



OPTISONIC 3400 Technical Datasheet

Robust, ultrasonic flowmeter for District Heating

- Dedicated for thermal energy measurement.
- MID 2014/32/EU Annex VI (MI004) approved.
- Accurate bi-directional flow measurement

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1.1 Robust ultrasonic flow meter for heating applications

The **OPTISONIC 3400** flowmeter is an unique, 3-beam, inline, ultrasonic flowmeter, designed especially for measuring homogeneous conductive and non-conductive liquids, with high accuracy and reproducibility, over a long period of time. KROHNE is a main supplier for ultrasonic in-line process flowmeters for liquids with the largest installed base / proven record in terms of robustness and measurement accuracy.

Building on vast knowledge and expertise, KROHNE now introduces the type approved **OPTISONIC 3400** for heating applications.



- ① High performance signal converter for all applications
- ② Robust body without moving parts

The **OPTISONIC 3400** ...features advanced meter diagnostics.

This provides extensive self-checking of internal circuits and information regarding the health of the measuring sensor, but just as importantly, vital information about the process and process conditions.

The **OPTISONIC 3400** ...features velocity of sound

Another unique feature of the **OPTISONIC 3400** is the free of charge measurement of velocity of sound per acoustic path. For instance, this can supply information about pollution in the liquid, or changes in the process conditions.

Highlights

- High performance signal converter for energy measurement applications
- Completely welded construction, wear and maintenance free
- Full bore, unobstructed sensor tube, without pressure loss and without moving parts
- Accurate bi-directional flow measurement, with three beams to measure continuously, and starts measurement at nearly zero flow
- No influences of scaling
- Compact dimensions and easy installation and commissioning

1.2 Legal Metrology

KROHNE's OPTISONIC 3400 ultrasonic flowmeter provides excellent performance, due to the flow sensor design with 3 parallel acoustics paths, under all circumstances



EG-Baumusterprüfbescheinigung

EC Type-examination Certificate

Ausgestellt für:	Krohne Altimeter
ausgegeben:	Körferplatz 12 33113 LC Dordrecht NIEDERLANDE
gemäß:	Anhang B der Richtlinie 2004/22/EG des Europäischen Parlaments und des Rates vom 21. März 2004 über Messgeräte (in (ABL L 136 S. 1) Annex B of the Directive 2004/22/EC of the European Parliament and of the Council of 21 March 2004 on measuring instruments (OJ L 136 p. 1))
Gerätart:	Durchflusssensor Flow sensor
Type of instrument:	
Typbezeichnung:	OPTISONIC 3400
Typ-Bezeichnung:	
Nr. der Bescheinigung:	DE-16-M004-PTB001
Certificate No.:	
Gültig bis:	27.01.2026
Valid until:	
Anzahl der Seiten:	11
Number of pages:	
Geschäftszeichen:	PTB-7 5-4078296
Reference No.:	
Notifizierte Stelle:	0102
Notified Body:	
Zertifizierung:	Berlin, 27.01.2016
Certification:	
Im Auftrag:	Siegel
On behalf of PTB:	
Bewertung:	Passieren
Assessment:	
Im Auftrag:	
On behalf of PTB:	

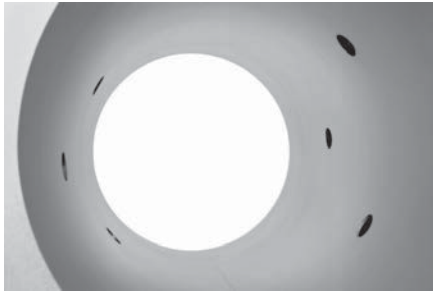
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PTB 33099 03

For thermal energy measurements OPTISONIC 3400 MI-004 is Class 1, 2 and 3 approved, according to the latest Measurement Instrument Directive 2014/32/EU Annex VI MI-004, reflecting our extensive experience in providing Custody Transfer measurement solutions in a range of industries and applications

Heat metering systems consist of 3 main parts: temperature sensors, flowmeter, heat calculator. Heat demand is regulated by flow rather than by temperature. Therefore at low energy demand, low minimum flow measurement is a critical factor. Ultrasonic flow measurement starts already at zero flow, and is MI-004 approved starting from 0,1 m/s.

1.3 Flow sensor and signal converter details

**Engineers favorite flow meter**

- All welded sensor construction
- Patented inert metal transducer technology
- No moving parts
- Full bore unobstructed sensor
- No need for auxiliary parts

**Legal metrology**

The OPTISONIC 3400 liquid flowmeters, compliant to legal metrology MID MI-004 (and harmonized CEN EN1434, OIML R74) are protected against manipulation.

As such the signal converter housing is sealed and the software is dedicated with relevant menu parameters that are blocked

1.4 Measuring principle

- Like canoes crossing a river, acoustic signals are transmitted and received along a diagonal measuring path.
- A sound wave going downstream with the flow travels faster than a sound wave going upstream against the flow.
- The difference in transit time is directly proportional to the mean flow velocity of the medium.

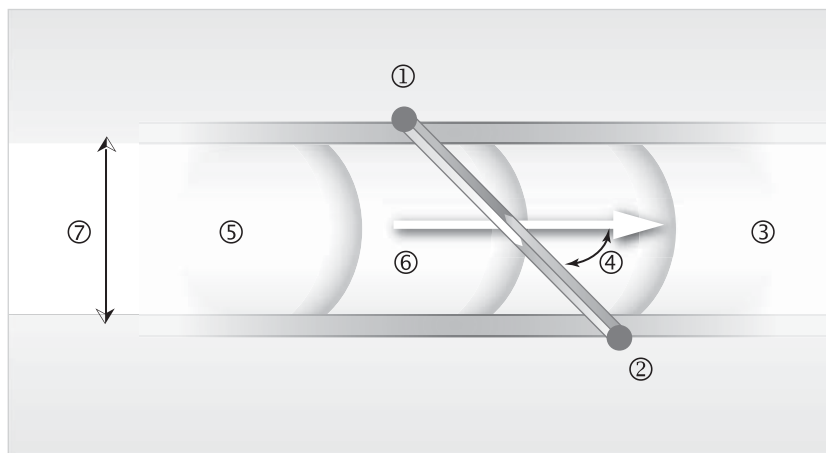


Figure 1-1: Measuring principle

- ① Transducer A
- ② Transducer B
- ③ Flow velocity
- ④ Angle of incidence
- ⑤ Velocity of sound of liquid
- ⑥ Path length
- ⑦ Inner diameter

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	Ultrasonic transit time
Application range	Flow measurement of heated water
Measured value	
Primary measured value	Transit time
Secondary measured values	Volume flow, mass flow, flow speed, flow direction, velocity of sound, gain, signal to noise ratio, reliability of flow measurement, totalised volume or mass

Design

Features	3 parallel acoustic paths fully welded.
Modular construction	The measurement system consists of a measuring sensor and a signal converter.
Compact version	OPTISONIC 3400
Remote version	OPTISONIC 3000 F with UFC 400 signal converter
Nominal diameter	DN25...2000 / 1...80"
Measurement range	0.1...10 m/s / 0.33...33 fts see for more details refer to <i>MID Annex MI-004</i> on page 15
Signal converter	
Inputs / outputs	Current , pulse, frequency and/or status output, limit switch and/or control input
Totaliser	internal totalisers with a max. of 8 digits (e.g. for totalising volume and/or mass units)
Verification and self-diagnostics	Integrated verification, diagnostic functions: measuring device, process, measured values, device configuration, etc.

