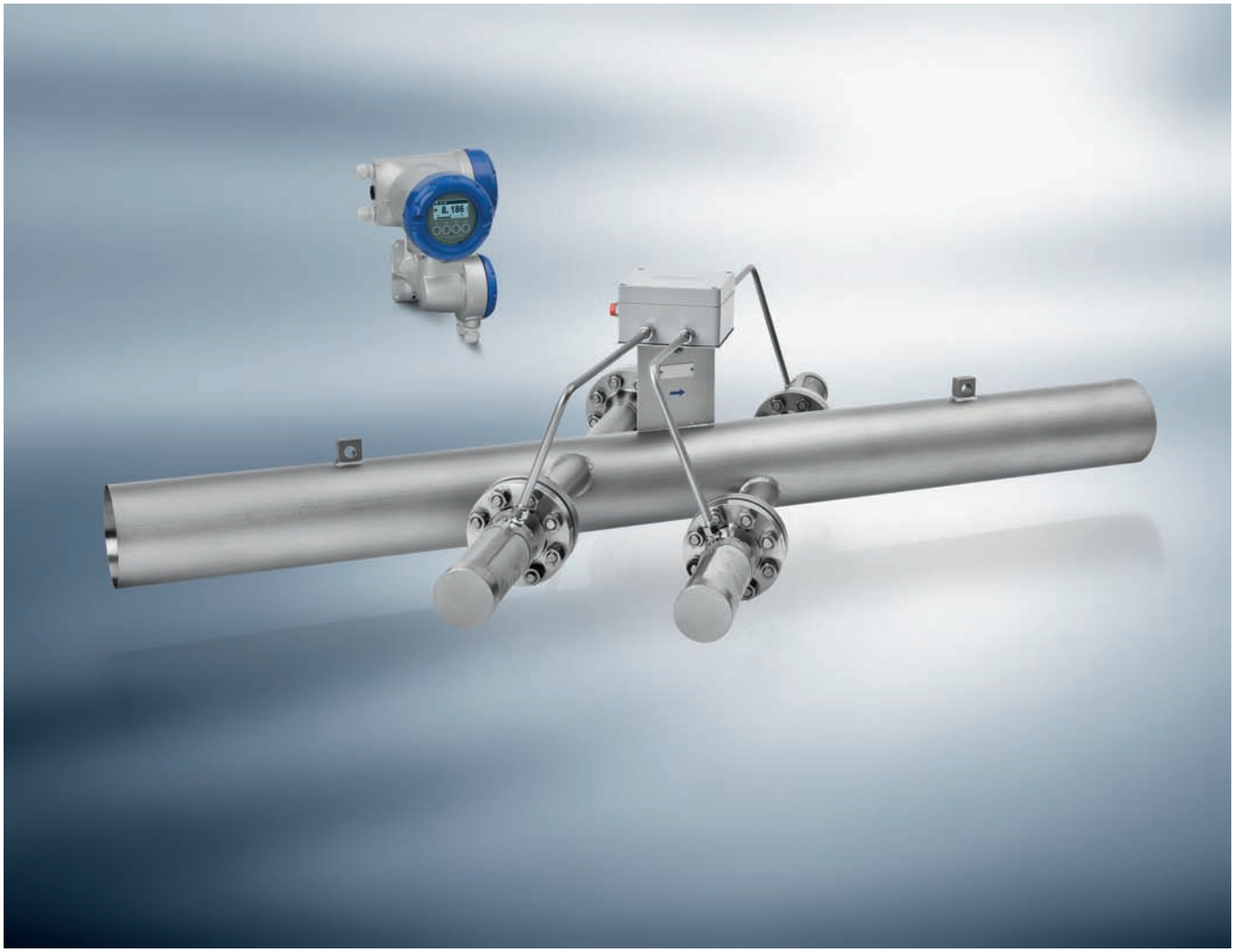


OPTISONIC 8300 Technical Datasheet

Ultrasonic flowmeter
for high temperature gas and steam

- Excellent long term stability
- Wide measurement range
- Integrated solution for massflow and enthalpy measurement

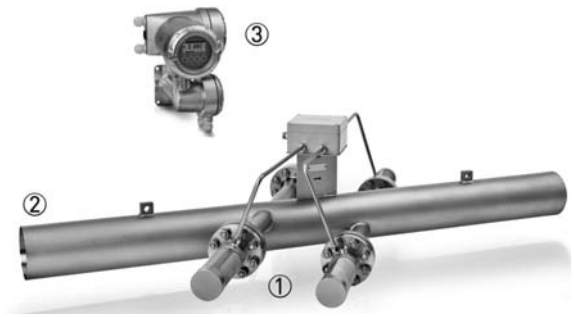
1.1 Ultrasonic steam flow measurement

Due to the increasing cost of steam, accurate measurement is becoming increasingly important. As is prevention of energy losses that can be caused by a pressure drop in the steam line. By providing accurate measurement without pressure drop, the OPTISONIC 8300 provides an optimal solution.

Besides this installation cost of a steam measurement system can be considerable. As the OPTISONIC 8300 provides a large measurement range and does not require recalibration, the installation can be simplified and cost reduced. For example since the flow sensor does not need to be removed, shut off valves and a bypass are not required. And thanks to the large measurement range, a dual range measurement setup is not required.

Traditional steam measurement solutions need continuous attention to guarantee proper operation and for recalibration. As the diagnostics of the OPTISONIC 8300 enables it to look after itself, it does not require any attention.
Even periodically recalibration is not required since the OPTISONIC 8300 provides excellent long term stability. Periodical verification of the proper functioning of the device can easily be done using the diagnostics as required.

With temperature and pressure inputs, the GFC 300 converter will calculate mass flow and enthalpy display in addition to volumetric flow. This omits the need for an additional flowcomputer.



