ALTOSONIC V12 Technical Datasheet

12-chord ultrasonic gas flowmeter for custody transfer

- 12 acoustic chords for excellent swirl immunity and built-in redundancy
- Just 5D straight inlet piping required to comply to AGA9, ISO 17089 and MID
- First ever ultrasonic gas flowmeter to receive OIML R137 class 0.5 certification

1.1 Custody transfer measurement of natural gas

ALTOSONIC V12 has been designed to offer the best possible measurement accuracy, not only during a calibration under ideal conditions but also during the less ideal conditions in the field. As a result ALTOSONIC V12 is the first ultrasonic flowmeter that was certified to OIML R137 class 0.5 by NMi. This provides a significant improvement of the overall measurement uncertainty compared to more traditional ultrasonic gas flowmeters that are typically OIML R137 class 1 approved.

Due to its design with 12 acoustic chords a flow conditioner is no longer required; standards such as AGA9, ISO 17089 and MID are met with just 5D straight inlet piping. Flowmeter diagnostics are standard and give an exact picture of what is happening inside the flowmeter. With the optional KROHNE Care expert system the accuracy of the meter is even evaluated 24/7 inside the meter itself and an integrated web server presents the results as an easy to access webpage.

Highlights

- 12 acoustic chords for excellent swirl immunity and built-in redundancy
- No flow conditioner required
- Just 5D straight inlet piping required to comply to AGA9, ISO 17089 and MID
- First ever ultrasonic flowmeter to receive OIML R137 class 0.5 approval by NMi
- Meter accuracy evaluated 24/7 by optional web-based KROHNE Care expert system

Industries

- Oil & Gas
- Natural gas distribution
- Large consumers of natural gas

Applications

- Custody transfer and allocation measurement
- Border stations
- Large transfer points
- Master metering
- Check metering
- LNG production and regasification

1.2 Variants

ALTOSONIC V12

6 paths that use a single reflection to provide 12 acoustic measurement chords. Offering the best possible accuracy in high pressure, natural gas applications.

ALTOSONIC V12 Direct

6 paths without reflection for low pressure and high CO_2 applications. Due to non-reflective technology this meter is OIML R137 class 1 approved, just like most other direct path meter designs.

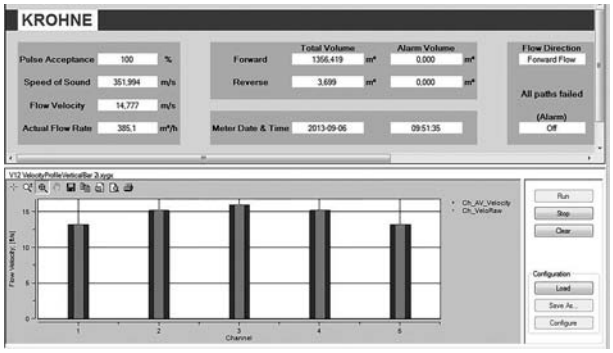
ALTOSONIC V12 Twin

Two flowmeters in a single body, permitting two completely independent measurements with the installation of just a single flowmeter.

ALTOSONIC V12 Reference

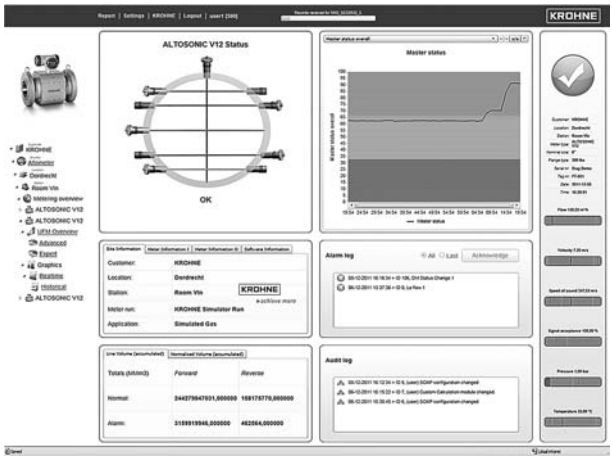
Specially designed as reference in calibration facilities and very high-end master meter applications. Standard in stainless steel with integrated inlet piping.

1.3 Features



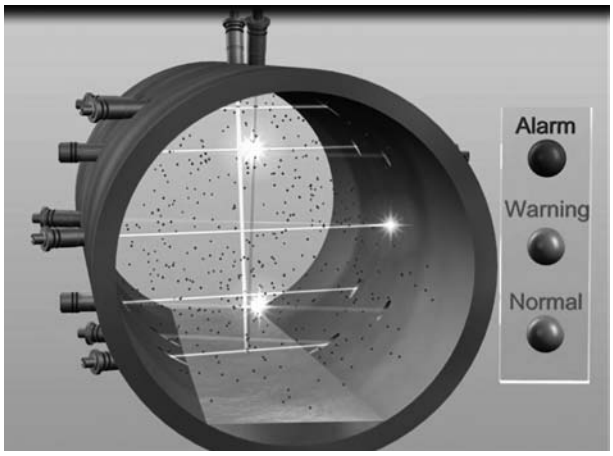
Standard diagnostics

Diagnostic parameters such as signal reliability, AGC (Automatic Gain Control of acoustic signals), SoS (speed of sound), SNR (Signal to Noise Ratio), etc., can be evaluated on a PC with the free-of-charge ALTOSONIC V12 monitoring tool.