Display and user interface	
Graphic display	LC display, backlit white
	Size: 128x64 pixels Corresponds to 59x31 mm = 2.32"x1.22"
	Display turnable in 90° steps.
Operating elements	4 push buttons for operator control of the signal converter without opening the housing.
Remote operation	PACTware™, including Device Type Manager (DTM)
	HART® handheld communicator (Emerson), AMS (Emerson), PDM (Siemens)
Display functions	
Operating menu	Programming of parameters at 2 measured value pages, 1 status page, 1 graphic page (measured values and descriptions adjustable as required)
Language of display texts (as language package)	Standard: English, French, German, Dutch
	Russia: English, German, Russian
Measurement functions	Units: Metric, British and US units selectable as desired from lists for volume/mass flow and counting, velocity, temperature
	Measured values: Volume flow, mass flow, flow speed, velocity of sound, gain, signal to noise ratio, flow direction, diagnostics
Diagnostic functions	Standards: VDI/NAMUR NE 107
	Status messages: Output of status messages via display, current and/or status output
	Sensor diagnostics: per acoustic path velocity of sound, flow speed, gain, signal to noise ratio
	Process diagnostics: Empty pipe, signal integrity, cabling, flow conditions
	Signal converter diagnostics: Data bus monitoring, I/O connections, electronics temperature, parameter and data integrity

Measuring accuracy

Reference conditions	
Medium	Water
Temperature	+20°C / +68°F
Pressure	1 bar / 14.5 psi
Inlet section	10 DN
Maximum measuring error	
Class 1	$\pm 1\% (1 + 0.01 q_p / q) =$ with limit of 3.5%
Class 2	$\pm 2\% (2 + 0.02 q_p / q) =$ with limit of 5%
Class 3	$\pm 3\% (3 + 0.03 q_p / q) =$ with limit of 5%
Calibration / Verification	Standard
	3 Point calibration by a direct volume comparison
	Optional
	Verification to Measurement Instrument Directive (MID), Annex VI (MI-004)

MID MI-004 (Directive 2014/32/EU)	EC-Type examination certificate to MID Annex VI (MI-004)
	Diameter: DN25...2000
	Minimal straight inlet flow: 10 DN
	Forward and reverse (bi-directional) flow
	Orientation: horizontal, vertical
	Ratio: up to 100
	Maximum operating pressure: 40 bar- 580 psi at 20°C - 158°F / 32 bar - 460psi at 180°C - 356°F
	for more details refer to <i>MID Annex MI-004</i> on page 15
Environmental class	Electromagnetic: E2
	Mechanical: M1

Operating conditions

Temperature	
Process temperature	Compact version: -0...+90°C / 32...+194°F
	Remote version: 0...+180°C / +32...+356°F
	Carbon steel flanges; minimal process temperatures acc. to EN1092: -10°C / +14°F; ASME: -29°C / -20°F
Ambient temperature	-25...+55°C / -13...+131°F
Protect inside electronics against self-heating (increasing of the electronics temperature will lead to a reduction of the corresponding service life by a factor 2 for each step of 10°C / 50°F increase). Protect the signal converter from external heat sources such as direct sunlight, as higher temperatures reduce the life cycle of all electronic components.	
Storage temperature	-50...+70°C / -58...+158°F
Pressure	
Atmospheric	
EN 1092-1	DN25...80: PN 40
	DN100...150: PN 16
	DN200...2000: PN 10
ASME B16.5	1...40": 150 lb RF
	1...40": 300 lb RF
Properties of medium	
Physical condition	Liquid,
Permissible gas content	≤ 2% (volume)
Permissible solid content	≤ 5% (volume)

Installation conditions

Installation	For detailed information refer to <i>Installation</i> on page 20.
Inlet run	Minimal 10 DN (straight inlet)
Outlet run	Minimal 3 DN (straight outlet)
Dimensions and weights	For detailed information refer to <i>Dimensions and weights</i> on page 17.

Materials

Measuring sensor	
Flanges (wetted)	DN25...2000 / 1"...80": Carbon steel
	Option: Stainless steel 1.4404 (AISI 316(L))
Measuring tube (wetted)	DN25...2000 / 1"...80": Carbon steel
	Option: Stainless steel 1.4404 (AISI 316(L))
Measuring sensor housing	DN25...300 / 1"...12": Carbon steel
	Option: Stainless steel 1.4404 (AISI 316(L))
Transducer	
Transducers (wetted)	Stainless steel 1.4404 (AISI 316L)
Transducer holders incl. caps	DN350...2000 / 14"...80"; Stainless steel 1.4404 (AISI 316L)
Tube transducer cabling	Stainless steel 1.4404 (AISI 316L)
Connection box and connection box support (remote version only)	Standard: Die-cast aluminium; polyurethane coated
	Option: Stainless steel 316 (1.4408)
Coating (flow sensor)	Standard: Polyurethane
Signal converter	
Housing	Versions C and F: Die-cast aluminium
	Option: Stainless steel 316 (1.4408)
Coating	Standard: Polyurethane

Electrical connections

Description of used abbreviations; Q = xxx; $I_{\max}$ = maximum current; U_i = xxx; U_{int} = internal voltage; U_{ext} = external voltage; $U_{\text{int, max}}$ = maximal internal voltage	
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	Standard: 100...230 VAC (-15% / +10%), 50/60 Hz
Power consumption	AC: 22 VA
Signal cable (remote version only)	MR06 (shielded cable with 6 coax cores): Ø 10.6 mm / 0.4"
	5 m / 16 ft
	Option: 10...30 m / 33...98 ft
Cable entries	Standard: M20 x 1.5 (8...12 mm)
	Option: ½" NPT, PF ½

