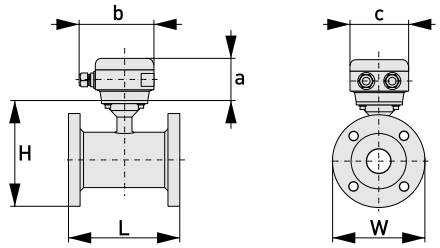
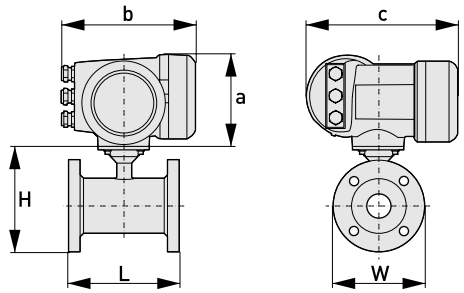
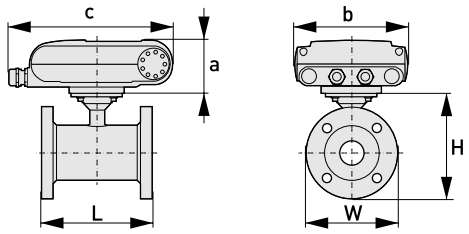
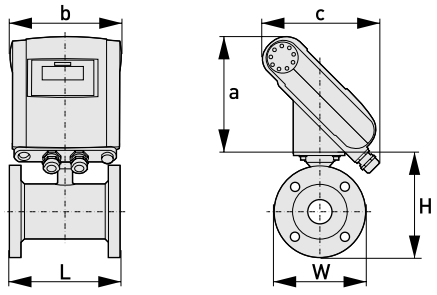


Figure 2-3: ISO flow rates added to figure as comparison towards MID
X: Flow rate; **Y:** Maximum measuring error [%]

MI-001

DN	Span (R)	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
25	400	0.040	0.064	16	20.0
32	400	0.063	0.100	25	31.3
40	400	0.063	0.100	25	31.3
50	400	0.100	0.160	40	50.0
65	625	0.160	0.256	100	125.0
80	640	0.250	0.400	160	200.0
100	625	0.400	0.640	250	312.5
125	667	0.600	0.960	400	500.0
150	667	0.600	0.960	400	500.0
200	1000	1.000	1.600	1000	1250.0
250	1000	1.600	2.560	1600	2000.0
300	1000	2.500	4.000	2500	3125.0
350	500	5.000	8.000	2500	3125.0
400	500	8.000	12.800	4000	5000.0
450	500	8.000	12.800	4000	5000.0
500	500	12.600	20.160	6300	7875.0

2.6 Dimensions and weight

Remote version		a = 77 mm / 3.1" b = 139 mm / 5.5" ① c = 106 mm / 4.2" Total height = H + a
Compact version with IFC 300		a = 155 mm / 6.1" b = 230 mm / 9.1" ① c = 260 mm / 10.2" Total height = H + a
Compact version with IFC 100 (0°)		a = 82 mm / 3.2" b = 161 mm / 6.3" c = 257 mm / 10.1" ① Total height = H + a
Compact version with IFC 100 (45°)		a = 186 mm / 7.3" b = 161 mm / 6.3" c = 184 mm / 2.7" ① Total height = H + a

① The value may vary depending on the used cable glands.

- *All data given in the following tables are based on standard versions of the sensor only.*
- *Especially for smaller nominal sizes of the sensor, the converter can be bigger than the sensor.*
- *Note that for other pressure ratings than mentioned, the dimensions may be different.*
- *For full information on converter dimensions see relevant documentation.*

EN 1092-1

Nominal size		Dimensions [mm]				Approx. weight [kg]
DN	PN [bar]	L		H	W	
		DIN	ISO			
25	40	150	200	140	115	5
32	40	150	200	157	140	6
40	40	150	200	166	150	7
50	40	200	200	186	165	11
65	16	200	200	200	185	9
80	40	200	200	209	200	14
100	16	250	250	237	220	15
125	16	250	250	266	250	19
150	16	300	300	300	285	27
200	10	350	350	361	340	34
250	10	400	450	408	395	48
300	10	500	500	458	445	58
350	10	500	550	510	505	78
400	10	600	600	568	565	101
450	10	600	-	618	615	111
500	10	600	-	671	670	130
600	10	600	-	781	780	165
700	10	700	-	898	895	248
800	10	800	-	1012	1015	331
900	10	900	-	1114	1115	430
1000	10	1000	-	1225	1230	507
1200	6	1200	-	1417	1405	555
1400	6	1400	-	1619	1630	765
1600	6	1600	-	1819	1830	1035
1800	6	1800	-	2027	2045	1470
2000	6	2000	-	2259	2265	1860

150 lb flanges

Nominal size		Dimensions [inches]			Approx. weight [lb]
ASME	PN [psi]	L	H	W	
1"	284	5.91	5.39	4.25	18
1½"	284	5.91	6.10	5.00	22
2"	284	7.87	7.05	5.98	29
3"	284	7.87	8.03	7.50	37
4"	284	9.84	9.49	9.00	51
5"	284	9.84	10.55	10	60
6"	284	11.81	11.69	11	75
8"	284	13.78	14.25	13.5	95
10"	284	15.75	16.30	16.0	143
12"	284	19.69	18.78	19.0	207
14"	284	27.56	20.67	21.0	284
16"	284	31.50	22.95	23.5	364
18"	284	31.50	24.72	25.0	410
20"	284	31.50	26.97	27.5	492
24"	284	31.50	31.38	32.0	675

- *Pressures at 20°C / 68°F.*
- *For higher temperatures, the pressure and temperature ratings are as per ASME B16.5 (up to 24") or ASME B16.47 (>24").*
- *Dimensions for other sizes on request.*

300 lb flanges

Nominal size		Dimensions [inches]			Approx. weight [lb]
ASME	PN [psi]	L	H	W	
1"	741	5.91	5.71	4.87	11
1½"	741	7.87	6.65	6.13	13
2"	741	9.84	7.32	6.50	22
3"	741	9.84	8.43	8.25	31
4"	741	11.81	10.00	10.00	44
6"	741	12.60	12.44	12.50	73
8"	741	15.75	15.04	15.0	157
10"	741	19.69	17.05	17.5	247
12"	741	23.62	20.00	20.5	375
14"	741	27.56	21.65	23.0	474
16"	741	31.50	23.98	25.5	639
20"	741	31.50	28.46	30.5	937
24"	741	31.50	33.39	36.0	1345

- *Pressures at 20°C / 68°F.*
- *For higher temperatures, the pressure and temperature ratings are as per ASME B16.5 (up to 24") or ASME B16.47 (>24").*
- *Dimensions for other sizes on request.*

3.1 Notes on installation

Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Check the packing list to check if you received completely all that you ordered.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Intended use

The **OPTIFLUX 2000** electromagnetic flow sensor is the optimum solution for water and wastewater applications. Its long-term reliability and durability make it the standard flow sensor for the water market.

3.3 Installation conditions

3.3.1 Inlet and outlet

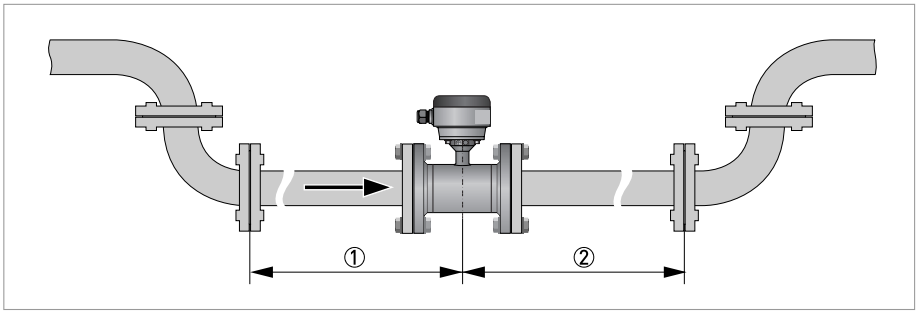


Figure 3-1: Recommended inlet and outlet sections

① ≥ 5 DN
② ≥ 2 DN

3.3.2 Mounting position

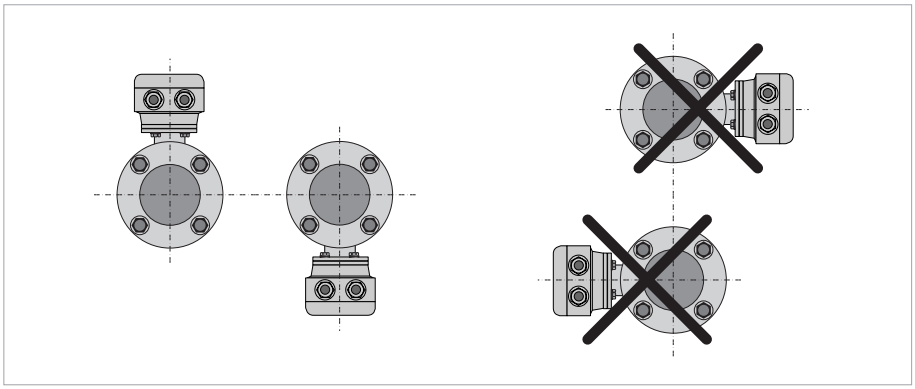


Figure 3-2: Mounting position

3.3.3 Flange deviation

Max. permissible deviation of pipe flange faces:
L_{max} - L_{min} ≤ 0.5 mm / 0.02"