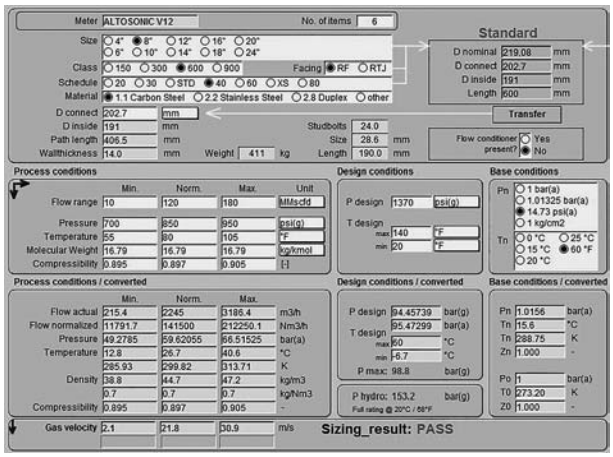
KROHNE Care expert system

The optional KROHNE Care expert system uses diagnostic parameters to 24/7 interpret the health and accuracy of ALTOSONIC V12. KROHNE Care runs inside the V12 electronics housing on a dedicated web server and can be accessed as a regular webpage. It gives very clear and straightforward information on the health of the meter without the need for a specialist to interpret the diagnostics parameters.



Bottom-fouling detection

ALTOSONIC V12 has a dedicated acoustic path to check for bottom fouling. Bottom fouling occurs when heavier components in the natural gas (condensate, water, solids) form a layer of contamination on the bottom of the meter.



EVA sizing for ALTOSONIC V12

For natural gas measurement a number of process variables are important, such as pressure, flow rate, CO_2 concentration, calibration requirements, etc. Each application is evaluated with the KROHNE internal EVA evaluation package to make sure that the meter will work flawlessly from the moment it is installed.

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.
- The ALTOSONIC V12 has 6 paths that, through single reflection, form 12 acoustic measurement chords:
- 5 horizontal paths are used to detect flow profile changes and distortions as well as to compensate for swirl due to upstream disturbances.
- 1 vertical path is dedicated to bottom fouling detection

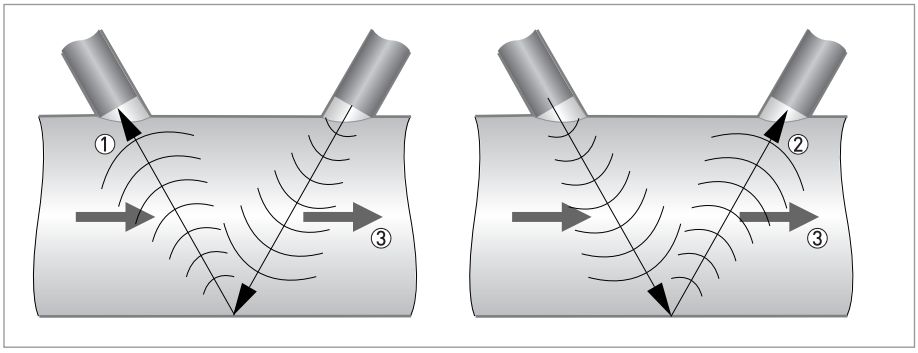


Figure 1-1: Measuring principle

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

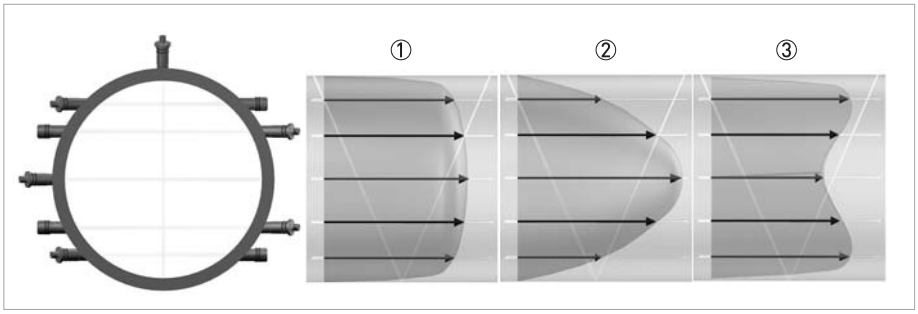


Figure 1-2: Detection of different flow profiles

① Normal flow profile
② Highest flow velocity in middle of the sensor
③ Highest flow velocity in lower and upper part of the sensor

2.1 Technical data table

- *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 natural gases with a minimum of 75% methane.
	Other applications on request.
Measured value	
Primary measured value	Transit time
Secondary measured values	Actual volume flow and totalized flow rate.

Design

Construction	The ALTOSONIC V12 measurement system consists of a meter body with ultrasonic transducers and a signal converter for signal processing and counter display on top of the meter body.
Nominal diameter	DN100...350 / 4"...14": machined out of one piece of metal.
	DN400...1600 / 16"...64": welded design.
	Other diameters on request.
Flow range	For more detailed information, refer to *Flow table* on page 18 .
Signal converter	
Inputs / outputs	**Without integrated diagnostics board:**
	Digital output: 4x
	Serial: 1x Modbus over RS 485 (individually configurable)
	With integrated diagnostics board:
	Signals from the diagnostic board are categorised non-Custody transfer. Only signals coming directly from the base electronic unit are certified for Custody transfer purpose.
	Digital output: 4x
	Serial: 2x Modbus over RS 485 (individually configurable)
	Ethernet: 2x
	Current output: 1x 4...20 mA
	Current input: 1x Multidrop (dual) HART®

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.
Display functions	
Language of display texts	English, French, German, Dutch, Russian
Units	Metric and Imperial units selectable from list / free unit.

Measuring accuracy

Accuracy	≤ ±0.2% of measured flow rate, for high pressure flow calibrated.
	≤ ±0.1% of measured flow rate, for high pressure flow calibrated and linearised.
Repeatability	< ± 0.1%

Operating conditions

Temperature	
Process temperature	Standard: -20...+70°C / -4...+158°F
	Option: -40...+100°C / -40...+212°F
Ambient temperature	-40...+60°C / -40...+140°F
Storage temperature	-40...+60°C / -40...+140°F

Pressure	
Pressure range	1...450 bar / 0.1...45MPa / 15...6525 psi (ASME 150...2500)
	All sensor designs at full rating acc. to below flange standards for standard materials.
Properties of medium (other properties on request)	
Physical condition	Natural gas with a minimum of 75% methane.
	Other applications on request.
Wet gas content	Typically ≤ 1% LVF, contact manufacturer for detailed sizing.
CO_2 content	Depends on diameter and pressure, contact manufacturer for detailed sizing.
Minimum pressure requirement	Depends on diameter and CO_2 concentration, contact manufacturer for detailed sizing.

