Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Cubemass DCI

Coriolis mass flow measuring system

Applications
The Coriolis measuring principle operates independently of physical fluid properties.

- Fluid temperatures up to +200 °C (+392 °F)
- Process pressures up to 400 bar (5800 psi)
- Mass flow measurement up to 1000 kg/h (36.75 lb/min)

Approvals for hazardous area:
- ATEX, NEC/CEC, NEPSI

Connection to commonly used process control systems:
- MODBUS RS485

Your benefits
The Cubemass DCI make it possible to simultaneously record several process variables (mass/density/temperature) for various process conditions during measuring operation.

The **transmitter concept** includes:
- FieldCare for onsite operation and diagnosis
- Very low power consumption

TI099D/06/en/04.10
71112154

Endress+Hauser
People for Process Automation

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Function and system design

Measuring principle

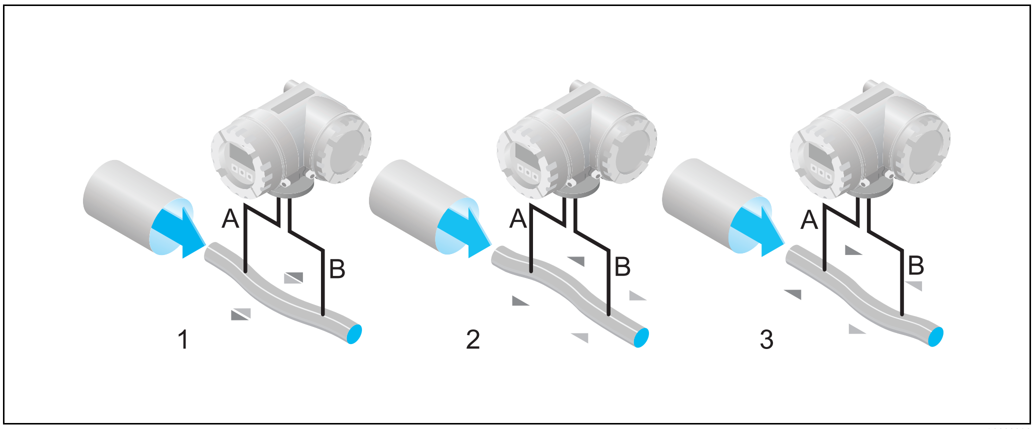
The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present when both translational and rotational movements are superimposed.

$F_C = 2 \cdot \Delta m \ (v \cdot \omega)$
F_C = Coriolis force
Δm = moving mass
ω = rotational velocity
v = radial velocity in rotating or oscillating system

The amplitude of the Coriolis force depends on the moving mass Δm, its velocity v in the system, and thus on the mass flow. Instead of a constant angular velocity ω, oscillation occurs.

This causes the measuring tube loop through which the fluid is flowing to oscillate. The Coriolis forces produced at the measuring tube loop cause a phase shift in the oscillations of the tube loop (see illustration):

- If there is zero flow, i.e. when the fluid stands still, the oscillation measured at points A and B has the same phase, and thus there is no phase difference (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tube loop (2) and acceleration at the outlet (3).



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The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube loop oscillations at the inlet and outlet.
Compared to two-tube systems, other design solutions are required in single-tube systems to ensure system balance. In the case of the CNGmass DCI, an internal reference mass is provided for this purpose.
The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

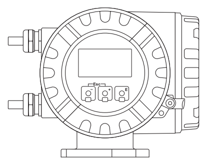
Density measurement
The measuring tube is continuously excited at its resonance frequency. A change in the mass and thus the density of the oscillating system (comprising the measuring tube loop and fluid) results in a corresponding, automatic adjustment in the oscillation frequency. Resonance frequency is thus a function of fluid density. The microprocessor utilizes this relationship to obtain a density signal.

Temperature measurement
The temperature of the measuring tube loop is determined in order to calculate the compensation factor due to temperature effects.
This signal corresponds to the process temperature and is also available as an output.

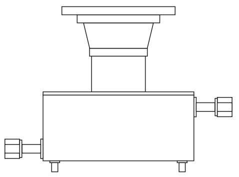
Measuring system

The measuring system consists of a transmitter and a sensor. Two versions are available:
- Compact version: transmitter and sensor form a mechanical unit.
- Remote version: transmitter and sensor are mounted physically separate from one another.

Transmitter

 A0003672	■ Four-line liquid crystal display ■ Configuration via Touch Control, HART, MODBUS RS485, FieldCare ■ Application-specific Quick Setup ■ Mass flow, volume flow, density and temperature measurement as well as calculated variables (e.g. fluid concentrations)

Sensor

 A0011878	■ Universal sensor for fluid temperatures up to 200 °C. ■ Nominal diameters DN 1 to 6 ■ Tube material: stainless steel

Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Volume flow (calculated using mass flow and density)
- Fluid density (proportional to the resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range

Measuring ranges for liquids

DN		Range for full scale values (liquids) $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$	
[mm]	[inch]	[kg/h]	[lb/min]
1	1/24"	0 to 20	0 to 0.75
2	1/12"	0 to 100	0 to 3.7
4	1/8"	0 to 450	0 to 16.5
6	¼"	0 to 1000	0 to 37

Operable flow range

1:100

Input signal

Status input (auxiliary input)

U = 3 to 30 V DC, R_i = 5 kΩ, galvanically isolated.
Switching level: 3 to 30 V DC, polarity-independent.
Configurable for: totalizer reset, positive zero return, error message reset, start zero point adjustment.

Output

Output signal

Current output

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% o.f.s. / °C, resolution: 0.5 µA

- Active: 0/4 to 20 mA, R_L < 700 Ω, $R_L \geq 250$ Ω (HART)
- Passive: 4 to 20 mA; supply voltage V_S: 18 to 30 V DC; $R_i \geq 150$ Ω

o.f.s. = of full scale value

Pulse/frequency output

Active/passive selectable, galvanically isolated

- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms), R_L > 100 Ω
- Passive: open collector, 30 V DC, 250 mA
- Frequency output: full scale frequency 2 to 10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

MODBUS RS485

- MODBUS device type: slave
- Address range: 1 to 247
- Supported function codes: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Physical interface:
  RS485 in accordance with EIA/TIA-485 standard
- Supported baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Transmission mode:
  RTU or ASCII
- Response times:
  Direct data access = typically 25 to 50 ms
  Auto-scan buffer (data range) = typically 3 to 5 ms
- Possible output combinations → Operating Instructions

Signal on alarm

Current output
Failsafe mode selectable (for example, according to NAMUR Recommendation NE 43)

Pulse/frequency output
Failsafe mode selectable

Relay output
De-energized in the event of fault or power supply failure

MODBUS RS485
If an error occurs, the value NaN (not a number) is output for the process variables.

Switching output

Relay output
Normally closed (NC or break) or normally open (NO or make) contacts available
(factory setting: relay 1 = normally open),
max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated.