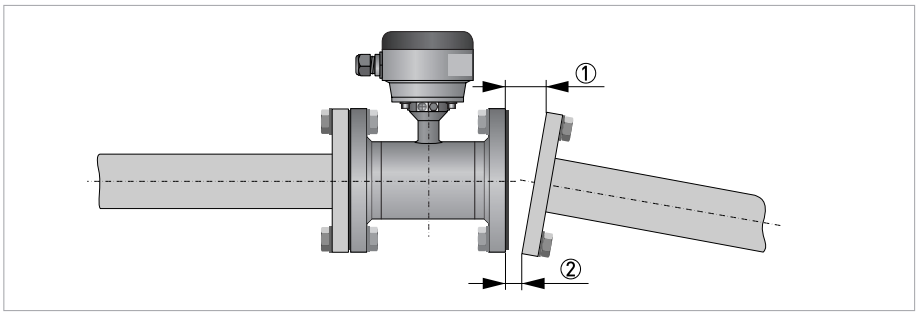


Figure 3-3: Flange deviation

① L_{max}
② L_{min}

3.3.4 T-section

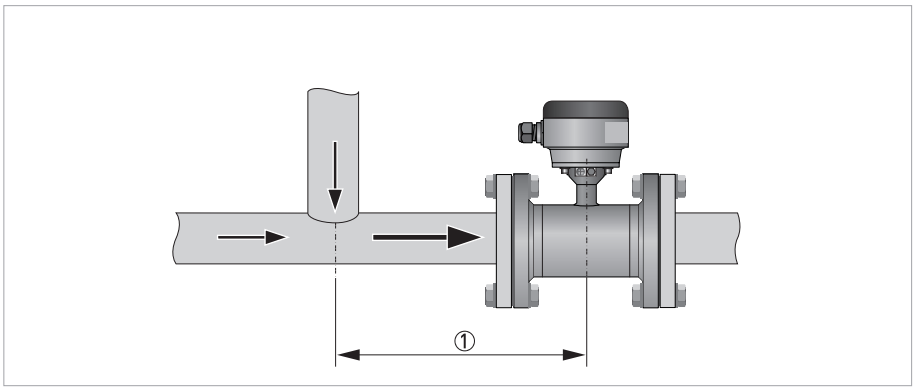


Figure 3-4: Distance after T-sections

① ≥ 10 DN

3.3.5 Vibration

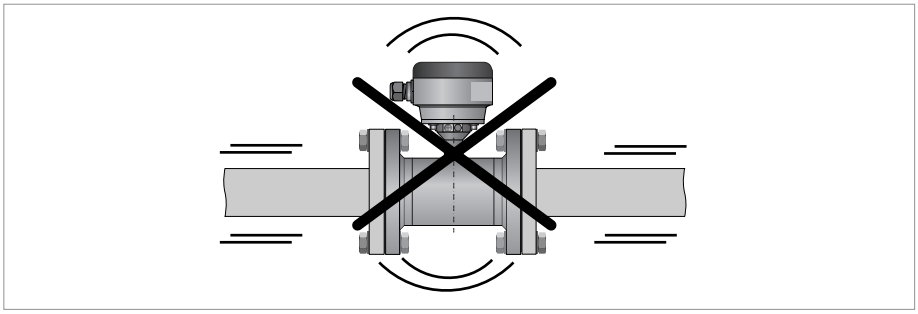


Figure 3-5: Avoid vibrations

3.3.6 Magnetic field

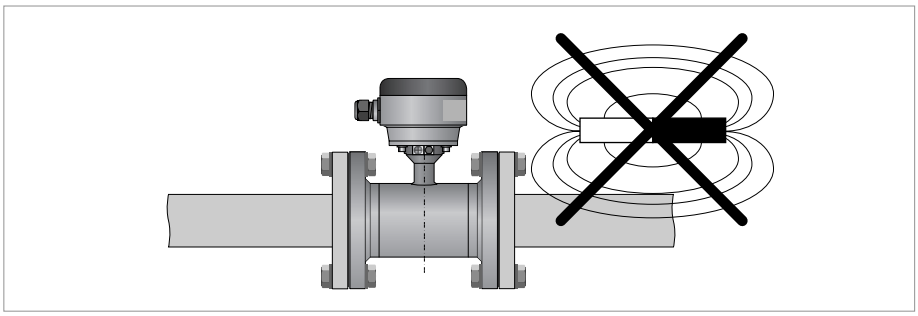


Figure 3-6: Avoid magnetic fields

3.3.7 Bends

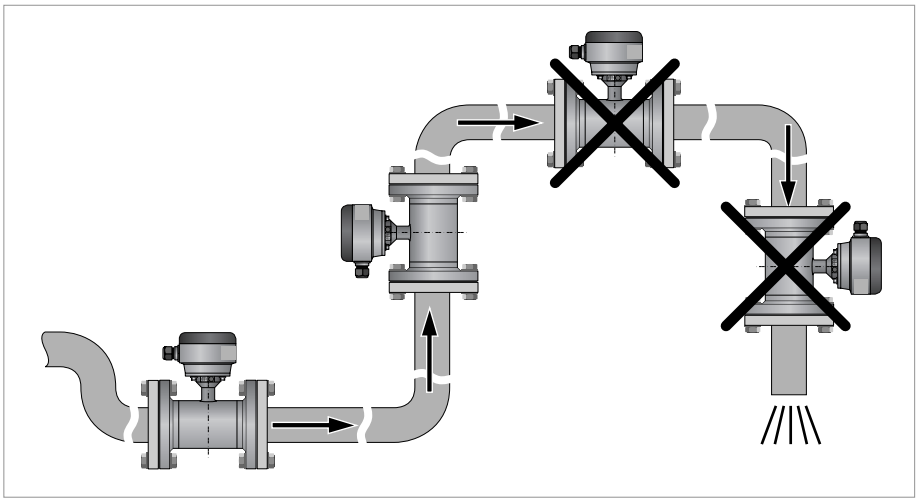


Figure 3-7: Installation in bending pipes

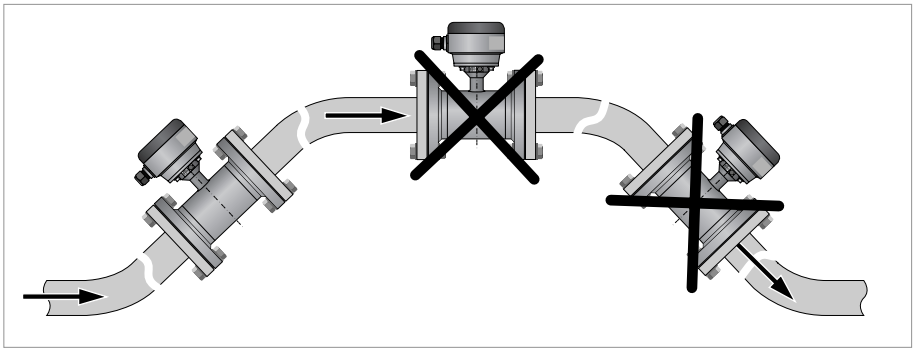


Figure 3-8: Installation in bending pipes

3.3.8 Open discharge

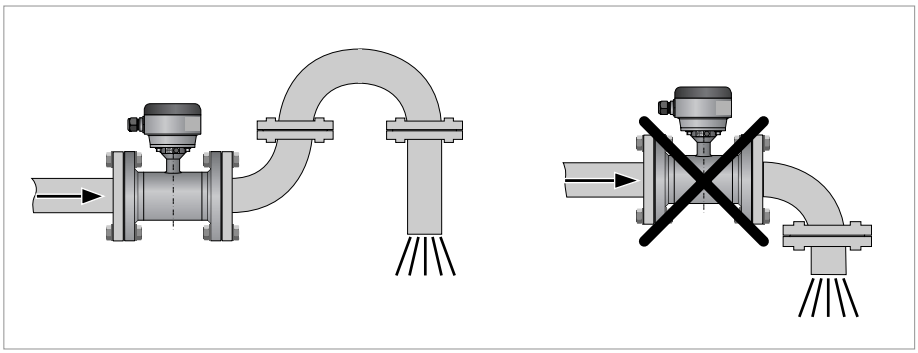


Figure 3-9: Installation before an open discharge

3.3.9 Control valve

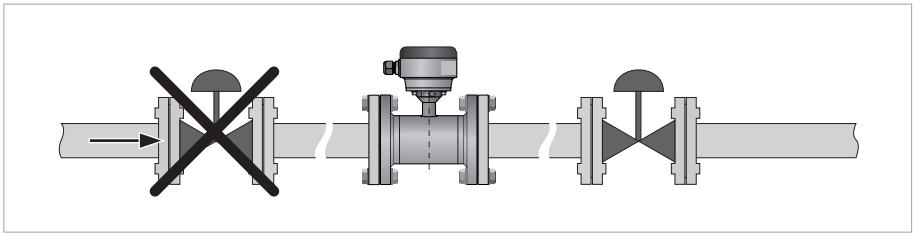


Figure 3-10: Installation before control valve

3.3.10 Air venting

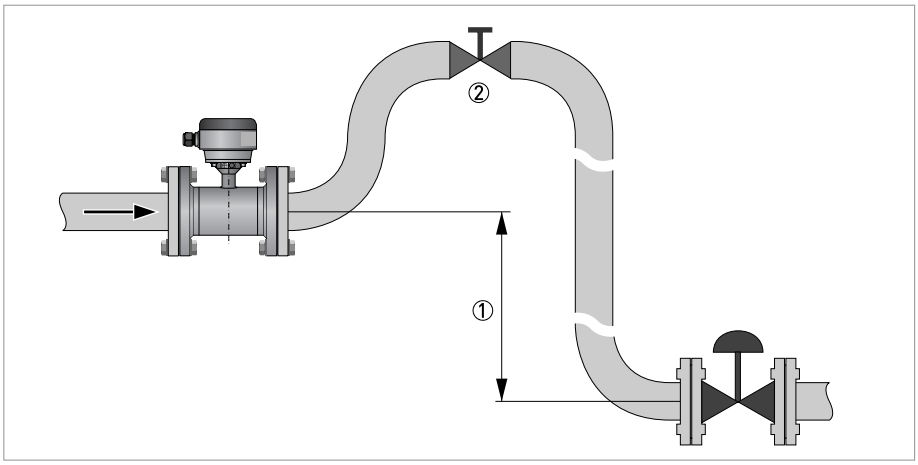


Figure 3-11: Air venting

① ≥ 5 m
② Air ventilation point

3.3.11 Pump

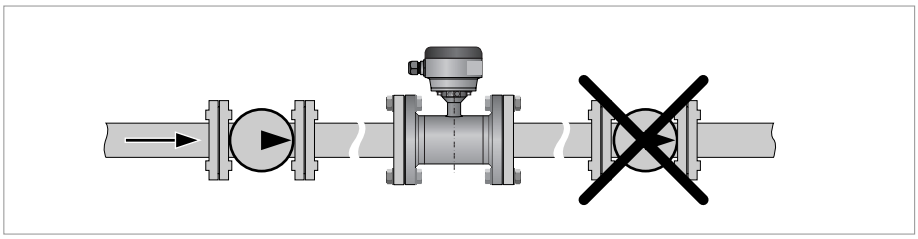


Figure 3-12: Installation after pump

4.1 Safety instructions

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Grounding

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

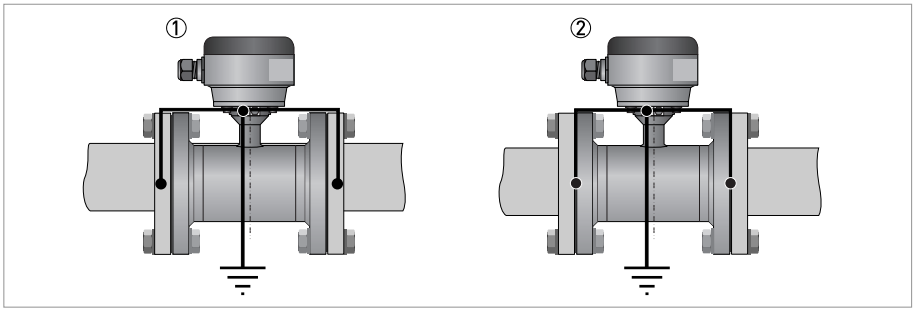


Figure 4-1: Grounding

① Metal pipelines, not internally coated. Grounding without grounding rings.
② Metal pipelines with internal coating and non-conductive pipelines. Grounding with grounding rings.

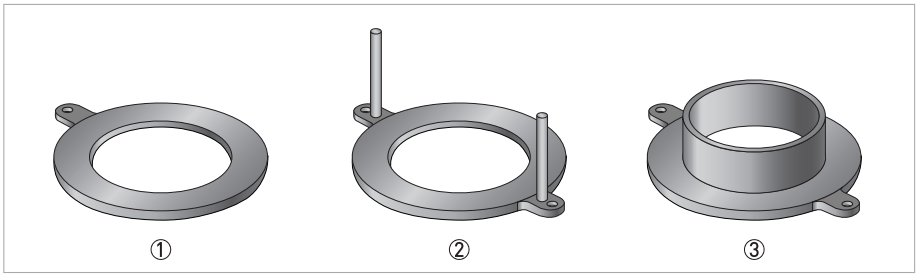


Figure 4-2: Different types of grounding rings

① Grounding ring number 1
② Grounding ring number 2
③ Grounding ring number 3

Grounding ring number 1:

- 3 mm / 0.1" thick (tantalum: 0.5 mm / 0.1")

Grounding ring number 2:

- 3 mm / 0.1" thick
