



OPTISONIC 3400 Technical Datasheet

Multi purpose, all round, ultrasonic flowmeter for liquids in all industrial processes

- Measurement of conductive and non-conductive, low and high viscous liquids, from -200°C to +250°C media temperature
- Accurate bi-directional measurement that starts from zero flow
- Advanced signal converter, covering all I/O 's, HART[®]7, FOUNDATION[™]fieldbus, Modbus communication protocols with NAMUR NE107 diagnostics



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1.1 Multipurpose, all round ultrasonic flow meter in all process industries

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 **OPTISONIC 3400**. This flowmeter is able to measure:

- conductive and non-conductive liquids
- cryogenic - and high process temperatures
- standard and straightforward applications and applications that require high performance
- non-viscous aqueous liquids and extreme viscous liquids
- low pressure ratings and extreme pressure ratings



- 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.

Fieldbusses are, HART[®]7, Foundation Fieldbus, Profibus PA and Modbus, all with NAMUR NE 107. These advanced diagnostic features makes process life comfortable, reliable and accurate over a long period of time.

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

- Advanced signal converter with full range of I/O 's and communication protocols
- Diagnostic functions according to NAMUR NE107
- Improved user interface: optical- and push buttons
- 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
- Multipurpose, all round, ultrasonic flowmeter for single phase liquids

Industries

- Chemicals
- Petrochemicals
- Oil & Gas
- Energy
- Water (utilities)

Applications

- Conductive and non-conductive liquids
- Cryogenic- and high process temperature, low and extreme high pressure range
- Expanded applicability; for standard and high performance applications
- Measuring aqueous liquids as well as extreme viscous oils
- High turn down ratio; e.g. transportation pipeline measurements
- Broad pressure and temperature range (e.g. midstream oil measurements)
- Multiple products; e.g. allocation measurements in on/off loading
- Water utilities in all process industries; make-up water, boiler feed water, demineralized water

1.2 Variants

An **OPTISONIC 3400** flow meter consists of an OPTISONIC 3000 flow sensor and a UFC 400 signal converter. The standard version is available as a compact and remote version. Next to standard, also variants for demanding applications can be supplied.

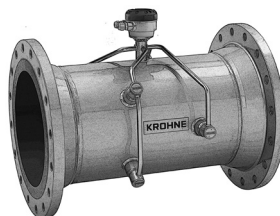


- **Compact** version up to 140°C [284 °F]
- Aluminium or Stainless Steel housing



UFC 400

- Remote;
Aluminium
or Stainless
Steel
housing



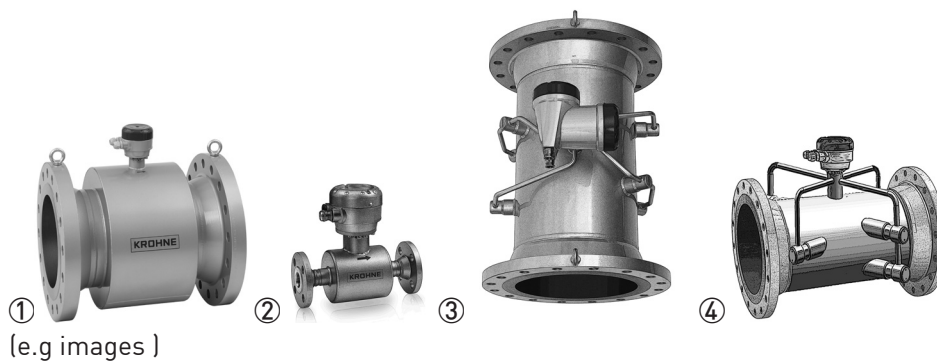
- **Remote** version up to 180°C [356 °F]
- Aluminium or Stainless Steel housing
Ex and non-Ex
IP66/IP67

OPTISONIC 3000

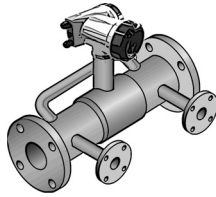
Flow sensor variants for demanding applications

A full range of sensors to cover simple to difficult applications, such as;

1. For extended process temperatures up to 250°C [482°F] (remote version)
2. Cryogenic version: for extreme low process temperatures, as low as minus 200°C [-328°F] (remote version, IP68)
3. High viscous liquids: ranging from 100...1000 cSt
4. High pressure rating

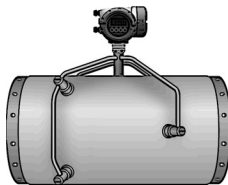


1.3 Features on request



Including heating jacket

- for steam or thermal oil tracing of the flowmeter
- suitable for standard and variant for extended process temperatures (remote)



Flangeless, weld-in connections

- greenfield
- flexibility in innerpipe diameters

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.

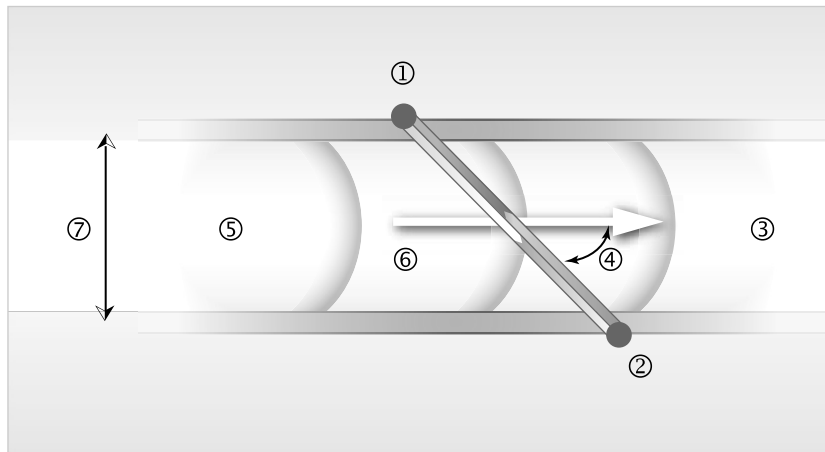


Figure 1-1: Measuring principle

- 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 (Download Center).*

Measuring system

Measuring principle	Ultrasonic transit time
Application range	Flow measurement of (non) conductive fluids
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 path 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...3000 / 1...120"
Measurement range	0.3...20 m/s / 0.98...65 ft/s
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	2 (optional 3) 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.
Communication interfaces	Modbus RS485, HART® 7, Foundation Fieldbus ITK6, Profibus PA Profile 3.02 (pending)

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 optical- and push buttons for operator control of the signal converter without opening the housing.
	Option: Infrared interface (GDC)
Remote operation	PACTware™ including Device Type Manager (DTM)
	HART® handheld communicator (Emerson), AMS (Emerson), PDM (Siemens)
	All DTM's and drivers will be available at the internet homepage of the manufacturer.
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	English, French, German, Dutch
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, HART® or via other bus interface
	Sensor diagnostics: per acoustic path velocity of sound, flow speed, gain, signal to noise ratio
	Process diagnostics: empty pipe, signal integrity, cabling, flow conditions
	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	
Standard:	±0.3% ±2 mm/s of actual measured flow rate (depending on the measuring sensor)
Repeatability	0.2%