Inputs and 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 used abbreviations	U_{ext} = external voltage; R_L = load + resistance; U_0 = terminal voltage; I_{nom} = nominal current Safety limit values (Ex i): U_i = max. input voltage; I_i = max. input current; P_i = max. input power rating; C_i = max. input capacity; L_i = max. input inductivity

Current output			
Output data	Measurement of volume flow, mass flow, flow speed, velocity of sound, gain, SNR, diagnostics (flow speed, VoS, SNR, gain), NAMUR NE107, HART® communication.		
Temperature coefficient	Typically ±30 ppm/K		
Settings	Without HART®		
	Q = 0%: 0...20 mA; Q = 100%: 10...20 mA		
	Error identification: 3...22 mA		
	With HART®		
	Q = 0%: 4...20 mA; Q = 100%: 10...20 mA		
	Error identification: 3...22 mA		
	Q = 100%: 10...20 mA		
	Error identification: 3...22 mA		
	Basic I/Os		
Active	$U_{\text{int, nom}} = 24 \text{ VDC}$ $I \leq 22 \text{ mA}$ $R_L \leq 1 \text{ k}\Omega$		
Passive	$U_{\text{ext}} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $U_0 \geq 1.8 \text{ V}$ $R_{L, \max} = (U_{\text{ext}} - U_0) / I_{\max}$		

HART®		
Description	HART® protocol via active and passive current output	
	HART® version: V7	
	Universal HART® parameter: completely integrated	
Load	≥ 250 Ω at HART® test point: Note maximum load for current output!	
Multidrop	Yes, current output = 10% e.g. 4 mA	
	Multidrop addresses adjustable in operation menu 0...63	
Device drivers	DD for FC 375/475, AMS, PDM, DTM for FDT	
Pulse or frequency output		
Output data	Volume flow, mass flow	
Function	Puls / frequency output is fixed and set in factory according order.	
Pulse rate/frequency	0.01...10000 pulses/s or Hz	
Settings	For Q = 100%: 0.01...10000 pulses per second or pulses per unit volume	
	Pulse width: adjustable as automatic, symmetric or fixed (0.05...2000 ms)	
Active	-	
Passive	U _{ext} ≤ 32 VDC	-
	f _{max} in operating menu set to: f _{max} ≤ 100 Hz: I ≤ 100 mA R _{L, max} = 47 kΩ R _{L, max} = (U _{ext} - U ₀) / I _{max} 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} ≤ 10 kHz: I ≤ 20 mA R _L ≤ 10 kΩ for f ≤ 1 kHz R _L ≤ 1 kΩ for f ≤ 10 kHz R _{L, max} = (U _{ext} - U ₀) / I _{max} 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	

Status output / limit switch			
Function and settings	Adjustable as automatic measuring range conversion, display of flow direction, overflow, error, switching point		
	Valve control with activated dosing function		
Operating data	Basic I/Os		
Active	-		
Passive	$U_{\text{ext}} \leq 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ $R_{L, \text{max}} = 47 \text{ k}\Omega$ $R_{L, \text{max}} = (U_{\text{ext}} - U_0) / I_{\text{max}}$ open: $I \leq 0.05 \text{ mA}$ at $U_{\text{ext}} = 32 \text{ VDC}$ closed: $U_{0, \text{max}} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $U_{0, \text{max}} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$		-
NAMUR	-		

Control input			
Function	Hold value of the outputs (e.g. for cleaning work), set value of the outputs to "zero", counter and error reset, stop counter, range conversion, zero calibration		
	Start of dosing when dosing function is activated.		
Operating data	Basic I/Os		
Active	-		
Passive	$U_{\text{ext}} \leq 32 \text{ VDC}$ $I_{\text{max}} = 6.5 \text{ mA}$ at $U_{\text{ext}} \leq 24 \text{ VDC}$ $I_{\text{max}} = 8.2 \text{ mA}$ at $U_{\text{ext}} \leq 32 \text{ VDC}$ Contact closed (On): $U_0 \geq 8 \text{ V}$ with $I_{\text{nom}} = 2.8 \text{ mA}$ Contact open (Off): $U_0 \leq 2.5 \text{ V}$ with $I_{\text{nom}} = 0.4 \text{ mA}$		
NAMUR	-		-

Approvals and certificates

CE	
This device fulfils the statutory requirements of the EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.	
	For full information of the EU directive & standards and the approved certifications; see the CE declaration or the manufacturer website.
NAMUR	NE 21, 43, 53, 80, 107
MID directive	Directive 2014/32/EU, Annex VI (MI-004)
Other approvals and standards	
Non-Ex	Standard
Hazardous areas	
Ex zone 1 - 2	For detailed information, please refer to the relevant Ex documentation.
	According to European directive 2014/34/EU (ATEX 100a)
ATEX	KIWA 15ATEX0007 X
Protection category acc. to IEC 529 / EN 60529	Signal converter
	Compact (C): IP66/67 (NEMA 4X/6)
	Field (F): IP66/67 (NEMA 4X/6)
	All flow sensors
	IP67 (NEMA 6)
Shock resistance	IEC 68-2-27
	30 g for 18 ms
Vibration resistance	IEC 68-2-6; 1 g up to 2000 Hz
	IEC 60721; 10 g

2.2 MID Annex MI-004

All liquid flow meters for heated water and thermal energy measurement, that are to be used for legal purposes in Europe, require certification under the Measurement Instrument Directive (MID) 2014/32/EU.

Annex VI (MI-004) of the MID applies to these liquid flow meters intended for the measurement of volume of heated water in residential, commercial, and industrial use. An EC-type examination certificate is valid in all countries of the European Union.

The OPTISONIC 3400 has an EC type examination certificate and can be verified to the MID Annex VI (MI-004) for liquid flow meters with diameter DN25...DN2000 / 1"...80". The conformity assessment procedure followed for OPTISONIC 3400 is Module B (Type Examination) and Module D (Quality Assurance of the Production Process).