① Flow sensor with two parallel paths for optimal accuracy
② Flanged or weld-in design
③ Remote converter

Highlights

- Excellent long term stability
- No recalibration required
- Maintenance free
- Diagnostics guarantee proper operation and support verification
- Integrated mass flow and enthalpy calculation according IAPWS-IF97, using pressure and temperature input

Industries

- Power plants
- Chemical
- Petrochemical

Applications

- Allocation of used steam
- Custody transfer of steam
- Turbine performance measurement
- Boiler performance measurement

1.2 Variants

Application range

- Diameter range DN100...600 / 4...24", extended range up to DN1000 / 40"
- Temperature up to 540°C
- Pressure standard up to 100 Bar, extended pressure up to 200 Bar

Connection options

- Flangeless (weld-in) process connection
- Standard flange ratings available up to ASME 600lbs / PN100
- Extended pressure versions up to ASME 1500 lbs / PN250

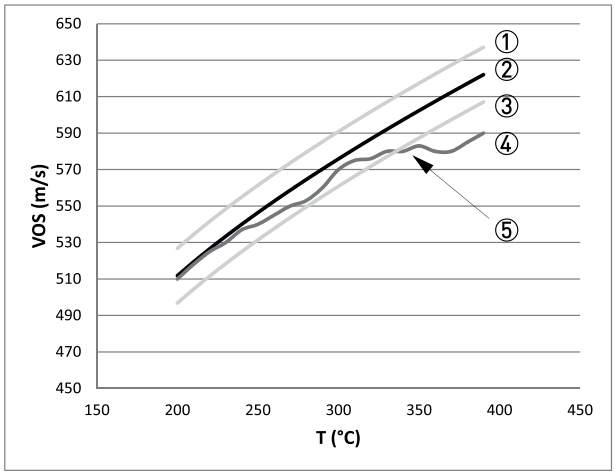
Output options

- Uncorrected gas flow speed and volume
- Mass flow and enthalpy by using the integrated flow computer option

1.3 Features

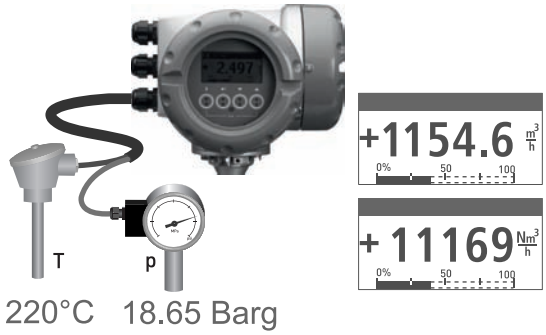
Highly accurate flow measurement
Accuracy better than 1% thanks to two parallel path design.

Velocity of Sound (VOS) monitoring



① VOS upper limit
② VOS calculated
③ VOS lower limit
④ VOS measured
⑤ VOS alarm trip

Diagnostics for verification
The OPTISONIC 8300 provides a number of online diagnostic parameters and functions. For example since the process medium is known, the velocity of sound can be calculated with the input of temperature and pressure. The calculated velocity of sound can be monitored against the measured value. In this way not only the flow sensor is continuously diagnosed but also the temperature and pressure sensor.
In addition, the diagnostics parameters can be used for in-situ verification of the steam flowmeter by comparing diagnostics values recorded at initial calibration or at commissioning, with actual values. In this way accurate and reliable measurement can be guaranteed continuously.



Mass flow and energy flow calculation
The OPTISONIC 8300 integrates the functionality of a flow computer in a flowmeter. Two optional current inputs for pressure and temperature allow the OPTISONIC 8300 to provide output like corrected volume flow, mass flow and energy flow. An additional flow computer is not required.

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.

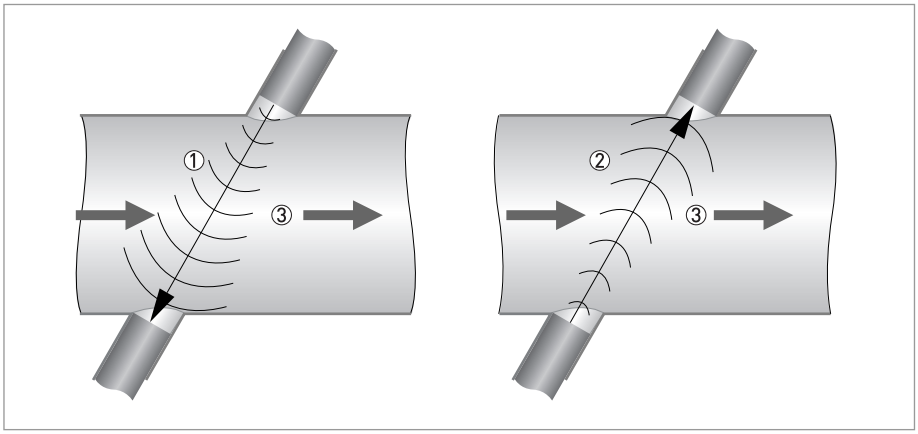


Figure 1-1: Measuring principle

① Sound wave against flow direction
② Sound wave with flow direction
③ Flow direction

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 super heated steam and other high temperature gasses
Measured value	
Primary measured value	Transit time
Secondary measured values	Volume flow, enthalpy flow, mass flow, flow speed, flow direction, speed of sound, gain, signal to noise ratio, reliability of flow measurement, quality of acoustic signal

Design

Features	1 or 2 path flow sensor with high temperature tranducers.
Modular construction	The measurement system consists of a measuring sensor and a signal converter.
Remote version	In field (F) mount version: OPTISONIC 8000 with GFC 300 F signal converter
Nominal diameter	DN100...600 / 4...24"
Measurement range	-60...60 m/s / -197...197 ft/s
Input / output options	
Inputs / outputs	Current (incl. HART®), pulse, frequency and/or status output, limit switch and/or control input (depending on the I/O version)
Counters	2 internal counters with a max. of 8 counter places (e.g. for counting volume and/or mass units).
Self diagnostics	Integrated verification, diagnosis functions, flowmeter, process, measured value, bargraph
Communication interfaces	Modbus, HART®, FF
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.
	The readability of the display could be reduced at ambient temperatures below -25°C / -13°F.
Operator input elements	4 optical keys for operator control of the signal converter without opening the housing.
	Option: Infrared interface (GDC)
Remote control	PACTware® including Device Type Manager (DTM)
	All DTM's and drivers are available at the internet homepage of the manufacturer.

Display functions	
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
Units	Metric, British and US units selectable from list / free unit.