- Prevents damage to the flanges during transport and installation
- Especially for flow sensors with PTFE liner

Grounding ring number 3:

- 3 mm / 0.1" thick
- With cylindrical neck (length 30 mm / 1.25" for DN10...150 / 3/8...6")
- Prevents damage to the liner when abrasive liquids are used

4.3 Virtual reference for IFC 300 (C, W and F version)

The virtual reference option on the IFC 300 flow converter provides complete isolation of the measurement circuit.
The benefits of virtual reference are that grounding rings or grounding electrodes can be omitted, safety increases by reducing the number of potential leakage points and the installation of the flowmeters is much easier.

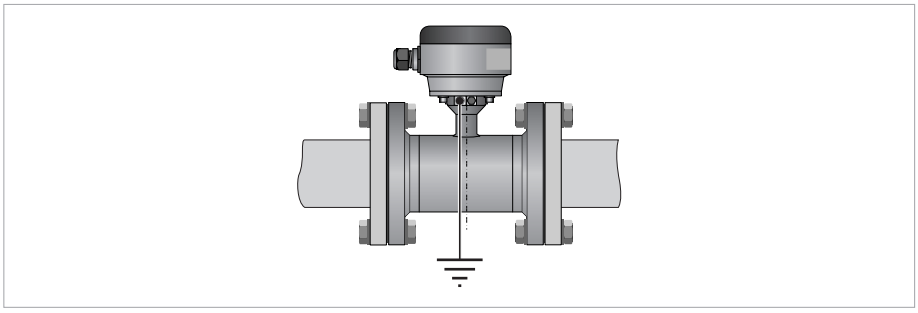


Figure 4-3: Virtual reference

Possible if:

- ≥ DN10
- Electrical conductivity ≥ 200 µS/cm
- Electrode cable max. 50m.



IFC 050 Technical Datasheet

Signal converter for electromagnetic flowmeters

- For simple applications
- Multiple outputs, incl. active pulse output and RS485 Modbus
- Excellent price/performance ratio

HART COMMUNICATION PROTOCOL

The documentation is only complete when used in combination with the relevant documentation for the flow sensor.

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1.1 The standard for simple applications

The electromagnetic signal converter **IFC 050** is a perfect choice for measuring volumetric flow in various kinds of applications in the water industry but also in the food and beverage business.

The signal converter can be combined with the flow sensors OPTIFLUX 1000, 2000, 4000, 6000 and the WATERFLUX 3000. The output represents measured values for flow, mass and conductivity.

