OPTICHECK
technology built-in

OPTISONIC 3400

Technical Datasheet

Robust, ultrasonic flowmeter for District Heating

- Dedicated for thermal energy measurement
- MID 2014/32/EU Annex VI (MI004 class 2 and 3)
- Accurate bi-directional flow measurement

OIML MID

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KROHNE

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1.1 Robust ultrasonic flow meter for heating applications

The **OPTISONIC 3400** flowmeter is a unique, 3-beam, in-line, 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 of ultrasonic in-line process flowmeters for liquids with the largest global installed base/proven track record in terms of robustness and measurement accuracy.

Building on vast knowledge and expertise, KROHNE now introduces the type approved **OPTISONIC 3400** for district 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 flow 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 the velocity of sound per acoustic path. For instance, this can supply information about pollution in the liquid, or changes in the process conditions.

OPTICHECK technology built-in

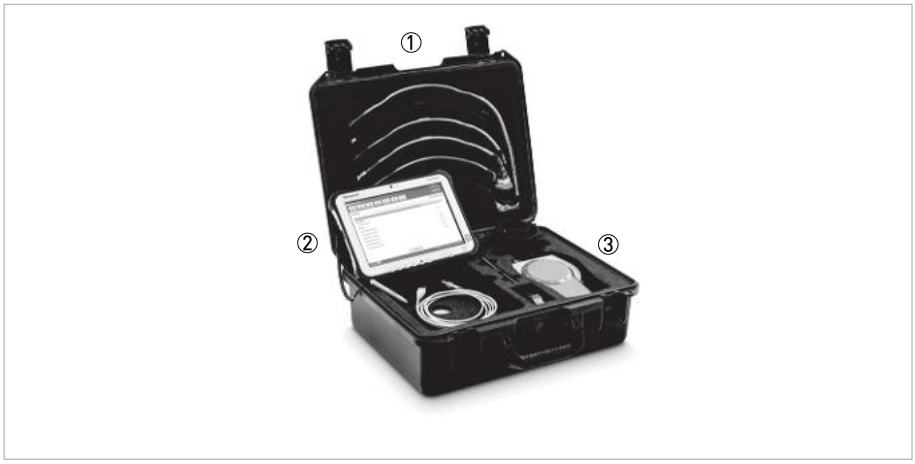
State-of-the-art measuring devices combine robust measuring principles and powerful electronics to produce a wide range of readings and device-specific data. OPTICHECK technology built-in leverages the features of the devices to translate their available comprehensive measuring system data into sophisticated diagnostics information for plant personnel. It goes beyond extensive device diagnostics, self-tests and on-site verification.

OPTICHECK tool for on-site verification

The OPTICHECK provides an inline health check of the device under test by an external tool.

A hard copy of the verification report can be printed for every flowmeter and verification data is digitally stored.

Contact us for more information or for an on-site service visit.



① Suitcase
② Tablet
③ OPTICHECK Master

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
- 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.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

EG-Baumusterprüfbescheinigung
EC Type-examination Certificate

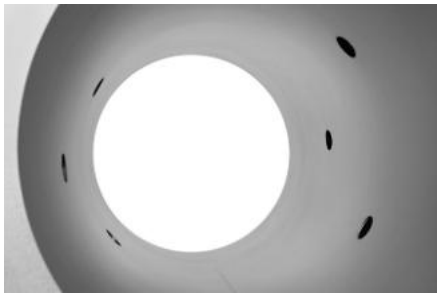
Ausgestellt für:	Krohne Altometer Kerkeplaat 12 3313 LC Dordrecht NIEDERLANDE
gemäß:	Anhang II Modul B der Richtlinie 2014/32/EU des Europäischen Parlaments und des Rates vom 26. Februar 2014 zur Harmonisierung der Rechtsvorschriften der Mitgliedstaaten über die Bereitstellung von Messgeräten auf dem Markt. Annex II Module B of the Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments.
Geräteart:	Durchflusssensor *Flow sensor*
Typbezeichnung:	OPTISONIC 3400
Nr. der Bescheinigung:	DE-16-MI004-PTB001, Revision 3
Gültig bis:	12 01.03.2036
Anzahl der Seiten:	
Geschäftszeichen:	PTB-7. 5-4124897
Notifizierte Stelle:	0102
Zertifizierung:	Berlin, 01.03.2026
Im Auftrag	Siegel
Bewertung:	Im Auftrag

EG-Baumusterprüfbescheinigungen ohne Unterschrift und Siegel haben keine Gültigkeit. Diese EG-Baumusterprüfbescheinigung darf nur unverändert weiterverbreitet werden. Auszüge bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.
EC Type-examination Certificates without signature and seal are not valid. This EC Type-examination Certificate may not be reproduced other than in full. Extracts may be taken only with the permission of the Physikalisch-Technische Bundesanstalt.

For thermal energy measurements OPTISONIC 3400 MI-004 is Class 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 and 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 favourite 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 average flow velocity of the medium.