Measuring accuracy

Volume flow	
Reference conditions for calibration	Medium: air
	Temperature: 20°C / 68°F
	Pressure: 1 bar / 14.5 psi
Air calibration (standard)	DN100 / 4": < ± 1.5% of actual measured flow rate
	DN150...600 / 6...24": < ± 1% of actual measured flow rate
Repeatability	< ± 0.2%
Mass flow	
Reference conditions for calibration	Medium: Pressurised Natural Gas
	Temperature: depending on calibration
	Pressure: depending on calibration
Pressurised natural gas calibration (optional)	Calculations and correction in GFC 300 converter or Summit flow computer.
	DN100 / 4": ≤ ± 1.5% of actual measured mass flow.
	DN150...600 / 6...24": ≤ ± 1% of actual measured mass flow.
Repeatibility	< ± 0.2%

Operating conditions

Temperature	
Process temperature	Standard version: -25...+540°C / -13...+1004°F
	Higher temperatures on request.
Ambient temperature	Sensor: -40...+70°C / -40...+158°F
	Signal converter: -40...+65°C / -40...+149°F
Storage temperature	-50...+70°C / -58...+158°F
Pressure	
Flanged	According to flange standard, maximum pressure limited by transducer material:
	SS347: 10 MPa at 540°C
	INCONEL® Alloy 625: 20 MPa at 540°C
Flangeless (weld in) connection	Acc. to design pressure
Properties of medium	
Physical condition	Super heated steam (>15°C superheat), high temperature gas
Density	Standard: 0.6...50 kg/m^3 (> 15°C superheat)
Velocity of sound	450...750 m/s

Installation conditions

Installation	For detailed information see chapter "Installation".
Inlet run	≥ 20 DN
Outlet run	≥ 3 DN
Dimensions and weights	For detailed information see chapter "Dimensions and weights".

Materials

Sensor	
Flanges	Standard: carbon steel ASTM A105 N
	Optional: high temperature steel like for example P-11, P-22
Tube	Standard: carbon steel ASTM A106 Gr. B or equivalent
	(For flangeless design: according to pipe specification)
	Optional: high temperature steel like for example P-11, P-22
Transducer nozzles	Carbon steel compatible with tube material
Transducers	Standard: stainless steel 347 (UNS S34700, W. nr.:1.4550)
	High pressure: INCONEL® Alloy 625 (UNS N06625, W. nr.:2.4856)
Tube transducer cabling	Stainless steel 316 L (1.4401)
Connection box	Die-cast aluminium; polyurethane coated
Converter housing	
Field version	Standard: die-cast aluminium, polyurethane coated
	Option: stainless steel 316 L (1.4408)

Electrical connections

Power supply	**Standard**
	100…230 VAC (-15% / +10%), 50/60 Hz
	Option
	24 VDC (-55% / +30%)
	24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%)
Power consumption	AC: 22 VA
	DC: 12 W
Signal cable	MR02 (shielded cable with 2 triax cores): Ø 10.6 mm; 1 cable per acoustic path
	5 m / 16 ft
	Option: max. 30m / 90 ft
Cable entries	Standard: M20 x 1.5
	Option: ½" NPT, PF ½

Inputs and outputs

General	All in-and outputs are galvanically isolated from each other and from all other circuits.		
Description of used abbreviations	U_{ext} = external voltage U_{nom} = nominal voltage U_{int} = internal voltage U_o = terminal voltage R_L = resistance of load I_{nom} = nominal current		
Current output			
Output data	Measurement of volume, enthalpy and mass (at constant density), HART® communication.		
Settings	**Without HART®**		
	Q = 0%: 0…15 mA		
	Q = 100%: 10…20 mA		
	Error identification: 3…22 mA		
	With HART®		
	Q = 0%: 4…15 mA		
	Q = 100%: 10…20 mA		
	Error identification: 3…22 mA		
Operating data	**Basic I/Os**	**Modular I/Os**	**Ex-i**
Active	U_{int} = 24 VDC I ≤ 22 mA R_L ≤ 1 kΩ		U_{int} = 20 VDC I ≤ 22 mA R_L ≤ 450 Ω
			U_0 = 21 V I_0 = 90 mA P_0 = 0.5 W C_0 = 90 nF / L_0 = 2 mH C_0 = 110 nF / L_0 = 0.5 mH
Passive	U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≥ 1.8 V R_L≤ (U_{ext} - U_o) / I_{max}		U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≥ 4 V R_L≤ (U_{ext} - U_o) / I_{max}
			U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I = 0 mH

HART®			
Description	HART® protocol via active and passive current output		
	HART® version: V5		
	Universal HART® parameter: completely integrated		
Load	≥ 250 Ω at 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	HART®, AMS DD / FDT / DTM		
Pulse or frequency output			
Output data	Pulse output: volume, enthalpy or mass counting		
	Frequency output: volume flow, enthalpy flow, mass flow, specific enthalpy, density, flow speed, velocity of sound, gain		
Function	Adjustable as pulse of frequency output		
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_{int} = 24 VDC	-
		f_{max} in operating menu set to: **f_{max}**≤ 100 Hζ: 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 κHζ: 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	

<table>
<tr><td rowspan="3">Passive</td><td colspan="2">U_{ext} ≤ 32 VDC</td><td rowspan="3">-</td></tr>
<tr><td colspan="2">f_{max} in operating menu set to:
f_{max} ≤ 100 Hζ:

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</td></tr>
<tr><td colspan="2">f_{max} in operating menu set to:
100 Hz < f_{max}≤ 10 κHζ:

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 ≤ 1mA
$U_{0, max}$ = 2.5 V at I ≤ 10 mA
$U_{0, max}$ = 5.0 V at I ≤ 20 mA</td></tr>
<tr><td rowspan="2">NAMUR</td><td rowspan="2">-</td><td rowspan="2">Passive to
EN 60947-5-6

open:
I_{nom} = 0.6 mA
closed:
I_{nom} = 3.8 mA</td><td>Passive to
EN 60947-5-6

open:
I_{nom} = 0.43 mA
closed:
I_{nom} = 4.5 mA</td></tr>
<tr><td>U_I = 30 V
I_I = 100 mA
P_I = 1 W
C_I = 10 nF
L_I = 0 mH</td></tr>
</table>

Status output / limit switch			
Function and settings	Settable as indicator for direction of flow, overflow, error, operating point.		
	Status and/or control: ON or OFF		
Operating data	Basic I/Os	Modular I/Os	Ex-i
Active	-	U_{int} = 24 VDC I ≤ 20 mA $R_{L, max}$ = 47 kΩ open: I ≤ 0.05 mA closed: $U_{0, nom}$ = 24 V at I = 20 mA	-
Passive	U_{ext} ≤ 32 VDC 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	U_{ext} ≤ 32 VDC 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	-
NAMUR	-	Passive to EN 60947-5-6 open: I_{nom} = 0.6 mA closed: I_{nom} = 3.8 mA	Passive to EN 60947-5-6 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

