

Technical Information

Proline Promass 84A

Coriolis flowmeter



The Single-tube flowmeter for smallest quantities with custody transfer functionality

Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Measuring accurately smallest quantities of liquids and gases for continuous process control

Device properties

- Nominal diameter: DN 2 to 4 ($\frac{1}{12}$ to $\frac{1}{8}$ ")
- Process pressure up to 400 bar (5800 psi)
- Medium temperature up to +200 °C (+392 °F)
- 4-line backlit display with touch control
- Device in compact or remote version
- Phase-shifted pulse, HART, Modbus RS485

Your benefits

- Highest process safety – self-drainable measuring tube design
- Fewer process measuring points – multivariable measurement (flow, density, temp)
- Space-saving installation – no in/outlet run needs
- Quality – designed for custody transfer; featuring worldwide recognized metrological approvals
- Fewer process measuring points – extended functionality enables multivariable measurement
- Automatic recovery of data for servicing

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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

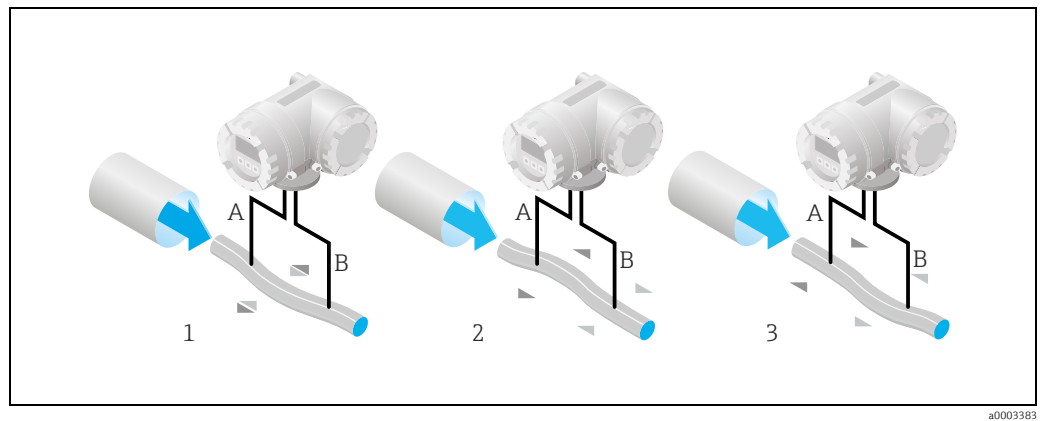
ω = rotational velocity

v = velocity of the moving mass in a 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 , the Promass sensor uses oscillation.

The measuring tube, through which the medium flows, oscillates. The Coriolis forces produced at the measuring tube cause a phase shift in the tube oscillations (see illustration):

- At zero flow, i.e. when the fluid is at a standstill, the oscillation registered at points A and B is in phase, i.e. there is no phase difference (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet.

Compared to two-tube systems, other constructive solutions are required for the system balance for single-tube systems. For this purpose, Promass A has an internal reference mass.

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 measuring tube 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 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.

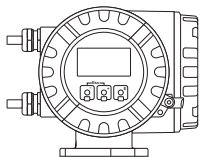
The temperature measurement cannot be used to generate data for invoicing in applications subject to legal metrology controls.

Measuring system

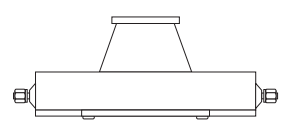
The measuring system consists of a transmitter and a sensor. Two versions are available:

- Compact version: transmitter and sensor form a mechanical unit.
- Remote version: transmitter and sensor are mounted physically separate from one another.

Transmitter

Promass 84  a0003672	■ Four-line liquid-crystal display ■ Operation with "Touch control" ■ Application-specific Quick Setup ■ Mass flow, volume flow, density and temperature measurement as well as calculated variables (e.g. fluid concentrations)
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Sensor

A  a0003679	■ Single-tube system for high-precision measurement of minimum flow rates ■ Simultaneous measurement of flow, volume flow, density and temperature (multivariable) ■ Immune to process influences ■ Nominal diameters DN 2 to 4 ($\frac{1}{12}$ to $\frac{1}{8}$") ■ Materials: – Sensor: stainless steel, 1.4301 (304) – Measuring tube: stainless steel, 1.4539 (904L); Alloy C22 – Process connections: stainless steel, 1.4404 (316/316L); stainless steel, 1.4539 (904L); Alloy C22
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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)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range in non-custody transfer mode**Measuring ranges for liquids**

Nominal Diameter		Range for full scale values (liquids), $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
2	$\frac{1}{12}$ "	0 to 100.0	0 to 3.675
4	$\frac{1}{8}$ "	0 to 450.0	0 to 16.54

Measuring ranges for gases

The full scale values depend on the density of the gas.

Use the formula below to calculate the full scale values:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_{(G)} / 32 \text{ [kg/m}^3\text{]}$$

$$\dot{m}_{\max(G)} = \text{max. full scale value for gas [kg/h]}$$

$$\dot{m}_{\max(F)} = \text{max. full scale value for liquid [kg/h]}$$

$$\rho_{(G)} = \text{gas density in [kg/m}^3\text{] at process conditions}$$

Here, $\dot{m}_{\max(G)}$ can never be greater than $\dot{m}_{\max(F)}$

Calculation example for gas:

- Measuring device: Promass A, DN 2
- Gas: air with a density of 11.9 kg/m³ (at 20 °C and 10 bar)
- Measuring range: 100 kg/h

Max. possible full scale value:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_{(G)} / 32 \text{ [kg/m}^3\text{]} = 100 \text{ kg/h} \cdot 11.9 \text{ kg/m}^3 / 32 \text{ kg/m}^3 = 37.2 \text{ kg/h}$$

Recommended full scale values:

See information in the "Limiting flow" Section →  20

Measuring range in custody transfer mode

MI-005 Evaluation Certificate

The following are example data for MI-005 Evaluation Certificate (liquids other than water).

Measuring ranges for liquids in mass flow

Nominal Diameter		Range for mass flow (liquids) $Q_{\min}$ to $Q_{\max}$		Smallest measured quantity	
[mm]	[in]	[kg/min]	[lb/min]	[kg]	[lbs]
2	$\frac{1}{12}$ "	0.1 to 2	0.221 to 4.41	0.05	0.110
4	$\frac{1}{8}$ "	0.4 to 8	0.882 to 17.64	0.20	0.441

Measuring ranges for liquids in volume flow

Nominal Diameter		Range for mass flow (liquids) $Q_{\min}$ to $Q_{\max}$		Smallest measured quantity	
[mm]	[in]	[l/min]	[gal/min]	[l]	[gal]
2	$\frac{1}{12}$ "	0.1 to 2	0.0264 to 0.528	0.05	0.0132
4	$\frac{1}{8}$ "	0.4 to 8	0.106 to 2.113	0.20	0.0528



Note!