Installation conditions

Installation	For detailed information refer to *Installation* on page 19.
Dimensions and weights	For detailed information, refer to *Dimensions and weights* on page 13.

Materials

Flanges	Standard: low temperature carbon steel A350 LF2
	Option: stainless steel, Duplex
Measuring tube	≤ 14": low temperature carbon steel A350 LF2
	≥ 16": low temperature carbon steel A333 GR6
	Option: stainless steel, Duplex
Converter housing	Stainless steel 316 (1.4408)
	Inside: corrosion preservative oil film
	Outside: 3 layer epoxy coating RAL 9006 (silver)
	Other outside coatings available on request.

Electrical connections

Power supply	24 VDC (-25% / +30%) / 3 A.
Power consumption	Without integrated diagnostics board: ≤ 10 W
	With integrated diagnostics board: ≤ 17 W
Cable entries	Standard: M20 x 1.5
	Option: ½" NPT, PF ½

Inputs and outputs

MODBUS	
Description	Modbus RTU or Modbus ASCII, Slave, RS485 (galvanically isolated)
Transmission procedure	Half duplex, asynchronous
Address range	1...247
Supported function codes	03, 04, 06, 08, 16
Supported Baudrate	50, 75. 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 56000, 64000, 115200, 128000 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
Pressure Equipment Directive	Directive: 97/23/EC
	Category I, II, III
	Gas group 1
	Production module H
Other approvals and standards	
Hazardous areas	
ATEX	II 1/2G Ex de ma IIB T6...T4
IECEx	Ex de ma IIB T5 Gb
CSA	Class I, Div 1and 2, Groups B, C and D, T6...T4
	Class II, Div 1and 2, Groups E, F and G
FM	Class I, Div 2, Groups C and D, T5
	Class II, Div 1, Groups E, F and G (Type 4x)
	Class I, zone 1, Aex de ma IIB T5, IP 66
Custody transfer	OIML R137 class 0.5 by NMi
	MID (Measurement Instrument Directive): 2004/22/EC by NMi
	Fully compliant with AGA 9 and ISO 17089.
Protection category acc. to IEC 529 / EN 60529	IP66 (NEMA 4X)
Verifications	**Standard:** High pressure hydrostatic pressure test on meter body Factory Acceptance Test (FAT) Low pressure leakage test on nitrogen on complete meter. High pressure helium test on transducers **Option:** High pressure leakage test on nitrogen on complete meter High pressure flow calibration.

2.2 Dimensions and weights

- *Flowmeters with diameters ≥ 6" and ASME ≤ 900 lb are standard equipped with transducers that are retractable under pressure.*
- *All measures are provided as indication. They can vary slightly with different schedule sizes.*
- *Values for larger diameters are avalable on request.*

ASME 150 lb

Nominal size [mm]	H [mm]	L [mm]	Weight [kg]
100	520	400 ①	151
150	570	450	238
200	620	600	351
250	660	750	498
300	740	900	719
350	780	1050	911
400	840	1200	420
450	890	1350	529
500	940	1500	709
600	1050	1800	1113

① 300 mm available on request.

ASME 150 lb

Nominal size [inch]	H [inch]	L [inch]	Weight [lbs]
4	20.47	15.75 ①	333
6	22.44	17.72	525
8	24.41	23.62	774
10	25.98	29.53	1098
12	29.13	35.43	1585
14	30.71	41.34	2009
16	33.07	47.24	926
18	35.04	53.15	1166
20	37.01	59.06	1563
24	41.34	70.87	2454

① 11.81" available on request.

ASME 300 lb

Nominal size [mm]	H [mm]	L [mm]	Weight [kg]
100	520	400 ①	158
150	570	450	248
200	620	600	371
250	680	750	533
300	760	900	755
350	810	1050	1008
400	870	1200	520
450	920	1350	659
500	980	1500	862
600	1100	1800	1354

① 300 mm available on request.

ASME 300 lb

Nominal size [inch]	H [inch]	L [inch]	Weight [lbs]
4	20.47	15.75 ①	348
6	22.44	17.72	547
8	24.41	23.62	818
10	26.77	29.53	1175
12	29.92	35.43	1665
14	31.89	41.34	2223
16	34.25	47.24	1147
18	36.22	53.15	1453
20	38.58	59.06	1901
24	43.31	70.87	2986

① 11.81" available on request.

ASME 600 lb

Nominal size [mm]	H [mm]	L [mm]	Weight [kg]
100	520	400 ①	168
150	575	450	271
200	630	600	411
250	710	750	618
300	780	900	850
350	815	1050	1070
400	880	1200	640
450	930	1350	805
500	1000	1500	1055
600	1100	1800	1621

① 300 mm available on request.

ASME 600 lb

Nominal size [inch]	H [inch]	L [inch]	Weight [lbs]
4	20.47	15.75 ①	370
6	22.64	17.72	598
8	24.8	23.62	906
10	27.95	29.53	1363
12	30.71	35.43	1874
14	32.09	41.34	2359
16	34.65	47.24	1411
18	36.61	53.15	1775
20	39.37	59.06	2326
24	43.31	70.87	3574

① 11.81" available on request.

ASME 900 lb

Nominal size [mm]	H [mm]	L [mm]	Weight [kg]
100 ①	520	400	176
150	590	600	324
200	660	600	464
250	730	750	684
300	810	900	957
350	840	1050	1190
400	890	1200	720
450	960	1350	964
500	1020	1500	1254
600	1160	1800	2200
① Minimum Inner diameter: 80 mm (≤ sch 80).			