This low-cost signal converter has some specific features:

- An active pulse output for a simple system, like driving an electro-mechanical counter
- RS485 Modbus communication with a data processing system
- Extra insulation of the electronic device and housing for high performance in areas with extreme humidity and chances for flooding
- Cost-effective flow measurement for a wide range of process conditions and still a very acceptable degree of accuracy



① Large graphic display with 4 magnet keys for operating the signal converter when the housing is closed
② 4 push buttons to operate the signal converter when the housing is open
③ Supply voltage: 100…230 VAC and 24 VDC

Highlights

- Available outputs: current output (incl. HART®), active pulse/frequency output, status output and Modbus
- Intuitive operation with touch buttons
- Excellent price/performance ratio
- Modern robust housing design
- Asymmetric mounting possible
- All versions with and without display are available
- Simple installation and start-up
- Bright graphic display
- A variety of operating languages integrated as standard
- Certified tests for humidity and vibration
- Extremely quick signal conversion

Industries

- Water & Wastewater
- Food & Beverage
- Heating, Ventilation & Air Conditioning (HVAC)
- Agriculture
- Steel

Applications

- Water and wastewater treatment
- Water distribution network
- Irrigation installation
- Water abstraction
- CIP cleaning stations

1.2 Options and variants

Modular signal converter concept with display



The modular concept gives the opportunity to combine the IFC 050 with the flow sensors OPTIFLUX 1000, OPTIFLUX 2000, OPTIFLUX 4000, OPTIFLUX 6000 and the WATERFLUX 3000.
With respect to the housing versions, both a compact and a remote design are available. The signal converter for the compact version is directly mounted under a 10° angle to the flow sensor for easy reading of the display after rainfall or frost.

If the measuring point is difficult to access or if the ambient conditions like temperature effects and vibration prevent the use of the compact version, a remote signal converter with a wall housing is available.

Remote version in wall housing with display



A signal cable is used to connect the flow sensor to the signal converter for power supply and signal processing.
The same electronic unit can be used in both (Compact + Wall) versions without configuration.

Remote version in wall housing without display



A blind version is the perfect option in a situation where the display is not required and the menu will be approached once a time.
A separate display can be easily connected to the electronic unit to enter the menu. This tool will be provided as a spare part.

1.3 Signal converter/flow sensor combination possibilities

Flow sensor	Flow sensor + signal converter IFC 050	
	Compact	Remote wall-mounted housing
OPTIFLUX 1000	OPTIFLUX 1050 C	OPTIFLUX 1050 W
OPTIFLUX 2000	OPTIFLUX 2050 C	OPTIFLUX 2050 W
OPTIFLUX 4000	OPTIFLUX 4050 C	OPTIFLUX 4050 W
OPTIFLUX 6000	OPTIFLUX 6050 C	OPTIFLUX 6050 W
WATERFLUX 3000	WATERFLUX 3050 C	WATERFLUX 3050 W

1.4 Measuring principle

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

in which:
v = mean flow velocity
k = factor correcting for geometry
B = magnetic field strength
D = inner diameter of flowmeter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate Q. A signal converter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

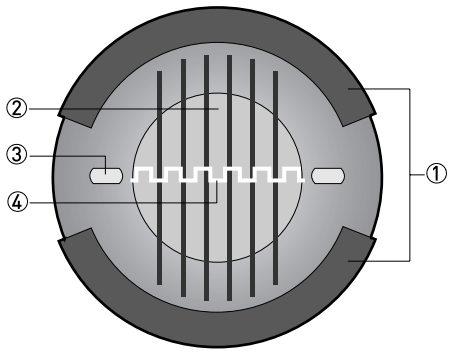


Figure 1-1: Measuring principle

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

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	Faraday's law of induction
Application range	Continuous measurement of current volume flow, flow velocity, conductivity, mass flow (at constant density), coil temperature of the flow sensor

Design

Modular construction	The measuring system consists of a flow sensor and a signal converter.
Flow sensor	
OPTIFLUX 1000	DN10...150 / 3/8...6"
OPTIFLUX 2000	DN25...1200 / 1...48"
OPTIFLUX 4000	DN10...1200 / 3/8...48"
OPTIFLUX 6000	DN10...150 / 3/8...6"
WATERFLUX 3000	DN25...600 / 1...24"
Signal converter	
Compact version (C)	IFC 050 C
Remote version (W)	IFC 050 W
Options	
Outputs	Current output (incl. HART®), pulse output, frequency output, status output and/or limit switch
	Note: It's not possible to use the pulse/frequency output with the status output at the same time!
Counter	2 internal counters with a max. of 10 counter places (e.g. for counting volume and/or mass units)
Verification	Integrated verification, diagnostic functions: measuring device, empty pipe detection, stabilisation
Communication interfaces	HART®
	Modbus

Display and user interface	
Graphic display	LC display, backlit white
	Size: 128 x 64 pixels, corresponds to 59 x 31 mm = 2.32" x 1.22"
	Ambient temperatures below -25°C / -13°F may affect the readability of the display.
Operating elements	4 push buttons for operating the signal converter when the housing is open.
	4 magnet keys for operating the signal converter when the housing is closed.
Remote control	Only generic and not device-specific DDs and DTMs available!
	PACTware™ (including Device Type Manager (DTM))
	HART® Hand Held Communicator from Emerson Process
	AMS® from Emerson Process
	PDM® from Siemens
	All DTMs and drivers are available free of charge from the manufacturer's website.
Display functions	
Operating menu	Setting the parameters using 2 measuring pages, 1 status page, 1 graphic page (measured values and graphics are freely adjustable)
Language display texts (as language package)	Standard: English, French, German, Dutch, Portuguese, Swedish, Spanish, Italian
	Eastern Europe: English, Slovenian, Czech, Hungarian
	Northern Europe: English, Danish, Polish, Finnish
	Southern Europe: English, Turkish
	China: English, German, Chinese
	Russia: English, German, Russian
Units	Metric, British and US units selectable as required from lists for volume / mass flow and counting, flow velocity, electrical conductivity, temperature

Measuring accuracy

Max. measuring accuracy	**Standard:** ±0.5% of the measured value ± 1 mm/s
	Option (optimised accuracy with extended calibration): ±0.25% of the measured value ± 1.5 mm/s
	For detailed information and accuracy curves refer to *Measuring accuracy* on page 19.
	Special calibrations are available on request.
	Current output electronics: ±10 µA; ±100 ppm/°C (typically: ±30 ppm/°C)
Repeatability	±0.1%

Operating conditions

Temperature	
Process temperature	Refer to technical data for the flow sensor.
Ambient temperature	Depending on the version and combination of outputs.
	It is a good idea to protect the converter from external heat sources such as direct sunlight as higher temperatures reduce the life cycle of all electronic components.
	Ambient temperatures below -25°C / -13°F may affect the readability of the display.
Storage temperature	-40…+70°C / -40…+158°F
Pressure	
Medium	Refer to technical data for the flow sensor.
Ambient pressure	Atmosphere
Chemical properties	
Electrical conductivity	All media except for water: ≥ 5 µS/cm (also refer to the technical data for the flow sensor)
	Water: ≥ 20 µS/cm
State of aggregation	Conductive, liquid media
Solid content (volume)	≤ 10%
Gas content (volume)	≤ 3%
Flow rate	For detailed information, refer to chapter "Flow tables".
Other conditions	
Ingress protection acc. to IEC 529 / EN 60529	IP66/67 (acc. to NEMA 4/4X)

Installation conditions

Installation	For detailed information, refer to chapter "Installation conditions".
Inlet / outlet sections	Refer to technical data for the flow sensor.
Dimensions and weight	For detailed information refer to chapter "Dimensions and weight".

Materials

Signal converter housing	Aluminum with a polyester topcoat
Flow sensor	For housing materials, process connections, liners, grounding electrodes and gaskets, refer to technical data for the flow sensor.