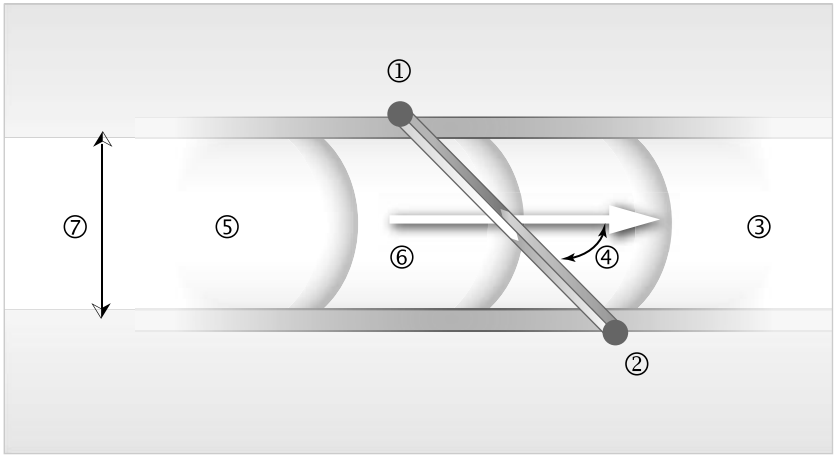


Figure 1-1: Measuring principle

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 (Download Center).*

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 For more details refer to *MID Annex MI-004* on page 18
Signal converter	
Inputs / outputs	Current (incl. HART®), pulse, frequency and/or status output, limit switch and/or control input (depending on the I/O version)
Totaliser	Optional 2 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: 128 x 64 pixels Corresponds to 59 x 31 mm = 2.32" x 1.22"
	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 (with a minimum of 1 meter/ 3.3 ft)
Maximum measuring error	
Class 1	± 1% (1 + 0.01 q_p / q) = with limit of 3.5%
Class 2	± 2% (2 + 0.02 q_p / q) = with limit of 5%
Class 3	± 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 with a minimum of 1 m/ 3.3 ft
	Minimal straight outlet flow: 3 DN
	Forward and reverse (bi-directional) flow
	Orientation: horizontal, vertical
	Ratio: up to 100
	Maximum operating pressure: 40 bar- 580 psi at 20°C - 68°F / 32 bar - 460psi at 180°C - 356°F
	For more details refer to *MID Annex MI-004* on page 18
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
	Ambient temperatures below -25°C / -13°F may affect the readability of the display.
Protect inside electronics against self-heating. 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...80": 150 lb RF
	1...80": 300 lb RF
Properties of medium	
Physical condition	Liquid, water, heated or chilled
Permissible gas content	≤ 2% (volume)
Permissible solid content	≤ 5% (volume)

Installation conditions

Installation	For detailed information refer to *Installation* on page 23.
Inlet run	Minimal 10 DN (straight inlet with a minimum of 1 m/ 3.3 ft)
Outlet run	Minimal 3 DN (straight outlet)
Dimensions and weights	For detailed information refer to *Dimensions and weights* on page 20.

Materials

Measuring sensor	
Flanges (wetted)	DN25...65 / 1...2½": stainless steel 1.4401 / 1.4404 - AISI 316/316L
	DN80...2000 / 3...80": carbon steel A105N
	Option: stainless steel 1.4401 / 1.4404 - AISI 316/316L
	Other materials on request.
Measuring tube (wetted)	DN25...65 / 1...2½": stainless steel 1.4401 / 1.4404 - AISI 316/316L
	DN80...2000 / 3...80": carbon steel A106 gr B or equivalent
	Option: stainless steel 1.4404 / AISI 316L
Measuring sensor housing	DN25...300 / 1"...12": carbon steel
	Option: stainless steel 1.4404 / AISI 316L
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; standard coated
	Option: stainless steel 316 / 1.4408
Coating (flow sensor)	Standard coating
Signal converter	
Housing	Versions C and F: die-cast aluminium
	Option: stainless steel 316 / 1.4408
Coating	Standard coating

Electrical connections

Description of used abbreviations; Q = xxx; I_{max} = maximum current; V_{in} = xxx; V_{int} = internal voltage; V_{ext} = external voltage; $V_{int, max}$ = 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	V_{ext} = external voltage; R_L = load + resistance; V_0 = terminal voltage; I_{nom} = nominal current Safety limit values (Ex i): V_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		
Operating data	**Basic I/Os**	**Modular I/Os**	
Active	$V_{int, nom}$ = 24 VDC I ≤ 22 mA R_L ≤ 1 kΩ		
Passive	V_{ext} ≤ 32 VDC I ≤ 22 mA V_0 ≥ 1.8 V $R_{L, max} = (V_{ext} - V_0 / I_{max}$		

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	Pulse / 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)		
Operating data	Basic I/Os	Modular I/Os	
Active	-	V_{nom} = 24 VDC	
		f_{max} in operating menu set to: f_{max} **≤ 100 Hz:** I ≤ 20 mA $R_{L, max}$ = 47 kΩ open: I ≤ 0.05 mA closed: $V_{0,nom}$ = 24 V at I = 20 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 open: I ≤ 0.05 mA closed: $V_{0,nom}$ = 22.5 V at I = 1 mA $V_{0,nom}$ = 21.5 V at I = 10 mA $V_{0,nom}$ = 19 V at I = 20 mA	