ASME 900 lb

Nominal size [inch]	H [inch]	L [inch]	Weight [lbs]
4 ①	20.47	15.75	388
6	23.23	23.62	714
8	25.98	23.62	1023
10	28.74	29.53	1508
12	31.89	35.43	2110
14	33.07	41.34	2624
16	35.04	47.24	1588
18	37.8	53.15	2126
20	40.16	59.06	2765
24	45.67	70.87	4851
① Minimum Inner diameter: 3.15" (≤ sch 80).			

ASME 1500 lb

Nominal size [mm]	H [mm]	L [mm]	Weight [kg]
100 ①	530	500	221
150	600	600	434
200	660	800	652
250	760	750	1030
300	860	900	1507
① Minimum Inner diameter: 80 mm (≤ sch 80).			

ASME 1500 lb

Nominal size [inch]	H [inch]	L [inch]	Weight [lbs]
4 ①	20.87	19.69	487
6	23.62	23.62	957
8	25.98	31.5	1438
10	29.92	29.53	2271
12	33.86	35.43	3323
① Minimum Inner diameter: 3.15" (≤ sch 80).			

ASME 2500 lb

Nominal size [mm]	H [mm]	L [mm]	Weight [kg]
100 ①	574	500	298
150	681	750	658
200	729	800	946
250	844	1000	1664
300	947	1200	2359
① Minimum Inner diameter: 80 mm (≤ sch 80).			

ASME 2500 lb

Nominal size [inch]	H [inch]	L [inch]	Weight [lbs]
4 ①	22.6	19.69	657
6	26.81	29.53	1451
8	28.7	31.5	2086
10	33.23	39.37	3669
12	37.28	47.24	5205
① Minimum Inner diameter: 3.15" (≤ sch 80).			

2.3 Flow table

Nominal size [inch]	Q_{min}		Q_{max}	
	[m^3/h]	[cf/h]	[m^3/h]	[cf/h]
4	25	900	1000	35300
6	45	1600	2300	81200
8	75	2600	4100	145000
10	110	3900	6200	219000
12	140	4900	8200	290000
14	170	6000	9700	343000
16	210	7400	11700	413000
18	240	8500	13900	491000
20	260	9200	15700	554000
24	285	10100	21400	756000
30	450	15900	30900	1091000
36	650	23000	44500	1572000
40	800	28300	54900	1939000
42	880	31100	58000	2048000
48	1200	42400	75800	2677000
56	1600	56500	94200	3327000
64	2100	74200	117000	4132000
Qt as per ISO 17089 (Vt = 3 m/s for <12" and Vt=1.5 m/s for ≥ 12"				
For piping > Sch 80 values can vary slightly.				
Calculations are provided as indication, please ask KROHNE for detailed sizing.				

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 ALTOSONIC V12 is a gas flowmeter for custody transfer applications.
The meter is suitable to operate at least under the following conditions:

- relative density from 0.55 and upwards
- methane concentrations 75...100%

High levels of CO_2 can inhibit the operation of an ultrasonic flowmeter due to its acoustic absorption properties. It is recommended to submit a specification of the process medium to be measured at the manufacturer for advice.

3.2 Pre-installation requirements

The equipment is designed for safe operation under conditions according to the following classifications:

- *Pollution degree 2: this means that normally only nonconductive (dry) pollution will occur. Temporary conductivity caused by condensation can occur.*
- *Protection class I: this means the equipment must be earthed.*
- *Humidity: <95% RH*
- *Ambient temperature: -40...+65°C / -40...+149°F*
- *Suitable for indoor and outdoor use.*
- *IP66 / NEMA 4X classification.*

The flowmeter should be protected from corrosive chemicals or gases and dust or particles accumulation.

Do not intend to perform a hydrostatic test of the installed flowmeter.

The flowmeter has been hydrostatically tested during manufacturing (see reports) and must not be retested with the ultrasonic sensors installed. Water will protude in the sensor pockets and remain. This will create acoustic shortcuts and possibly cause the flowmeter to start operating in failure.

3.3 Installation

3.3.1 Mounting position

Install the ultrasonic gas flowmeter in horizontal position with the flow arrow indicator on the nameplate or on the meter body in the direction of the positive (forward) gas flow.
Make sure that the converter is on top of the flowmeter after the installation.
Check the weight of the meter. Typically the weight of the meter will be considerably more than the same length of pipe line.

To support the meter additional supports might be needed, preferably two, one on either side of the meter.
Always support the meter at its flanges, the weight of the meter shall never rest on the case around the transducers and the cabling.
If supports can not be placed under the meter flanges, supports may be placed under the mating flanges of the pipeline. If supports can only be placed under the pipeline sections upstream or downstream of the meter, these supports shall be as close as possible to the meter. In this case a calculation must be made to verify that the load on the pipeline will not exceed acceptable values.
The meter should be installed in the pipe line with gaskets, nuts and bolts according to the type and size of the flanges of the gas flowmeter. The flanges of the meter should match with the flanges of the pipeline where the meter should be installed.

Make sure that the gaskets do not protude into the flow as this can reduce the accuracy of the flowmeter.
In order to install the gas flowmeter, the pipeline must have a slot of such length that the meter including the gaskets fits nicely in the slot. It should not be necessary to use excessive force to tighten the bolts in order to close the gaps on either side of the meter.
Nor should the slot be too small, implying the slot has to be widened by applying brute force to fit the meter and gaskets in the slot.
For tightening the bolts of the flanges, apply a lubricant as required, in accordance with the materials as used and applicable standards.
Tighten the bolts of the flanges with a torque according to the standards applicable to the flanges and materials used.

3.3.2 Pipe diameters and lengths

Make sure that the inner diameter of upstream and downstream pipes matches the specified connection diameter of the ultrasonic flowmeter within 1%. Contact the manufacturer if the inner diameter deviates more than 1%.

3.3.3 Flow conditioners

Although the flowmeter is a highly accurate device, an additional flow conditioner can be installed upstream of the flowmeter in order to minimize measuring uncertainty, in particular when a strongly distorted flow velocity profile is expected, or when the available space for a metering run is critical. If a flow conditioner is used the total inlet length may be reduced to only 5 DN: having 2 DN upstream of the flow conditioner and 3 DN in between the flow conditioner and the flowmeter.