For accuracy class 1, 2 and 3:

The flow range, Q_i and Q_p must be defined as follows;

Ratio of $Q_p / Q_i \geq 10$

Minimum flowrate: $Q_p \geq 0.1 \times Q_p (\text{max})$

Q_s = flow range

Q_p = maximum flow

Q_i = minimum flow

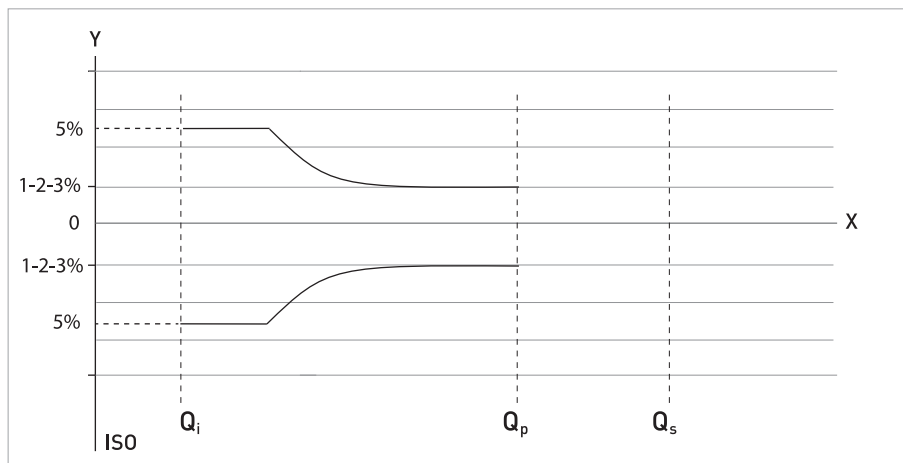


Figure 2-1: ISO flow rates added to figure as comparison towards MID

X: Flow rate

Y [%]: Maximum measuring error

MI-004 certified flow characteristics; valid for accuracy classes 1, 2 & 3

DN Size	Maximum pressure rating	Overall length [mm]		Flow rate [m ³ /h]		
		Min.	Max.	Q _s	Q _p	Q _i
25	PN40	250	400	18 [27]	18	0.18
32	PN40	260	400	29 [44]	29	0.29
40	PN40	270	400	45 [68]	45	0.45
50	PN40	300	475	71 [106]	71	0.71
65	PN40	300	475	180	120	1.2
80	PN40	300	400	180 [270]	180	1.8
100	PN40 *	350	400	280 [430]	280	2.8
125	PN40 *	350	400	500	440	4.4
150	PN40 *	350	400	630	630	6.3
200	PN40 *	400	500	1130	1130	11.3
250	PN40 *	400	600	1750	1750	7.5
300	PN40 *	500	600	2500	2500	25.0
350	PN40 *	500	880	3400	3400	34.0
400	PN40 *	600	975	4500	4500	45.0
450	PN40 *	600	1000	5750	5750	57.5
500	PN40 *	600	1080	7000	7000	70.0
600	PN40 *	600	1165	10000	10000	100
700	PN40 *	800	1240	14000	14000	140
800	PN40 *	800	1240	18000	18000	180
900	PN40 *	900	1370	23000	2300	230
1000	PN40 *	1000	1370	28000	28000	280
1200	PN40 *	1200	1600	40000	40000	400
1400	PN40 *	1400	1800	55000	55000	550
1600	PN40 *	1600	2000	70000	70000	700
1800	PN40 *	1600	2100	90000	90000	900
2000	PN40 *	1800	2100	113000	113000	1130

* maximum pressure 40 bar- 580psi at 20°C - 68°F / 32 bar - 460 psi at 180°C - 356°F

Between brackets () ; Q_s value only valid for accuracy classes 2 & 3

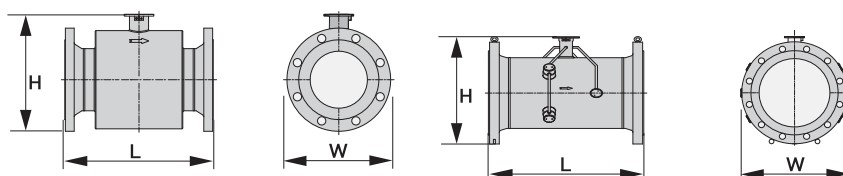
2.3 Dimensions and weights

Remote version		$a = 88 \text{ mm} / 3.5''$ $b = 139 \text{ mm} / 5.5''$ ① $c = 106 \text{ mm} / 4.2''$ Total height = $H + a$ ②
Compact version		$a = 155 \text{ mm} / 6.1''$ $b = 230 \text{ mm} / 9.1''$ ① $c = 260 \text{ mm} / 10.2''$ Total height = $H + a$ ②

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

② The value depends on version

2.3.1 Standard flow sensor



The following dimensions are applicable for the OPTISONIC 3400 in compact and remote versions.

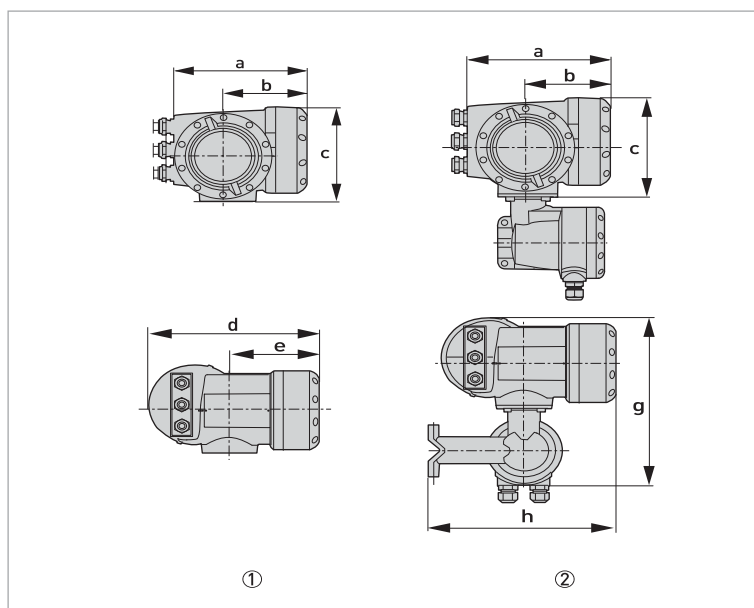
EN1092-1; Standard variant - PN40

Nominal size	Dimensions [mm], CS = carbon steel / SS = stainless steel / Di = inner diameter					Approx. weight [kg]	
DN	L	H	W	Di CS	Di SS	CS	SS
25	250	155	115	27	27	8	8
32	260	156	140	35	35	9	10
40	270	173	150	39	41	11	14
50	300	193	165	53	53	14	17
65	300	203	185	63	63	18	19
80	300	238	200	78	81	17	18
100	350	268	235	102	104	24	24
125	350	297	270	127	130	30	29
150	400	326	300	154	158	37	37
200	400	427	375	207	207	63	63
250	500	492	450	260	260	100	100
300	500	547	515	308	308	140	140

Other pressure classes like PN25, PN16, PN10 or ASME 150, 300 lb are also MI-004 certified. Dimensions and weights are available on request.