Passive	V_{ext} ≤ 32 VDC		-
	f_{max} in operating menu set to: f_{max} ≤ 100 Hz: I ≤ 100 mA $R_{L, max}$ = 47 kΩ $R_{L, max} = (V_{ext} - V_0) / I_{max}$ open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 0.2 V at I ≤ 10 mA $V_{0, max}$ = 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 $R_{L, max} = (V_{ext} - V_0) / I_{max}$ open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 1.5 V at I ≤ 1mA $V_{0, max}$ = 2.5 V at I ≤ 10 mA $V_{0, max}$ = 5.0 V at I ≤ 20 mA		
NAMUR	-	Passive to EN 60947-5-6 open: I_{nom} = 0.6 mA closed: I_{nom} = 3.8 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	Modular I/Os	
Active	-	V_{int} = 24 VDC I ≤ 20 mA $R_{L, max}$ = 47 kΩ open: I ≤ 0.05 mA closed: $V_{0, nom}$ = 24 V at I = 20 mA	
Passive	V_{ext} ≤ 32 VDC I ≤ 100 mA $R_{L, max}$ = 47 kΩ $R_{L, max}$ = (V_{ext} - V_0) / I_{max} open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 0.2 V at I ≤ 10 mA $V_{0, max}$ = 2 V at I ≤ 100 mA	V_{ext} = 32 VDC I ≤ 100 mA $R_{L, max}$ = 47 kΩ $R_{L, max}$ = (V_{ext} - V_0) / I_{max} open: I ≤ 0.05 mA at V_{ext} = 32 VDC closed: $V_{0, max}$ = 0.2 V at I ≤ 10 mA $V_{0, max}$ = 2 V at I ≤ 100 mA	
NAMUR	-	Passive to EN 60947-5-6 open: I_{nom} = 0.6 mA closed: I_{nom} = 3.8 mA	

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	Modular I/Os	
Active	-	V_{int} = 24 VDC Terminals open: $V_{0, nom}$ = 22 V Terminals bridged: I_{nom} = 4 mA On: $V_0 \geq$ 12 V with I_{nom} = 1.9 mA Off: $V_0 \leq$ 10 V with I_{nom} = 1.9 mA	
Passive	$V_{ext} \leq$ 32 VDC I_{max} = 6.5 mA at $V_{ext} \leq$ 24 VDC I_{max} = 8.2 mA at $V_{ext} \leq$ 32 VDC Contact closed (On): $V_0 \geq$ 8 V with I_{nom} = 2.8 mA Contact open (Off): $V_0 \leq$ 2.5 V with I_{nom} = 0.4 mA	$V_{ext} \leq$ 32 VDC I_{max} = 9.5 mA at $V_{ext} \leq$ 24 V I_{max} = 9.5 mA at $V_{ext} \leq$ 32 V Contact closed (On): $V_0 \geq$ 3 V with I_{nom} = 1.9 mA Contact open (Off): $V_0 \leq$ 2.5 V with I_{nom} = 1.9 mA	
NAMUR	-	Active to EN 60947-5-6 Contact open: $V_{0, nom}$ = 8.7 V Contact closed (On): I_{nom} = 7.8 mA Contact open (off): $V_{0, nom}$ = 6.3 V with I_{nom} = 1.9 mA Identification for open terminals: $V_0 \geq$ 8.1 V with $I \leq$ 0.1 mA Identification for short circuited terminals: $V_0 \leq$ 1.2 V with $I \geq$ 6.7 mA	

Approvals and certificates

CE	
This device fulfils the statutory requirements of the relevant directives. The manufacturer certifies successful testing of the product by applying the conformity mark on the device.	
	For more information on the directives, standards and the approved certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.
NAMUR	NE 21, 43, 53, 80, 107
MID directive	Directive 2014/32/EU, Annex VI (MI-004) For more information, please refer to the dedicated documentation.
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 114)
IECEx	Approval number: IECEx KIWA15.0033 X
ATEX	Approval number: KIWA 15ATEX0007 X
Protection category acc. to IEC 60529	**Signal converter**
	Compact (C): IP66/67, NEMA 4X/6
	Field (F): IP66/67, NEMA 4X/6
	Flow sensors
	IP66/67, NEMA 4X/6
Shock resistance	IEC 60068-2-27
	30 g for 18 ms
Vibration resistance	IEC 60068-2-6; 1 g up to 2000 Hz
	IEC 60721; 10 g

2.2 MID Annex MI-004

All liquid flow meters for heated water e.g. 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 for class 2 and 3 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).

In general 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 flow rate: $Q_p \geq 0.1 \times Q_p$ (max)