Operating conditions

Temperature	
Process temperature	Compact version: -45...+140°C / -49...+284°F (for SS housing at ambient temperature ≤ 45°C)
	Remote version: -45...+180°C / -49...+356°F
	Extended temperature version: -45...+250°C / -49...+482°F (only remote version)
	Cryogenic version: -200...+180°C / -328...+356°F (only remote version, IP68, complete stainless steel)
	Carbon steel flanges; minimal process temperatures acc. to EN1092: -10°C / +14°F; ASME: -29°C / -20°F
Ambient temperature	Depending on the version and combination of outputs.
	-40...+65°C / -40...+149°F
	Option (stainless steel converter housing): -40...+60°C / -40...+140°F.
	Ambient temperatures below -25°C / -13°F may affect the readability of the display.
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). 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.	
Storage temperature	-50...+70°C / -58...+158°F
Pressure	
Atmospheric	
EN 1092-1	DN25...50: PN 40
	DN100...150: PN 16
	DN200...1000: PN 10
	DN1200...2000: PN 6
	DN2200...3000: PN 2.5
	Higher pressure ratings on request
ASME B16.5	1...24": 150 lb RF
	1...24": 300 lb RF
	1...24": 600 lb RF
	1...24": 900 lb RF
	Larger diameters on request.
JIS	DN25...40: 20K
	DN50...300: 10K
Properties of medium	
Physical condition	Liquid, single phase (well mixed, rather clean)
Permissible gas content	≤ 2% (volume)
Permissible solid content	≤ 5% (volume)
Viscosity	Standard: Up to 100 cSt (for all diameters higher; on request)
	Option: High viscosity variant up to 1000 cSt (for compact and remote version)

Installation conditions

Installation	For detailed information refer to <i>Installation</i> on page 28.
Inlet run	Minimal 5 DN (straight inlet)
	If no details are known, minimal 10 DN. (recommended)
Outlet run	Minimal 3 DN. (straight outlet)
	If no details are known; minimal 5 DN recommended
Dimensions and weights	For detailed information refer to <i>Dimensions and weights</i> on page 21.

Materials

Sensor	
Flanges (wetted)	DN25...65 / 1"....2.5": Stainless steel 1.4404 (AISI 316L)
	DN80...3000 / 3"....120": Carbon steel
	Other materials on request.
Measuring Tube (wetted)	DN25...300 / 1"....12": Stainless steel 1.4404 (AISI 316L), some 316Ti / 1.4571
	DN350...3000 / 14"....120": Carbon steel
	Other materials on request.
Sensor housing	DN25...65 / 1"....2.5": Stainless steel 1.4404 (AISI 316L)
	DN80...3000 / 3"....120": Carbon steel
Transducer	
Transducers (wetted)	Stainless steel 1.4404 (AISI 316L)
	Other materials on request.
Transducer holders incl. caps	DN350...3000 / 14"....120"; Stainless steel 1.4404 (AISI 316L) (same material as flanges)
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 (sensor)	Standard: Polyurethane
	Option: Offshore coating
NACE conformity	On request; wetted materials conform NACE MR 175/103
Converter	
Converter housing	Versions C and F: Die-cast aluminium
	Option: Stainless steel 316 (1.4408)
Coating	Standard: Polyurethane
	Option: Offshore coating

Electrical connections

Description of used abbreviations; Q=xxx; I _{max} = maximum current; U _{in} =xxx; U _{int} = internal voltage; U _{ext} = external voltage; U _{int max} = maximal internal	
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
	Option: 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%)
Power consumption	AC: 22 VA
	DC: 12 W
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; U₀ = 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 1, 2, 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		
Operating data	Error identification: 3...22 mA		
	Basic I/Os	Modular I/Os	Ex i
Active	$U_{\text{int, nom}} = 24 \text{ VDC}$ $I \leq 22 \text{ mA}$ $R_L \leq 1 \text{ k}\Omega$		$U_{\text{int, nom}} = 20 \text{ VDC}$ $I \leq 22 \text{ mA}$ $R_L \leq 450 \Omega$
			$U_0 = 21 \text{ V}$ $I_0 = 90 \text{ mA}$ $P_0 = 0.5 \text{ W}$ $C_0 = 90 \text{ nF} / L_0 = 2 \text{ mH}$ $C_0 = 110 \text{ nF} / L_0 = 0.5 \text{ mH}$
Passive	$U_{\text{ext}} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $U_0 \geq 1.8 \text{ V}$ $R_{L, \text{ max}} = (U_{\text{ext}} - U_0) / I_{\text{ max}}$		$U_{\text{ext}} \leq 32 \text{ VDC}$ $I \leq 22 \text{ mA}$ $U_0 \geq 4 \text{ V}$ $R_{L, \text{ max}} = (U_{\text{ext}} - U_0) / I_{\text{ max}}$
			$U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i \sim 0 \text{ mH}$

HART®			
Description	HART® protocol via active and passive current output		
	HART® version: V7		
	Universal HART® parameter: completely integrated		
Load	≥ 250 Ω t HART® test point: Note maximum load for current output!		
Multidrop	Yes, current output = 4 mA		
	Multidrop addresses adjustable in operation menu 1...15		
Device drivers	DD for FC 375/475, AMS, PDM, DTM for FDT		
Pulse or frequency output			
Output data	Volume flow, mass flow		
Function	Adjustable as pulse or frequency output		
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	Ex i
Active	-	U _{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: U _{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: U _{0, nom} = 22.5 V at I = 1 mA U _{0, nom} = 21.5 V at I = 10 mA U _{0, nom} = 19 V at I = 20 mA	

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} - U₀) / 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} - U₀) / I_{max} open: I ≤ 0.05 mA at U_{ext} = 32 VDC closed: U_{0, max} = 1.5 V at I ≤ 1mA U_{0, max} = 2.5 V at I ≤ 10 mA U_{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	open: I _{nom} = 0.43 mA closed: I _{nom} = 4.5 mA
			U _i = 30 V I _i = 100 mA P _i = 1 W C _i = 10 nF L _i = 0 mH