For information about the other approvals → see corresponding certificate.

Operable flow range

Over 20 : 1 for verified device

Input signal

Status input (auxiliary input) with HART

$U = 3$ to 30 V DC, $R_i = 5$ k Ω , galvanically isolated

Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start, batching start stop (optional), totalizer reset for batching (optional).

Status input (auxiliary input) with Modbus RS485

$U = 3$ to 30 V DC, $R_i = 3$ k Ω , galvanically isolated, switch level: ± 3 to ± 30 V DC, independent of polarity

Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start.

Output

Output signal

Current output, HART

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

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

Pulse/frequency output, HART

For custody transfer measurement, two pulse outputs can be operated.

Passive, galvanically isolated, 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. In "Phase-shifted pulse outputs" operating mode, the end frequency is limited to a maximum of 5000 Hz.
- Pulse output: Pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

Pulse/frequency output, Modbus

Active/passive selectable, galvanically isolated

- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100 \Omega$
- 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 interface

- Modbus device type: slave
- Address range: 1 to 247
- Functions codes supported: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Physical interface: RS485 in accordance with standard EIA/TIA-485
- Baud rate supported: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Transmission mode: RTU or ASCII
- Response time:
 - Direct data access = typically 25 to 50 ms
 - Auto-scan buffer (data area) = typically 3 to 5 ms
- Possible output combinations → 6

Signal on alarm	■ Current output: Failsafe mode selectable (e.g. in accordance with NAMUR Recommendation NE 43) ■ Pulse/frequency output: Failsafe mode selectable ■ Relay output: De-energised by fault or power supply failure ■ Modbus RS485: If an error occurs, the value NaN (not a number) is output for the process variables
Load	See "Output signal"
low flow cut off	Switch points for low flow cut off are selectable.
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.
Switching output	Relay output ■ Max. 30 V, 0.5 A AC; 60 V, 0.1 A DC ■ Galvanically isolated ■ Normally closed (NC or break) or normally open (NO or make) contacts available (factory setting: relay 1 = NO, relay 2 = NC)

Power supply

Terminal assignment	The inputs and outputs on the communication board can be either permanently assigned (fixed) or variable (flexible), depending on the version ordered (see table). Replacements for modules which are defective or which have to be replaced can be ordered as accessories.
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Order characteristic for "inputs/outputs"	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
<i>Fixed communication boards (permanent assignment)</i>				
S	–	–	Pulse/freq. output Ex i passive	Current output Ex i active, HART
T	–	–	Pulse/freq. output Ex i, passive	Current output Ex i passive, HART
<i>Flexible communication boards</i>				
D	Status input	Relay output	Pulse/frequency out- put	Current output HART

Order characteristic for "inputs/outputs"	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
M	Status input	Pulse/frequency output 2	Pulse/frequency output 1	Current output HART
N	Current output	Pulse/frequency output	Status input	Modbus RS485
Q	–	–	Status input	Modbus RS485
1	Relay output	Pulse/frequency output 2	Pulse/frequency output 1	Current output HART
2	Relay output	Current output 2	Pulse/frequency output	Current output 1 HART
7	Relay output 2	Relay output 1	Status input	Modbus RS485

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

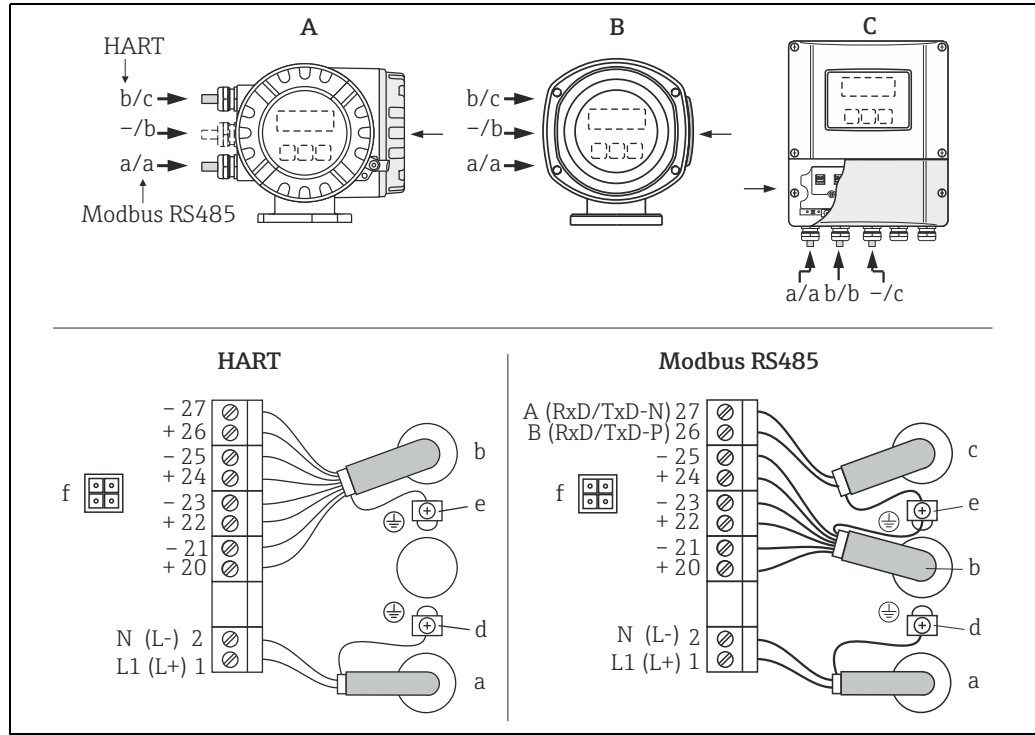
Power consumption AC: <15 VA (including sensor)
DC: <15 W (including sensor)
Switch-on current

- 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 and T-DAT save measuring system data if the power supply fails.
- HistoROM/S-DAT: exchangeable data storage chip with sensor specific data (nominal diameter, serial number, calibration factor, zero point, etc.).
- See also "Switching on the power supply in custody transfer mode" → 9.