Q_s = flow range

Q_p = maximum flow

Q_i = minimum flow

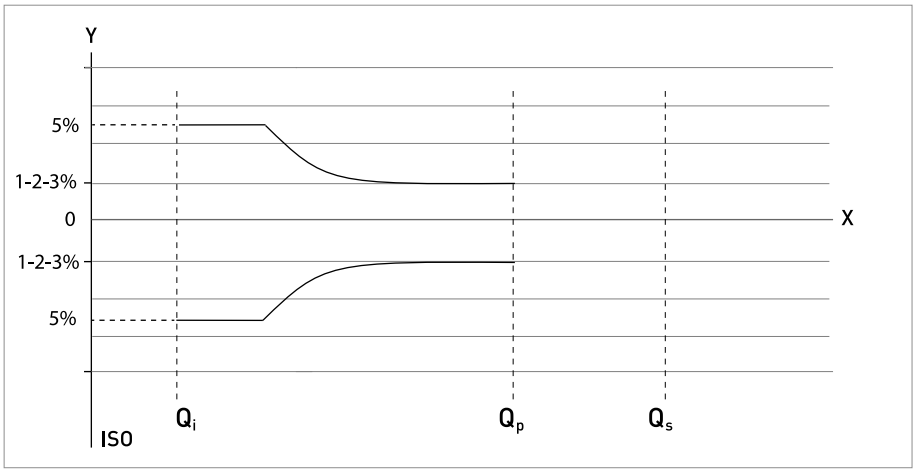


Figure 2-1: ISO flow rates added to figure as comparison towards MID
X: Flow rate
Y [%]: Maximum measuring error

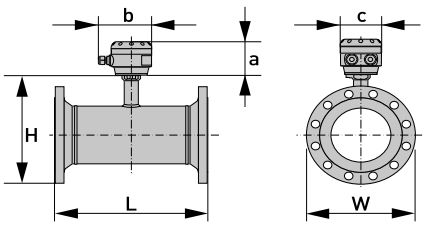
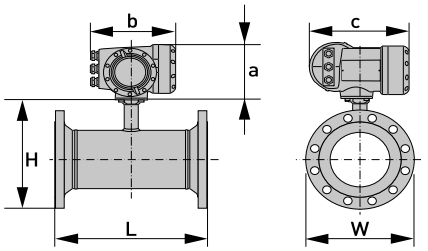
MI-004 certified flow characteristics; valid for accuracy classes 2 and 3

DN Size	Maximum pressure rating	Overall length [mm]		Flow rate [m^3/h]		
		Min.	Max.	Q_s	Q_p	Q_i
25	PN 40	250	400	18 (27)	18	0.18
32	PN 40	260	400	29 (44)	29	0.29
40	PN 40	270	400	45 (68)	45	0.45
50	PN 40	300	475	71 (106)	71	0.71
65	PN 40	300	475	180	120	1.2
80	PN 40	300	400	180 (270)	180	1.8
100	PN 40 *	350	400	280 (430)	280	2.8
125	PN 40 *	350	400	500	440	4.4
150	PN 40 *	350	400	630	630	6.3
200	PN 40 *	400	500	1130	1130	11.3
250	PN 40 *	400	600	1750	1750	17.5
300	PN 40 *	500	600	2500	2500	25.0
350	PN 40 *	500	880	3400	3400	34.0
400	PN 40 *	600	975	4500	4500	45.0
450	PN 40 *	600	1000	5750	5750	57.5
500	PN 40 *	600	1080	7000	7000	70.0
600	PN 40 *	600	1165	10000	10000	100
700	PN 40 *	800	1240	14000	14000	140
800	PN 40 *	800	1240	18000	18000	180
900	PN 40 *	900	1370	23000	23000	230
1000	PN 40 *	1000	1370	28000	28000	280
1200	PN 40 *	1200	1600	40000	40000	400
1400	PN 40 *	1400	1800	55000	55000	550
1600	PN 40 *	1600	2000	70000	70000	700
1800	PN 40 *	1600	2100	90000	90000	900
2000	PN 40 *	1800	2100	113000	113000	1130

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

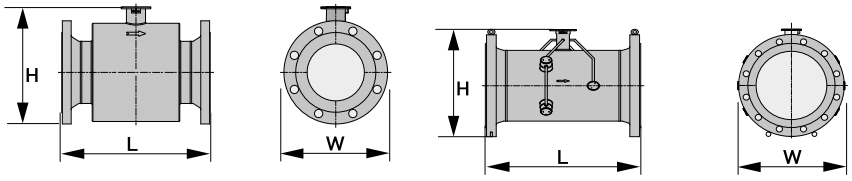
Between brackets ( ) ; Q_s value only valid for accuracy classes 2 & 3 (class 1 is not available).

2.3 Dimensions and weights

Remote version		a = 88 mm / 3.5" b = 139 mm / 5.5" ① c = 106 mm / 4.2" Total height = H + a ②
Compact version		a = 155 mm / 6.1" b = 230 mm / 9.1" ① c = 260 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.