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	Ex i
Active	-	$U_{int} = 24 \text{ VDC}$ $I \leq 20 \text{ mA}$ $R_{L, max} = 47 \text{ k}\Omega$ open: $I \leq 0.05 \text{ mA}$ closed: $U_{0, nom} = 24 \text{ V}$ at $I = 20 \text{ mA}$	-
Passive	$U_{ext} \leq 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, max} = (U_{ext} - U_0) / I_{max}$ open: $I \leq 0.05 \text{ mA}$ at $U_{ext} = 32 \text{ VDC}$ closed: $U_{0, max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $U_{0, max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$	$U_{ext} = 32 \text{ VDC}$ $I \leq 100 \text{ mA}$ $R_{L, max} = 47 \text{ k}\Omega$ $R_{L, max} = (U_{ext} - U_0) / I_{max}$ open: $I \leq 0.05 \text{ mA}$ at $U_{ext} = 32 \text{ VDC}$ closed: $U_{0, max} = 0.2 \text{ V}$ at $I \leq 10 \text{ mA}$ $U_{0, max} = 2 \text{ V}$ at $I \leq 100 \text{ mA}$	-
NAMUR	-	Passive to EN 60947-5-6 open: $I_{nom} = 0.6 \text{ mA}$ closed: $I_{nom} = 3.8 \text{ mA}$	Passive to EN 60947-5-6 open: $I_{nom} = 0.43 \text{ mA}$ closed: $I_{nom} = 4.5 \text{ mA}$ $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$

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	Ex i
Active	-	$U_{int} = 24 \text{ VDC}$ Terminals open: $U_{0, nom} = 22 \text{ V}$ Terminals bridged: $I_{nom} = 4 \text{ mA}$ On: $U_0 \geq 12 \text{ V}$ with $I_{nom} = 1.9 \text{ mA}$ Off: $U_0 \leq 10 \text{ V}$ with $I_{nom} = 1.9 \text{ mA}$	-
Passive	$U_{ext} \leq 32 \text{ VDC}$ $I_{max} = 6.5 \text{ mA}$ at $U_{ext} \leq 24 \text{ VDC}$ $I_{max} = 8.2 \text{ mA}$ at $U_{ext} \leq 32 \text{ VDC}$ Contact closed (On): $U_0 \geq 8 \text{ V}$ with $I_{nom} = 2.8 \text{ mA}$ Contact open (Off): $U_0 \leq 2.5 \text{ V}$ with $I_{nom} = 0.4 \text{ mA}$	$U_{ext} \leq 32 \text{ VDC}$ $I_{max} = 9.5 \text{ mA}$ at $U_{ext} \leq 24 \text{ V}$ $I_{max} = 9.5 \text{ mA}$ at $U_{ext} \leq 32 \text{ V}$ Contact closed (On): $U_0 \geq 3 \text{ V}$ with $I_{nom} = 1.9 \text{ mA}$ Contact open (Off): $U_0 \leq 2.5 \text{ V}$ with $I_{nom} = 1.9 \text{ mA}$	$U_{ext} \leq 32 \text{ VDC}$ $I \leq 6 \text{ mA}$ at $U_{ext} = 24 \text{ V}$ $I \leq 6.6 \text{ mA}$ at $U_{ext} = 32 \text{ V}$ On: $U_0 \geq 5.5 \text{ V}$ or $I \geq 4 \text{ mA}$ Off: $U_0 \leq 3.5 \text{ V}$ or $I \leq 0.5 \text{ mA}$
			$U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i = 10 \text{ nF}$ $L_i = 0 \text{ mH}$
NAMUR	-	Active to EN 60947-5-6 Contact open: $U_{0, nom} = 8.7 \text{ V}$ Contact closed (On): $I_{nom} = 7.8 \text{ mA}$ Contact open (off): $U_{0, nom} = 6.3 \text{ V}$ with $I_{nom} = 1.9 \text{ mA}$ Identification for open terminals: $U_0 \geq 8.1 \text{ V}$ with $I \leq 0.1 \text{ mA}$ Identification for short circuited terminals: $U_0 \leq 1.2 \text{ V}$ with $I \geq 6.7 \text{ mA}$	-

PROFIBUS PA (pending)	
Description	Galvanically isolated acc. to IEC 61158
	Profile version: 3.02
	Current consumption: 10.5 mA
	Permissible bus voltage: 9...32 V; in Ex application 9...24 V
	Bus interface with integrated reverse polarity protection
	Typical error current FDE (Fault Disconnection Electronic): 4.3 mA
	Bus address adjustable via local display on the measuring device
Function blocks	6 x analogue input, 3 x totaliser
Output data	Volume flow, mass flow, velocity of sound, flow speed, gain, SNR, electronic temperature, power supply (Further meas. values and diagnostic data is available via acyclic access)
FOUNDATION Fieldbus	
Description	Galvanically isolated acc. to IEC 61158
	Current consumption: 10.5 mA
	Permissible bus voltage: 9...32 V; in Ex application 9...24 V
	Bus interface with integrated reverse polarity protection
	Link Master function (LM) supported
	Tested with Interoperable Test Kit (ITK) version 6.0
Function blocks	4: 1 x analogue input, 2 x integrator, 1 x PID
Output data	Volume flow, mass flow, flow speed, electronic temperature, velocity of sound, gain, SNR Diagnostic data
MODBUS	
Description	Modbus RTU, Master / Slave, RS485
Address range	1...247
Supported function codes	01, 02, 03, 04, 05, 08, 16, 43
Supported Baudrate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud

Approvals and certificates

CE	
	This device fulfills 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, III or SEP
	Fluid group 1, table 6
	Production module H
NAMUR	NE 21,43,53,80,107
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 94/4 EC (ATEX 100a)
IECEX	Approval number; IECEX DEK13.0023 X
ATEX	DEKRA 13ATEX0092X
FM class 1, Div. 1 and 2	Approval number; [tbd]
CSA class 1 Div. 1 and 2	Approval number; [tbd]
NEPSI	Approval number; [tbd]
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)
	Option: IP68 (NEMA 6P)
Shock resistance	IEC 68-2-27
	30 g for 18 ms
Vibration resistance	IEC 68-2-6 ; 1g up to 2000 Hz.
	IEC 60721; 10g

2.2 Dimensions and weights

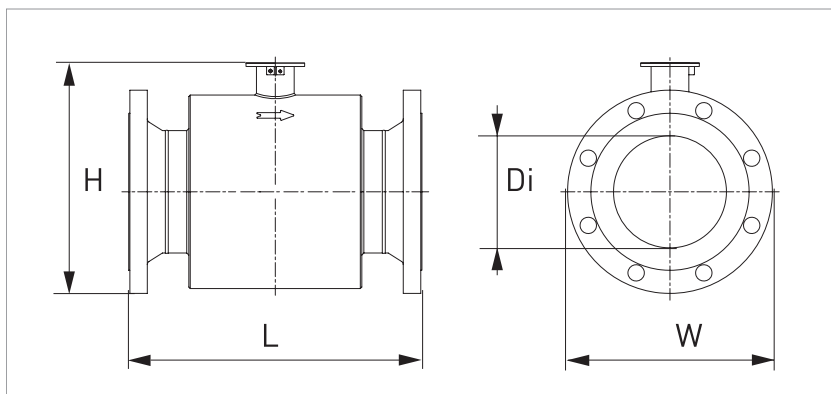
Remote version		a = 88 mm / 3.5"
		b = 139 mm / 5.5" ①
		c = 106 mm / 4.2"
		Total height = H + a
Compact version		a = 155 mm / 6.1"
		b = 230 mm / 9.1" ①
		c = 260 mm / 10.2"
		Total height = H + a