Mounting length of larger diameters; on request.

2.3.2 Signal converter housing



- ① Compact housing (C)
② Field housing (F)

Dimensions and weights in mm and kg

Version	Dimensions [mm]							Weight [kg]
	a	b	c	d	e	g	h	
C	202	120	155	260	137	-	-	4.2
F	202	120	155	-	-	295.8	277	5.7

Dimensions and weights in inch and lb

Version	Dimensions [inch]							Weight [lb]
	a	b	c	d	e	g	h	
C	7.75	4.75	6.10	10.20	5.40	-	-	9.30
F	7.75	4.75	6.10	-	-	11.60	10.90	12.60

3.1 Intended use

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The **OPTISONIC 3400 MI-004** is designed exclusively for bi-directional measurements on conductive and / or non-conductive water for district heating systems. Excess of contaminations (gas, particles, 2 phases) disturb the acoustic signal and thus must be avoided.

The overall functionality of the **OPTISONIC 3400 MI-004** flowmeter, is the continuous measurement of actual volume flow, mass flow, flow speed, velocity of sound, gain, SNR, totalized flow mass and diagnosis values.

3.2 General notes on installation

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

Do a check of the packing list to make sure that you have all the elements given in the order.

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.

3.3 Vibration

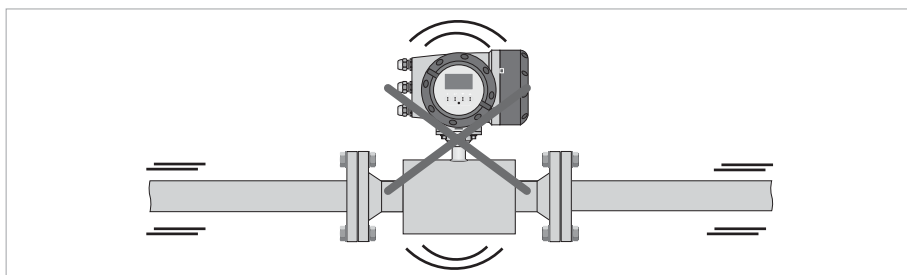


Figure 3-1: Avoid vibrations

In case of expected vibrations, please install a field version.

3.4 Installation requirements signal converter

- Allow 10...20 cm / 3.9...7.9" of space at the sides and rear of the signal converter to permit free air circulation.
- Protect signal converter against direct solar radiation, install a sunshield if necessary.
- Signal converters installed in switchgear cabinets require adequate cooling, e.g. by fan or heat exchanger.
- Do not expose the signal converter to intense vibration.

3.5 Installation conditions

3.5.1 Inlet and outlet

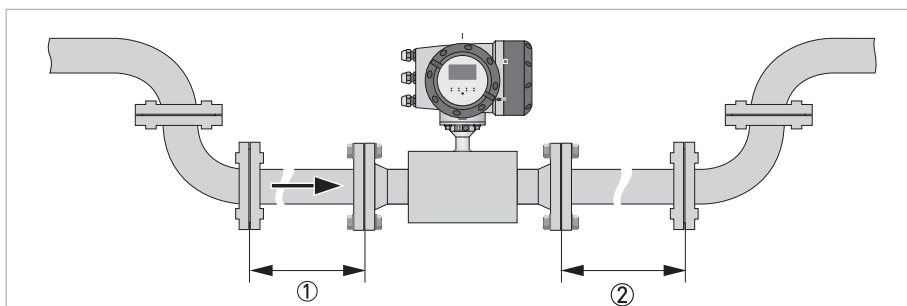


Figure 3-2: Recommended inlet and outlet

- ① Refer to chapter "Bends in 2 or 3 dimensions"
- ② $\geq 3 \text{ DN}$

3.5.2 Bends in 2 or 3 dimensions

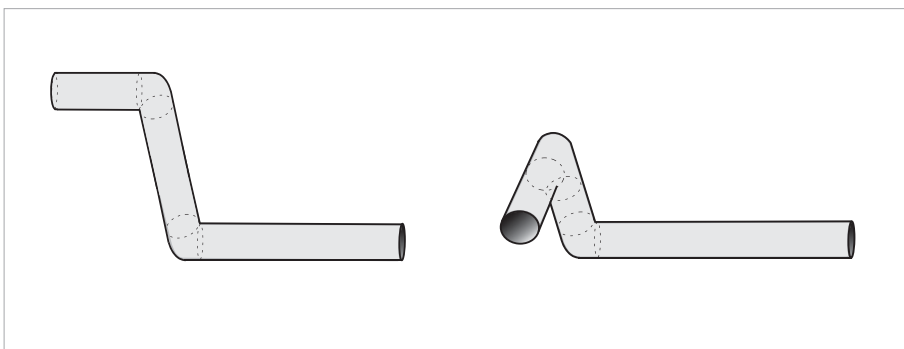


Figure 3-3: Inlet when using 2 and/or 3 dimensional bends in front of the flowmeter

Inlet length: using bends in 2 dimensions: $\geq 10 \text{ DN}$; when having bends in 3 dimensions: $\geq 15 \text{ DN}$