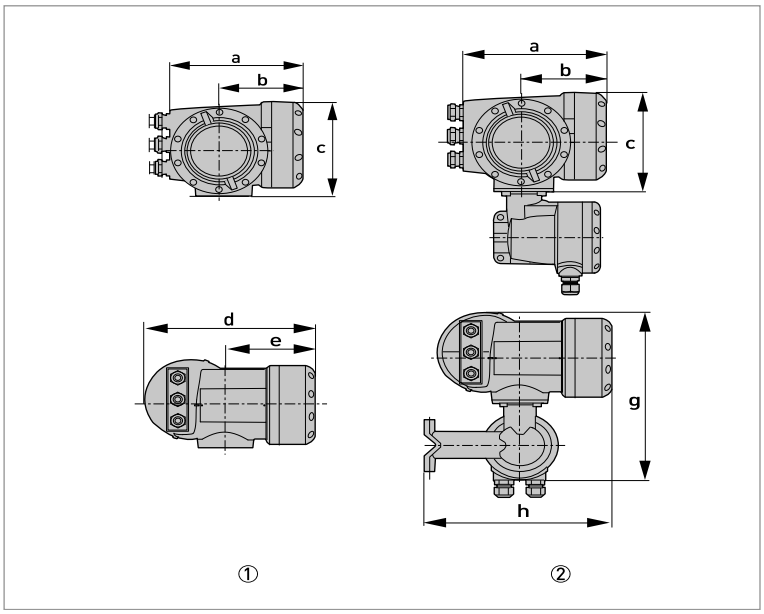
EN1092-1; Standard variant - PN 40

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 PN 25, PN 16, PN 10 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 ddesigned exclusively for flow measurement in both unidirectional (standard operation) and bidirectional applications, on conductive and / or nonconductive fluids. Contaminations, like entrained gas, particles, 2 phase and non-homogeneous mixtures, can affect the acoustic signal and 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, the 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

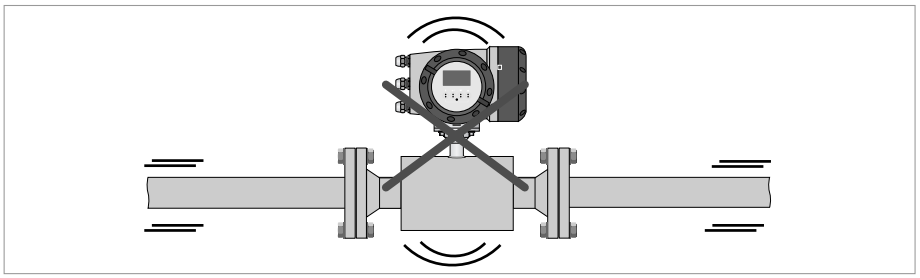


Figure 3-1: Avoid vibrations

In case of expected vibrations, please install a remote signal converter (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 sun shield 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 vibrations and mechanical shocks. The measuring devices are tested for a vibration/shock level as described in the chapter "Technical data".

3.5 Installation conditions

3.5.1 Inlet and outlet

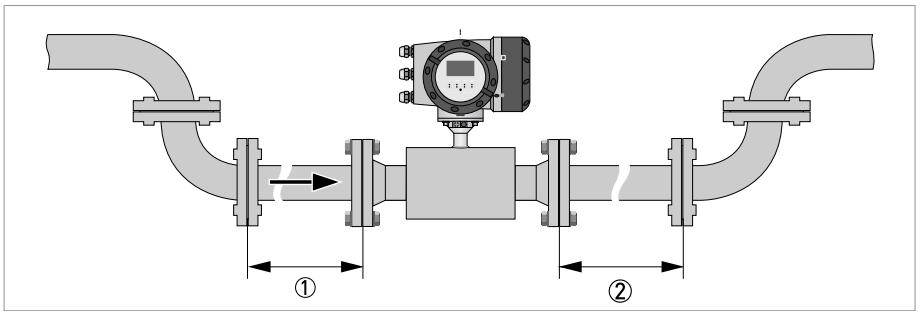


Figure 3-2: Required inlet and outlet

① Minimal 10 DN with a minimum of 1 meter/ 3.3 ft (straight inlet)

② ≥ 3 DN

3.5.2 Bends

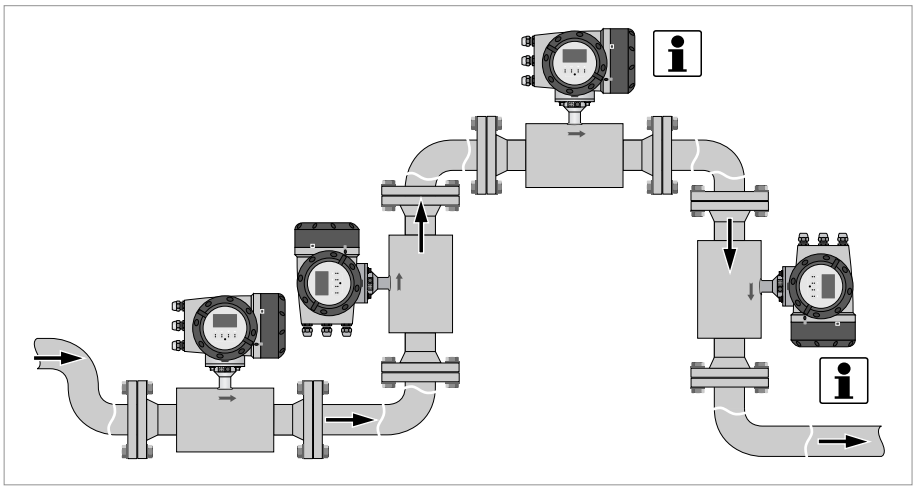


Figure 3-5: Installation in bending pipes (90°)

NOTE!
Recommended installation positions are at a lowered or ascending section of the pipeline installation. Installation at the highest point will enlarge the risk of flowmeter malfunction, because of air/gas bubbles.
Vertical installation in combination with an open discharge has to be avoided.
Vertical installation with a controlled back-pressure is possible.