Load

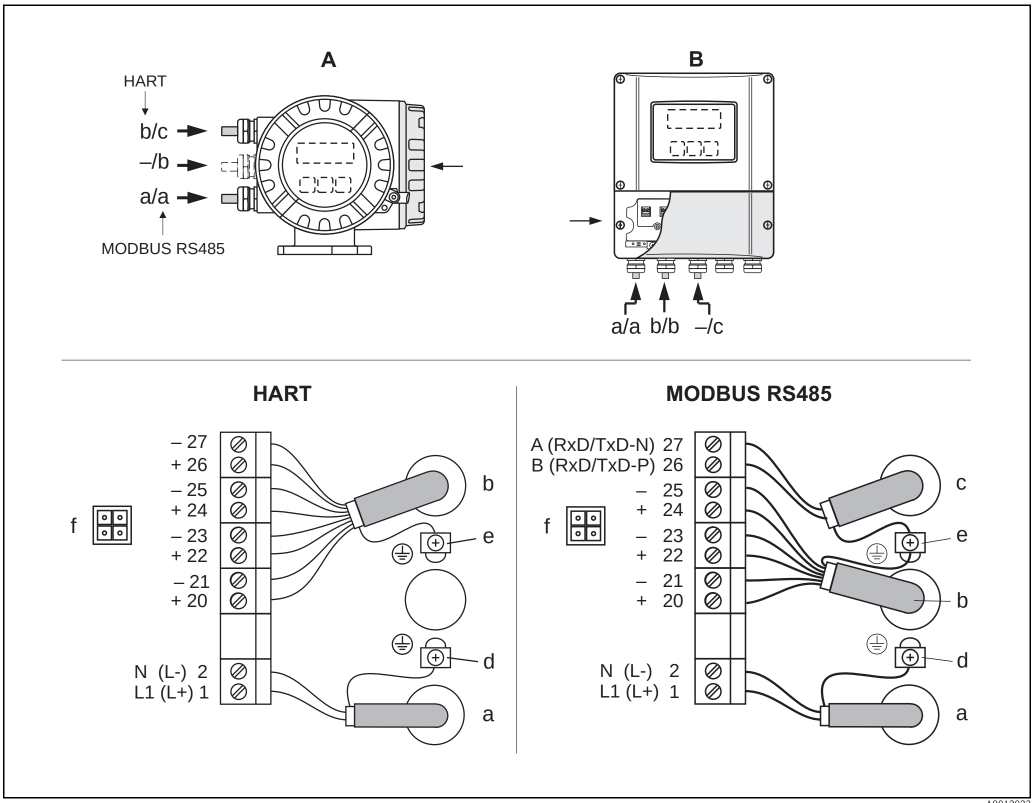
→ "Output signal"

Galvanic isolation

All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

Power supply

Electrical connection Measuring unit



Connecting the transmitter, cable cross-section: max. 2.5 mm² (14 AWG)

A View A (field housing)
B View B (wall-mount housing)

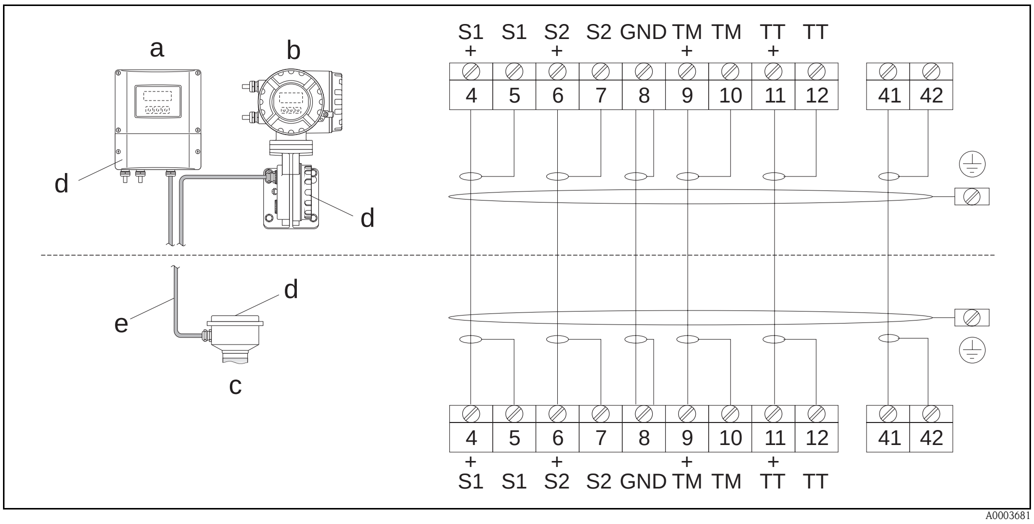
a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
– Terminal No. 1: L1 for AC, L+ for DC
– Terminal No. 2: NN for AC, L- for DC
b Signal cable: Terminal assignment → 8
c Fieldbus cable
– Terminal No. 26: B (RxD/TxD-P)
– Terminal No. 27: A (RxD/TxD-N)
d Ground terminal for protective ground
e Ground terminal for signal cable shield/ fieldbus cable shield
Please note:
– shielding and grounding of fieldbus cable → Operating Instructions
– that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

Electrical connection, terminal assignment

Electrical values for inputs/outputs ➞ Operating Instructions

	Terminal No. (inputs/outputs)			
Order version	**20 (+) / 21 (-)**	**22 (+) / 23 (-)**	**24 (+) / 25 (-)**	**26 (+) / 27 (–)**
Fixed communication boards (permanent assignment)				
8CN**–**S*********	–	–	Frequency output, Ex i, passive	Current output, Ex i, active, HART
8CN**–**T*********	–	–	Frequency output, Ex i, passive	Current output, Ex i, passive, HART
8CN**–**Q*********	–	–	Status input	MODBUS RS485
Flexible communication boards				
8CN**–**D*********	Status input	Relay output	Frequency output	Current output, HART
8CN**–**M*********	Status input	Frequency output 2	Frequency output 1	Current output, HART
8CN**–**N*********	Current output	Frequency output	Status input	MODBUS RS485
8CN**–**1*********	Relay output	Frequency output 2	Frequency output 1	Current output, HART
8CN**–**2*********	Relay output	Current output 2	Frequency output	Current output 1, HART
8CN**–**7*********	Relay output 2	Relay output 1	Status input	MODBUS RS485

Electrical connection, Remote version



Connecting the remote version

a Transmitter wall-mount housing: non-hazardous area → separate documentation
b Transmitter wall-mount housing: ATEX II2G / Zone 1 / NEC/CEC → separate Ex documentation
c Sensor connection housing
d Cover of connection compartment or connection housing
e Connecting cable

Terminal No.: 4/5 = gray; 6/7 = green; 8 = yellow; 9/10 = pink; 11/12 = white; 41/42 = brown

Supply voltage

85 to 260 V AC, 45 to 65 Hz
20 to 55 V AC, 45 to 65 Hz
16 to 62 V DC

Cable entries

Power supply and signal cables (inputs/outputs):
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Threads for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Threads for cable entries, ½" NPT, G ½"

Cable specifications

Any suitable cable with a temperature specification of at least 20 °C (68 °F) higher than the ambient temperature of the application. We recommend the use of a cable with a temperature specification of +80 °C (+176 °F).

Remote version:

- 6 × 0.38 mm^2 (20 AWG) PVC cable with common shield and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 140 pF/m (≤ 42.7 pF/ft)
- Cable length: max. 20 m (65.6 ft)
- Permanent operating temperature: max. +105 °C (+221 °F)

✎ Note!
The cable must be installed securely, to prevent movement.

MODBUS RS485 (cable type A):

- Characteristic impedance: 135 to 165 Ω at a measuring frequency of 3 to 20 MHz
- Cable capacity: < 30 pF/m (< 9.2 pF/ft)
- Core cross-section: > 0.34 mm^2 (AWG 22)
- Cable type: twisted pairs
- Loop-resistance: ≤ 110 Ω/km (≤ 0.034 Ω/ft)
- Signal damping: max. 9 dB along the entire length of the cable cross-section
- Shield: Copper braided shielding or braided shielding and foil shielding

Power consumption

AC: < 15 VA (including sensor)
DC: < 15 W (including sensor)

Switch-on current
- max. 13.5 A (< 50 ms) at 24 V DC
- max. 3 A (< 5 ms) at 260 V AC

Power supply failure

Lasting min. 1 power cycle:
- EEPROM or HistoROM T-DAT saves measuring system data if power supply fails.
- HistoROM/S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point etc.)