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

2.2.1 Variants;

Standard version; ≤ DN300 / 12"		DIN: L= 250..500 mm / 9.8"...19.7"
		ANSI: L= 250..500 mm / 9.8"...19.7"
		For all dimensions and options; see table (note; tables not final)
Extended temperature - High Viscosity - Cryogenic version; ≤ DN300 / 12"		DIN: L= 250..500 mm / 9.8"...19.7"
		ANSI: L= 250..550 mm / 9.8"...21.7"
		For all dimensions and options; see table (note; tables not final)
Standard version; ≥ DN350 / 14"		DIN: L= 500..600 mm / 19.7"...23.6"
		ANSI: L= 500..800 mm / 19.7"...31.5"
		For all dimensions and options; see table (note; tables not final)
Extended temperature - High Viscosity - Cryogenic version; ≥ DN350 / 14"		DIN: L= 500..700 mm / 19.7"...27.6"
		ANSI: L= 550..850 mm / 21.7"...33.5"
		For all dimensions and options; see table (note; tables not final)

2.2.2 Standard flow sensor DN300 and smaller



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

EN1092-1; Standard variant $\leq$ DN300

DIN \ DN		Standard PN / Dimensions [mm]			Optional PN / L (mounting length)		
	Approx. weight [kg]	L	H	W	PN16	PN25	PN40
25	6.5	250	150	115	-	-	250
32	8.5	260	162	140	-	-	260
40	9.5	270	167	150	-	-	270
50	12.5	300	190	165	-	-	300
65	15.5	300	200	185	-	-	300
80	16.5	300	239	200	-	-	300
100	19	350	262	220	350	350	350
125	23	350	288	250	350	350	350
150	28	350	320	285	350	400	400
200	51	400	394	340	400	400	450
250	61	400	445	395	400	450	500
300	76	500	495	445	500	500	500

ASME B16.5; Standard variant $\leq 12''$.

ASME size		Standard (PN 150 lb) / Dimensions [inch]			Optional PN / L (mounting length)		
	Approx. weight [lb]	L	H	W	300 lb	600 lb	900 lb
1	14	9.84	5.98	4.25	9.84	10.63	11.42
1¼	16	10.24	6.14	4.65	10.24	-	11.81
1½	20	10.63	6.34	5.0	10.63	11.42	11.81
2	24	11.81	7.4	6.0	11.81	12.99	14.57
2½	30	11.81	8.5	7.0	11.81	-	15.35
3	40	13.78	9.3	7.5	13.78	15.75	17.72
4	54	13.78	10.5	9.0	15.75	15.75	17.72
5	66	13.78	11.4	10.0	15.75	-	19.69
6	84	15.75	12.5	11.0	17.72	19.69	23.62
8	146	15.75	15.7	14.5	17.72	19.69	31.5
10	166	19.69	18.0	16.5	19.69	23.62	31.5
12	236	19.69	20.6	19.0	23.62	23.62	35.43

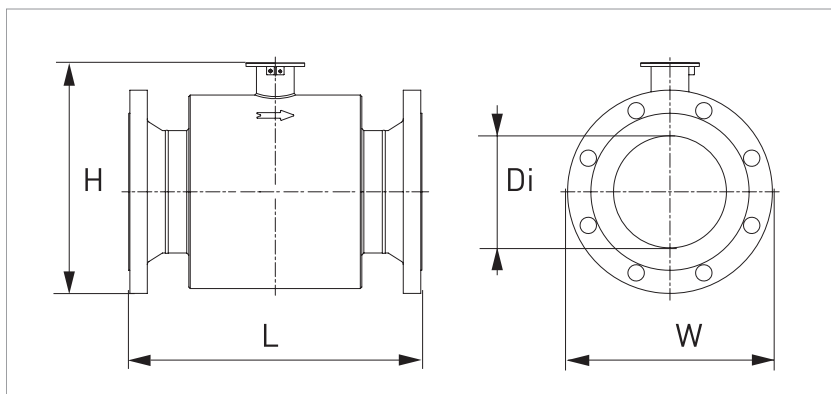
EN1092-1; Extended temperature, High Viscosity & Cryogenic variant $\leq \text{DN}300$

DIN \ DN		Standard PN / Dimensions [mm]			Optional PN / L (mounting length)		
	Approx. weight [kg]	L	H	W	PN16	PN25	PN40
25	6.5	250	150	115	-	-	250
32	8.5	260	162	140	-	-	260
40	9.5	270	167	150	-	-	270
50	12.5	300	190	165	-	-	300
65	15.5	300	200	185	-	-	300
80	16.5	300	239	200	-	-	300
100	19	350	262	220	350	350	350
125	23	350	288	250	350	350	350
150	28	350	320	285	350	400	400
200	47	450	394	340	450	-	500
250	63	500	445	395	500	-	550
300	72	500	495	445	500	-	550

ASME B16.5; Extended temperature, High Viscosity & Cryogenic variant ≤ 12".

ASME size		Standard (PN 150 lb) / Dimensions [inch]			Optional PN / L (mounting length)		
	Approx. weight [lb]	L	H	W	300 lb	600 lb	900 lb
1	14	9.84	5.98	4.25	9.84	10.63	11.42
1¼	16	10.24	6.14	4.65	10.24	-	11.81
1½	20	10.63	6.34	5.0	10.63	11.42	11.81
2	24	11.81	7.4	6.0	11.81	12.99	14.57
2½	30	11.81	8.5	7.0	11.81	-	15.35
3	40	13.78	9.3	7.5	13.78	15.75	17.72
4	54	13.78	10.5	9.0	15.75	15.75	17.72
5	66	13.78	11.4	10.0	15.75	-	19.69
6	84	15.75	12.5	11.0	17.72	19.69	23.62
8	146	17.72	15.7	14.5	19.69	21.65	31.5
10	166	21.65	18.0	16.5	21.65	25.59	31.5
12	236	21.65	20.6	19.0	23.62	27.56	35.43

2.2.3 Flow sensor variant DN350 and larger



The following dimensions are applicable for; Extended temperature , High Viscosity and Cryogenic variants

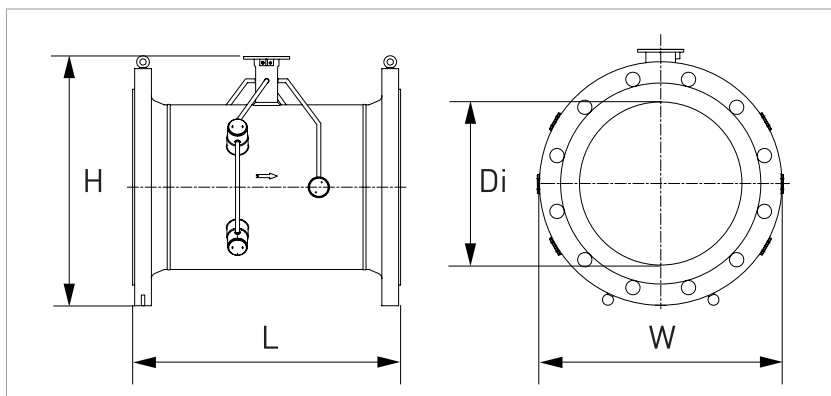
EN1092-1; Extended Temperature, High Viscosity & Cryogenic variant $\geq$ DN350.