- *Preferred model is the "perforated plate" type. A "pipe bundle" type of flow conditioner is not recommended.*
- *When a flow conditioner is included in the metering run, it is strongly advised to use the same flow conditioner and inlet pipe configuration during a flow (wet) calibration (see e.g. ISO 17089 or AGA-9 for detailed requirements).*

3.3.4 Inlet and outlet for uni-directional use

Without flow conditioner (OIML R137 class 0.5)

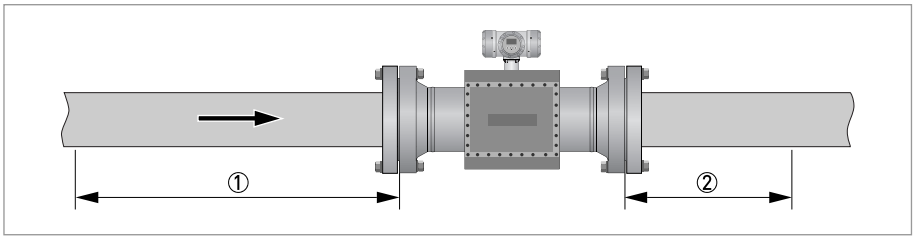


Figure 3-1: Required straight lengths for inlet and outlet

① Inlet section: 10 DN
② Outlet section: 3 DN

Without flow conditioner (AGA9, ISO 17089 and OIML R137 class 1)

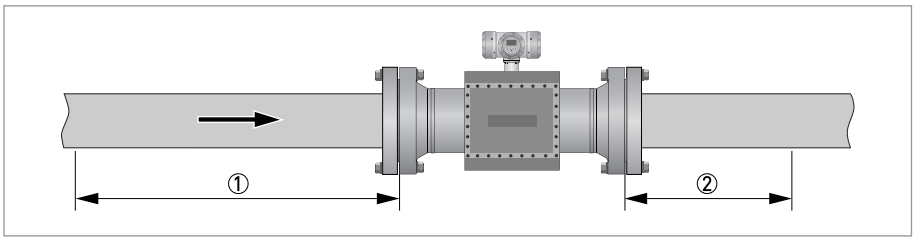


Figure 3-2: Required straight lengths for inlet and outlet

① Inlet section: 5 DN
② Outlet section: 3 DN

With flow conditioner

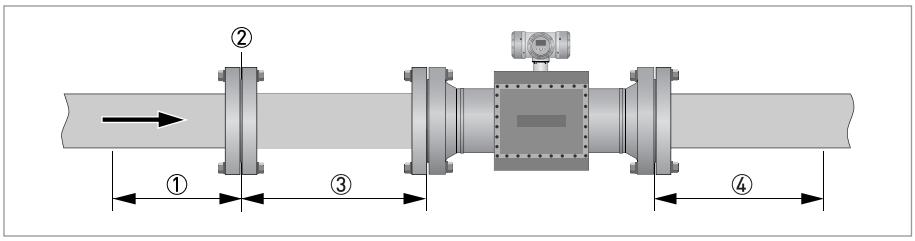


Figure 3-3: Required straight lengths for inlet and outlet

① Inlet section before flow conditioner: 2 DN
② Flow conditioner (perforated plate)
③ Inlet section after flow conditioner: 3 DN
④ Outlet section: 3 DN

Contact the manufacturer for recommendations on bi-directional use.

3.3.5 Control valves

Under adverse circumstances ultrasonic gas flowmeters can suffer from interference from noise generated by pressure control valves (PCV). In case the frequency spectrum of the PCV-noise extends in the range of the operation frequency of the ultrasonic transducers and the strength of the noise results in a signal to noise ratio smaller than the critical value, the ultrasonic flowmeter will not be able to operate. Consult the manufacturer for advice in case a PCV with high pressure cut will be operated close to the ultrasonic flowmeter.

3.3.6 P and T sensors

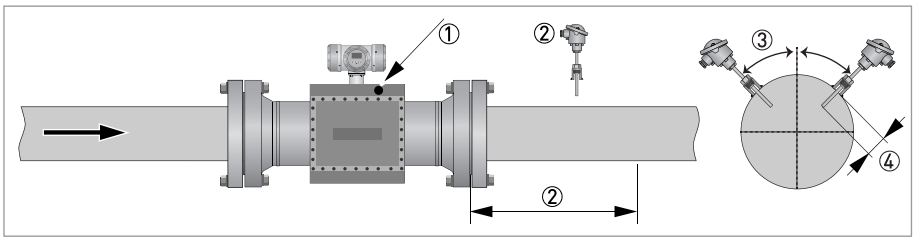


Figure 3-4: Location of pressure and temperature sensors

① Install pressure sensor on body of flowmeter at Pr point
② Install temperature sensor at 2...5 DN downstream of flowmeter
③ Install temperature sensor at an angle of no more than 45 degrees from the vertical
④ Install temperature sensor with an insertion depth between 0.1 and 0.33 of nominal pipe diameter

- *See ISO 17089 for further details.*
- *Use a Pt100 element with thermowell and transmitter as temperature sensor. Preferably use tapered thermowells to avoid vibrations.*
- *Connect the pressure sensor to the Pr-point in the meter body using an intermediate isolation valve and/or valve manifold.*

Either use a suitable blind plug or blind flange (and sealing as required) to blind the pressure port, or a pressure sensing line should be connected in an appropriate way.
A pressure sensing line should be properly supported to avoid vibrations and to prevent the weight of the sensing line from applying a strain on the pressure port connection.