Potential equalization

No measures necessary.
For explosion-protected equipment → separate Ex-documentation supplied

Performance characteristics

Reference operating conditions

- Error limits following ISO/DIS 11631
- Water, typically 20 to 30 °C (68 to 86 °F); 2 to 4 bar (30 to 60 psi)
- Data as per the calibration report ±5 °C (±9 °F) and ±2 bar (±30 psi)
- Data on the measured error based on accredited calibration rigs traced back to ISO 17025

Maximum measured error

The values indicated refer to the pulse/frequency output.
The additional measured error for the current output is typically ±5 µA. Basis for calculations → 🗎 11.

o.r. = of reading

Mass flow and volume flow (liquids)

- ±0.10% o.r. (mass flow)
- ±0.10% o.r. (volume flow)

Density (liquids)

- ±0.001 g/cc (after field density calibration or under reference conditions)
- ±0.002 g/cc (special density calibration (optional)
  Calibration range: 0.0 to 2.0 g/cc, 5 to 80 °C (41 to 176 °F)
  Application range: 0.0 to 5.0 g/cc, –50 to 200 °C (–58 to 392 °F)
- ±0.02 g/cc (standard calibration)

Temperature

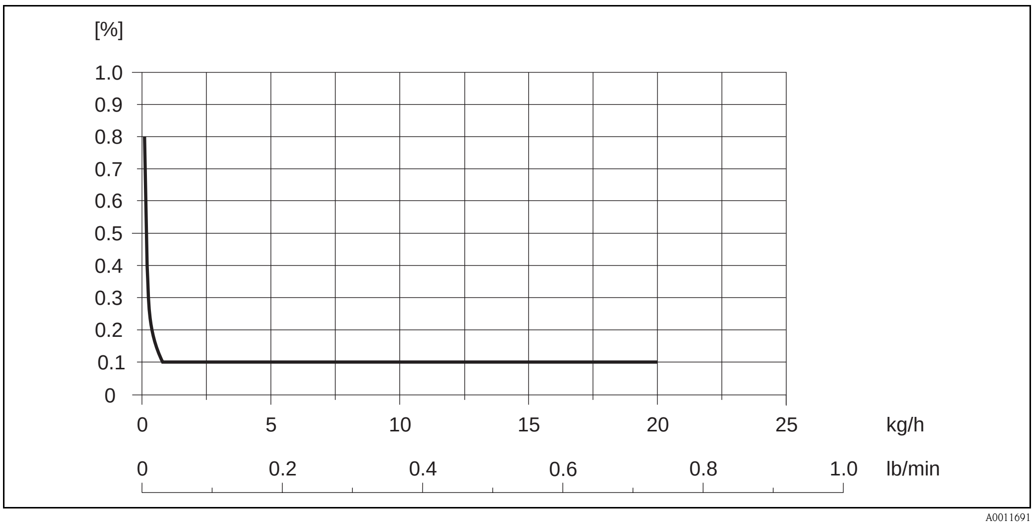
±0.5 °C ± 0.005 · T °C
(±1.0 °F ± 0.003 · (T – 32) °F)

T = Fluid temperature

Zero point stability

DN		Max. full scale value		Zero point stability	
[mm]	[inch]	[kg/h]	[lb/min]	[kg/h]	[lb/min]
1	1/24"	0 to 20	0 to 0.75	0.0008	0.00003
2	1/12"	0 to 100	0 to 3.7	0.002	0.00007
4	1/8"	0 to 450	0 to 16.5	0.014	0.0005
6	¼"	0 to 1000	0 to 37	0.02	0.0007

Example of maximum measured error



Max. measured error in % o.r. (example: Cubemass DCI, DN 1)

Flow values (examples)

Basis for calculations→ 📄 11.

Flow rate		Maximum measured error
[kg/h]	[lb/min]	[% o.r.]
0.1	0.0037	0.8
0.7	0.0257	0.114
2.5	0.0919	0.1
15	0.5513	0.1

Repeatability

Basis for calculations→ 📄 11.

o.r. = of reading

Mass flow and volume flow (liquids)

- ±0.05% o.r. (mass flow)
- ±0.05% o.r. (volume flow)

Density (liquids)

- ±0.0005 g/cc

1 g/cc = 1 kg/l

Temperature

±0.25 °C ± 0.0025 · T °C
(±0.5 °F ± 0.0015 · (T – 32) °F)

T = Fluid temperature

Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error is ±0.0002% of the full scale value / °C (±0.0001% of the full scale value / °F).

Influence of medium pressure

The tables below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		Medium pressure	
[mm]	[inch]	[% o.r./bar]	[% o.r./psi]
1	1/24"	–0.001	–0.00007
2	1/12"	0	0
4	1/8"	–0.005	–0.0004
6	¼"	–0.003	–0.0002

o.r. = of reading

Basis for calculations

Depends on the flow:

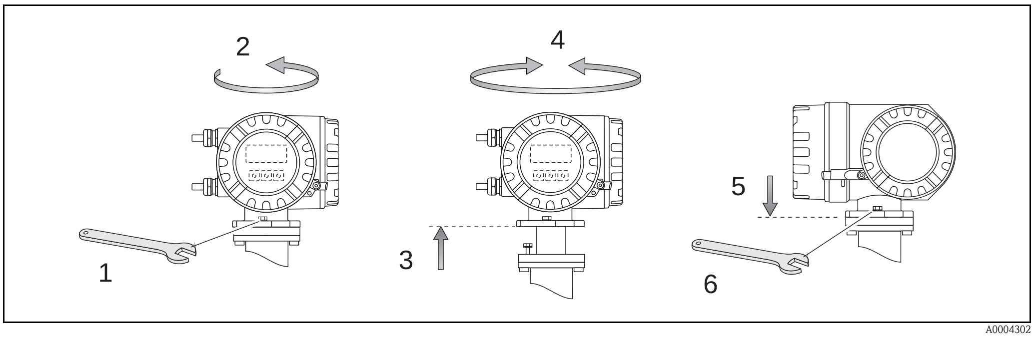
- Flow ≥ zero point stability : (basic accuracy : 100)
  - Max. measured error: ±basic accuracy in % o.r.
  - Repeatability: ±½ · basic accuracy in % o.r.
- Flow < zero point stability : (basic accuracy : 100)
  - Max. measured error: ±(zero point stability : measured value) · 100% o.r.
  - Repeatability: ±½ · (zero point stability : measured value) · 100% o.r.

o.r. = of reading

Operating conditions: Installation

Installation instructions

Note the following points:
- The measuring device is designed for mounting on tabletops, walls or pipes.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces etc.) as long as no cavitation occurs.

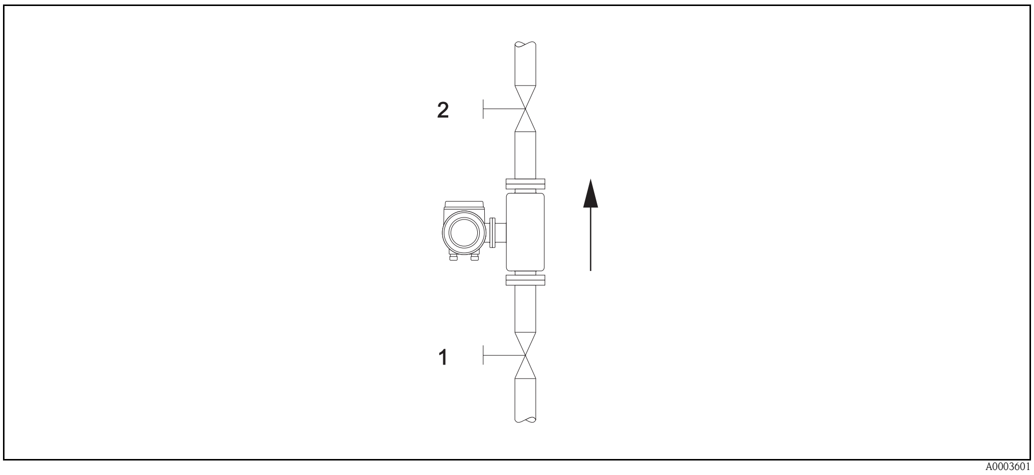


Rotating the transmitter housing

Zero point adjustment

All measuring devices are calibrated using state-of-the-art technology. The zero point obtained in this way is printed on the nameplate. Calibration takes place under reference conditions (→ 🗎 10).
Therefore, a zero point adjustment is generally **not** required!