3.5.3 T-section

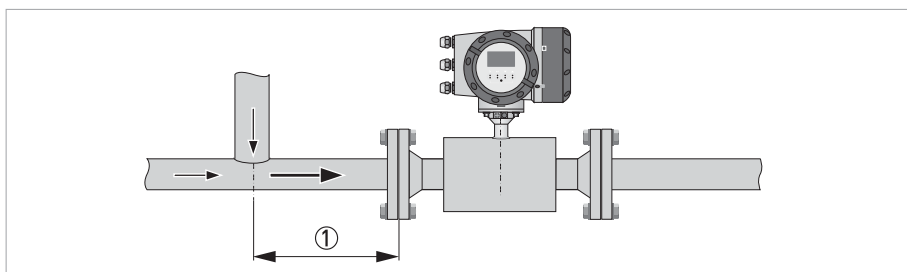


Figure 3-4: Distance behind a T-section

- ① $\geq 10 \text{ DN}$

3.5.4 Bends

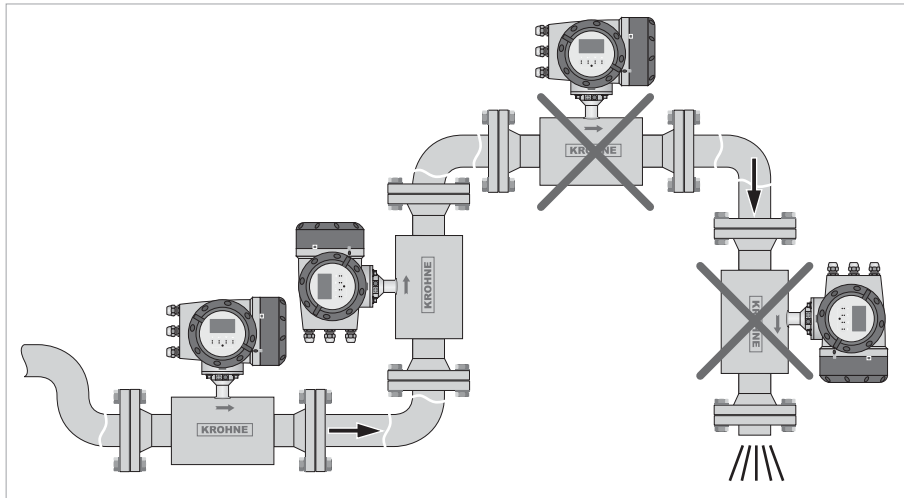


Figure 3-5: Installation in bending pipes

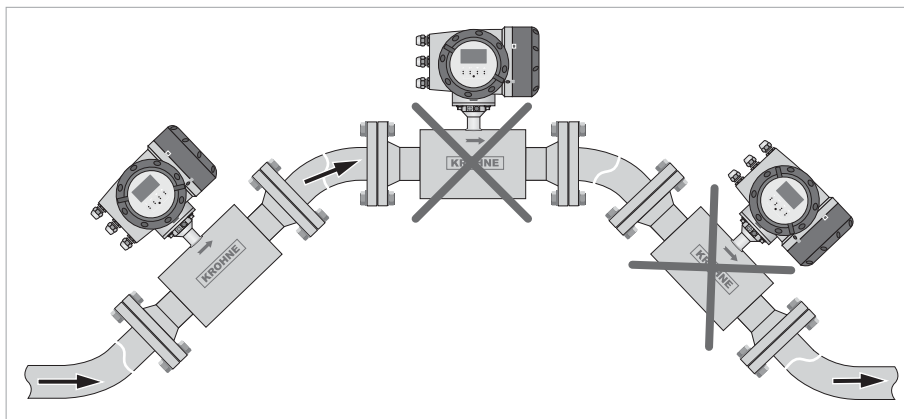


Figure 3-6: Installation in bending pipes

3.5.5 Open feed or discharge

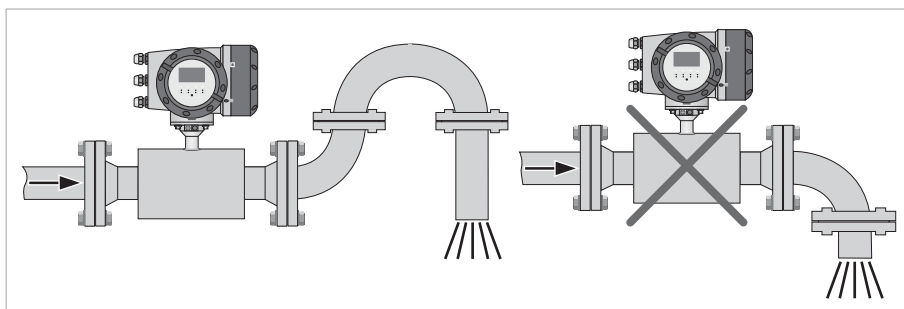


Figure 3-7: Open discharge

Install meter on a lowered section of the pipe to ensure a full pipe condition through the meter.

3.5.6 Position of pump

Never install flowmeter at a pump suction side in order to avoid cavitation or flashing in the flowmeter.

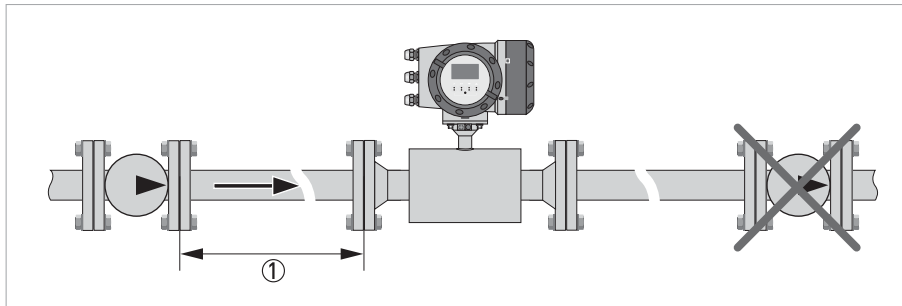


Figure 3-8: Position of pump

① ≥ 15 DN

3.5.7 Control valve

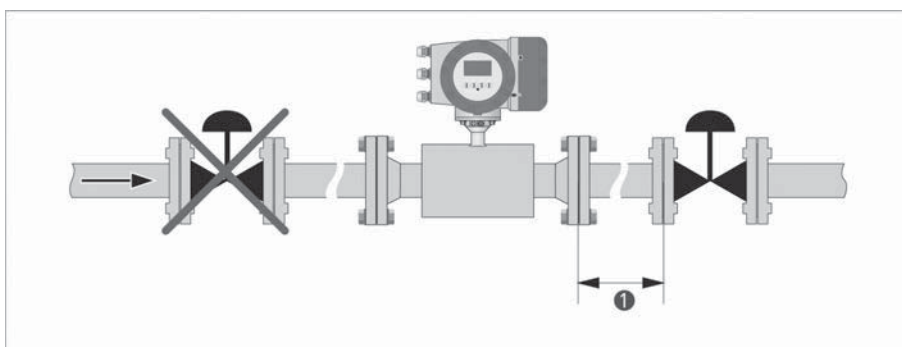


Figure 3-9: Installation in front of a control valve

① ≥ 20 DN

3.5.8 Down going pipeline over 5 m / 16 ft length

Install air vent downstream of the flowmeter to prevent vacuum. Although this will not harm the meter, it may cause gases to come out of solution (cavitate) and interfere with proper measurements.