Control input			
Function	Set value of the outputs to "zero", counter and error reset, range change.		
Operating data	Basic I/Os	Modular I/Os	Ex-i
Active	-	U_{int} = 24 VDC Terminals open: $U_{0, nom}$ = 22 V Terminals bridged: I_{nom} = 4 mA On: $U_0 \leq$ 10 V with I_{nom} = 1.9 mA Off: $U_0 \geq$ 12 V with I_{nom} = 1.9 mA	-
Passive	$U_{ext} \leq$ 32 VDC I_{max} = 6.5 mA at $U_{ext} \leq$ 24 VDC I_{max} = 8.2 mA at $U_{ext} \leq$ 32 VDC Contact closed (On): $U_0 \geq$ 8 V with I_{nom} = 2.8 mA Contact open (Off): $U_0 \leq$ 2.5 V with I_{nom} = 0.4 mA	$U_{ext} \leq$ 32 VDC I_{max} = 9.5 mA at $U_{ext} \leq$ 24 V I_{max} = 9.5 mA at $U_{ext} \leq$ 32 V Contact closed (On): $U_0 \geq$ 3 V with I_{nom} = 1.9 mA Contact open (Off): $U_0 \leq$ 2.5 V with I_{nom} = 1.9 mA	$U_{ext} \leq$ 32 VDC $I \leq$ 6 mA at U_{ext} = 24 V $I \leq$ 6.6 mA at U_{ext} = 32 V On: $U_0 \geq$ 5.5 V or $I \geq$ 4 mA Off: $U_0 \leq$ 3.5 V or $I \leq$ 0.5 mA
			U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I = 0 mH
NAMUR	-	Active to EN 60947-5-6 Contact open: $U_{0, nom}$ = 8.7 V Contact closed (On): I_{nom} = 7.8 mA Contact open (off): $U_{0, nom}$ = 6.3 V with I_{nom} = 1.9 mA Identification for open terminals: $U_0 \geq$ 8.1 V with $I \leq$ 0.1 mA Identification for short circuited terminals: $U_0 \leq$ 1.2 V with $I \geq$ 6.7 mA	-

Low-flow cutoff			
On	0...±9.999 m/s; 0...20.0%, settable in 0.1% steps, separately for each current and pulse output.		
Off	0...±9.999 m/s; 0...19.0%, settable in 0.1% steps, separately for each current and pulse output.		
Time constant			
Function	Can be set together for all flow indicators and outputs, or separately for: current, pulse and frequency output, and for limit switches and the 3 internal counters.		
Time setting	0...100 seconds, settable in 0.1 second steps.		
Current input			
Function	For conversion to standard conditions, input from external temperature and pressure transmitters is required.		
Operating data	Basic I/Os	Modular I/Os	Ex i
Active	-	U_{int} = 24 VDC I ≤ 22 mA I_{max} ≤ 26 mA (electronically limited) $U_{0, min}$ = 19 V at I ≤ 22 mA	U_{int} = 20 VDC I ≤ 22 mA $U_{0, min}$ = 14 V at I ≤ 22 mA
			No HART®
		No HART®	U_0 = 24.1 V I_0 = 99 mA P_0 = 0.6 W C_0 = 75 nF / L_0 = 0.5 mH
			No HART®
Passive	-	U_{ext} ≤ 32 VDC I ≤ 22 mA I_{max} ≤ 26 mA (electronically limited) $U_{0, min}$ = 5 V at I ≤ 22 mA	U_{ext} ≤ 32 VDC I ≤ 22 mA $U_{0, min}$ = 4 V at I ≤ 22 mA
			No HART®
		No HART®	U_I = 30 V I_I = 100 mA P_I = 1 W C_I = 10 nF L_I =0 mH
			No HART®

MODBUS (in preparation)	
Description	Modbus RTU, Master / Slave, RS485
Address range	1...247
Supported function codes	03, 04, 16
Broadcast	Supported with function code 16
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 or SEP
	Fluid group 1
	Production module H
Other approvals and standards	
Non-Ex	Standard
Namur	NE 21, 45, 53, 80
Hazardous areas	
	For detailed information, please refer to the relevant Ex documentation.
ATEX	DEKRA 12 ATEX 0063 X
Protection category acc. to IEC 529 / EN 60529	**Signal converter**
	Field (F): IP 65 (NEMA 4X/6)
	All flow sensors
	IP 67 (NEMA 6)
Vibration resistance	IEC 68-2-64
Shock resistance	IEC 68-2-27

2.2 Dimensions and weights

2.2.1 Flow sensor

The OPTISONIC 8300 will primarily be welded to the connecting piping. The design of the tube of the OPTISONIC 8300 will be based on the specifications of the connecting piping. Detailed information for the dimensions and weights can not be specified as they will vary with each application. The information below should therefore be regarded as indicative.

Please note size d, the required extra space for installation and maintenance of the transducers.

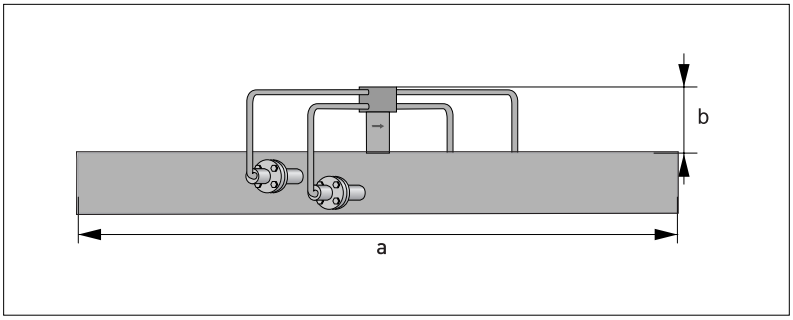


Figure 2-1: Front view of the GFS 8000

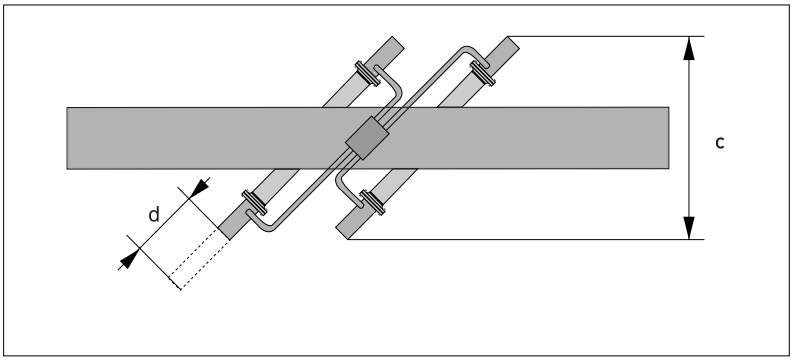


Figure 2-2: Upper view of the GFS 8000

Dimensions of the GFS 8000 in mm and inches

	[mm]	[inches]
a	DN100 / 4": 1000	DN100 / 4": 39.37
	DN150...600 / 6...24": 2000	DN150...600 / 6...24": 87.74
b	265	10.43
c	Transducer flange rating 600 lbs: 1184 + Di	600 lbs: 46.61 + Di
	Transducer flange rating 1500 lbs: 1205 + Di	1500 lbs: 47.44 + Di
d	300	11.81