If a zero point adjustment is desired, please note the following points before performing one:
- Adjustment can only be performed under stable pressure conditions.
- The zero point adjustment takes place at zero flow. This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  - Normal operation → valves 1 and 2 open
  - Zero point adjustment *with* process pressure → Valve 1 open / valve 2 closed
  - Zero point adjustment *without* process pressure → Valve 1 closed / valve 2 open
- A zero point adjustment is **not** possible if an error message is present.



Zero point adjustment and shutoff valves

Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs. If possible, mount the sensor upstream of fittings such as valves, T-pieces, elbows etc.

Connection cable length, remote version

Max. 20 m (max. 65 ft)

System pressure

It is important to ensure that cavitation does not occur as it could influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.
In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapor pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.

Consequently, it is generally best to install the sensor:
- On the pump pressure side (no risk of vacuum)
- At the lowest point in a riser

Operating conditions: Environment

Ambient temperature range	Sensor and transmitter: ▪ Standard: –20 to +60 °C (–4 to +140 °F) ▪ Optional: –40 to +60 °C (–40 to +140 °F) Note! ▪ Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions. ▪ At ambient temperatures below –20 °C (–4 °F), the readability of the display may be impaired.
Storage temperature	–40 to +80 °C (–40 to +175 °F), preferably at +20 °C (+68 °F)
Degree of protection	Standard: IP 67 (NEMA 4X) for transmitter and sensor
Shock resistance	According to IEC 68-2-31
Vibration resistance	Acceleration up to 1 g, 10 to 150 Hz, following IEC 68-2-6
CIP cleaning	Yes
SIP cleaning	Yes
Electromagnetic compatibility (EMC)	As per IEC/EN 61326 and NAMUR Recommendation NE 21

Operating conditions: Process

Medium temperature range

Sensor

- –50 to +200 °C (–58 to +392 °F)

Seals

- Only for mounting kits with threaded connections:
  - Viton: –15 to 200 °C (–5 to +392 °F)
  - EPDM: –40 to +160 °C (–40 to +320 °F)
  - Silicone: –60 to +200 °C (–76 to +392 °F)
  - Kalrez: –20 to +275 °C (–4 to +527 °F)

Fluid pressure range (nominal pressure)

DN		Max. nominal pressure	
[mm]	[inch]	[bar]	[psi]
1	1/24"	400	5800
2	1/12"	160	2320
4	1/8"		
6	¼"		

Pressure range of secondary containment

- 25 bar (363 psi)

Rupture element/disk (optional)

Further information → 25

Limiting flow

→ 5, "Measuring range"

Pressure loss (SI units)

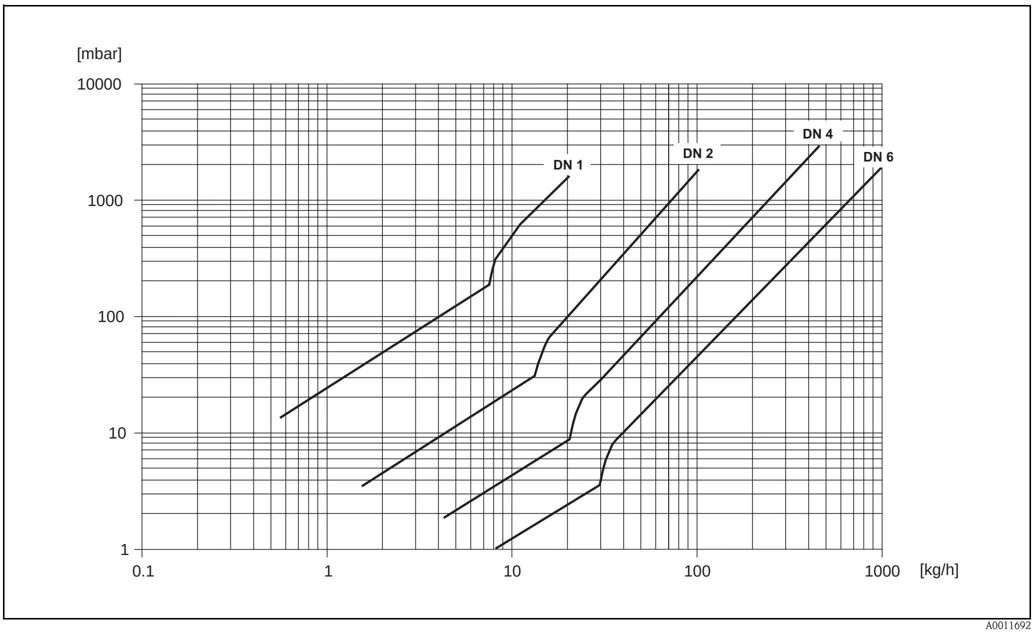
Pressure loss depends on the fluid properties and on the flow rate.
The following formulas can be used to approximately calculate the pressure loss:

Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ A0003381
Re ≥ 2300[1]	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.75} \cdot \rho^{-0.75}$ A0003380
Re < 2300	$\Delta p = K1 \cdot \nu \cdot \dot{m}$ A0003379

Δp = pressure loss [mbar]
ν = kinematic viscosity [m²/s]
$\dot{m}$ = mass flow [kg/s]
ρ = density [kg/m³]
d = inside diameter of measuring tubes [m]
K, K1 = constants (depending on nominal diameter)
[1] To compute the pressure loss for gases, always use the formula for Re ≥ 2300.

Pressure loss coefficients for Cubemass DCI

DN		d	K	K1
[mm]	[inch]	[m]		
1	1/24"	$1.40 \cdot 10^{-3}$	$7.78 \cdot 10^{10}$	$9.50 \cdot 10^{10}$
2	1/12"	$2.50 \cdot 10^{-3}$	$5.04 \cdot 10^{9}$	$9.51 \cdot 10^{9}$
4	1/8"	$3.90 \cdot 10^{-3}$	$6.31 \cdot 10^{8}$	$1.66 \cdot 10^{9}$
6	¼"	$5.35 \cdot 10^{-3}$	$1.49 \cdot 10^{8}$	$4.97 \cdot 10^{8}$



Pressure loss diagram for water

Pressure loss (US units)

Pressure loss depends on the nominal diameter and the fluid properties.
The "Applicator" PC software is available from Endress+Hauser and can be used to calculate the pressure loss in US units. The "Applicator" program contains all the important device data which allows the measuring system arrangement to be optimized.