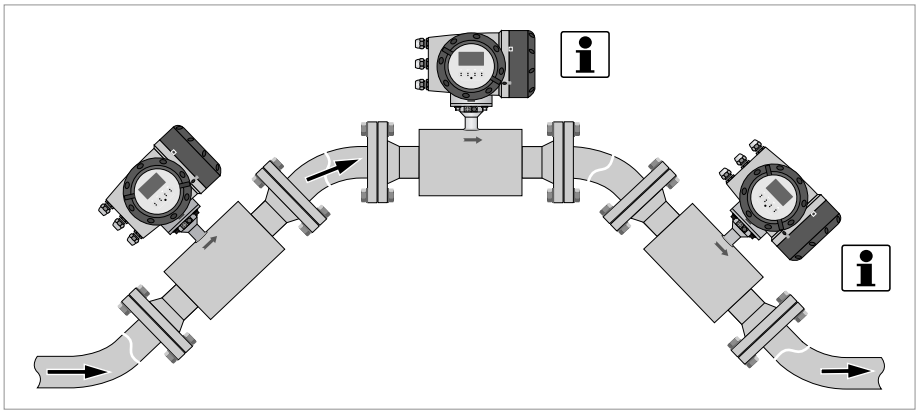


Figure 3-6: Installation in bending pipes (45°)

NOTE!
Vertical installation on a descending slope in the pipeline is only recommended when the back-pressure is controlled.

3.5.3 Position of pump

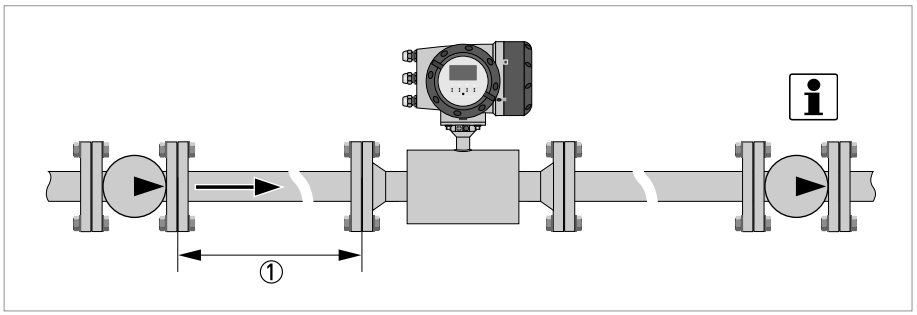


Figure 3-7: Installation behind a pump

① ≥ 15 DN

Provide a minimum straight upstream length ≥ 15 DN to ensure resolving of flow disturbances.

NOTE!
Recommended position to install a flowmeter is downstream a pump (on a position where the flow disturbances of the pump are resolved).
An ultrasonic flowmeter can be installed in the suction line of a pump if there is no cavitation in the pipeline system.

3.5.4 Control valve

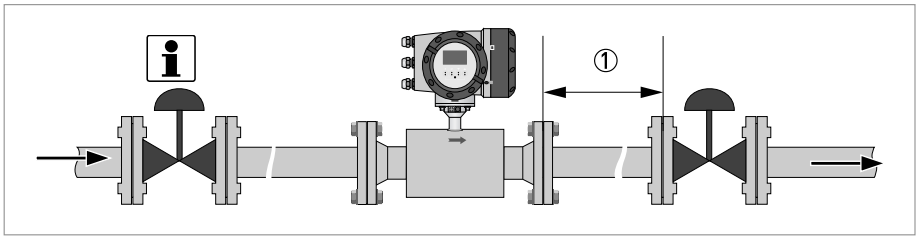


Figure 3-8: Installation in front of a control valve

① ≥ 3 DN

NOTE!
Recommended position to install a flowmeter is upstream a control valve.
An ultrasonic flowmeter can be installed downstream of the control valve if there is no cavitation in the pipeline system (e.g. flow profile disturbances are resolved).