2.2.2 Converter housing

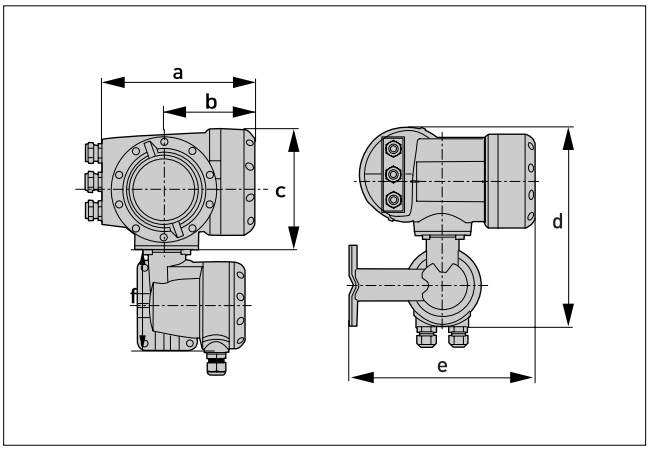


Figure 2-3: Field housing (F) - remote version.

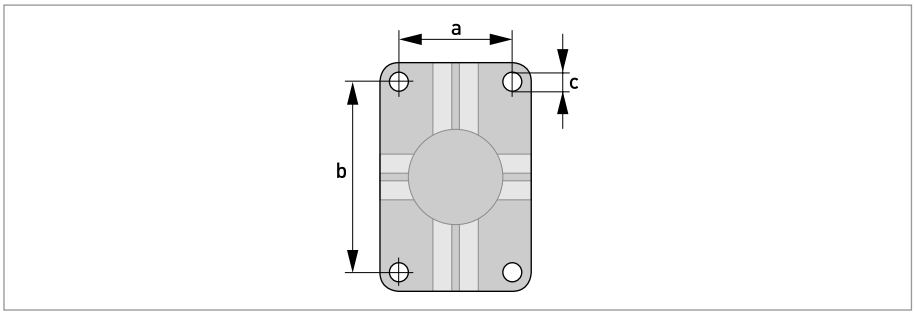
Dimensions and weights in mm and kg

Dimensions [mm]					Weight [kg]
a	b	c	d	e	
202	120	155	295.8	277	5.7

Dimensions and weights in inches and lb

Dimensions [inches]					Weight [lb]
a	b	c	d	e	
7.75	4.75	6.10	11.60	10.90	12.60

2.2.3 Mounting plate, field housing



Dimensions in mm and inches

	[mm]	[inches]
a	60	2.4
b	100	3.9
c	Ø 9	Ø 0.4

3.1 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.

3.2 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 overall functionality of the **OPTISONIC 8300** flowmeter is the continuous measurement of actual volume flow, enthalpy flow, mass flow, flow speed, velocity of sound, gain, SNR and diagnosis value. The working area is defined in the next figure.

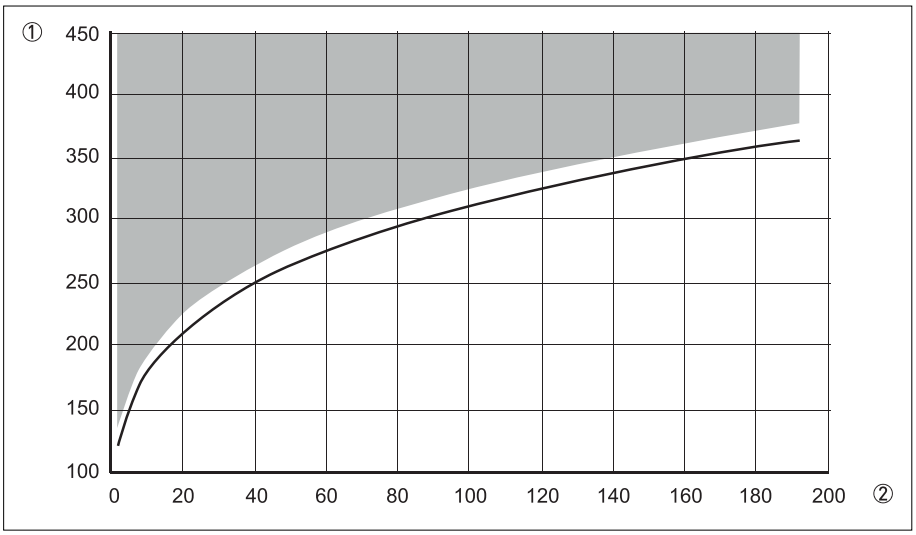


Figure 3-1: Steam saturation curve

① Temperature [°C]
② Pressure [Bara]

3.3 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.

3.4 Vibration

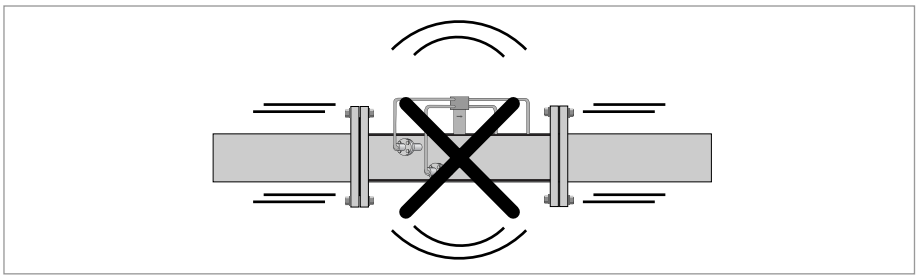


Figure 3-2: Avoid vibrations

3.5 General requirements sensor

To secure the optimum functioning of the flowmeter, please note the following observations.