DIN \ DN		Standard PN / Dimensions [mm]			Optional PN / L (mounting length)		
	Approx. weight [kg]	L	H	W	PN16	PN25	PN40
350	88	500	540	505	-	-	-
400	109	600	595	565	-	-	-
450	125	600	646	615	-	-	-
500	146	650	697	670	-	-	-
600	189	700	802	780	-	-	-

ASME B16.5; Extended temperature, High Viscosity & Cryogenic variant 14" ...24"

ASME size		Standard PN / Dimensions [inch]			Optional PN / L (=mounting length)		
	Approx. weight [lb]	L	H	W	300 lb	600 lb	900 lb
14	290	27.56	20.9	21.0	27.6	29.5	35.4
16	365	31.50	23.2	23.5	31.5	31.5	39.4
18	410	31.50	24.9	25.0	31.5	33.5	39.4
20	510	31.50	27.3	27.5	31.5	35.4	39.4
24	680	33.47	32.4	32.0	33.5	37.4	51.2

2.2.4 Standard flow sensor DN350 and larger



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

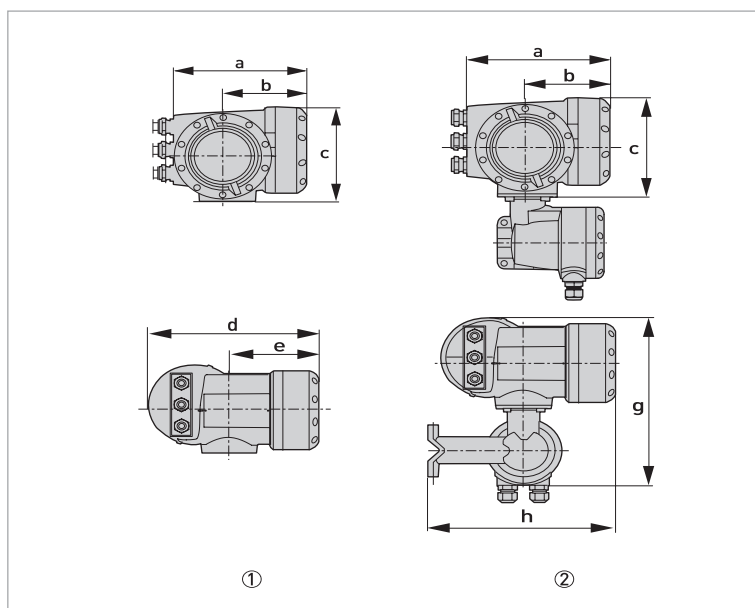
EN1092-1; Standard variant $\geq$ DN350.

DIN \ DN	Approx. weight [kg]	Standard PN / Dimensions [mm]			Optional PN / L (mounting length)		
		L	H	W	PN16	PN25	PN40
350	69	500	540	505	500	500	600
400	90	600	595	565	600	600	700
450	97	600	646	615	600	600	-
500	118	600	697	670	600	700	800
600	151	600	802	780	700	800	800

ASME B16.5; Standard variants 14"...24"

ASME size	Approx. weight [lb]	Standard PN / Dimensions [inch]			Optional PN / L (=mounting length)		
		L	H	W	300 lb	600 lb	900 lb
14	280	27.56	20.9	21.0	27.6	27.6	35.4
16	350	31.5	23.2	23.5	31.5	31.5	39.4
18	390	31.5	24.9	25.0	31.5	31.5	39.4
20	545	31.5	27.3	27.5	31.5	35.4	39.4
24	708	31.5	31.5	32.0	31.5	35.4	51.2

2.2.5 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** is designed exclusively for measurements on conductive and / or non-conductive fluids, in closed completely filled pipeline circuits. Excess of contaminations (gas, particles, 2 phases) disturb the acoustic signal and thus must be avoided.

The overall functionality of the **OPTISONIC 3400** 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 cartons 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