Electrical connection



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Connecting the transmitter, cable cross-section: max. 2.5 mm²

A View A (field housing)

B View B (stainless steel field housing)

C View C (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: N for AC, L- for DC

b Signal cable: Terminal assignment → 6

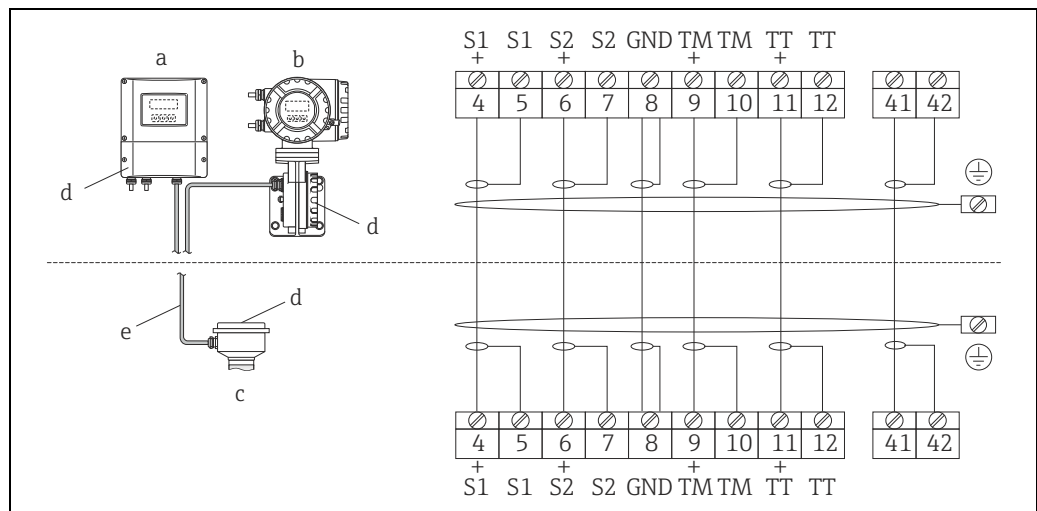
c Fieldbus cable: Terminal assignment → 6

d Ground terminal for protective earth

e Ground terminal for Signal cable/ RS485 line

f Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)

Electrical connection remote version



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Connection of remote version

a Wall-mount housing: non-hazardous area and ATEX II3G, zone 2 → see separate "Ex documentation"

b Wall-mount housing: ATEX II2G, Zone 1 / FM/CSA → see separate "Ex documentation"

c Remote version, flanged version

d Cover for connection compartment or connection housing

e Connecting cable

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

Switching on the power supply in custody transfer mode

If the device is started in custody transfer mode, for example also after a power outage, system error No. 271 "POWER BRK. DOWN" flashes on the local display. The fault message can be acknowledged or reset using the "Enter" key or by means of the status input configured accordingly.

Note!

For correct measuring operation, it is not mandatory to reset the fault message.

Potential equalization

No special measures for potential equalization are required. For instruments for use in hazardous areas, observe the corresponding guidelines in the specific Ex documentation.

Cable entries

Power-supply and signal cables (inputs/outputs)

- Cable entry M20 × 1.5 (8 to 12 mm / 0.31" to 0.47")
- Thread 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")
- Thread for cable entries, ½" NPT, G ½"

Remote version cable specifications

- 6 × 0.38 mm² PVC cable with common shield and individually shielded cores
- Conductor resistance: ≤50 Ω/km (≤0.015 Ω/ft)
- Capacitance: core/shield: ≤420 pF/m (≤128 pF/ft)
- Cable length: max. 20 m (65 ft)
- Operating temperature: max. +105 °C (+221 °F)

Operation in zones of severe electrical interference:

The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of ICE/EN 61326, and NAMUR recommendation NE 21/43.

Performance characteristics

Reference operating conditions

- Error limits following ISO 11631
- Water with 15 to 45 °C (59 to 113 °F); 2 to 6 bar (29 to 87 psi)
- Data according to calibration protocol
- Accuracy based on accredited calibration rigs that are traced to ISO 17025

To obtain measured errors, use the Applicator sizing tool *Applicator*: → 44.

Maximum measured error

Design fundamentals → 11

o.r. = of reading; 1 g/cm³ = 1 kg/l; T = fluid temperature

Base accuracy**Mass flow and volume flow (liquids)**

±0.10% o.r.

Mass flow (gases)

±0.50% o.r.

Density (liquids)

- Reference conditions: ±0.0005 g/cm³
- Field density calibration: ±0.0005 g/cm³ (valid after field density calibration under process conditions)
- Standard density calibrations: ±0.02 g/cm³ (valid over the entire measuring range of the sensor → 16)
- Special density calibration: ±0.002 g/cm³ (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0 to 2.0 g/cm³)

Temperature

±0,5 °C ± 0.005 · T °C (±1 °F ± 0.003 · (T – 32) °F)

Zero point stability

Nominal Diameter		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
2	$\frac{1}{12}$ "	0.0050	0.00018
4	$\frac{1}{8}$ "	0.0225	0.0008

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

DN [mm]	1:1 [kg/h]	1:10 [kg/h]	1:20 [kg/h]	1:50 [kg/h]	1:100 [kg/h]	1:500 [kg/h]
2	100.0	10.00	5.000	2.000	1.000	0.200
4	450.0	45.00	22.50	9.000	4.500	0.900

US units

DN [in]	1:1 [lb/min]	1:10 [lb/min]	1:20 [lb/min]	1:50 [lb/min]	1:100 [lb/min]	1:500 [lb/min]
$\frac{1}{12}$ "	3.675	0.368	0.184	0.074	0.037	0.007
$\frac{1}{8}$ "	16.54	1.654	0.827	0.330	0.165	0.033

Accuracy of outputs

o.r. = of reading; o.f.s. = of full scale value

The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

Current output

Accuracy: Max. $\pm 0,05$ % o.f.s. or ± 5 μ A

Pulse/frequency output

Accuracy: Max. ± 50 % ppm o.r.

Repeatability

Design fundamentals $\rightarrow$ 11

o.r. = of reading; $1 \text{ g/cm}^3 = 1 \text{ kg/l}$; T = fluid temperature

Base repeatability**Mass flow and volume flow (liquids)**

$\pm 0,05\%$ o.r.

Mass flow (gases)

$\pm 0,25\%$ o.r.