3.4 Temperatures

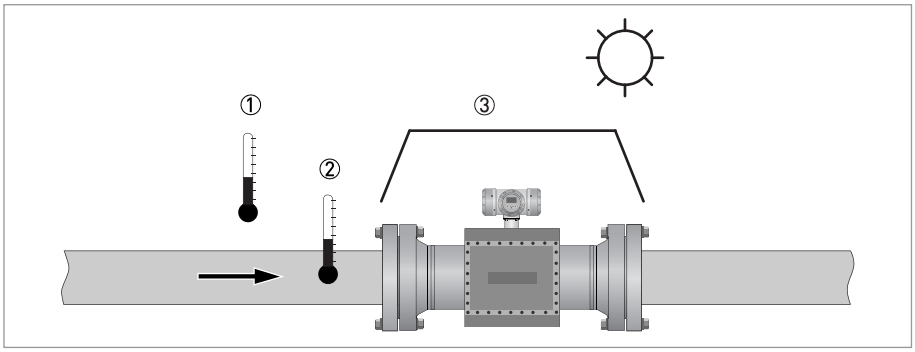


Figure 3-5: Temperatures

① Ambient temperature
② Process gas temperature
③ Use a sun shade to protect the flowmeter against direct solar radiation.

SUNSHADE

Direct solar radiation introduces temperature gradients in the metering section and must be avoided as much as possible. Use a sunshade or canopy over the flow, pressure and temperature sensors to protect against direct exposure to sunshine. Another option is to thermally insulate the complete metering section including the sensors.

For more detailed information about temperatures, refer to *Technical data table* on page 9.

4.1 Safety instructions

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

Observe the national regulations for electrical installations!

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

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

For FM installations, cables must be used that are resistant to high temperatures.
For all other applications, cable must be used that are resistant to high temperatures if the process temperature is 65°C / 149°F or higher.

4.2 Digital I/O connections

1. *In order to prevent unauthorized or inadvertent opening and removal of the covers, an interlocking device is provided for each cover. Before a cover can be rotated (counter clockwise) for opening, release this interlocking device with a 2.5 mm Allen key.*
2. *The foot of the converter housing provide an earthing point, this must be connected to the nearest safety earth conductor.*

3. *Only open the converter housing one minute after the power has been switched off and after it has been verified that there is no risk due to the presence of potentially explosive gas.*

- The digital outputs are passive open collector outputs, galvanically isolated from each other and from the main circuit. To use these outputs an external voltage source and current limiting resistors must be used. (NEC class 2 power supply (max. 100 VA, 24 VDC, IEC 61010-1, clause 6.3.1 and 6.3.2)
- For frequencies above 100 Hz, use shielded cables in order to reduce radiation from electrical interferences (EMC).
- Terminal A+ is not used.

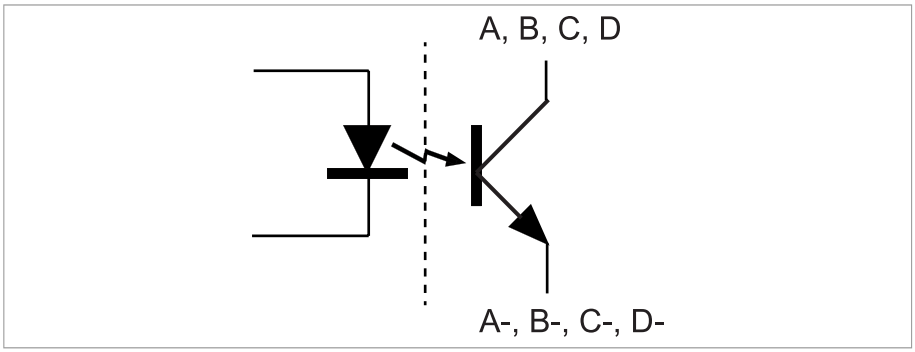


Figure 4-1: Digital I/O as NPN transistor

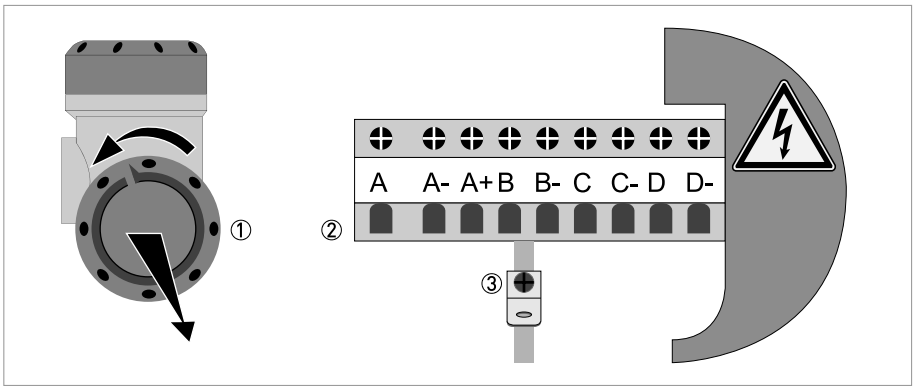


Figure 4-2: Terminal compartment for inputs and outputs in field housing

① Open the housing cover.
② Push the prepared cable through the cable entry and connect the necessary conductors.
③ Connect the shield if necessary.

- Close the cover of the terminal compartment.
- Close the housing cover.

Each time a housing cover is opened, the thread should be cleaned and greased. Use only resin-free and acid-free grease.
Ensure that the housing gasket is properly fitted, clean and undamaged.

4.2.1 Pulse and frequency output

By default the first digital I/O connection is set as a pulse/frequency output, having a frequency proportional to the volume flow rate (actual volume: under process conditions). It is possible to assign another variable to control this output (defined by means of parameter settings).

4.2.2 Status outputs

By default the next three digital I/O connections are defined as status outputs (Data not valid, Fail unreliable and Reverse flow). However the function of these outputs can be programmed to various alarms or status signals. One of the status outputs may be programmed to a second pulse output, having the same frequency as the first pulse output, however the phase difference can be set to either 0, 90, 180 or 270 degrees.

4.2.3 Emulation of a turbine meter

To emulate a turbine meter, use the following setup and settings:

- A/A-: Frequency output related to the line flow
- B/B-: Frequency output inverted related to the line flow whereby this frequency output will stop operating if data valid alarm on status bit C/C- will occur.