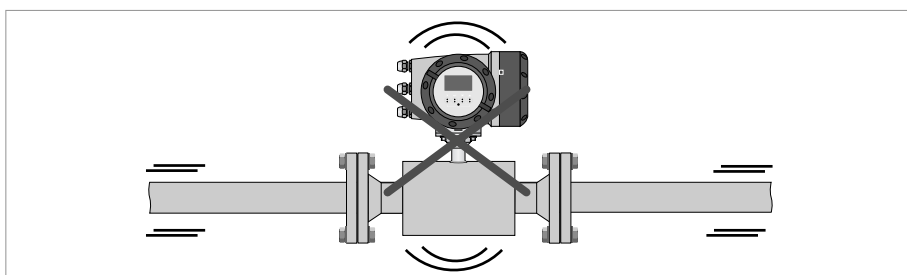


Figure 3-1: Avoid vibrations

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

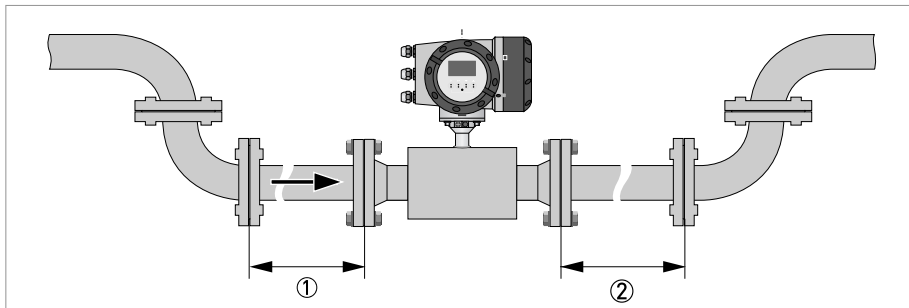


Figure 3-2: Recommended inlet and outlet

- ① Refer to chapter "Bends in 2 or 3 dimensions"
 ② ≥ 3 DN

3.5.2 Bends in 2 or 3 dimensions

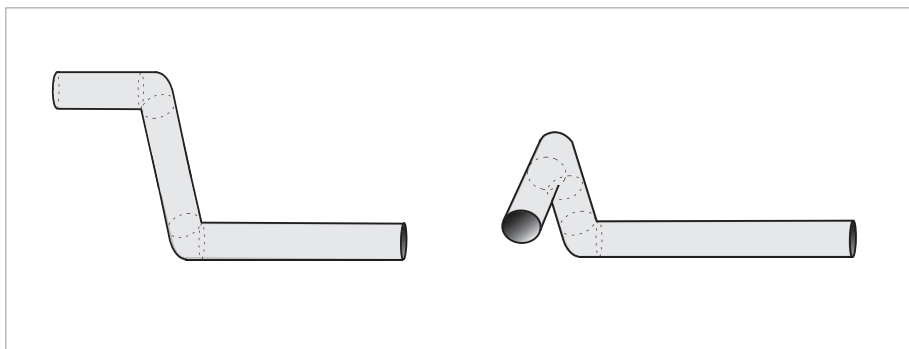


Figure 3-3: 2 and 3 dimensional bends, in front of flowmeter

- ① Bends in 2 dimensions: ≥ 5 DN; bends in 3 dimensions: ≥ 10 DN

3.5.3 T-section

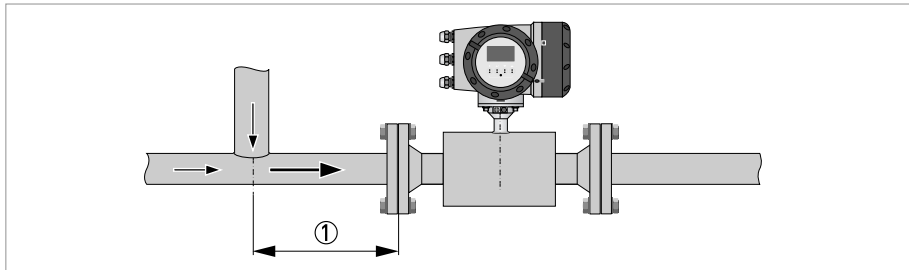


Figure 3-4: Distance behind a T-section

① $\geq 5 \text{ DN}$

3.5.4 Bends

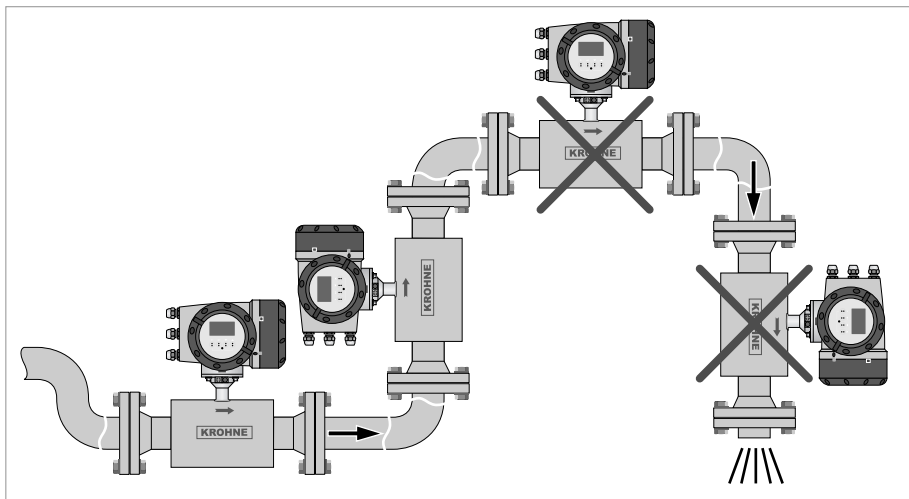


Figure 3-5: Installation in bending pipes

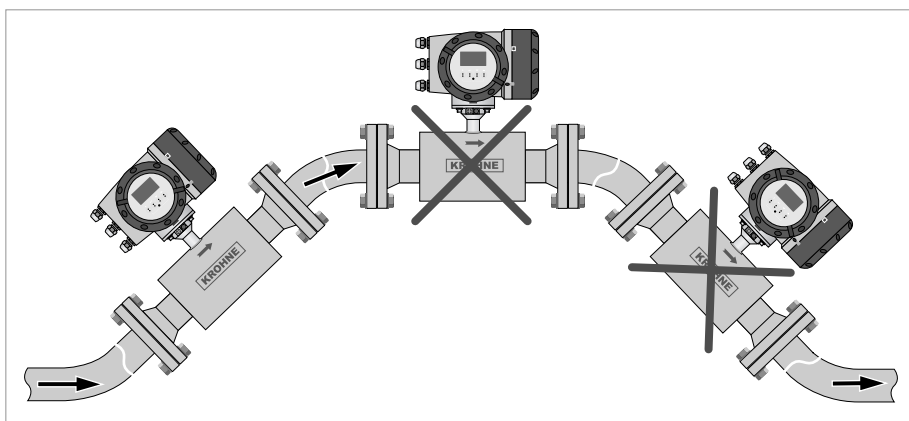


Figure 3-6: Installation in bending pipes

3.5.5 Open feed or discharge

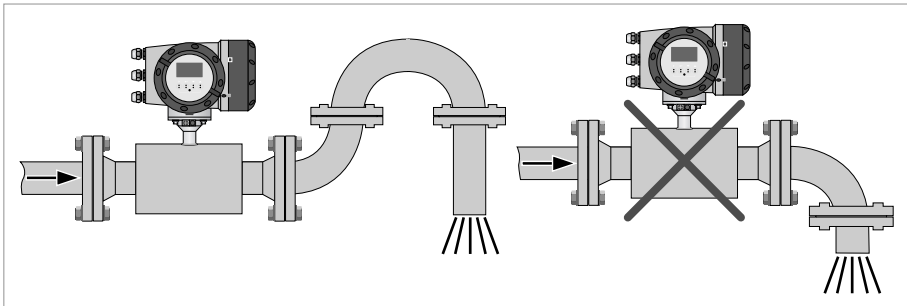


Figure 3-7: Open discharge

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.

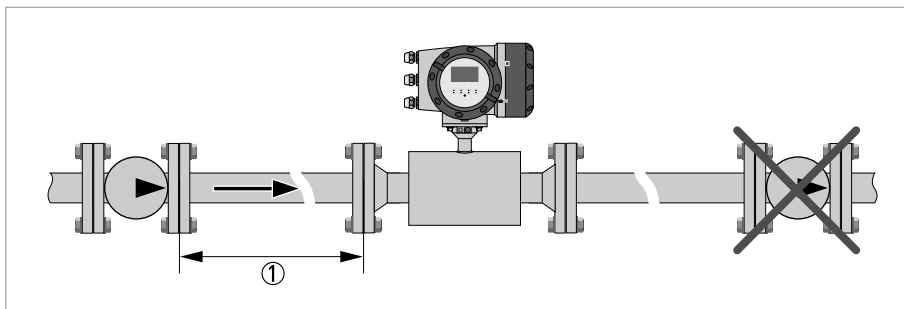


Figure 3-8: Position of pump

① ≥ 15 DN

3.5.7 Control valve

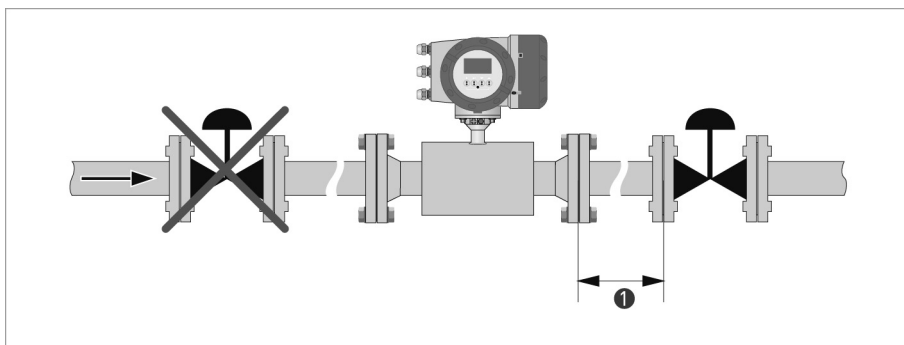


Figure 3-9: Installation in front of a control valve

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.