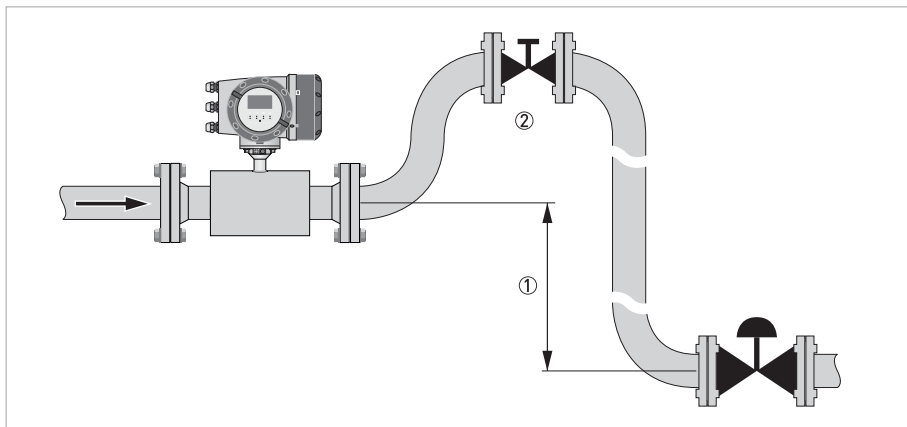


Figure 3-10: Down going pipeline over 5 m / 16 ft length

- ① ≥ 5 m / 16 ft
- ② Install air vent

3.5.9 Insulation

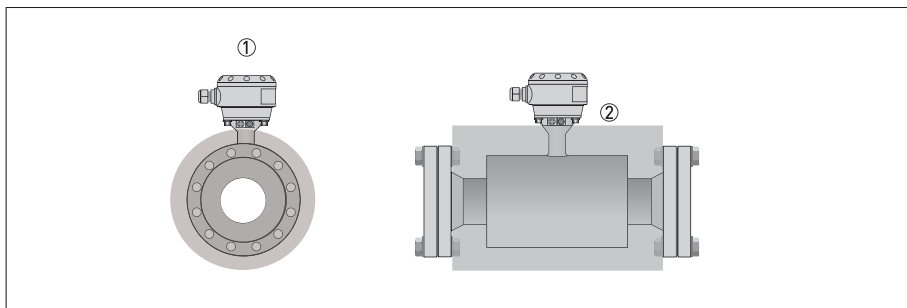


Figure 3-11: Insulation

- ① Connection box
- ② Insulation area

*The flow sensor can be insulated completely, except for the connection box.
(Ex: maximum temperature, refer to Ex supplement)*

For devices used in hazardous area, additional maximum temperature and insulation precautions apply. Please refer to the Ex documentation!

3.5.10 Mounting

3.5.11 Flange deviation

Max. permissible misalignment of pipe flange faces: M_{max} 0.5 degree, according ASME B16.5 Individual flanges. See Appendix 12 ; Flange face alignment of the General Piping Requirements DEP 31.38.01.11-GEN

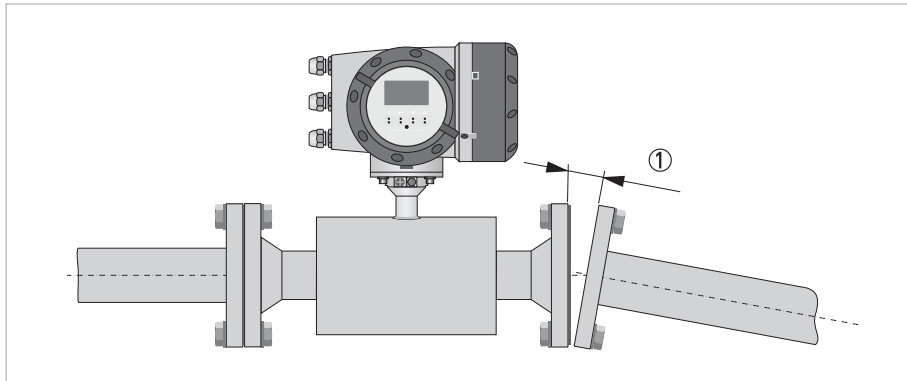


Figure 3-12: Flange deviation

① M_{max}

3.5.12 Mounting position

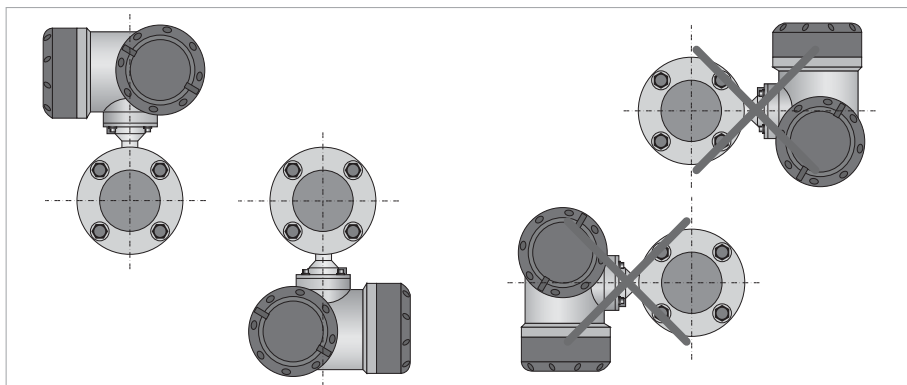


Figure 3-13: Horizontal and vertical mounting

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!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

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 Signal cable (remote versions only)

The flow sensor is connected to the signal converter via one signal cable, with 2, 4 or 6 (labeled) inner coax cables for the connection of maximal three acoustic paths.

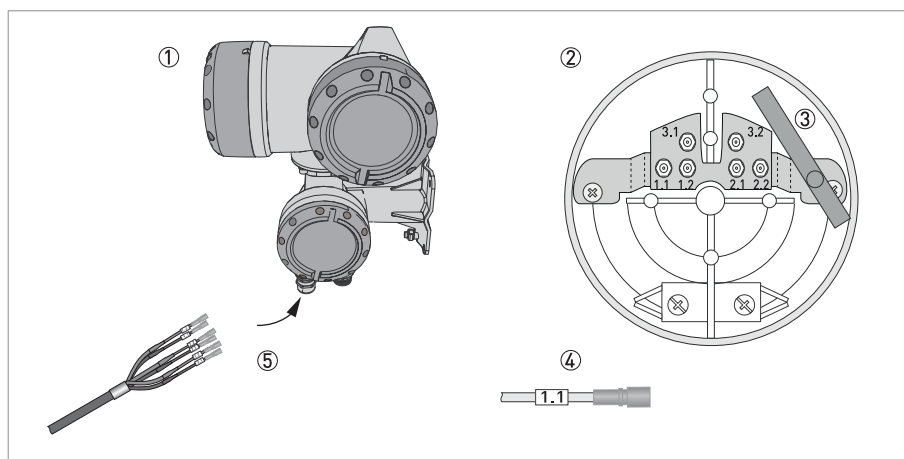


Figure 4-1: Construction of field version

- ① Signal converter
- ② Open connection box
- ③ Tool for releasing connectors
- ④ Marking on cable
- ⑤ Insert cable(s) into terminal compartment

Connect the cable on connector with similar numeral marking

4.3 Power supply

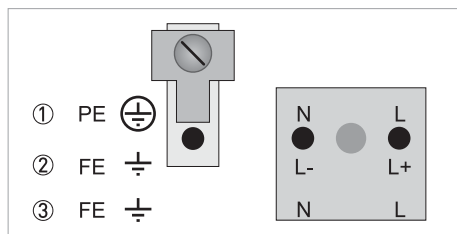
When this device is intended for permanent connection to the mains.