Density (liquids)

$\pm 0,00025$ g/cc

Temperature

$\pm 0,25$ °C $\pm 0,0025 \cdot T$ °C ($\pm 0,45$ °F $\pm 0,0015 \cdot (T - 32)$ °F)

Response time	■ The response time depends on the configuration (damping). ■ Response time in the event of erratic changes in the measured variable (only mass flow): after 100 ms 95 % of the full scale value.
Influence of medium temperature	When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is $\pm 0.0002\%$ of the full scale value / °C ($\pm 0.0001\%$ of the full scale value / °F).
Influence of medium pressure	A difference in pressure between the calibration pressure and the process pressure does not have any effect on the accuracy.
Design fundamentals	o.r. = of reading BaseAccu = base accuracy in % o.r. BaseRepeat = base repeatability in % o.r. MeasValue = measured value (in flow units consistent with the zero point stability value → 10) ZeroPoint = zero point stability

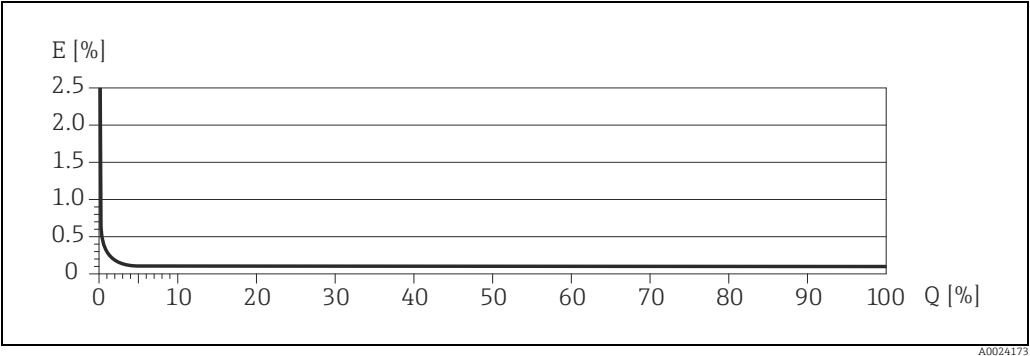
Calculation of the maximum measured error depending on flowrate

Flowrate (in flow units consistent with the zero point stability value → 10)	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021332	$\pm \text{BaseAccu}$ A0021339
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A002133	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021334

Calculation of the repeatability depending on flowrate

Flowrate (in flow units consistent with the zero point stability value → 10)	Repeatability in % o.r.
$\geq \frac{\frac{1}{2} \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021335	$\pm \text{BaseRepeat}$ A0021340
$< \frac{\frac{1}{2} \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021336	$\pm \frac{1}{2} \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021337

Example for maximum measured error



E = Error: Maximum measured error as % o.r.
Q = Flow rate as %

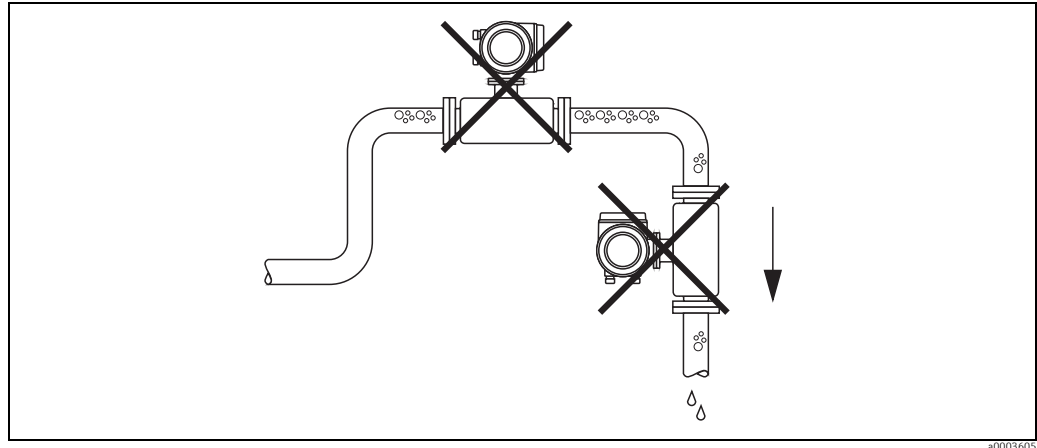
Installation

Mounting location

Entrained air or gas bubbles in the measuring tube can result in an increase in measuring errors.

For this reason, avoid the following mounting locations in the pipe:

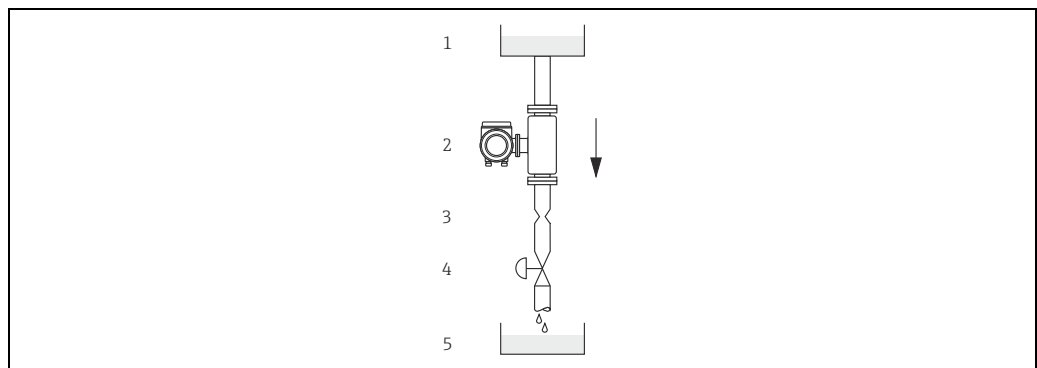
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream from a free pipe outlet in a vertical pipeline.



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Mounting location

Notwithstanding the above, the installation proposal below permits installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



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Installation in a down pipe (e.g. for batching applications)

- 1 Supply tank
- 2 Sensor
- 3 Orifice plate, pipe restriction (see Table)
- 4 Valve
- 5 Batching tank

Nominal Diameter		Ø Orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
2	1/12"	1.5	0.06
4	1/8"	3.0	0.12

Orientation

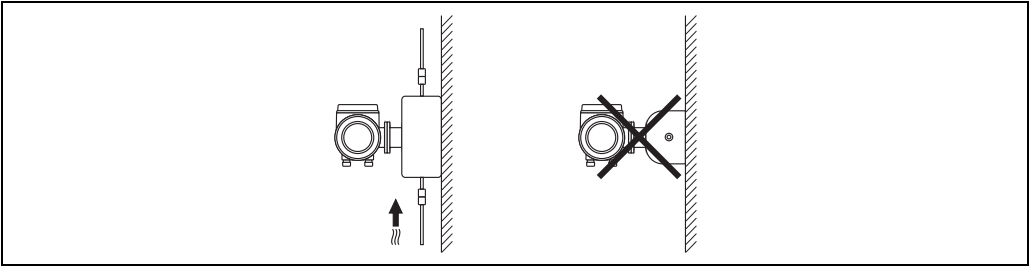
Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction of fluid flow through the pipe).

Vertical

Recommended orientation with direction of flow upwards. When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids build-up.

Horizontal

When installation is correct the transmitter housing is above or below the pipe. This means that no gas bubbles or solids deposits can form in the bent measuring tube (single-tube system).