The software is used for the following calculations:

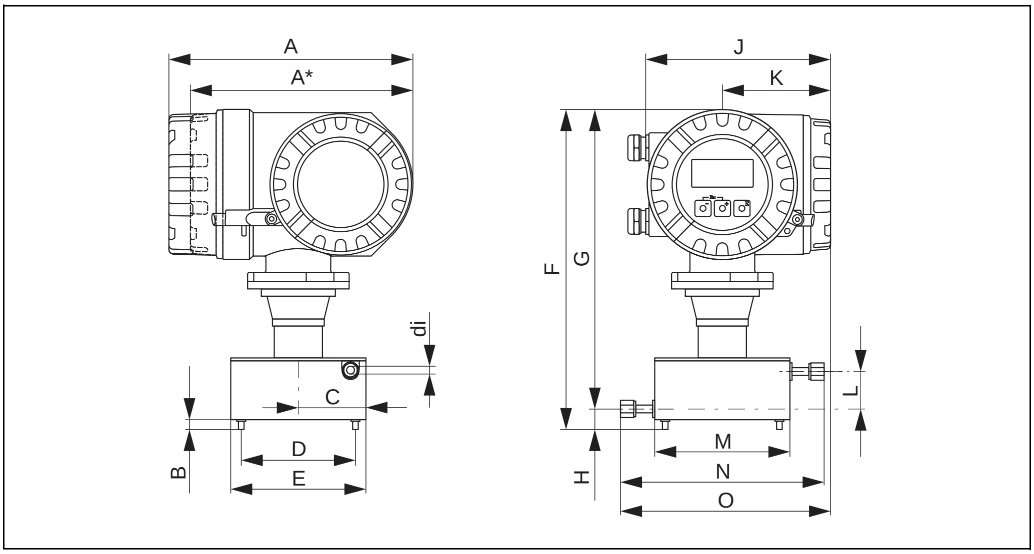
- Nominal diameter of the sensor with fluid properties such as viscosity, density etc.
- Pressure loss downstream from the measuring point
- Conversion of mass flow to volume flow etc.
- Simultaneous display of variables determined by different measuring devices
- Determining measuring ranges

The Applicator program runs on any IBM-compatible PC with Windows.

Mechanical construction

Design/dimensions

Field housing compact version (non-hazardous area II2G / zone 1)



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Dimensions in SI units

DN	A	A*	B	C	D	E	F	G	H	J	K	L	M	N	O	di
1	227	207	10	40	90	120	291.2	269.3	22	168	100	30	120	175	187.5	1.3
2																2
4																3.9
6																5.35

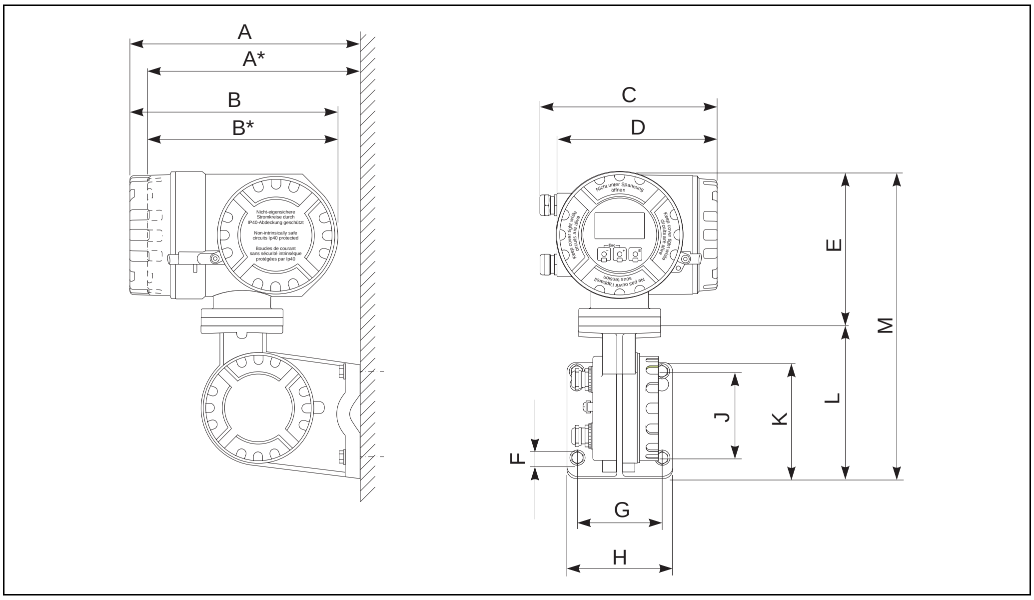
* Blind version (without local display)
DN 1 to 4: 4-VCO-4
DN 6: 8-VCO-4
All dimensions in [mm]

Dimensions in US units

DN	A	A*	B	C	D	E	F	G	H	J	K	L	M	N	O	di
1/24"	8.94	8.15	0.39	1.57	3.54	4.72	11.5	10.6	0.87	6.61	3.94	1.18	4.72	6.89	7.38	0.05
1/12"																0.08
1/8"																0.15
¼"																0.21

* Blind version (without local display)
DN 1/24 to 1/8": 4-VCO-4
DN ¼": 8-VCO-4
All dimensions in [inch]

Transmitter, remote version, connection housing (II2G/zone 1)



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Dimensions in SI units

A	A*	B	B*	C	D	E	F	G	H	J	K	L	M
265	242	240	217	206	186	178	∅ 8.6 (M8)	100	130	100	144	170	355

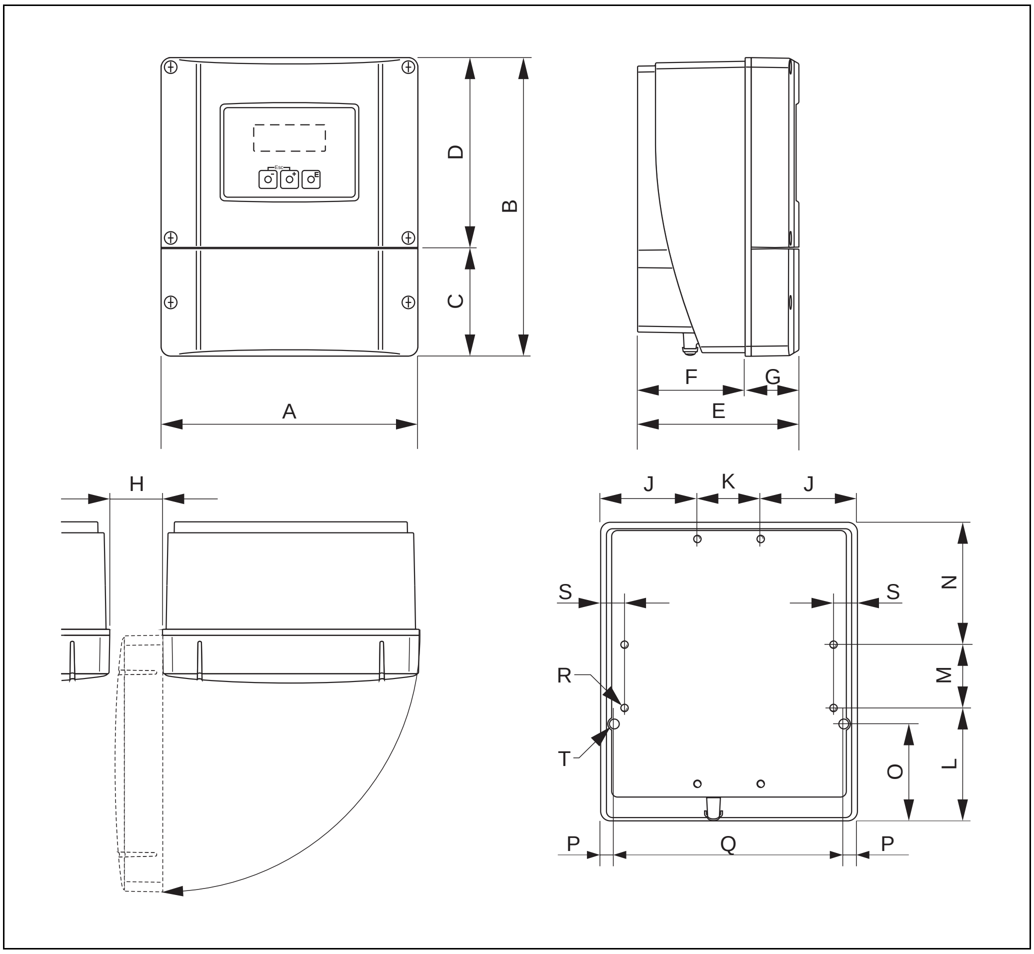
* Blind version (without local display)
All dimensions in [mm]