It is required (for example for service) to mount an external switch or circuit breaker near the device for disconnection from the mains. It shall be easily reachable by the operator and marked as the disconnecting the device for this equipment.

The switch or circuit breaker and wiring has to be suitable for the application and shall also be in accordance with the local (safety) requirements of the (building) installation (e.g. IEC 60947-1 / -3)

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

The power terminals in the terminal compartments are equipped with additional hinged lids to prevent accidental contact.



- ① 100...230 VAC (-15% / +10%), 22 VA
- ② 24 VDC (-55% / +30%) 12 W
- ③ 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%), 22 VA or 12 W

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

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

- Note the power supply voltage and frequency (50...60 Hz) on the nameplate.
- The protective ground terminal **PE** of the power supply must be connected to the separate U-clamp terminal in the terminal compartment of the signal converter

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

4.4 Input and outputs, overview

4.4.1 Combinations of the inputs/outputs (I/Os)

This signal converter is available with the input/output combinations.

Basic version

- Has 1 current output, 1 pulse output and 2 status outputs / limit switches.
- The pulse output can be set as status output/limit switch and one of the status outputs as a control input.

Ex option

- For hazardous areas, all of the input/output variants for the housing designs C and F with terminal compartment in the Ex d (pressure-resistant casing) or Ex e (increased safety) versions can be delivered.
- Please refer to the separate instructions for connection and operation of the Ex-devices.

4.4.2 Description of the CG-number

Description of abbreviations and CG identifier for possible optional modules on terminals A and B

Abbreviation	Identifier for CG No.	Description
I _a	A	Active current output
I _p	B	Passive current output
P _a / S _a	C	Active pulse output, frequency output, status output or limit switch (changeable)
P _p / S _p	E	Passive pulse output, frequency output, status output or limit switch (changeable)
C _a	G	Active control input
C _p	K	Passive control input
-	8	No additional module installed
-	0	No further module possible

4.4.3 Fixed, non-alterable input/output versions

This signal converter is available with various input/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.

CG-No.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-

Basic in-/output (I/O) (Standard)

1 0 0		I _p + HART® passive ①	S _p / C _p passive ②	S _p passive	P _p / S _p passive ②
	I _a + HART® active ①				

① Function changed by reconnecting

② Changeable

Please fill in this form and fax or email it to your local representative. Please include a sketch of the pipe layout as well, including the X, Y, Z dimensions.

5.1 Device Configuration Form

Customer information:

Date:
Submitted by:
Company:
Address:
Telephone:
Fax:
E-mail:

Flow application data:

Reference information (name, tag etc):
New application Existing application, currently using:
Measurement objective:
Medium
Liquid:
Gas content:
Solids content:
Density:
Velocity of sound:
Flowrate
Normal:
Minimum:
Maximum:
Temperature
Normal:
Minimum:
Maximum:
Pressure
Normal:
Minimum:
Maximum:

Piping details

Nominal pipe size:
Outer diameter:
Wall thickness / schedule:
Pipe material:
Straight inlet / outlet section (DN):
Upstream situation (elbows, valves, pumps):
Flow orientation (vertical up / horizontal / vertical down / other):

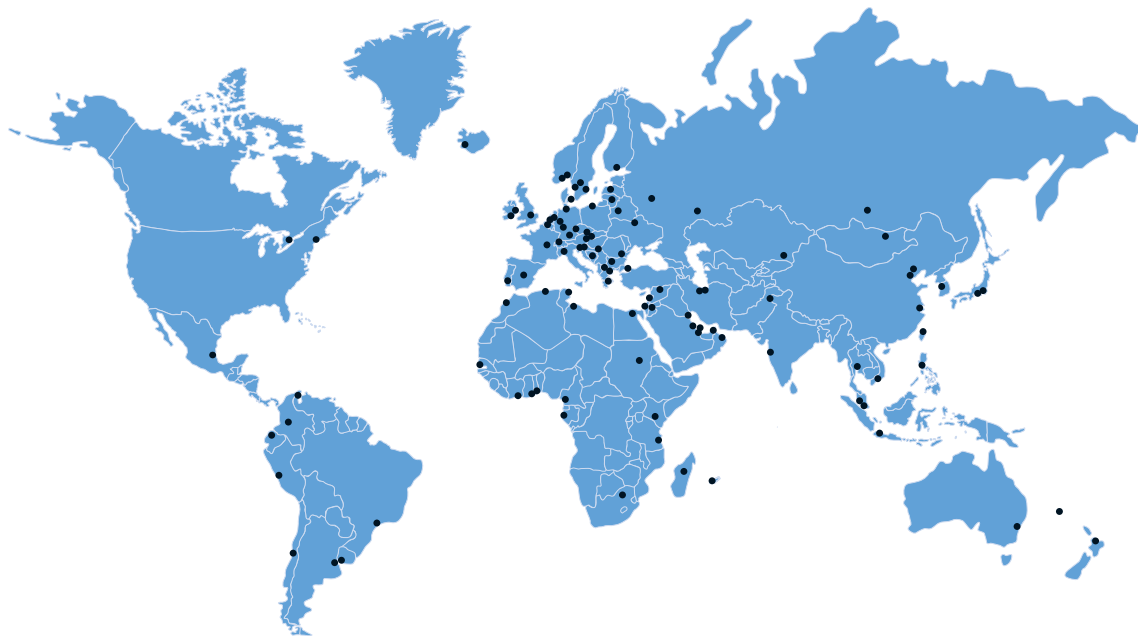
Environment details

Corrosive atmosphere:
Sea water:
High humidity (% R.H.)
Nuclear (radiation):
Hazardous area:
Additional details:

Hardware requirements:

Accuracy requested (percentage of rate):
Power supply (voltage, AC / DC):
Analog output (4-20 mA)
Pulse (specify minimum pulse width, pulse value):
Digital protocol:
Options:
Remote mounted signal converter:
Specify cable length:
Accessories:





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