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Installation instructions

Note the following points:

- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- 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, Tpieces, etc.), as long as no cavitation occurs.
- For mechanical reasons and to protect the pipe, support is recommended for heavy sensors.
- Please refer to the verification ordinances for the installation conditions of the approval for custody transfer in question.

The necessary steps for creating a measuring system and obtaining approval from the Standards Authorities must be clarified with the authority for legal metrology controls responsible.

Inlet and outlet run

There are no installation requirements regarding inlet and outlet runs.

Length of connecting cable

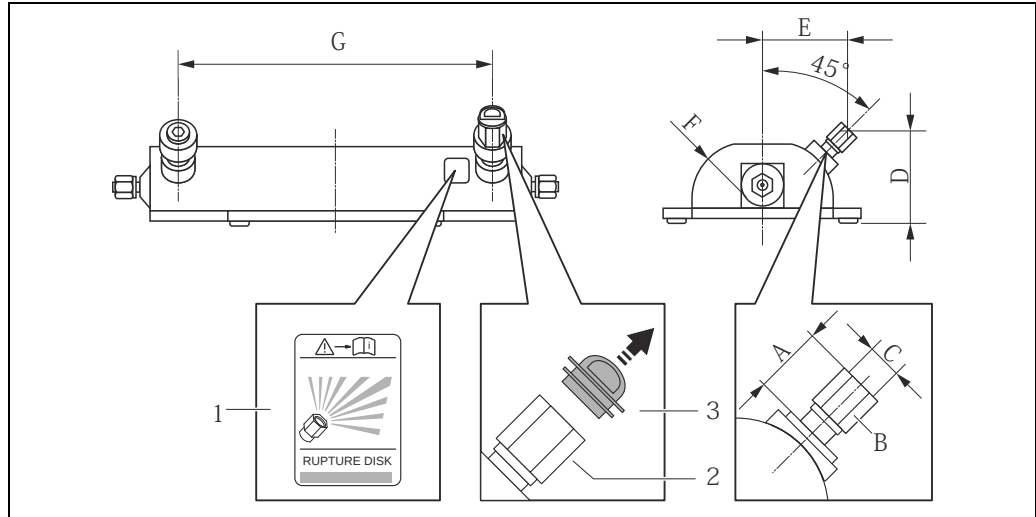
Max. 20 m (65 ft), remote version

Special installation instructions

Rupture disc

Make sure that the function and operation of the rupture disc is not impeded through the installation of the device. The position of the rupture disc is indicated on a sticker beside it. For additional information that is relevant to the process (→  20).

The existing connecting nozzles are not designed for a rinse or pressure monitoring function.



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1 = Rupture disk label, 2 = Rupture disk with 1/2" NPT internal thread with 1" width across flat, 3 = Transport protection

Dimensions in SI units

DN	A	B	C	D	E	F	G
[mm]	[mm]	[in]	[in]	[mm]	[mm]	[mm]	[mm]
2	ca. 42	SW 1	1/2 NPT	77,0	70,0	47,0	260
4	ca. 42	SW 1	1/2 NPT	83,0	81,5	59,5	385

Dimensions in US units

DN	A	B	E	F	G	L	R
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
1/12"	ca. 1,65	SW 1	1/2 NPT	3,0	2,8	1,85	10,24
1/8"	ca. 1,65	SW 1	1/2 NPT	3,3	3,2	2,34	15,16

Wall mounting



Note!

Risk of measuring pipe fracture if sensor installed incorrectly!

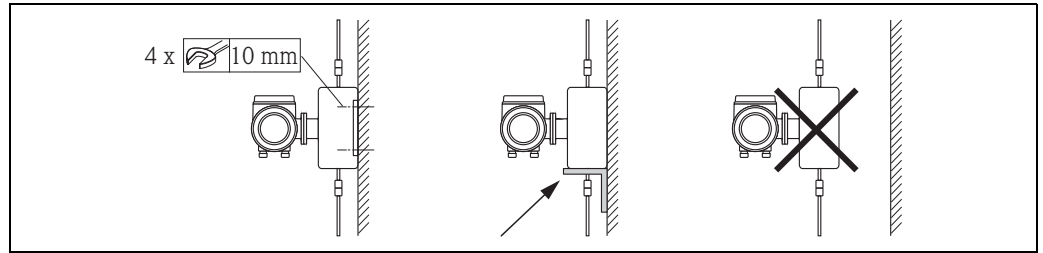
The sensor may not be installed in a pipe as a freely suspended sensor:

- Using the base plate, mount the sensor directly on the floor, the wall or the ceiling.
- Support the sensor on a firmly mounted support base (e.g. angle bracket).

Vertical

We recommend two installation versions when mounting vertically:

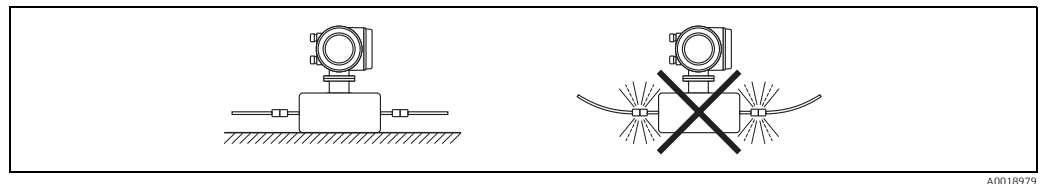
- Mounted directly on a wall using the base plate
- Measuring device supported on an angle bracket mounted on the wall



Horizontal

We recommend the following installation version when mounting horizontally:

- Measuring device standing on a firm support base



Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions (→ 9). Therefore, a zero point adjustment in the field is generally not required.

Experience shows that the zero point adjustment is advisable only in special cases:

- To achieve maximum measuring accuracy even with low flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

Environment

Ambient temperature range

Sensor, transmitter

- Standard: -20 to $+60$ °C (-4 to $+140$ °F)
- Optional: -40 to $+60$ °C (-40 to $+140$ °F)



Note!

- Install the device at 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 $+20$ °C ($+68$ °F)

Ambient class

B, C, I

Degree of protection Standard: IP 67 (NEMA 4X) for transmitter and sensor

Shock resistance In accordance with IEC/EN 60068-2-31

Vibration resistance Acceleration up to 1g, 10 to 150 Hz, following IEC/EN 60068-2-6

CIP cleaning Yes

SIP cleaning Yes

Electromagnetic compatibility (EMC) To IEC/EN 61326 and NAMUR recommendation NE 21

Process

Medium temperature range **Sensor**
-50 to +200 °C (-58 to +392 °F)

Seals

Only for mounting kits with screw-on connections)

- EPDM: -40 to +160 °C (-40 to +320 °F)
- Kalrez: -20 to +275 °C (-4 to +527 °F)
- Silicone: -60 to +200 °C (-76 to +392 °F)
- Viton: -15 to +200 °C (+5 to +392 °F)

Medium density 0 to 5000 kg/m³ (0 to 312 lb/ft³)

Secondary containment pressure rating The sensor housing is filled with dry nitrogen and protects the electronics and mechanics inside.
The following secondary containment pressure rating is only valid for a fully welded sensor housing and/or a device equipped with closed purge connections (never opened, as delivered).