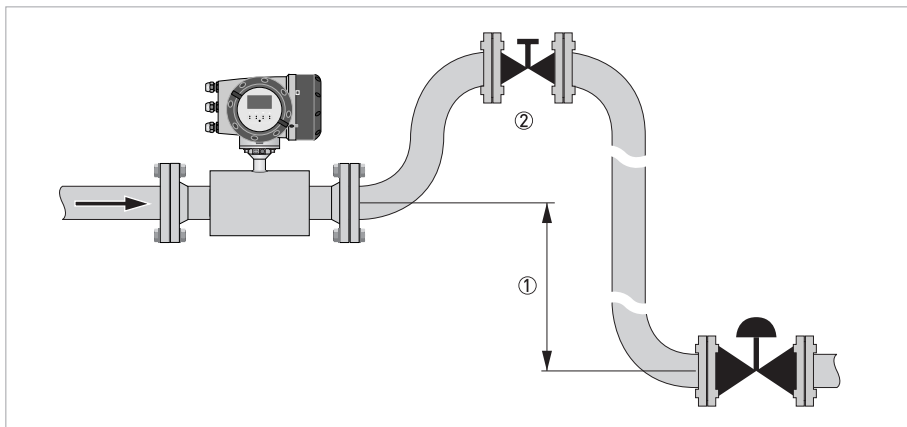


Figure 3-10: Down going pipeline over 5 m / 16 ft length

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

3.5.9 Insulation

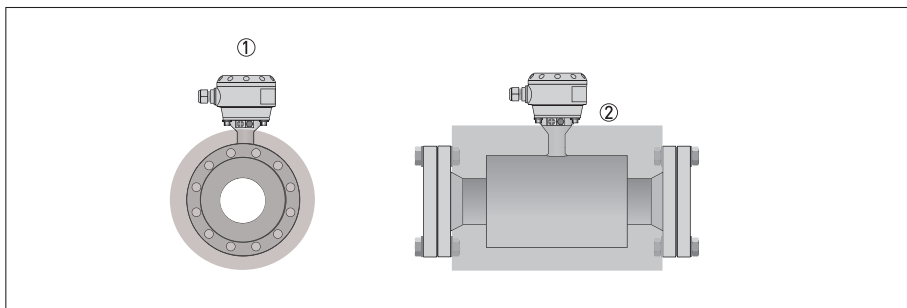


Figure 3-11: Insulation

- 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 deviation of pipe flange faces:

$$L_{max} - L_{min} \leq 0.5 \text{ mm} / 0.02''$$

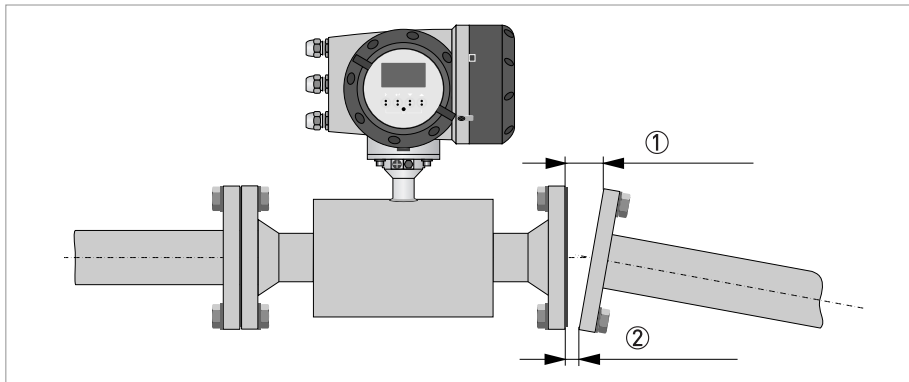


Figure 3-12: Flange deviation

- ① L_{max}
- ② L_{min}

3.5.12 Mounting position

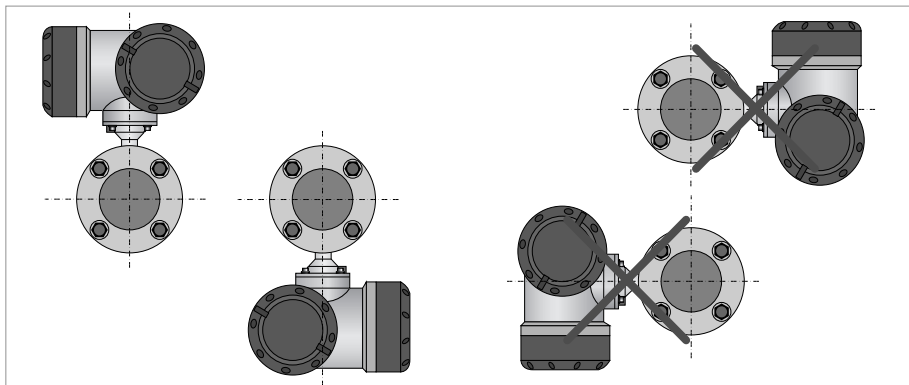


Figure 3-13: Horizontal and vertical mounting

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

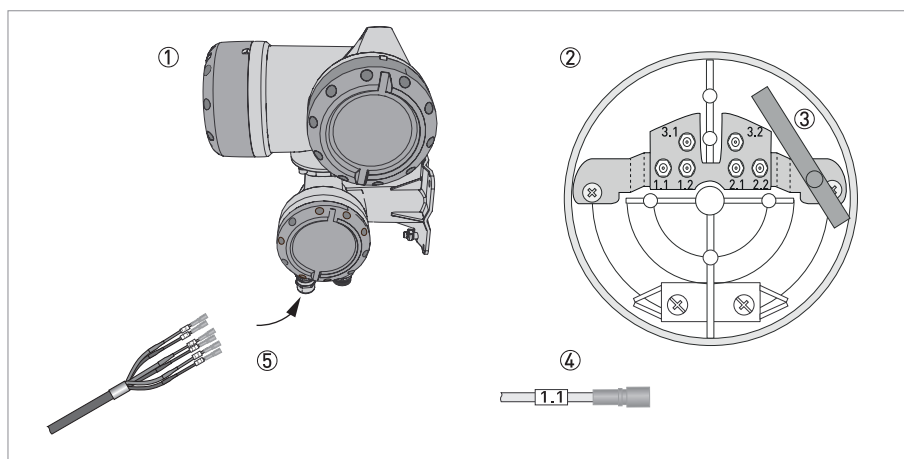


Figure 4-1: Construction of field version

- 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

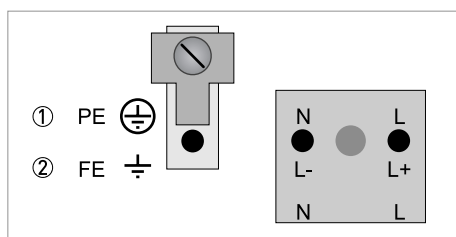
4.3 Power supply

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)

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 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

- Connect the protective ground conductor PE of the mains power supply to the separate terminal in the terminal compartment of the signal converter.
- Connect the live conductor to the L terminal and the neutral conductor to the N terminal.