Place the frequency output B/B- in series with status bit C/C- as presented in the figure shown below.

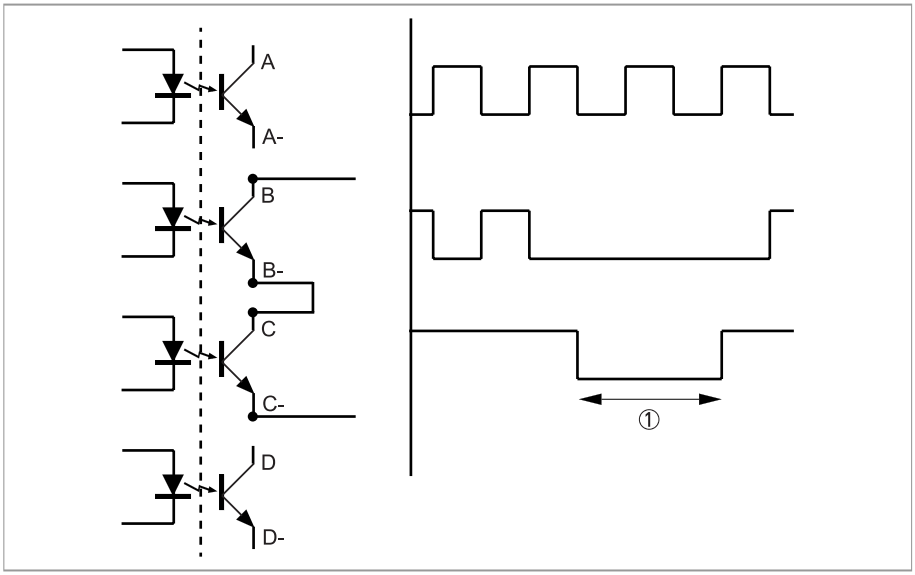


Figure 4-3: Connection diagram for turbine emulation

① Alarm

4.3 Serial data communication (RS 485)

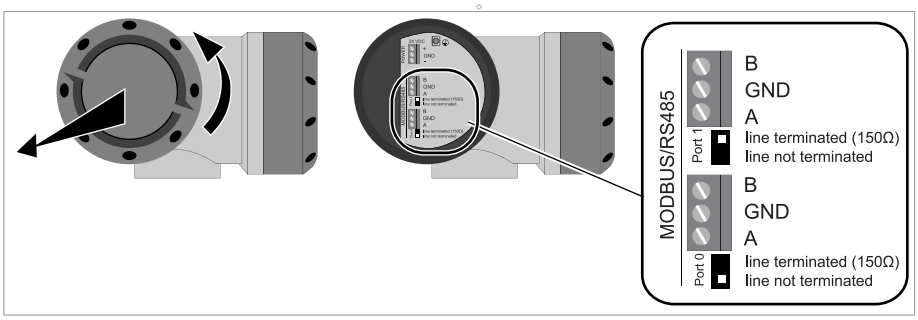


Figure 4-4: Connection of serial data communication

4.4 Power connection

- *Use a 24 VDC power supply to power the flowmeter, which complies to NEC class 2 (max. 100 VA, 24 VDC ± 10% , see also IEC 61010-1, clause 6.3.1 and 6.3.2). The maximum power consumption is 17 W. The power supply must be able to supply 3 A (needed during start-up).*
- *The protective earth conductor (1...4 mm^2, AWG 17...AWG 11) of the power supply must be connected to the protective conductor clamp terminal size M5, which is press-fitted in the terminal compartment.*
- *Use a cable entry to lead the power supply cable to the electronics. The power delivered from the power converter inside the unit is limited to a maximum of 15 W according to the "fold-back" principle (when the admissible internal power consumption is exceeded the delivered power is reduced to zero). Separately the current consumption is limited to appr. 1A. Requires typically 3 x 1.5 mm^2 (AWG 15) conductors.*
- *Connection to a flow computer, a data acquisition system or process control system by means of digital output signals; requires as a maximum 4 pairs of wires of 0.75 mm^2 (AWG 18) copper each.*
- *Connection by means of a RS 485 data line to a device for logging or monitoring data or running a software service tool for performing a function check or a service jobs; requires a shielded pair of two twisted conductors of 0.75 mm^2 (AWG 18) copper each.*
- *Connection to a data acquisition system by means of digital signals; requires a shielded pair of two twisted conductors of 0.75 mm^2 (AWG 18) copper each.*
- *Connection to safety / protective ground (earthing); requires insulated wire, minimum copper cross section area 4 mm^2 (AWG 11).*

- *The protective conductor clamp or GND of the connector can be used for the shielding of the cable.*
- *The electronics is protected against connecting a power supply with the wrong polarity.*

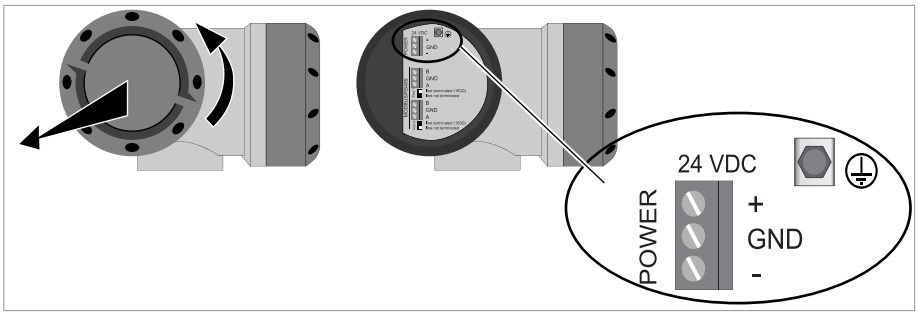


Figure 4-5: Location of power connector

4.5 Cabling

- *Replace any unused cable gland by an Ex-d blind plug!*
- *The temperature rating of all cables must have a temperature rating of at least 65° C / 149° F. In case the process design temperature exceeds 65° C, the cables must have a temperature rating at least as high as the maximum process design temperature.*

In respect of the model of the cable glands used, the outer diameter of the cable must be between 6.5 and 14 mm. Unused cable glands must be replaced by Ex d approved blind plugs.