- Install the flow sensor in a horizontal position in a slightly descending line.
- Do not install the flow sensor in a lowered pipe section to avoid that water can collect in the measuring tube.
- Orientate the flow sensor such that the path of the acoustic signal is in the horizontal plane.

For exchanging the transducers, please keep a free space of 0.3 m / 11.81" around the transducer.

3.5.1 Inlet and outlet

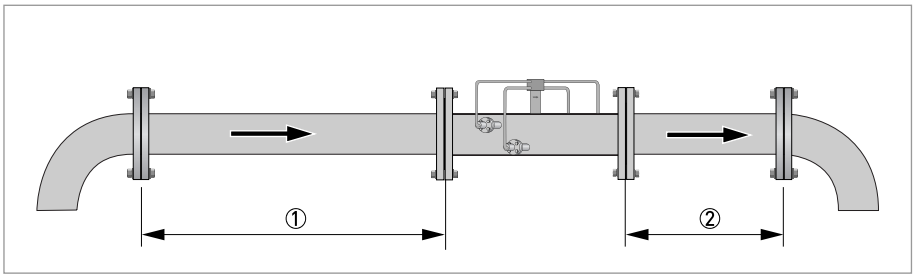


Figure 3-3: Recommended inlet and outlet

① ≥ 20 DN
② ≥ 3 DN

3.5.2 T-section

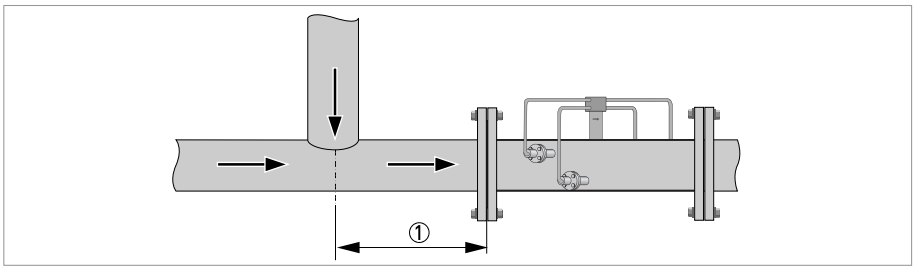


Figure 3-4: Distance behind a T-section

① ≥ 20 DN

3.5.3 Mounting position

- Horizontally with the acoustic path in horizontal plane

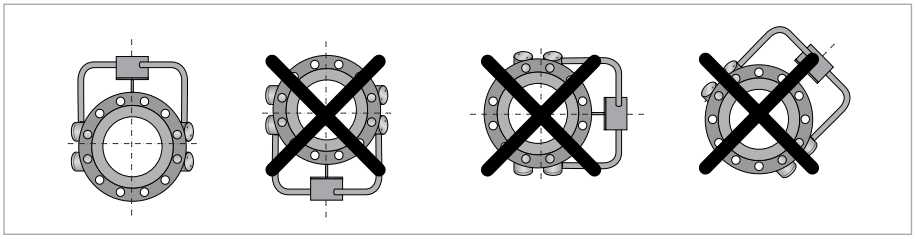


Figure 3-5: Mounting position

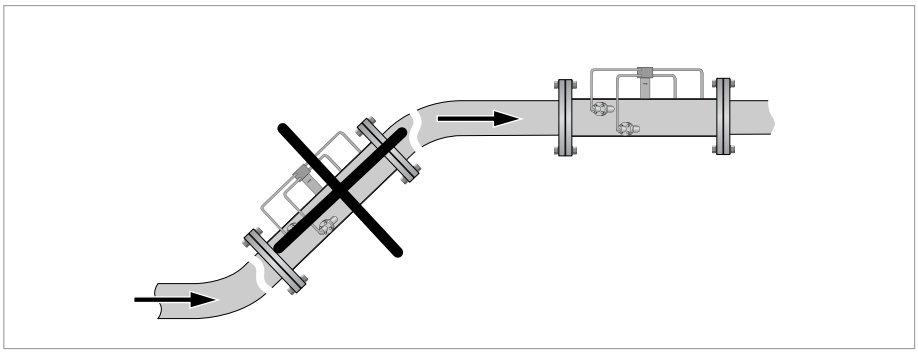


Figure 3-6: Horizontal mounting

Orientate connection box upwards and acoustic path(s) horizontally to avoid liquid in transducers.

3.5.4 Flange deviation

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

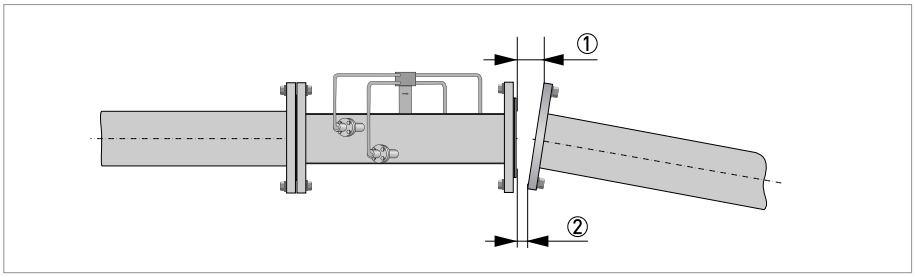


Figure 3-7: Flange deviation

① L_{max}
② L_{min}

3.5.5 Control valve

To avoid distorted flow profiles and interference caused by valve noise in the sensor, control valves or pressure reducers should not be installed in the same pipeline as the flowmeter. In case this is required, please contact the manufacturer.

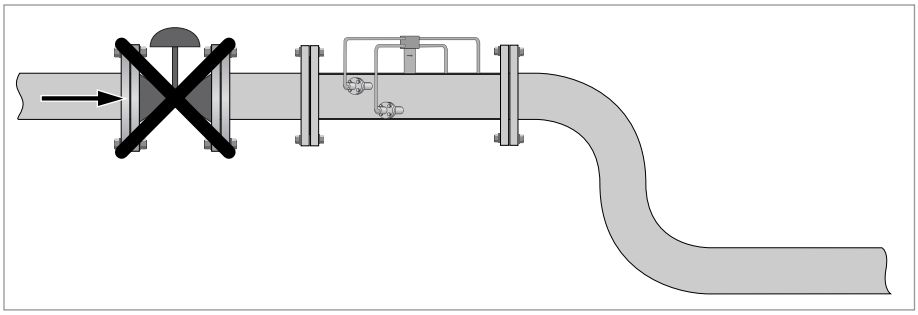


Figure 3-8: Control valve

3.5.6 Thermal insulation

The flow sensor must be insulated to prevent humidity problems caused by condensation. Please make sure that the insulation is installed in accordance with the next image.