Electrical connection

General	Electrical connection is carried out in conformity with the VDE 0100 directive "Regulations for electrical power installations with line voltages up to 1000 V" or equivalent national specifications.
Power supply	100…230 VAC (-15% / +10%), 50/60 Hz; 240 VAC + 5% is included in the tolerance range.
	24 VDC (-30% / +30%)
Power consumption	AC: 15 VA
	DC: 5.6 W
Signal cable	Only necessary for remote versions.
	DS 300 (type A) Max. length: 600 m / 1968 ft (depending on electrical conductivity and flow sensor version)
Cable entries	Standard: M20 x 1.5 (8...12 mm)
	Option: ½ NPT, PF ½

Outputs

General	All outputs are electrically isolated from each other and from all other circuits.
	All operating data and output values can be adjusted.
Description of abbreviations	U_{ext} = external voltage; R_L = load + resistance; U_o = terminal voltage; I_{nom} = nominal current

Current output	
Output data	Flow
Settings	**Without HART®**
	Q = 0%: 0…20 mA; Q = 100%: 10…21.5 mA
	Error identification: 20…22 mA
	With HART®
	Q = 0%: 4…20 mA; Q = 100%: 10…21.5 mA
	Error identification: 3…22 mA
Operating data	**Basic I/Os**
Active	Observe connection polarity.
	$U_{int, nom}$ = 20 VDC I ≤ 22 mA R_L ≤ 750 Ω
	HART® at terminals A
Passive	Observe connection polarity.
	U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≤ 2 V at I = 22 mA $R_{L, max} = (U_{ext} - U_0) / I_{max}$
	HART® at terminals A
HART®	
Description	HART® protocol via active and passive current output
	HART® version: V5
	Universal Common Practice HART® parameter: completely supported
Load	≥ 250 Ω at HART® test point; Note maximum load for current output!
Multi-drop mode	Yes, current output = 4 mA
	Multi-drop address adjustable in operation menu 1…15

Pulse or frequency output	
Output data	Flow
Function	Can be set as a pulse output or frequency output
Pulse rate/frequency	0.01...10000 pulses/s or Hz
Settings	Pulses per volume or mass unit or max. frequency for 100% flow
	Pulse width: adjustable as automatic, symmetric or fixed (0.05...2000 ms)
Operating data	**Basic I/Os + Modbus**
Active	This output is intended to drive mechanical or electronic counters directly.
	$U_{int, nom} \leq 20$ V $R_V = 1$ kΩ C = 1000 µF
	High current mechanical counter $f_{max} \leq 1$ Hz
	Low current mechanical counter I ≤ 20 mA $R_L \leq 10$ kΩ for f ≤ 1 kHz $R_L \leq 1$ kΩ for f ≤ 10 kHz closed: $U_0 \geq 12.5$ V at I = 10 mA open: I ≤ 0.05 mA at $U_{nom} = 20$ V
Passive	Independent of connection polarity.
	$U_{ext} \leq 32$ VDC
	f_{max} in operating menu set to $f_{max} \leq 100$ Hz: I ≤ 100 mA open: I ≤ 0.05 mA at $U_{ext} = 32$ VDC closed: $U_{0, max} = 0.2$ V at I ≤ 10 mA $U_{0, max} = 2$ V at I ≤ 100 mA
	f_{max} in operating menu set to 100 Hz < $f_{max} \leq 10$ kHz: I ≤ 20 mA open: I ≤ 0.05 mA at $U_{ext} = 32$ VDC closed: $U_{0, max} = 1.5$ V at I ≤ 1 mA $U_{0, max} = 2.5$ V at I ≤ 10 mA $U_{0, max} = 5.0$ V at I ≤ 20 mA

Low flow cut off	
Function	Switching point and hysteresis separately adjustable for each output, counter and the display
Switching point	Set in increments of 0.1%.
	0…20% (current output, frequency output) or 0...±9.999 m/s (pulse output)
Hysteresis	Set in increments of 0.1%.
	0...5% (current output, frequency output) or 0...5 m/s (pulse output)
Time constant	
Function	The time constant corresponds to the elapsed time until 67% of the end value has been reached according to a step function.
Settings	Set in increments of 0.1 seconds.
	0…100 seconds
Status output / limit switch	
Function and settings	Adjustable as automatic measuring range conversion, display of flow direction, counter overflow, error, switching point or empty pipe detection
	Valve control with activated dosing function
	Status and/or control: ON or OFF
Operating data	**Basic I/Os + Modbus**
Passive	Independent of connection polarity.
	$U_{ext} \leq 32$ VDC $I \leq 100$ mA open: $I \leq 0.05$ mA at $U_{ext} = 32$ VDC closed: $U_0 = 0.2$ V at $I \leq 10$ mA $U_0 = 2$ V at $I \leq 100$ mA
Modbus	
Description	Modbus RTU, Master / Slave, RS485
Address range	1…247
Broadcast	Supported with function code 16
Supported Baud rate	1200, 2400, 3600, 4800, 9600, 19200, 38400, 57600, 115200 Baud

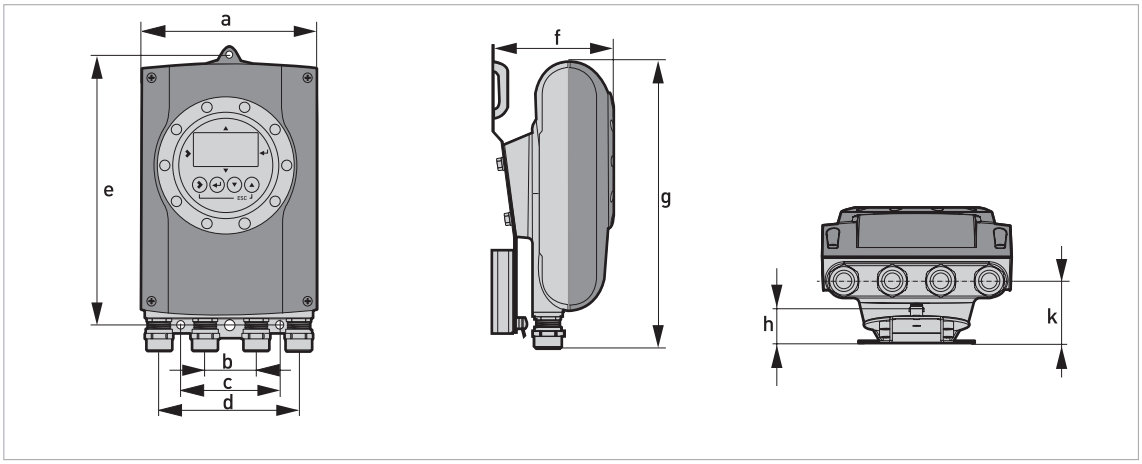
Approvals and certificates

CE	This device fulfils the statutory requirements of the relevant EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.
	For full information of the EU directives & standards and the approved certifications, please refer to the EU declaration or the manufacturer website.
Other standards and approvals	
Shock and vibration resistance	IEC 60068-2-3; EN 60068-2-6 and EN 60068-2-27; IEC 61298-3
NAMUR	NE 21, NE 43, NE 53

2.2 Dimensions and weight

2.2.1 Housing

Wall version



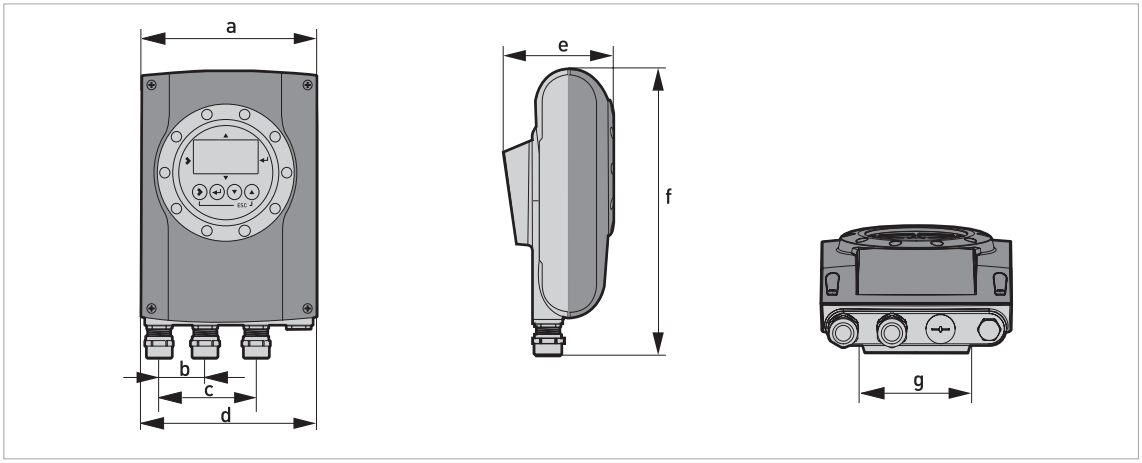
Dimensions and weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	k	
Version with & without display	157	40	80	120	248	111.7	260	28.4	51.3	1.9

Dimensions and weight in inch and lb

	Dimensions [inch]									Weight [lb]
	a	b	c	d	e	f	g	h	k	
Version with & without display	6.18	1.57	3.15	4.72	9.76	4.39	10.24	1.12	2.02	4.2