Dimensions in US units

A	A*	B	B*	C	D	E	F	G	H	J	K	L	M
10.4	9.53	9.45	8.54	8.11	7.32	7.01	∅ 8.6 (M8)	3.94	5.12	3.94	5.67	6.69	13.9

* Blind version (without local display)
All dimensions in [inch]

Transmitter, remote version, wall-mount housing (non-hazardous area)



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Dimensions in SI units

A	B	C	D	E	F	G	H	J	K
215	250	90.5	159.5	135	90	45	> 50	81	53
L	M	N	O	P	Q	R	S	T [1]	
95	53	102	81.5	11.5	192	8 × M5	20	2 × ∅ 6.5	

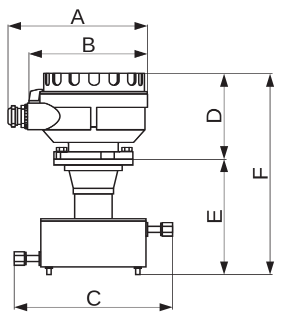
[1] Securing screw for wall mounting: M6 (screw head max. 10.5 mm)
All dimensions in [mm]

Dimensions in US units

A	B	C	D	E	F	G	H	J	K
8.46	9.84	3.56	6.27	5.31	3.54	1.77	> 1.97	3.18	2.08
L	M	N	O	P	Q	R	S	T [1]	
3.74	2.08	4.01	3.20	0.45	7.55	8 × M5	0.79	2 × ∅ 0.26	

[1] Securing screw for wall mounting: M6 (screw head max. 0.41")
All dimensions in [inch]

Sensor remote version, connection housing



A0012360

Dimensions in SI units

DN	A	B	C	D	E	F	G	H
1 to 6	163	143	175	102	133	235	129	120

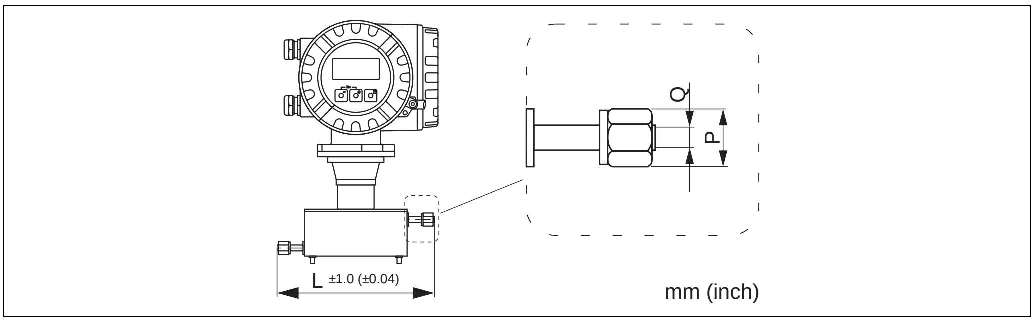
All dimensions in [mm]

Dimensions in US units

DN	A	B	C	D	E	F	G	H
1/24 to ¼"	6.42	5.63	6.89	4.02	5.24	9.25	5.08	4.72

All dimensions in [inch]

4-VCO-4 connection (welded; DN 1 to 4)
8-VCO-4 connection (welded; DN 6)



A0012329

Dimensions in SI units

4-VCO-4 / 8-VCO-4 connection: 1.4539/904L			
DN	L	P	Q
1 to 4	175	AF 11/16"	12.5
6	175	AF 1"	20

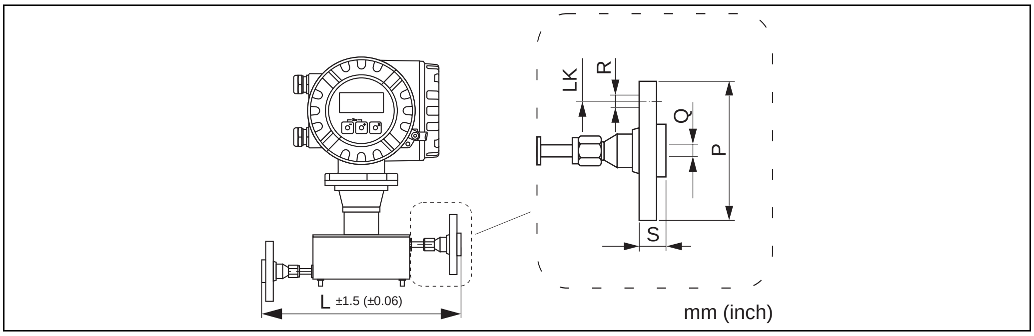
All dimensions in [mm]

Dimensions in US units

4-VCO-4 / 8-VCO-4 connection: 1.4539/904L			
DN	L	P	Q
1/24 to 1/8"	6.89	AF 11/16"	0.49
¼"	6.89	AF 1"	0.79

All dimensions in [inch]

4-VCO-4 connection with mounting kit: DN 15 flange (DN 1 to 4)
8-VCO-4 connection with mounting kit: DN 15 flange (DN 6)



A0012330

Dimensions in SI units

Mounting kit DN 15 flange EN 1092-1 (DIN 2501) PN 40: 1.4539/904L							
DN	PN	L	P	Q	R	S	LK
1 to 6	40	278	95	17.3	4 × Ø 14	28	65

Mounting kit DN 15 flange (JIS): 1.4539/904L							
DN	JIS	L	P	Q	R	S	LK
1 to 6	10K	278	95	15	4 × Ø 15	28	70

Mounting kit ½" flange (ASME): 1.4539/904L							
DN	ASME	L	P	Q	R	S	LK
1 to 6	Cl 150	278	88.9	15.7	4 × Ø 15.7	17.7	60.5
1 to 6	Cl 300	278	95.2	15.7	4 × Ø 15.7	20.7	66.5

Loose flanges (not wetted) made from stainless steel 1.4404/316L
All dimensions in [mm]

Dimensions in US units

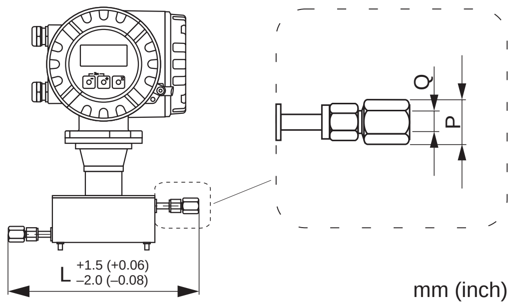
Mounting kit DN 15 flange EN 1092-1 (DIN 2501) PN 40: 1.4539/904L							
DN	PN	L	P	Q	R	S	LK
1/24 to ¼"	40	11	3.74	0.68	4 × Ø 0.55	1.10	2.56

Mounting kit DN 15 flange (JIS): 1.4539/904L							
DN	JIS	L	P	Q	R	S	LK
1/24 to ¼"	10K	11	3.74	0.59	4 × Ø 0.59	1.10	2.76

Mounting kit ½" flange (ASME): 1.4539/904L							
DN	ASME	L	P	Q	R	S	LK
1/24 to ¼"	Cl 150	11	3.50	0.62	4 × Ø 0.62	0.70	2.38
1/24 to ¼"	Cl 300	11	3.75	0.62	4 × Ø 0.62	0.82	2.62

Loose flanges (not wetted) made from stainless steel 1.4404/316L
All dimensions in [inch]

4-VCO-4 connection with mounting kit: NPT-F (DN 1 to 4)
8-VCO-4 connection with mounting kit: NPT-F (DN 6)



A0012332

Dimensions in SI units

Mounting kit NPT-F connection: 1.4539/904L			
DN	L	P	Q
1 to 4	265	AF ¾"	¼" NPT-F
6	265	AF 1 1/16"	½" NPT-F

All dimensions in [mm]