Keep the transducers and connection box free of insulation to allow cooling by free convection. The transducers can reach a temperature of up to 200° C!

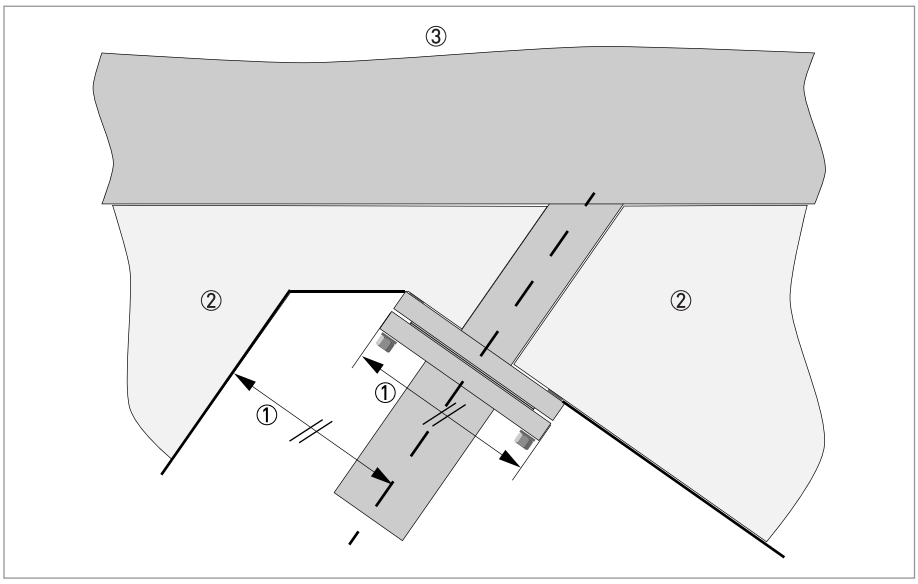


Figure 3-9: Thermal insulation

① Width of flange = free distance
② Insulation
③ Sensor tube

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 OPTISONIC 8000 Sensor

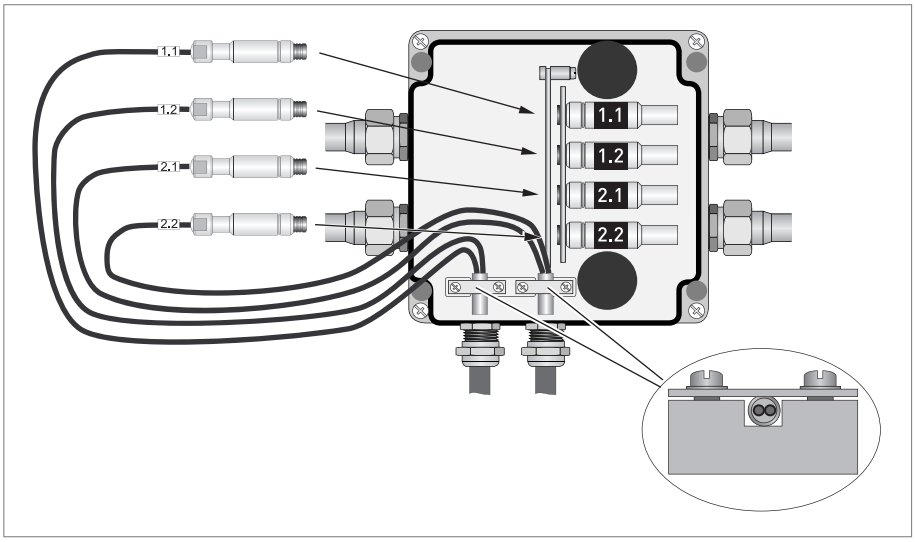
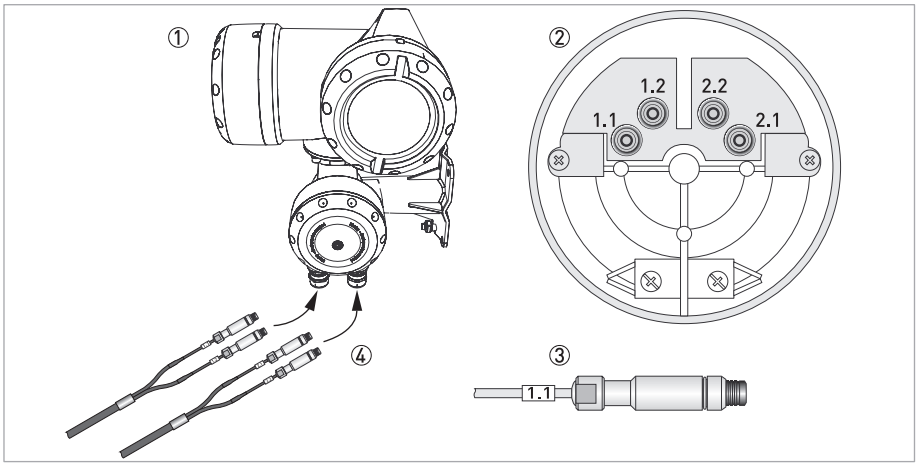


Figure 4-1: Connection of cables in connection box on sensor

4.3 Signal cable converter



① Converter housing.
② Open connection box.
③ Marking on cable.
④ Insert cables through cable glands.

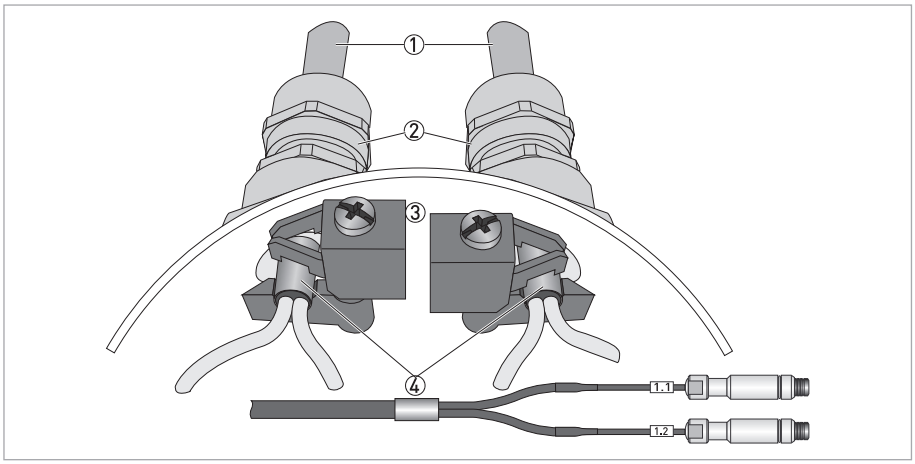


Figure 4-2: Clamp the cables on the shielding bush.