24 VAC/DC

- Connect a functional ground FE to the separate U-clamp terminal in the terminal compartment of the signal converter.
- When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (VDE 0100 / VDE 0106 and/or IEC 364 / IEC 536 or relevant national regulations).

4.4 Inputs and outputs, overview

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

This signal converter is available with various 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 i version

- Depending on the task, the device can be configured with various output modules.
- Current outputs can be active or passive.
- Optionally available also with Foundation Fieldbus and Profibus PA

Modular version

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

Bus systems

- The device allows intrinsically safe and non intrinsically safe bus interfaces in combination with additional modules.
- For connection and operation of bus systems, please note the separate documentation.

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

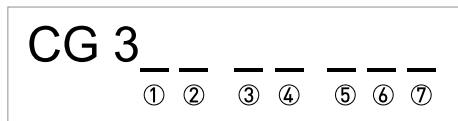


Figure 4-2: Marking (CG number) of the electronics module and input/output variants

- ① ID number:
- 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

CG 350 11 100	100...230 VAC & standard display; basic I/O: I_a or I_p & S_p/C_p & S_p & P_p/S_p
CG 350 11 7FK	100...230 VAC & standard display; modular I/O: I_a & P_N/S_N and optional module P_N/S_N & C_N
CG 350 81 4EB	24 VDC & standard display; modular I/O: I_a & P_a/S_a and optional module P_p/S_p & I_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)
P_N / S_N	F	Passive pulse output, frequency output, status output or limit switch acc. to NAMUR (changeable)
C_a	G	Active control input
C_p	K	Passive control input
C_N	H	Active control input to NAMUR Signal converter monitors cable breaks and short circuits acc. to EN 60947-5-6. Errors indicated on LC display. Error messages possible via status output.
-	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.
- 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				

Ex-i in-/outputs (Option)

2 0 0				I _a + HART® active	P _N / S _N NAMUR ②
3 0 0				I _p + HART® passive	P _N / S _N NAMUR ②
2 1 0		I _a active	P _N / S _N NAMUR C _p passive ②	I _a + HART® active	P _N / S _N NAMUR ②
3 1 0		I _a active	P _N / S _N NAMUR C _p passive ②	I _p + HART® passive	P _N / S _N NAMUR ②
2 2 0		I _p passive	P _N / S _N NAMUR C _p passive ②	I _a + HART® active	P _N / S _N NAMUR ②
3 2 0		I _p passive	P _N / S _N NAMUR C _p passive ②	I _p + HART® passive	P _N / S _N NAMUR ②

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
6 _ _		max. 2 optional modules for term. A + B	I _a + HART® active	P _p / S _p passive ①
B _ _		max. 2 optional modules for term. A + B	I _p + HART® passive	P _p / S _p passive ①
7 _ _		max. 2 optional modules for term. A + B	I _a + HART® active	P _N / S _N NAMUR ①
C _ _		max. 2 optional modules for term. A + B	I _p + HART® passive	P _N / S _N NAMUR ①

PROFIBUS PA (pending)

D _ _		max. 2 optional modules for term. A + B	PA+ (2)	PA- (2)	PA+ (1)	PA- (1)
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FOUNDATION Fieldbus (option)

E _ _		max. 2 optional modules for term. A + B	V/D+ (2)	V/D- (2)	V/D+ (1)	V/D- (1)
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Modbus (option)

G _ _ ②		max. 2 optional modules for term. A + B		Commo n	Sign. B (D1)	Sign. A (D0)
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① changeable

② not activated bus terminator

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

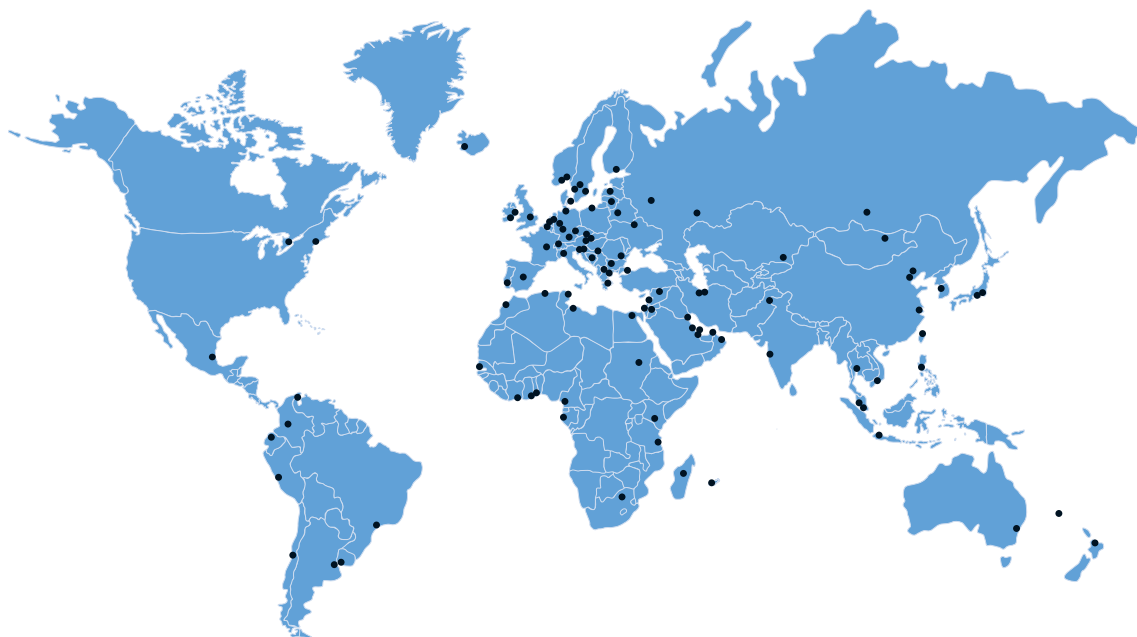
Corrosive atmosphere:
Sea water:
High humidity (% R.H.)
Nuclear (radiation):
Hazardous area:
Additional details:

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:







KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

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