DN		Secondary containment rating (designed with a safety factor ≥ 4)		Burst pressure of secondary containment	
[mm]	[in]	[bar]	[psi]	[bar]	[psi]
2	1/12"	25	362	155	2245
4	1/8"	25	362	130	1885



Note!

In case a danger of measuring tube failure exists due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose secondary containment is equipped with special pressure monitoring connections (ordering option). With the help of these connections, fluid collected in the secondary containment in the event of tube failure can be bled off. This is especially important in high pressure gas applications. These connections can also be used for gas circulation and/or gas detection (dimensions → 39).

Do not open the purge connections unless the containment can be filled immediately with a dry inert gas. Use only low gauge pressure to purge. Maximum pressure: 5 bar (72.5 psi).

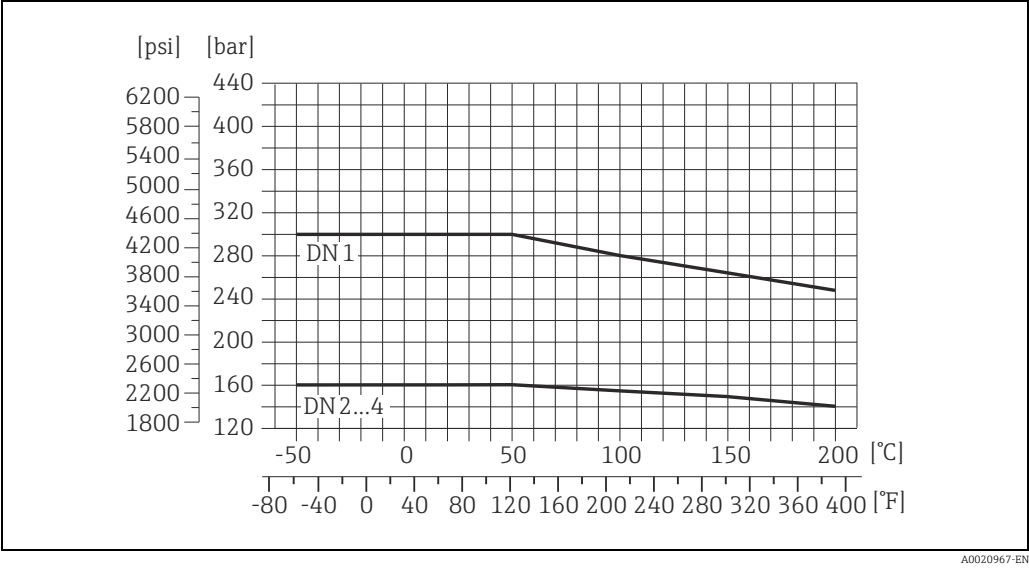
If a device fitted with purge connections is connected to the purge system, the maximum nominal pressure is determined by the purge system itself or by the device, depending on which component has the lower nominal pressure. If, on the other hand, the device is fitted with a rupture disk, the rupture disk is decisive for the maximum nominal pressure (→ 20).

Pressure-temperature ratings

The following pressure-temperature ratings refer to the entire sensor and not just the process connection.

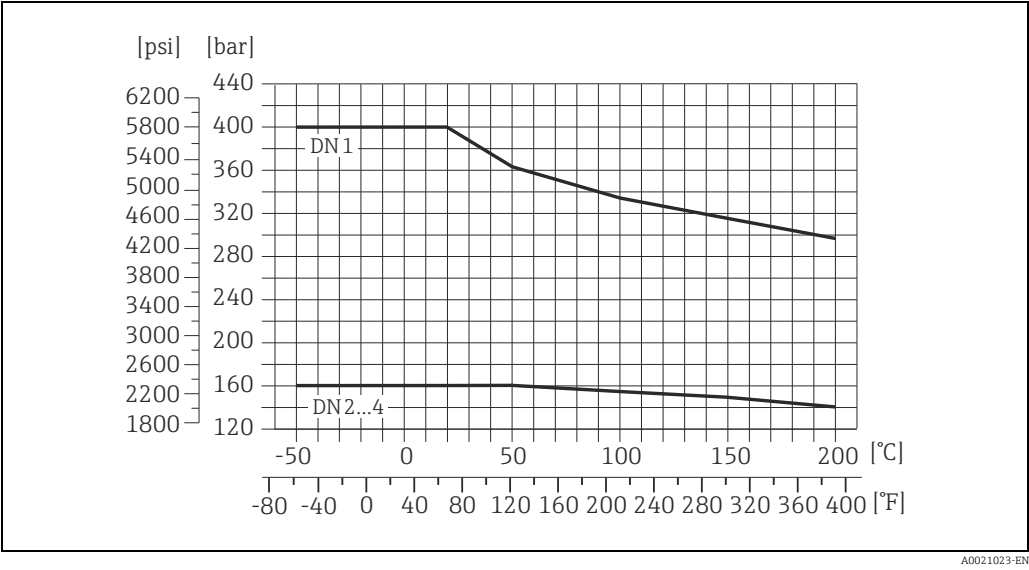
4-VCO-4 coupling (welded)

Connection material: 1.4539 (904L)



A0020967-EN

Connection material: Alloy C22



A0021023-EN

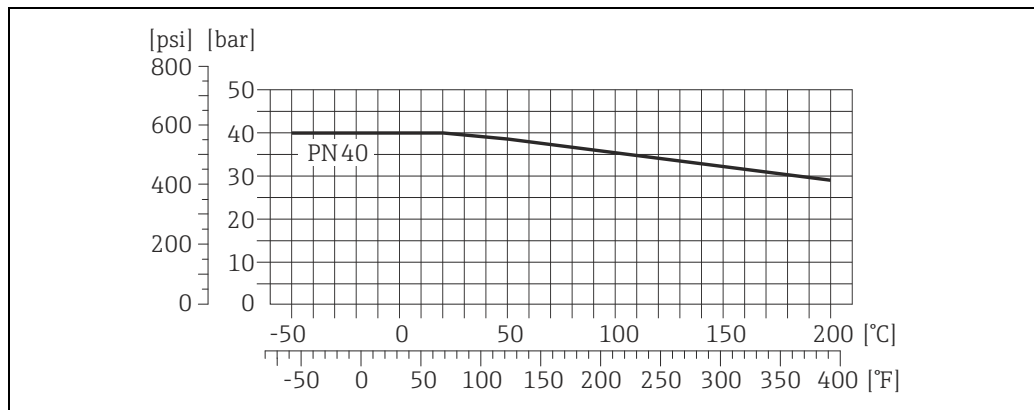
Tri-Clamp

The Clamp connections are suited up to a maximum pressure of 16 bar (232 psi). Please observe the operating limits of the clamp and seal used as they could be under 16 bar (232 psi). The clamp and the seal are not included in the scope of supply.