3.5.5 Open feed or discharge

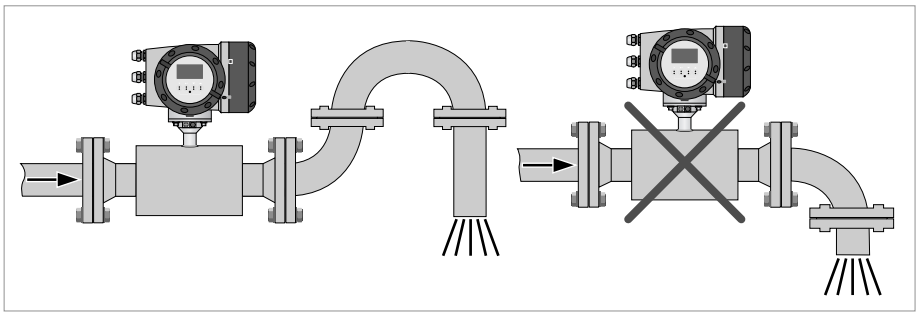


Figure 3-9: Open discharge

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

3.5.6 Insulation

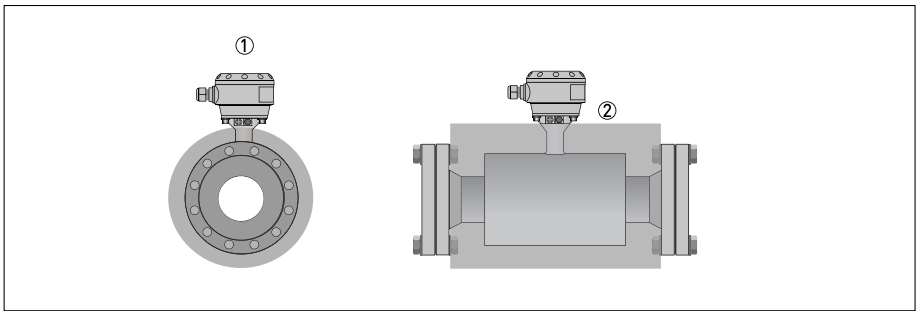


Figure 3-10: Insulation

① Connection box or compact converter
② Insulation area

The flow sensor can be insulated completely, except for the connection box (or the signal converter on the compact version).

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

3.5.7 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

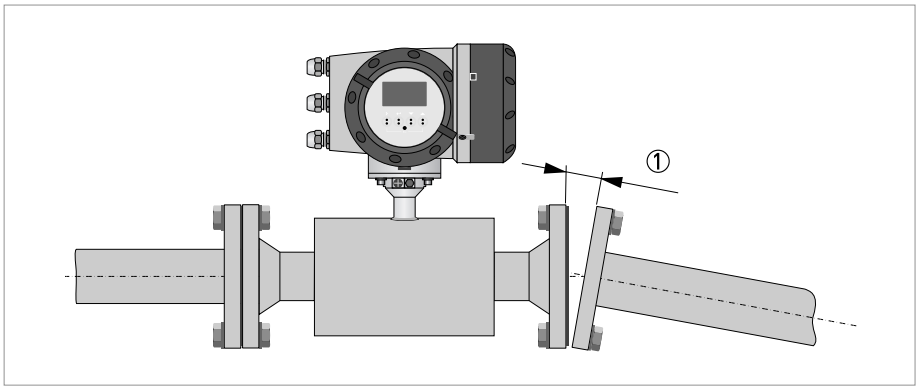


Figure 3-11: Flange deviation

① M_{max}

3.5.8 Mounting position

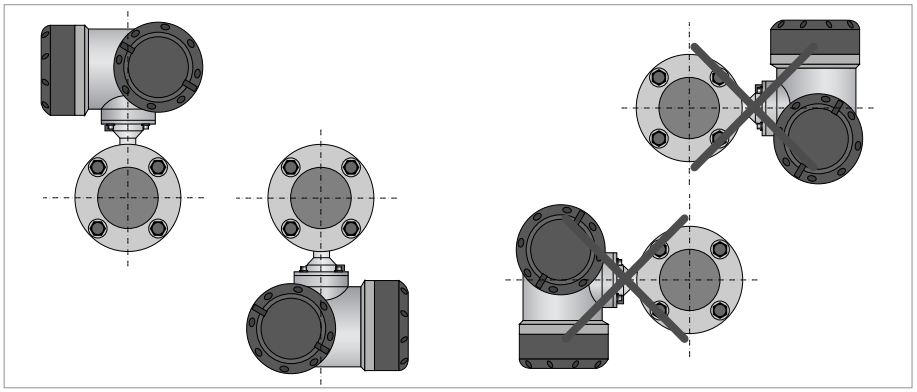


Figure 3-12: Installation position on horizontal pipe sections

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 6(labeled) inner coax cables for the connection of maximal three acoustic paths.