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

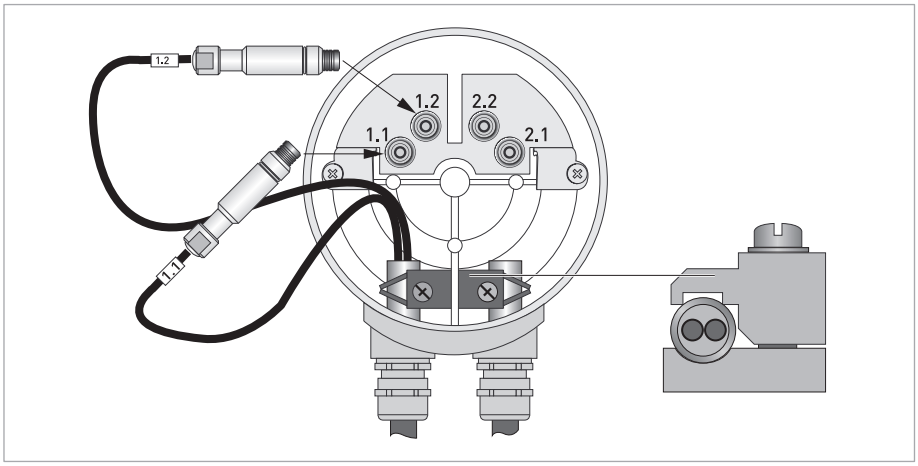
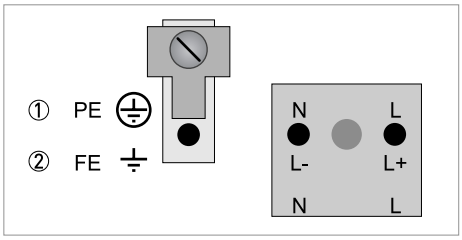


Figure 4-3: Connect the cables on the signal converter.

4.4 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).

4.5 Inputs and outputs, overview

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

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

Ex i version

- Current outputs can be active or passive.

Modular version

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

Bus systems

- For hazardous areas, all of the input/output variants for the housing designs 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.

4.5.2 Description of the CG number

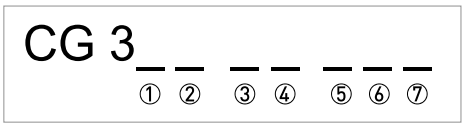


Figure 4-4: Marking (CG number) of the electronics module and input/output variants

① ID number: 6
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 see the following examples.

Examples for CG number

CG 360 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 360 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 360 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.
IIn_a	P	Active current input
IIn_p	R	Passive current input
-	8	No additional module installed
-	0	No further module possible

4.5.3 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

4.5.4 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	
Modbus (Option)									
G _ _ ②		max. 2 optional modules for term. A + B					Common	Sign. B (D1)	Sign. A (D0)
H _ _ ③		max. 2 optional modules for term. A + B					Common	Sign. B (D1)	Sign. A (D0)

① Changeable
② Not activated bus terminator
③ Activated bus terminator

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

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	
Gas composition:	
CO_2 content:	
H_2 content:	
Density:	
Velocity of sound:	
Flowrate	
Normal:	
Minimum:	
Maximum:	
Temperature	
Normal:	
Minimum:	
Maximum:	
Pressure	
Normal:	
Minimum:	
Maximum:	

Piping details

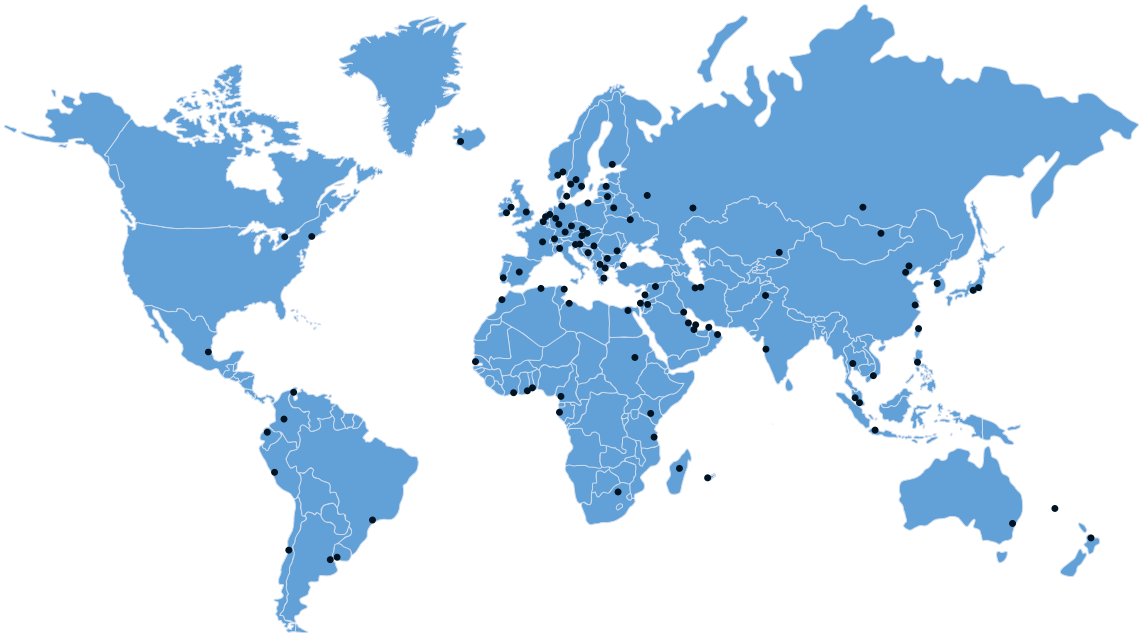
Nominal pipe size:	
Outer diameter:	
Wall thickness / schedule:	
Pipe material:	
Pipe condition (old / new / painted / internal scaling / exterior rust):	
Liner material:	
Liner thickness:	
Straight inlet / outlet section (DN):	
Upstream situation (elbows, valves, pumps):	
Flow orientation (vertical 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 assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

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www.krohne.com

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