We recommend to use screened cable with twisted pairs for connecting power, serial outputs and the status signals. The screen can be used to connect the ground terminal.

Length of power supply cable versus diameter

Length of cable between power supply and flowmeter		Required minimum copper cross section
[m]	[ft]	
70	230	2 x 0.5 mm^2 (AWG 20)
100	328	2 x 0.75 mm^2 (AWG 18)
200	656	2 x 1.5 mm^2 (AWG 15)
400	1312	2 x 4 mm^2 (AWG 11)

4.6 Grounding

There are two screw connection points (one M5 thread and one M4 thread) to attach a ground conductor. They can be used to connect the upstream and downstream piping to the flowmeter (Equipotential).

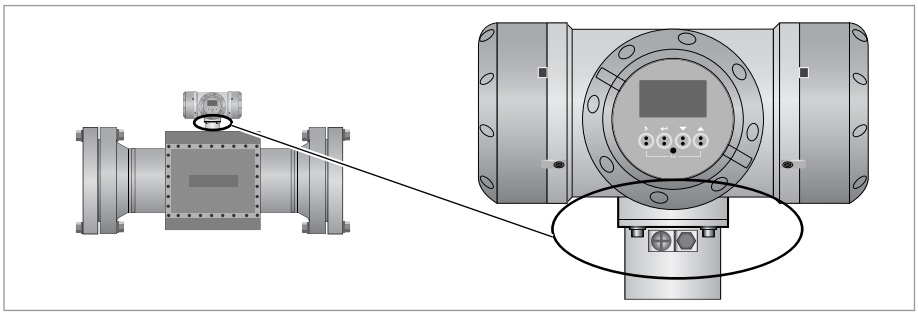


Figure 4-6: Location of grounding connectors

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.

5.1 Application Form

Information requested by

Name:	
Email:	
Phone number:	
Date:	
Quotation required by:	

Project details

Customer:	
Project:	
End user:	
End destination:	
Ref number:	

Process data	Min	Nom	Max	Design	Unit
Flow					
Pressure					
Temperature					
Density					
Compressibility					

Normalised pressure	Select one of the next options:
	1 bar(a)
	1.01325 bar(a)
	14.73 PSI(g)
	Other, specify:
Normalised temperature	Select one of the next options:
	0°C
	15°C
	20°C
	60°F
	Other, specify:
CO_2 content:	Select one of the next options:
	No CO_2 in line
	Specified in %Volume:
	Specified in %Mass:
	Specified in %Mole:

Worst case scenario	Select one of the next options:
	F_{max} combined with P_{min}
	F_{max} combined with P_{max}
	Other, specify:

Piping data

Nominal diameter	Select one of the next options:
	KROHNE to advise
	Specify size:
Pressure class	Select one of the next options:
	KROHNE to advise
	150 lb ASME RF
	300 lb ASME RF
	600 lb ASME RF
	900 lb ASME RF
	600 lb ASME RTJ
	900 lb ASME RTJ
	Other, specify:
Schedule size / ID	Select one of the next options:
	KROHNE to advise
	20
	30
	40S/STD
	40
	60
	80S/XS
	80
	Other, specify wall thickness:
	Other, specify pipe ID:
Material	Select one of the next options:
	Carbon steel A333/A350
	Stainless steel 316/316L
	Other, specify:
Pressure controle valve	Select one of the next options:
	No PCV within 10D
	Quiet PCV upstream
	Quiet PCV downstream
	Normal PCV upstream
	Normal PCV downstream
	Noisy PCV upstream
	Noisy PCV downstream
	Other, specify:

Flowmeter data

Custody Transfer standard	Select one of the next options:
	No Custody transfer
	ISO 17089
	AGA 9
	MID with NMi sealing
	MID with PTB sealing
	OIML R137, class 1
	OIML R137, class 0.5
	Other, specify:
Requested accuracy	Select one of the next options:
	0.1% (calibration required)
	0.2% (calibration required)
	0.5%
	Other, specify:
Requested outputs	Select one of the next options:
	4x pulse and 2x Modbus RS485
	Other, specify:
Calibration required	Select one of the next options:
	KROHNE to advise
	6 points, 3 runs
	6 points, 5 runs
	7 points, 3 runs
	7 points, 5 runs
	8 points, 3 runs
	8 points, 5 runs
	9 points, 3 runs
	9 points, 5 runs
	10 points, 3 runs
	10 points, 5 runs
	Other, specify:
Material certificates	Select one of the next options:
	3.1
	3.1plus
	3.1 + NACE MR01-75
	3.1plus + NACE MR01-75
	Other, specify:
Design codes	Select one of the next options:
	ASME B31.3
	ASME B31.8, des. fac. 0.6
	ASME VIII
	Other, specify:

Third party inspections	Select one of the next options:
	Not required
	Required, specify details:
Ex approvals	Select one of the next options:
	ATEX
	FM
	CSA
	IECEx
	Other, specify:
Documentation	Select one of the next options:
	Standard
	Standard and additional, specify:

Auxileries

Inlet piping	Select one of the next options:
	Not requested
	Requested, KROHNE to advise length
	5D
	5D with flow conditioner
	10D
	10D with flow conditioner
	Other, specify:
Outlet piping	Select one of the next options:
	Not requested
	3D
	3D with 1 thermowell connection
	3D with 2 thermowell connections
	Other, specify:
PT, TT and flow computer	Select one of the next options:
	Not requested
	1x TT
	1x PT
	1x flow computer
	1x PT + 1x TT
	1x PT + 1x TT + 1x flow computer
	Other, specify:

Other

Remarks	Specify other important information here:
More information	www.krohne.com/oilandgas

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

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.:+49 (0)203 301 0
Fax:+49 (0)203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com