Compact version



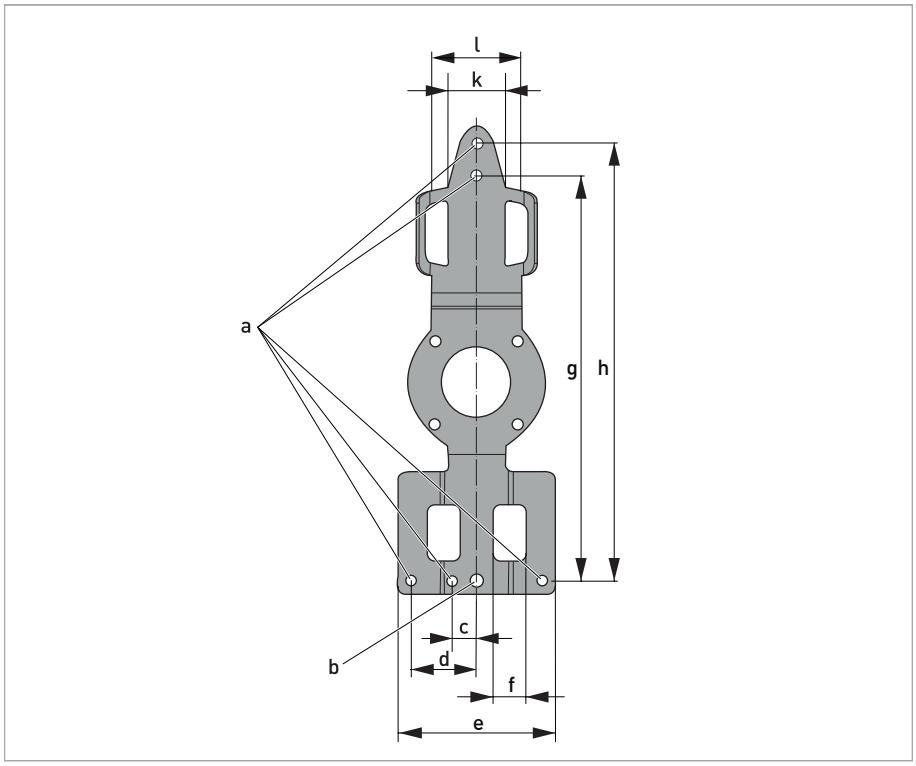
Dimensions and weight in mm and kg

	Dimensions [mm]							Weight [kg]
	a	b	c	d	e	f	g	
Version with & without display	157	40	80	148.2	101	260	95.5	1.8

Dimensions and weight in inch and lb

	Dimensions [inch]							Weight [lb]
	a	b	c	d	e	f	g	
Version with & without display	6.18	1.57	3.15	5.83	3.98	10.24	3.76	4.0

2.2.2 Mounting plate, wall version



Dimensions in mm and inch

	[mm]	[inch]
a	Ø6.5	Ø0.26
b	Ø8.1	Ø0.3
c	15	0.6
d	40	1.6
e	96	3.8
f	20	0.8
g	248	9.8
h	268	10.5
k	35	1.4
l	55	2.2

2.3 Flow tables

Flow rate in m/s and m^3/h

	$Q_{100\ \%}$ in m^3/h			
v [m/s]	0.3	1	3	12
DN [mm]	Minimum flow	Nominal flow		Maximum flow
2.5	0.005	0.02	0.05	0.21
4	0.01	0.05	0.14	0.54
6	0.03	0.10	0.31	1.22
10	0.08	0.28	0.85	3.39
15	0.19	0.64	1.91	7.63
20	0.34	1.13	3.39	13.57
25	0.53	1.77	5.30	21.21
32	0.87	2.90	8.69	34.74
40	1.36	4.52	13.57	54.29
50	2.12	7.07	21.21	84.82
65	3.58	11.95	35.84	143.35
80	5.43	18.10	54.29	217.15
100	8.48	28.27	84.82	339.29
125	13.25	44.18	132.54	530.15
150	19.09	63.62	190.85	763.40
200	33.93	113.10	339.30	1357.20
250	53.01	176.71	530.13	2120.52
300	76.34	254.47	763.41	3053.64
350	103.91	346.36	1039.08	4156.32
400	135.72	452.39	1357.17	5428.68
450	171.77	572.51	1717.65	6870.60
500	212.06	706.86	2120.58	8482.32
600	305.37	1017.90	3053.70	12214.80
700	415.62	1385.40	4156.20	16624.80
800	542.88	1809.60	5428.80	21715.20
900	687.06	2290.20	6870.60	27482.40
1000	848.22	2827.40	8482.20	33928.80
1200	1221.45	3421.20	12214.50	48858.00

Flow rate in ft/s and US gallons/min

	$Q_{100\ \%}$ in US gallons/min			
v [ft/s]	1	3.3	10	40
DN [inch]	Minimum flow	Nominal flow		Maximum flow
1/10	0.02	0.09	0.23	0.93
1/8	0.06	0.22	0.60	2.39
1/4	0.13	0.44	1.34	5.38
3/8	0.37	1.23	3.73	14.94
1/2	0.84	2.82	8.40	33.61
3/4	1.49	4.98	14.94	59.76
1	2.33	7.79	23.34	93.36
1.25	3.82	12.77	38.24	152.97
1.5	5.98	19.90	59.75	239.02
2	9.34	31.13	93.37	373.47
2.5	15.78	52.61	159.79	631.16
3	23.90	79.69	239.02	956.09
4	37.35	124.47	373.46	1493.84
5	58.35	194.48	583.24	2334.17
6	84.03	279.97	840.29	3361.17
8	149.39	497.92	1493.29	5975.57
10	233.41	777.96	2334.09	9336.37
12	336.12	1120.29	3361.19	13444.77
14	457.59	1525.15	4574.93	18299.73
16	597.54	1991.60	5975.44	23901.76
18	756.26	2520.61	7562.58	30250.34
20	933.86	3112.56	9336.63	37346.53
24	1344.50	4481.22	13445.04	53780.15
28	1829.92	6099.12	18299.20	73196.79
32	2390.23	7966.64	23902.29	95609.15
36	3025.03	10082.42	30250.34	121001.37
40	3734.50	12447.09	37346.00	149384.01
48	5377.88	17924.47	53778.83	215115.30

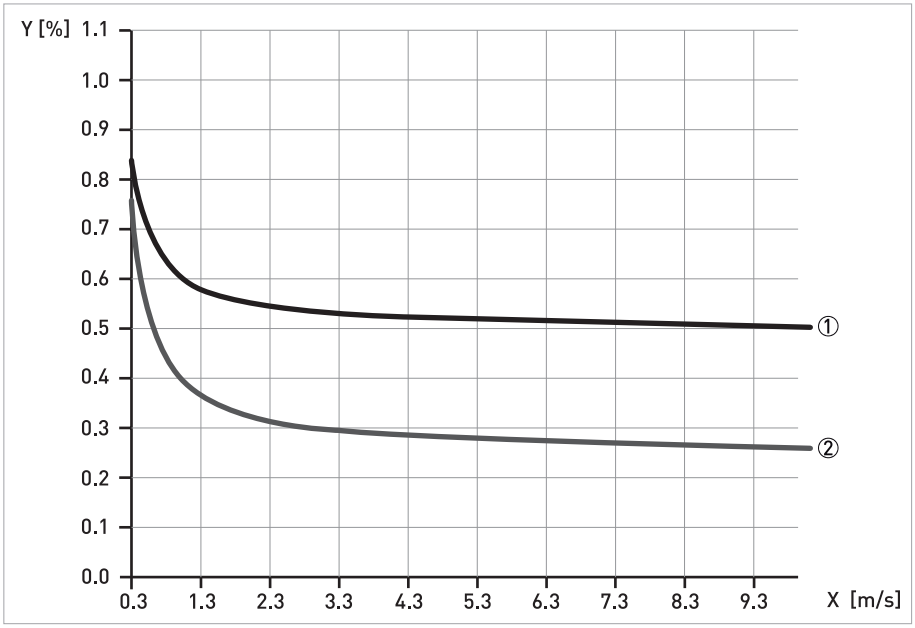
2.4 Measuring accuracy

Every electromagnetic flowmeter is calibrated by direct volume comparison. The wet calibration validates the performance of the flowmeter under reference conditions against accuracy limits.

The accuracy limits of electromagnetic flowmeters are typically the result of the combined effect of linearity, zero point stability and calibration uncertainty.

Reference conditions

- Medium: water
- Temperature: +5...+35°C / +41...+95°F
- Operating pressure: 0.1...5 barg / 1.5...72.5 psig
- Inlet section: ≥ 5 DN
- Outlet section: ≥ 2 DN



X [m/s]: flow velocity
Y [%]: Accuracy of measured value (mv)

	DN [mm]	DN [inch]	Standard accuracy ①	Optimised accuracy ②
OPTIFLUX 1050	10…150	3/8…6	±0.5% of mv ± 1 mm/s	±0.25% of mv ± 1.5 mm/s
OPTIFLUX 2050	10…1200	3/8…48		Extended calibration at 2 points
OPTIFLUX 4050				
OPTIFLUX 6050	10…150	3/8…6		
WATERFLUX 3050	25...600	1...24		-

3.1 Intended use

The electromagnetic flowmeters are designed exclusively to measure the flow and conductivity of electrically conductive, liquid media.