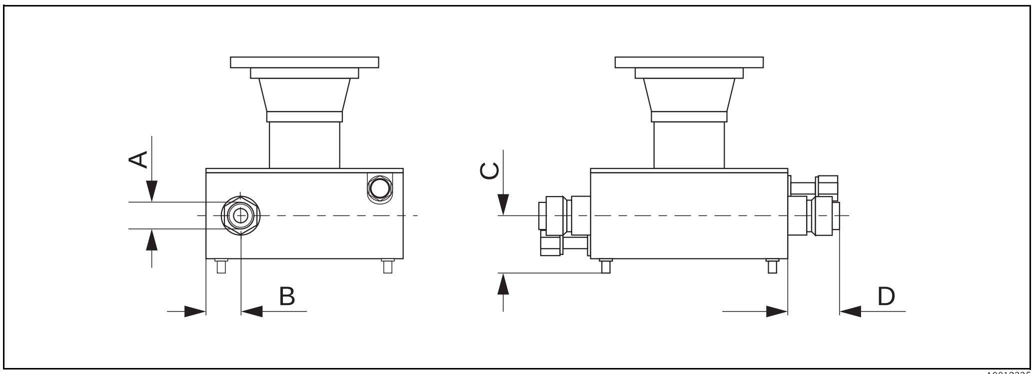
Dimensions in US units

Mounting kit NPT-F connection: 1.4539/904L			
DN	L	P	Q
1/24 to 1/8"	10.43	AF ¾"	¼" NPT-F
¼"	10.43	AF 1 1/16"	½" NPT-F

All dimensions in [inch]

Purge connections / secondary containment monitoring

Caution!
The secondary containment is filled with dry nitrogen (N_2). Do not open the purge connections unless the containment can be filled immediately with a dry inert gas. Use only low overpressure to purge.
Maximum pressure 5 bar (73 psi).



A0012335

Dimensions in SI units

DN	A	B	C	D
1 to 6	½" NPT	30	37	33

All dimensions in [mm]

Dimensions in US units

DN	A	B	C	D
1/24 to ¼"	½" NPT	1.18	1.46	1.30

All dimensions in [inch]

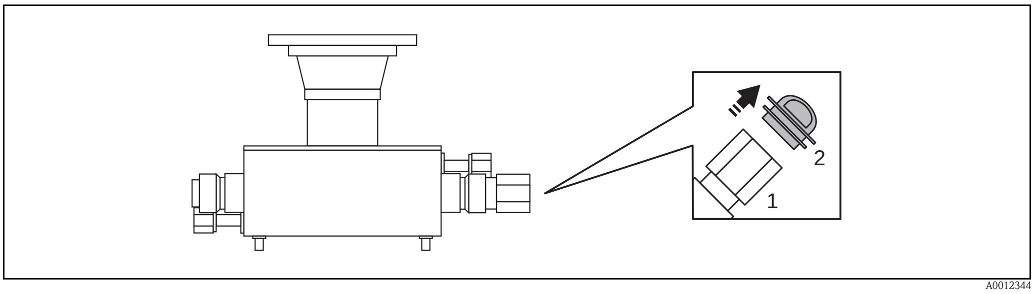
Rupture element/disk

The sensor housing is optionally available with an integrated rupture element.

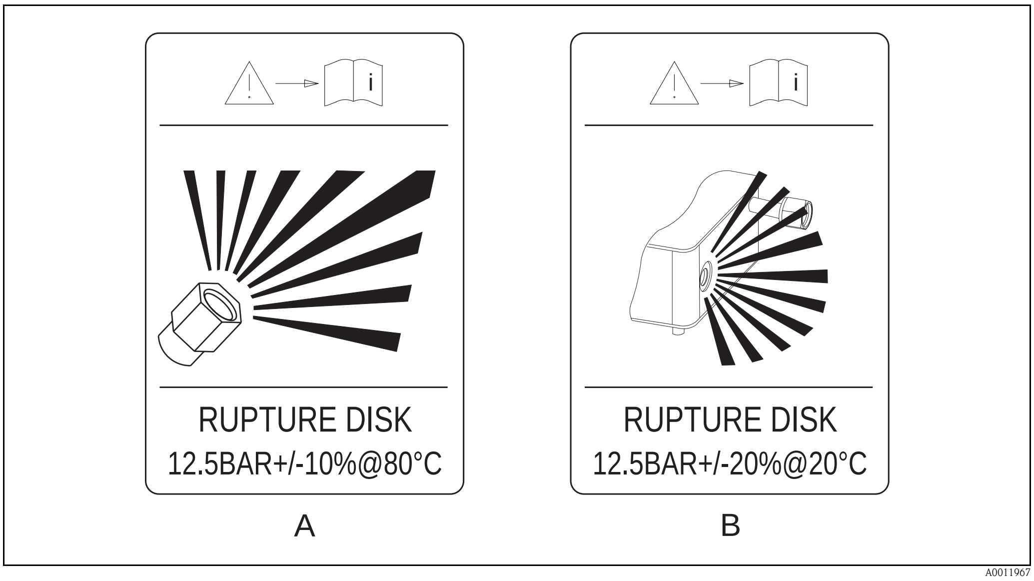
Warning!
- Make sure that the function of the rupture element is not impeded by the installation. The triggering pressure in the housing is indicated on the information notice. Take suitable measures to ensure that no damage can occur if the rupture disk is tripped and personal injury is ruled out.
  Triggering pressure in the housing 10 to 15 bar (145 to 217 psi)
- Please note that if a rupture disk is used, the housing can no longer assume a secondary containment function.
- It is not permitted to open the connections or remove the rupture disk.

Caution!
The existing connection nozzles are not designed for a purge or pressure monitoring function.

Note!
- The transportation guard on the rupture disk must be removed prior to commissioning.
- Comply with the information on information notices.



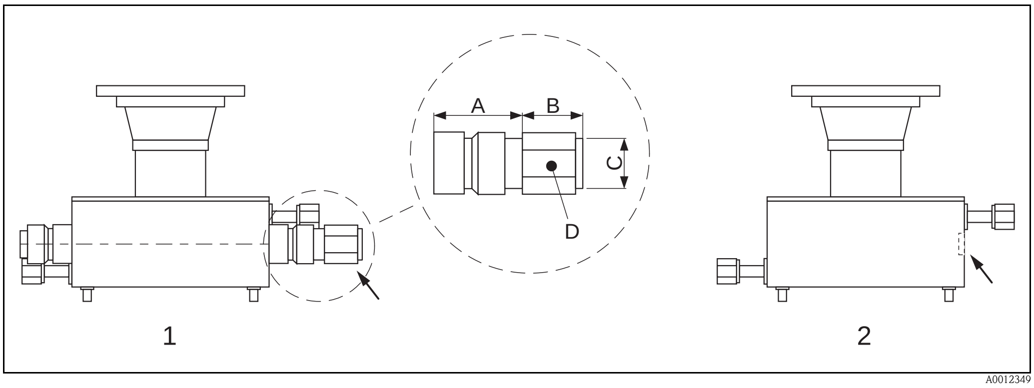
1 = Rupture element, 2 = Transportation guard



Additional sign regarding the position of the rupture disk (RUPTURE DISK)

A Sensor housing with rupture element (incl. rupture disk) → defined fluid exit
A Sensor housing with rupture disk → undefined fluid exit

Note!
The location of the rupture disk with undefined fluid exit is covered over by an adhesive label. If the rupture disk is tripped, the adhesive label is destroyed, meaning that a visual check is possible.