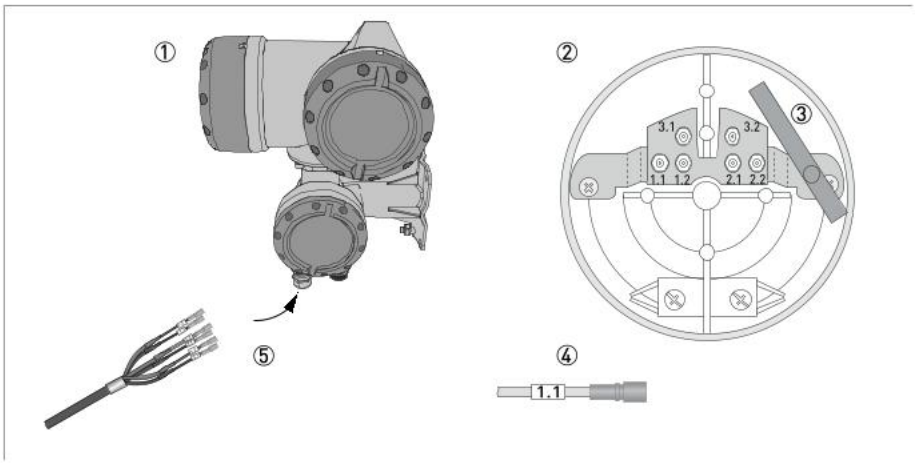


Figure 4-1: Construction of field version

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

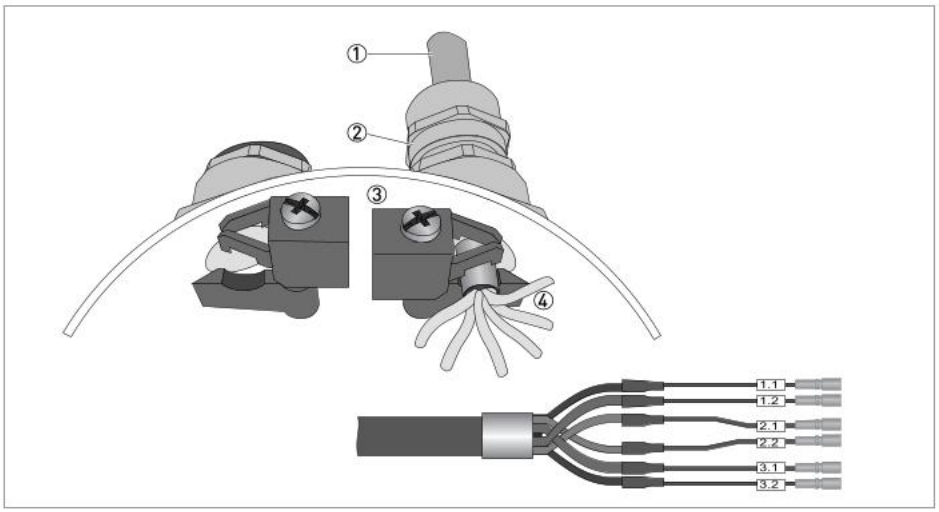


Figure 4-2: Clamp the cables on the shielding bush

① Cables
② Cable glands
③ Grounding clamps
④ Cable with metal shielding bush

Electrical connection - Standard version

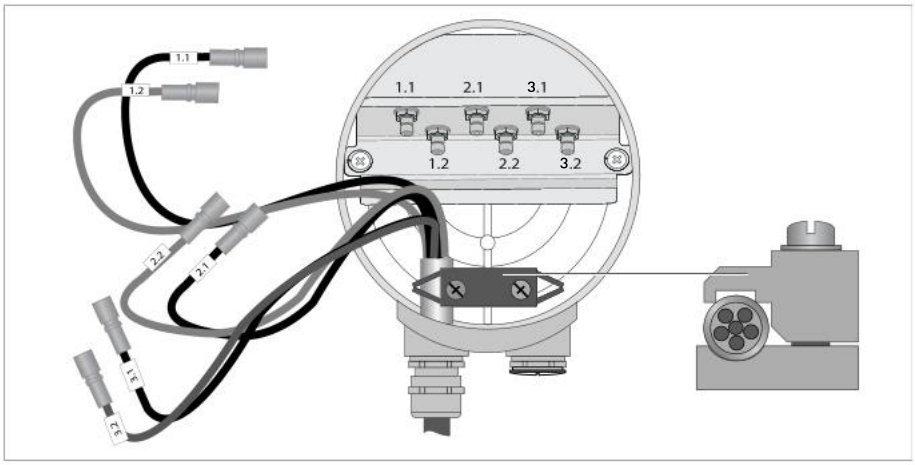


Figure 4-3: Connect the cables in the connection box of the flow sensor.

Connect the cable on connector with similar numeral marking.

4.3 Power supply

If 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 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.

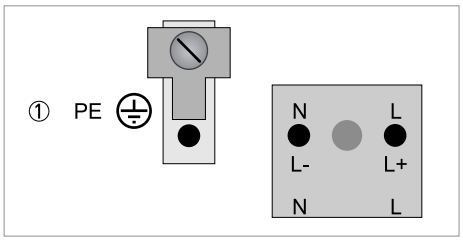


Figure 4-4: Power supply connection

① 100...230 VAC (-15% / +10%), 22 VA

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 in Basic version with fixed outputs or as a Modular I/O with a flexible I/O configuration and communication within the available options.

Basic version

- Has 1 current output with HART 7, 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.

Modular version

- Depending on the task, the device can be configured with various output modules .

Ex option

- For hazardous areas, all of the input/output variants for compact and field housings 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

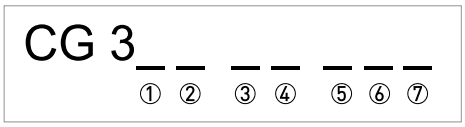


Figure 4-5: Marking (CG number) of the electronics module and input/output variants

① ID number: 5
② ID number: 0 = standard
③ Power supply option
④ Display (language versions)
⑤ Input/output version (I/O)
⑥ 1st optional module for connection terminal A
⑦ 2nd optional module for connection terminal B

The last 3 digits of the CG number (⑤ , ⑥ and ⑦) indicate the assignment of the terminal connections.Please refer to the following examples.

Examples for CG number-35021100

CG 350 21 100	100...230 VAC & standard display; basic I/O: I_a or I_p & S_p/C_p & S_p & P_p/S_p

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 gray boxes in the tables denote unassigned or unused connection terminals.
- In the table, only the final digits of the CG no. are depicted.
- Connection terminal A+ is only operable in the basic input/output version.

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

4.4.4 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.
- Term. = (connection) terminal

CG no.	Connection terminals								
	A+	A	A-	B	B-	C	C-	D	D-
Modular IOs (option)									
4 _ _		max. 2 optional modules for term. A + B				I_a + HART® active		P_a / S_a active ①	
8 _ _		max. 2 optional modules for term. A + B				I_p + HART® passive		P_a / S_a active ①	

① 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:
Inner / 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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