If the device is not used according to the operating conditions (refer to chapter "Technical data"), the intended protection could be affected.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

3.2 Installation specifications

The following precautions must be taken to ensure reliable installation.

- *Make sure that there is adequate space to the sides.*
- *Protect the signal converter from direct sunlight and install a sun shade if necessary.*
- *Signal converters installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the signal converter to intense vibrations. The measuring devices are tested for a vibration level in accordance with IEC 68-2-64.*

3.3 Mounting of the compact version

The signal converter is mounted directly on the flow sensor. For installation of the flowmeter, please observe the instructions in the supplied product documentation for the flow sensor.

3.4 Mounting of the wall housing, remote version

Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

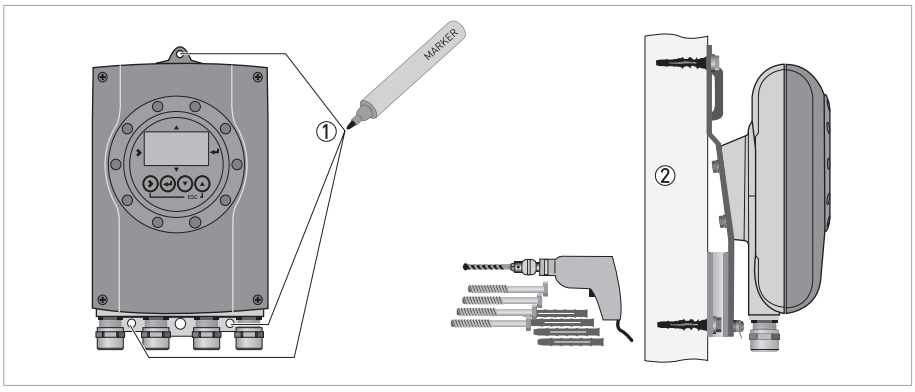


Figure 3-1: Mounting of the wall housing

① Prepare the holes with the aid of the mounting plate.
② Fasten the device securely to the wall with the mounting plate.

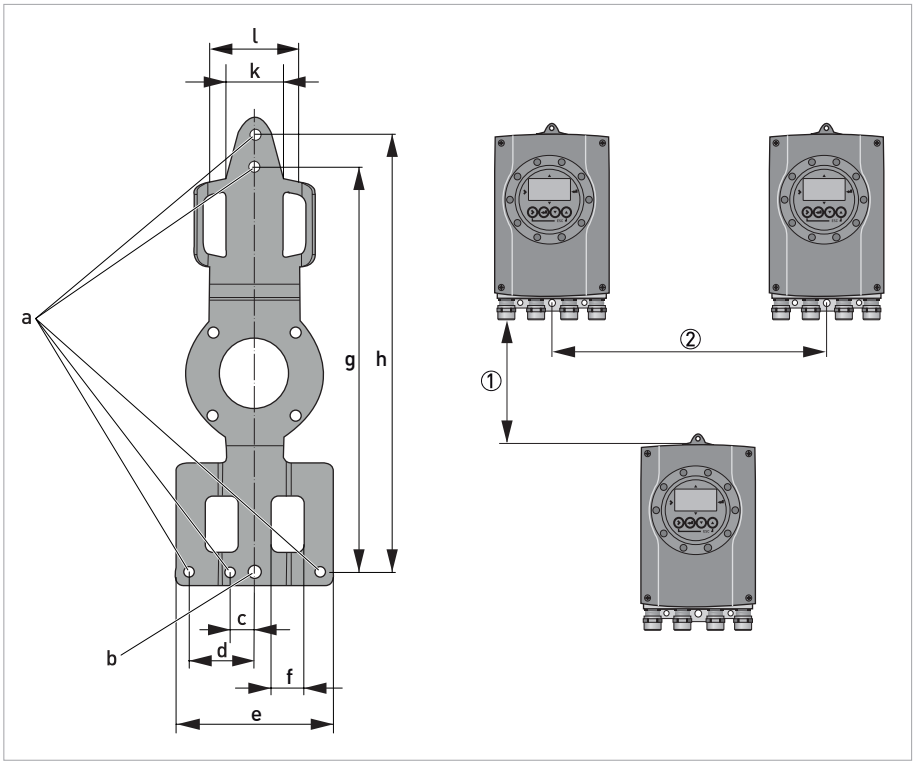


Figure 3-2: Dimensions of mounting plate and distances when mounting multiple devices next to each other

① 277 mm / 10.89"
② 310 mm / 12.2"

	[mm]	[inch]
a	Ø6.5	Ø0.26
b	Ø8.1	Ø0.3
c	15	0.6
d	40	1.6
e	96	3.8
f	20	0.8
g	248	9.8
h	268	10.5
k	35	1.4
l	55	2.2

4.1 Safety instructions

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Observe the national regulations for electrical installations!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Preparing the signal and field current cables

Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

4.2.1 Signal cable A (type DS 300), construction

- Signal cable A is a double-shielded cable for signal transmission between the flow sensor and signal converter.
- Bending radius: ≥ 50 mm / 2"

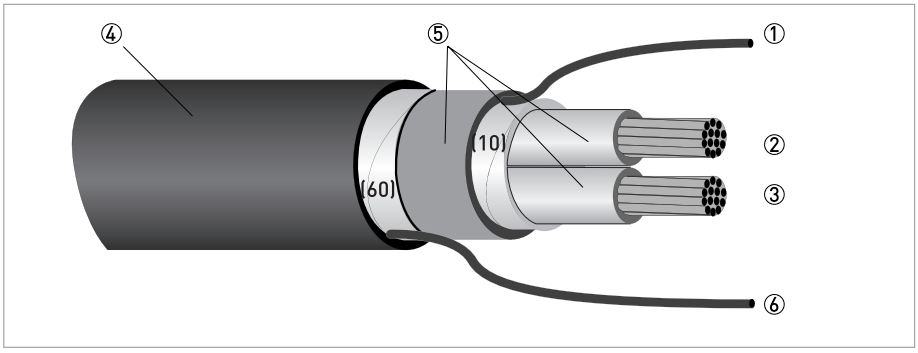


Figure 4-1: Construction of signal cable A

① Stranded drain wire (1) for the inner shield (10), 1.0 mm^2 Cu / AWG 17 (not insulated, bare)
② Insulated wire (2), 0.5 mm^2 Cu / AWG 20
③ Insulated wire (3), 0.5 mm^2 Cu / AWG 20
④ Outer sheath
⑤ Insulation layers
⑥ Stranded drain wire (6) for the outer shield (60)

4.2.2 Length of signal cable A

For temperatures of the medium above 150°C / 300°F, a special signal cable and a ZD intermediate socket are necessary. These are available including the changed electrical connection diagrams.

Flow sensor	Nominal size		Min. electrical conductivity [µS/cm]	Curve for signal cable A
	DN [mm]	[inch]		
OPTIFLUX 1000 F	10...150	3/8...6	20	A1
OPTIFLUX 2000 F	25...150	1...6	20	A1
	200...1200	8...48	20	A2
OPTIFLUX 4000 F	10...150	3/8...6	20	A1
	200...1200	8...48	20	A2
OPTIFLUX 6000 F	10...150	3/8...6	20	A1
WATERFLUX 3000 F	25...600	1...24	20	A1

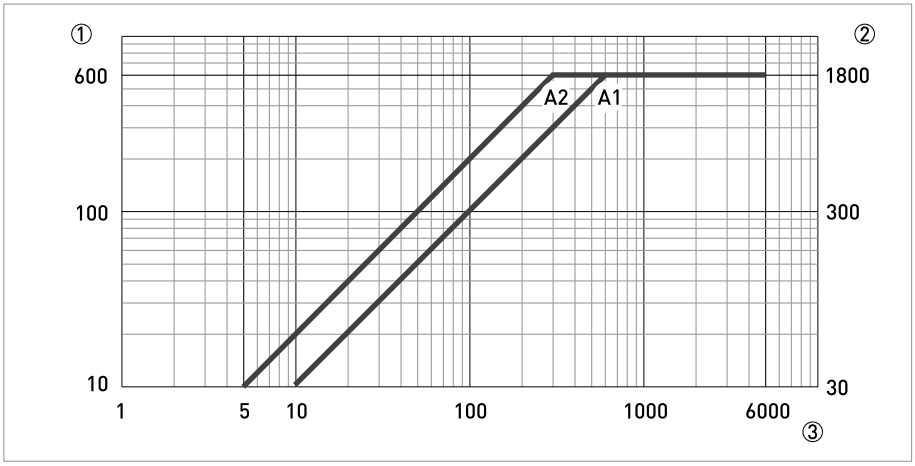


Figure 4-2: Maximum length of signal cable A

① Maximum length of signal cable A between the flow sensor and signal converter [m]
② Maximum length of signal cable A between the flow sensor and signal converter [ft]
③ Electrical conductivity of the medium being measured [µS/cm]

4.2.3 Connection diagram for signal and field current cable

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

- A shielded 2-wire copper cable is used as the field current cable. The shielding **MUST** be connected in the housing of the flow sensor and signal converter.
- The outer shield (60) is connected in the terminal compartment of the flow sensor directly via the shield and a clip.
- Bending radius of signal and field current cable: ≥ 50 mm / 2"
- The following illustration is schematic. The positions of the electrical connection terminals may vary depending on the housing version.