Dimensions with rupture element/disk

1 Sensor housing with rupture element (incl. rupture disk)
2 Sensor housing with rupture disk

Dimensions in SI units

DN	A	B	C	D
1 to 6	33	approx. 42	½" NPT	AF 1"

All dimensions in [mm]

Dimensions in US units

DN	A	B	C	D
1/24 to ¼"	1.30	approx. 1.65	½" NPT	AF 1"

All dimensions in [inch]

Weight

Compact version		**Remote version**	
[kg]	**[lb]**	**[kg]**	**[lb]**
5.5	12.1	3.3	7.3

Material

Transmitter housing

- Compact version
  - Aluminum housing: powder-coated die-cast aluminum
- Remote version
  - Wall-mount housing: powder coated die-cast aluminum
  - Field housing: powder-coated die-cast aluminum

Sensor connection housing (remote version)

- Powder-coated die-cast aluminum

Sensor housing / secondary containment

- Acid-resistant and alkali-resistant external surface, stainless steel 1.4301/304

Seals for mounting set

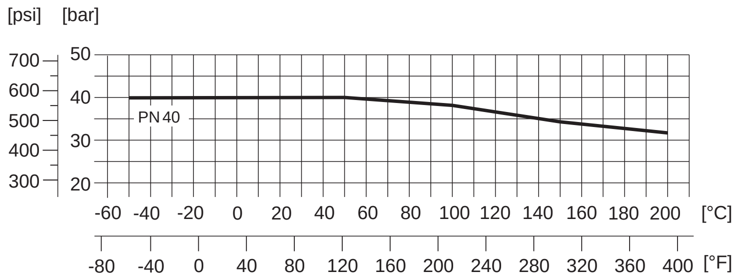
- Viton
- EPDM
- Silicone
- Kalrez

Material load diagram

⚠ Warning!
The following load curves relate to the entire measuring device and not just to the process connection.

Flange connections according to EN 1092-1 (DIN 2501) (mounting kit)

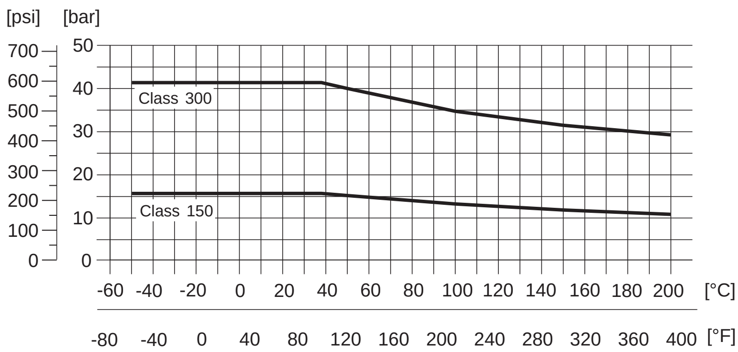
Wetted parts (flange, measuring tube): 1.4539/904L
Loose flanges (not wetted): 1.4404/316L



A0012140

Flange connections as per ASME B16.5 (mounting kit)

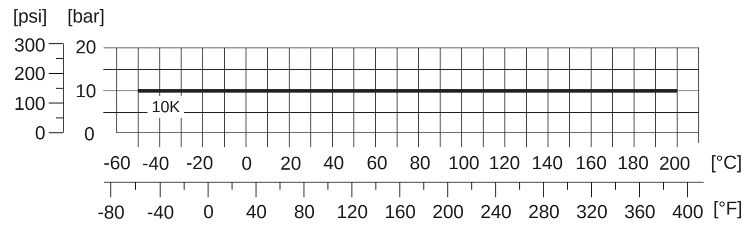
Wetted parts (flange, measuring tube): 1.4539/904L
Loose flanges (not wetted): 1.4404/316L



A0012141

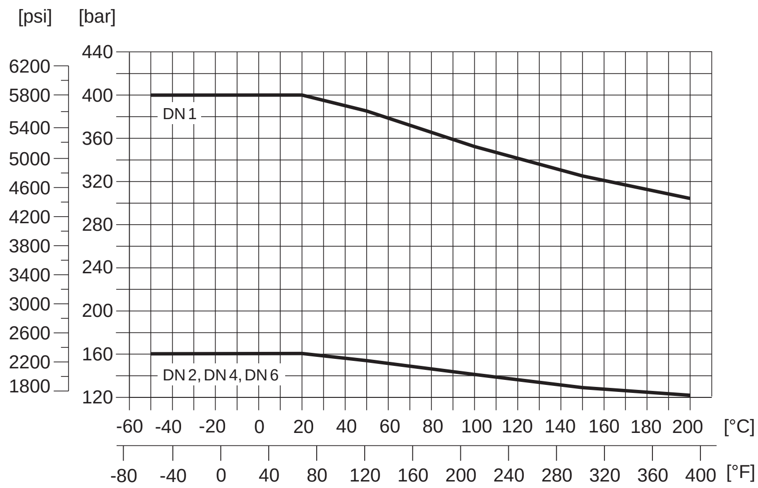
Flange connections as per JIS B2220 (mounting kit)

Wetted parts (flange, measuring tube): 1.4539/904L
Loose flanges (not wetted): 1.4404/316L



A0012143

Process connection 4-VCO-4, ¼" NPT-F (DN 1 to 4), 8-VCO-4, ½" NPT-F (DN 6)



A0011882

Process connections

- Welded process connections
  - 4-VCO-4 -coupling (DN 1 to 4)
  - 8-VCO-4 coupling (DN 6)
- Threaded process connections
  - Flanges according to EN 1092-1 (DIN 2501), JIS, ASME
  - ¼" NPT-F thread adapter (DN 1 to 4)
  - ½" NPT-F thread adapter (DN 6)

Human interface

Display elements

- Liquid crystal display: illuminated, four lines with 16 characters per line
- Selectable display of different measured values and status variables
- 3 totalizers
- At ambient temperatures below –20 °C (–4 °F), the readability of the display may be impaired.

Operating elements

- Onsite operation with three optical sensor keys (–/+/E)
- Application specific Quick Setup menus for straightforward commissioning

Language groups

Language groups available for operation in different countries:
- Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe/Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish, Czech
- South and East Asia (SEA): English, Japanese, Indonesian
- China (CN): English, Chinese

✎ Note!
You can change the language group via the operating program FieldCare.

Remote operation

Operation via HART or MODBUS protocol.

Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-Tick symbol	The measuring system meets the EMC requirements of the Australian Communications and Media Authority (ACMA).
Ex approval	Information about currently available Ex versions (ATEX, NEC/CEC etc.) can be supplied by your Endress+Hauser sales office on request. All information relevant to explosion protection is available in separate Ex documents that you can order as necessary.
Pressure Equipment Directive	Measuring devices with a nominal diameter smaller than or equal to DN 25 (1") correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice.
Functional safety	SIL 2: in accordance with IEC 61508/IEC 61511-1 (FDIS)
Other standards and guidelines	▪ EN 60529: Degrees of protection provided by enclosures (IP code) ▪ EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use ▪ IEC/EN 61326: Electromagnetic compatibility (EMC requirements) ▪ NAMUR Recommendation NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment ▪ NAMUR Recommendation NE 43: Standardization of the signal level for the breakdown information of digital transmitters with analog output signal. ▪ NAMUR Recommendation NE 53: Software of field devices and signal-processing devices with digital electronics

Ordering information

The Endress +Hauser service organization can provide ordering information and detailed information on the order code.

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor.

✎ Note!
The Endress +Hauser service organization can provide detailed information on the relevant order codes.

Documentation

- ❑ Flow measurement (FA005D/06)
- ❑ System Information Promass (SI032D/06)
- ❑ Operating Instructions (BA139D/06)
- ❑ Operating Instructions MODBUS RS485 (BA141D/06)
- ❑ Description of Device Parameters (GP002D/06)
- ❑ Description of Device Parameters MODBUS RS485 (GP004D/06)
- ❑ Ex-Supplementary documentation ATEX (II2G): (XA139D/06)
- ❑ Ex-Supplementary documentation NEC/CEC (Div. 1): (XA141D/06)
- ❑ Ex-Supplementary documentation NEPSI (Zone 1, Zone 21): (XA142D/06)

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