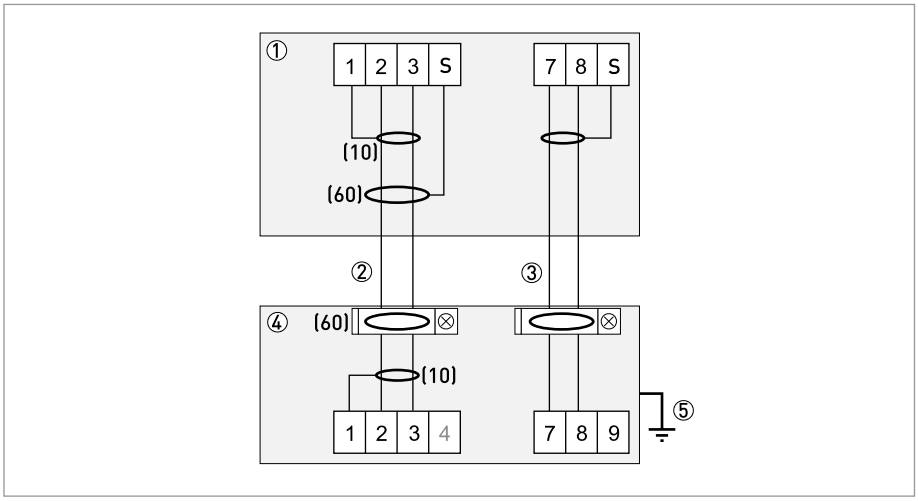


Figure 4-3: Connection diagram for signal and field current cable

① Electrical terminal compartment in the signal converter
② Signal cable A
③ Field current cable C
④ Electrical terminal compartment in the flow sensor
⑤ Functional ground FE

4.3 Grounding the flow sensor

There should be no difference in potential between the flow sensor and the housing or protective earth of the signal converter!

- The flow sensor must be properly grounded.
- The grounding cable should not transmit any interference voltages.
- Do not use the grounding cable to connect any other electrical devices to ground at the same time.
- The flow sensors are connected to ground by means of a functional grounding conductor FE.
- Special grounding instructions for the various flow sensors are provided in the separate documentation for the flow sensor.
- The documentation for the flow sensor also contain descriptions on how to use grounding rings and how to install the flow sensor in metal or plastic pipes or in pipes which are coated on the inside.

4.4 Connecting the power supply

- *To protect operators from electrical shock, during installation the cable for the power supply **must** be run with sheathing insulation up to the mains cover. The insulated individual wires have to be only below the mains cover!*
- *If there is no mains cover or if it has been lost, the 100...230 VAC device may only be operated from the outside (with a magnet pencil) while closed!*

- The housings of the devices, which are designed to protect the electronic equipment from dust and moisture, should be kept well closed at all times. Creepage distances and clearances are dimensioned to VDE 0110 and IEC 664 for pollution severity 2. Supply circuits are designed for overvoltage category III and the output circuits for overvoltage category II.
- Fuse protection ($I_N \leq 16$ A) for the infeed power circuit, and also a separator (switch, circuit breaker) to isolate the signal converter must be provided.

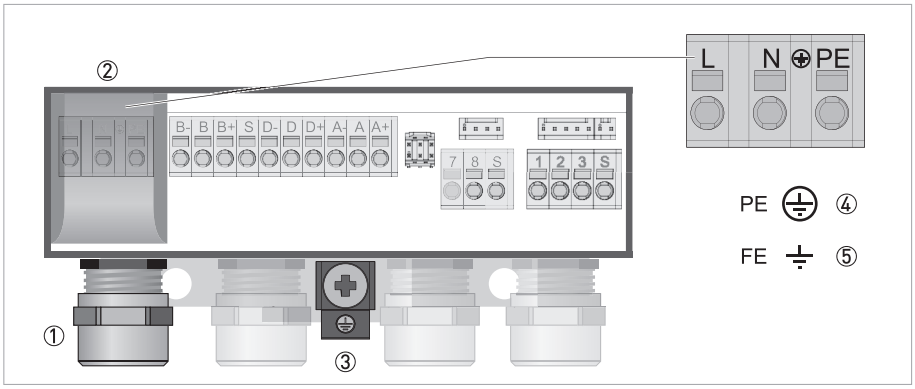


Figure 4-4: Terminal compartment for power

① Cable entry for power supply
② Mains cover
③ Ground terminal
④ 100...230 VAC (-15% / +10%)
⑤ 24 VDC (-30% /+30%)

- To open the cover of the electrical terminal compartment, lightly press in the side walls of the mains cover ②.
- Flip the mains cover up.
- Connect the power supply.
- Close the mains cover again by flipping it down.

100...230 VAC (tolerance range: -15% / +10%)

- Note the power supply voltage and frequency (50...60 Hz) on the nameplate.

240 VAC + 5% is included in the tolerance range.

24 VDC (tolerance range: -30% / +30%)

- Note the data on the nameplate!
- When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (acc. to VDE 0100 / VDE 0106 and/or IEC 364 / IEC 536 or relevant national regulations).

4.5 Inputs and outputs, overview

4.5.1 Description of the CG number

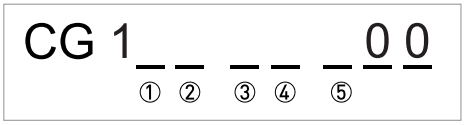


Figure 4-5: Marking (CG number) of the electronics module and output variants

① ID number: 0
② ID number: 0 = standard; 9 = special
③ Power supply
④ Display (language versions)
⑤ Output version

4.5.2 Fixed, non-alterable output versions

This signal converter is available with various output combinations.

- The grey boxes in the tables denote unassigned or unused connection terminals.
- In the table, only the final digits of the CG no. are depicted.
- Terminals D- and A- are connected for active pulse/frequency output (no galvanic isolation anymore).
- Available are an active or passive pulse/frequency output, or the active or passive status/limit output. It's not possible to use both at the same time!

Basic outputs (I/Os)

<table>
<tr><th rowspan="2">CG no.</th><th colspan="7">Connection terminals</th></tr>
<tr><th>S</th><th>D-</th><th>D</th><th>D+</th><th>A-</th><th>A</th><th>A+</th></tr>
<tr><td rowspan="3">1 0 0
R 0 0</td><td rowspan="3">①</td><td colspan="2">P_p / S_p passive</td><td></td><td colspan="2">I_p + HART® passive ②</td><td></td></tr>
<tr><td>connected to A-</td><td colspan="2">P_a active</td><td>connected to D-</td><td colspan="2">I_a + HART® active ②</td></tr>
<tr><td colspan="2">P_p / S_p passive</td><td colspan="2"></td><td colspan="2">I_a + HART® active ②</td></tr>
</table>

① Shielding
② Function changed by reconnecting

Modbus (I/O) (option)

CG no.	Connection terminals			
	B-	B	B+	S
R 0 0	Sign. A (D0-)	Common	Sign. B (D1+)	Shielding

Description of used abbreviations

I_a	I_p	Current output active or passive
P_a	P_p	Pulse/frequency output active or passive
S_a	S_p	Status output/limit switch active or passive

4.6 Laying electrical cables correctly

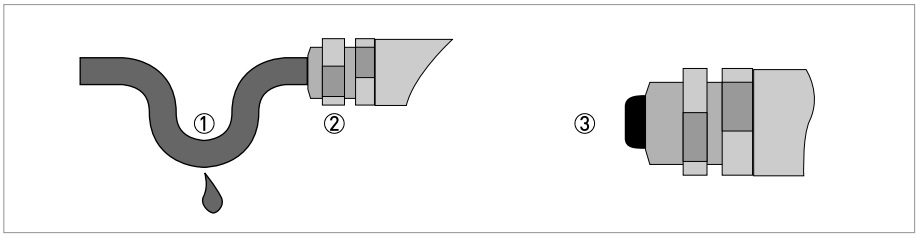


Figure 4-6: Protect housing from dust and water

① For compact versions with nearly horizontally-oriented cable entries, lay the necessary electric cables with a drip loop as shown in the illustration.
② Tighten the screw connection of the cable entry securely.
③ Seal cable entries that are not needed with a plug.