4-VCO-4 coupling with mounting kit: Flange according to EN 1092-1 (DIN 2501)

Wetted parts (flange, measuring tube): 1.4539 (904L); Alloy C22

Loose flanges (not wetted): 1.4404 (F316/F316L)

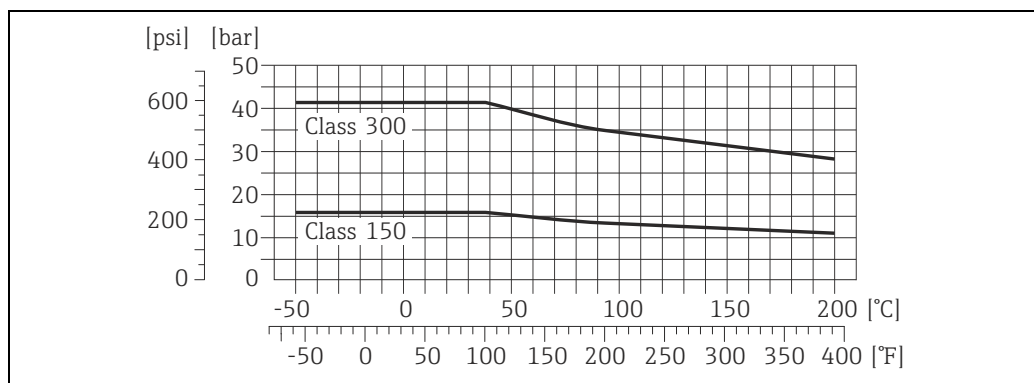


A0020836-EN

4-VCO-4 coupling with mounting kit: Flange according to ASME B16.5

Wetted parts (flange, measuring tube): 1.4539 (904L); Alloy C22

Loose flanges (not wetted): 1.4404 (F316/F316L)

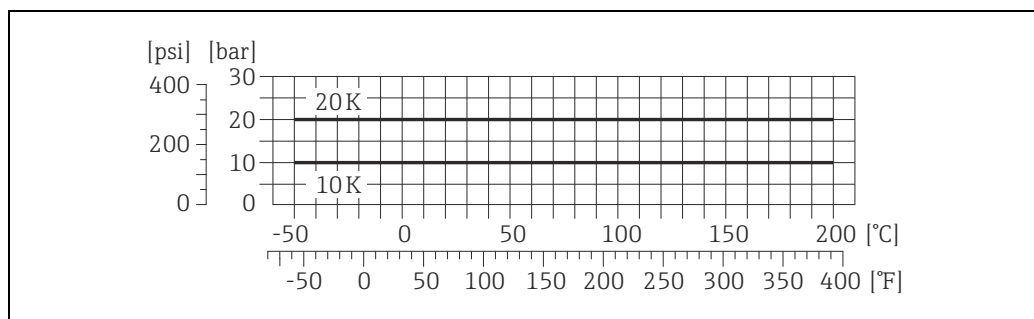


A0020920-EN

4-VCO-4 coupling with mounting kit: JIS B2220, flange

Wetted parts (flange, measuring tube): 1.4539 (904L); Alloy C22

Loose flanges (not wetted): 1.4404 (F316/F316L)

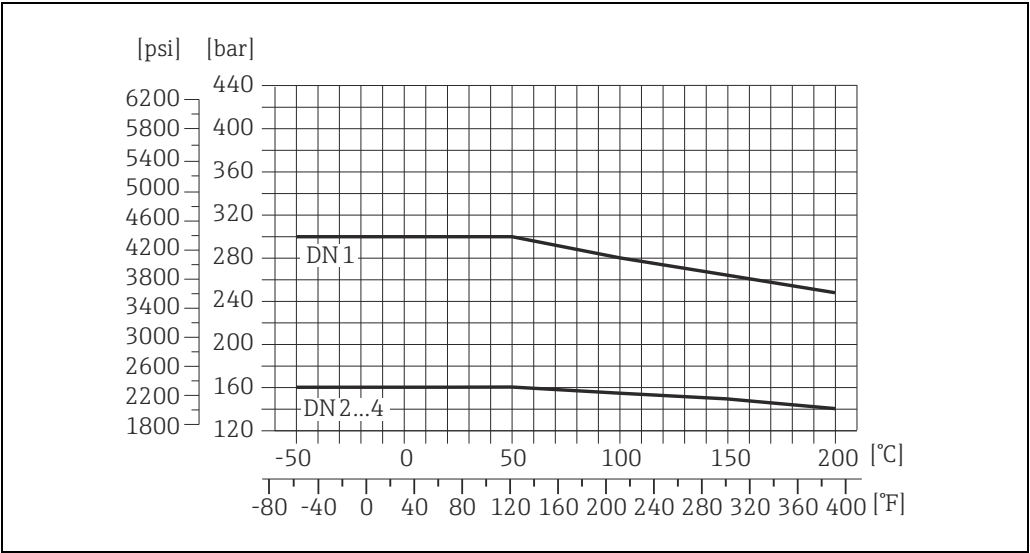


A0020922-EN

4-VCO-4 coupling with mounting kit: NPTF threaded adapter, 1/4" and Swagelok threaded joint, 1/4" or 1/8"

Connection material:

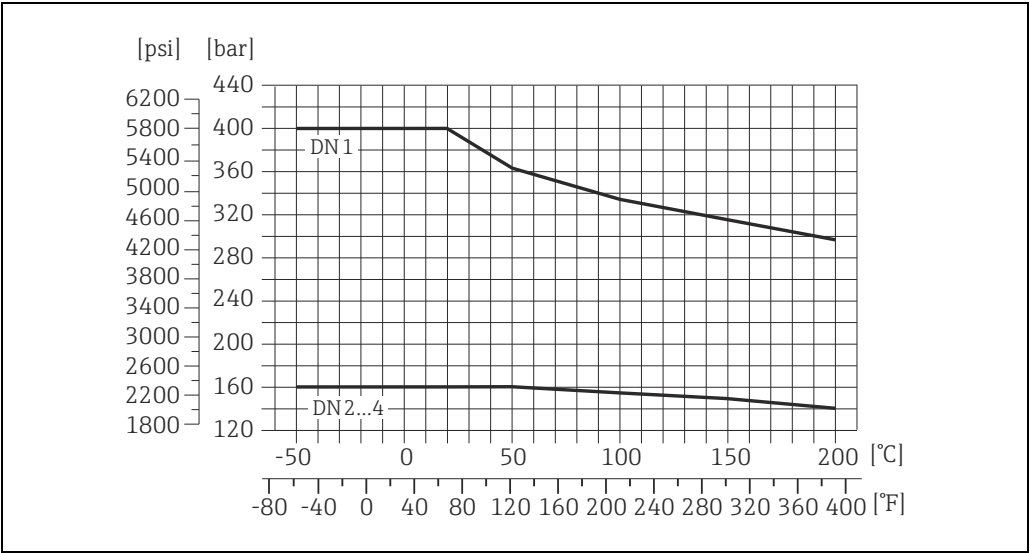
- 4-VCO-4; NPTF: 1.4539 (904L)
- Swagelok: 1.4401 (316/316L)



A0020967-EN

Connection material:

- 4-VCO-4, NPTF: Alloy C22
- Swagelok: 1.4401 (316/316L)

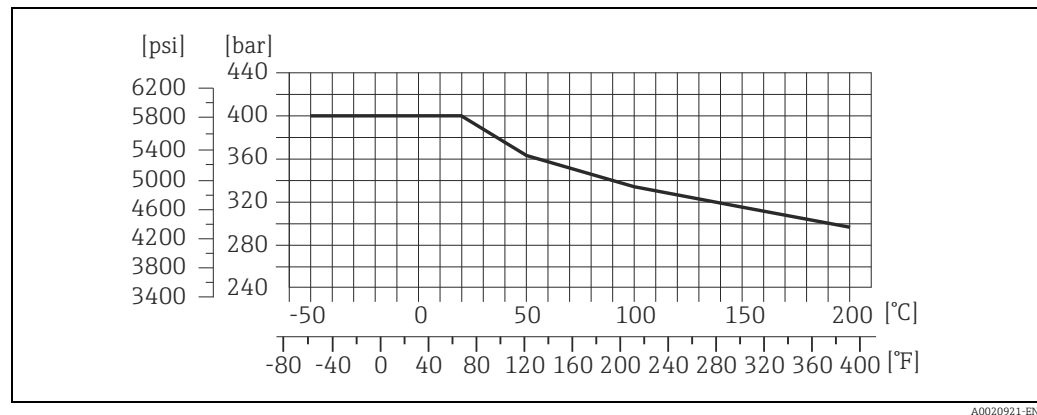


A0021023-EN

High-pressure version (DN 2, 4)

Connection material:

- 4-VCO-4; NPTF: 1.4539 (904L)
- Swagelok: 1.4401 (316/316L)

**Rupture disk**

To increase the level of safety, a device version with a rupture disk with a triggering pressure of 10 to 15 bar (145 to 217.5 psi) can be used. Special mounting instructions: (→ 14).

Rupture disks cannot be combined with the separately available heating jacket (→ 43).

Limiting flow

See "Measuring range" section → 4

Select nominal diameter by optimizing between required flow range and permissible pressure loss. An overview of max. possible full scale values can be found in the "Measuring range" Section.

- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as fluids with entrained solids (flow velocity < 1 m/s (< 3 ft/s)).
- For gas measurement the following rules apply:
 - Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
 - The maximum mass flow depends on the density of the gas: formula → 4

Pressure loss

To calculate the pressure loss, use the *Applicator* sizing tool (→ 44).

System pressure

It is important to ensure that cavitation does not occur, because it would 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 vapour 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:

- Downstream from pumps (no risk of partial vacuum)
- At the lowest point in a vertical pipe

Heating



Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper or heating jackets.

Note!

- Risk of electronics overheating. Make sure that the maximum permissible ambient temperature for the transmitter is not exceeded. Consequently, make sure that the adapter between sensor and transmitter and the connection housing of the remote version always remain free of insulating material. Note that a certain orientation might be required, depending on the fluid temperature.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, (i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such cases, the sensor must be magnetically shielded.

The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:

- Relative magnetic permeability $\mu_r \geq 300$
- Plate thickness $d \geq 0.35 \text{ mm}$ ($\geq 0.014''$)

- Information on permissible temperature ranges → 16

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for the sensors.

Custody transfer measurement

Promass 84 is a flowmeter suitable for custody transfer measurement for liquids (other than water) and gases.

Custody transfer variables

- Mass flow
- Volume flow
- Density

Suitability for custody transfer, metrological control, obligation to subsequent verification



Promass 84 flowmeters are usually verified on site using reference measurements. Only once it has been verified on site by the Verification Authority for legal metrology controls may the measuring device be regarded as verified and used for applications subject to legal metrology controls. The associated seal (stamp) on the measuring device ensures this status.

Note!

Only flowmeters verified by the Verification Authorities may be used for invoicing in applications subject to legal metrology controls. For all verification processes, both the corresponding approvals and the country-specific requirements resp. regulations (e.g. such as the German Verification Act) must be observed. The owner/user of the instrument is obliged to subsequent verification.

Approval for custody transfer

The requirements of the following test centres are taken into consideration:

- **PTB**, Germany; (www.eichamt.de)
- **METAS**, Switzerland; (www.metas.ch)
- **NMI**, Netherlands; (www.nmi.nl)
- **BEV**, Austria; (www.bev.gv.at)

Switching on the power supply in custody transfer mode

If the device is started in custody transfer mode, for example also after a power outage, system error No. 271 "POWER BRK. DOWN" flashes on the local display. The fault message can be acknowledged or reset using the "Enter" key or by means of the status input configured accordingly.



Note!

For correct measuring operation, it is not mandatory to reset the fault message.

Verification process

Type-approved measuring systems for liquids other than water are always verified at their place of deployment. For this purpose, the facility's owner-operator must make everything available when the Standards Authorities come to inspect and approve the system. This includes:

- Scales or container with a reading unit with a load or volumetric capacity that corresponds to the operation of the system at $Q_{\max}$ for one minute. The resolution of the scales display or the reading unit must be at least 0.1 % of the minimum measured quantity.
- Unit for removing the medium being measured after the totalizer to fill the scales or the container.
- Making a sufficient quantity of the medium being measured available. The quantity is derived from the operation of the system. The following rule of thumb applies - quantity at:
 - 3×1 minute at $Q_{\min}$,
 - plus 3×1 minute at $\frac{1}{2} Q_{\max}$,
 - plus 3×1 minute at $Q_{\max}$,
 - plus adequate quantity in reserve.
- Approval certificates



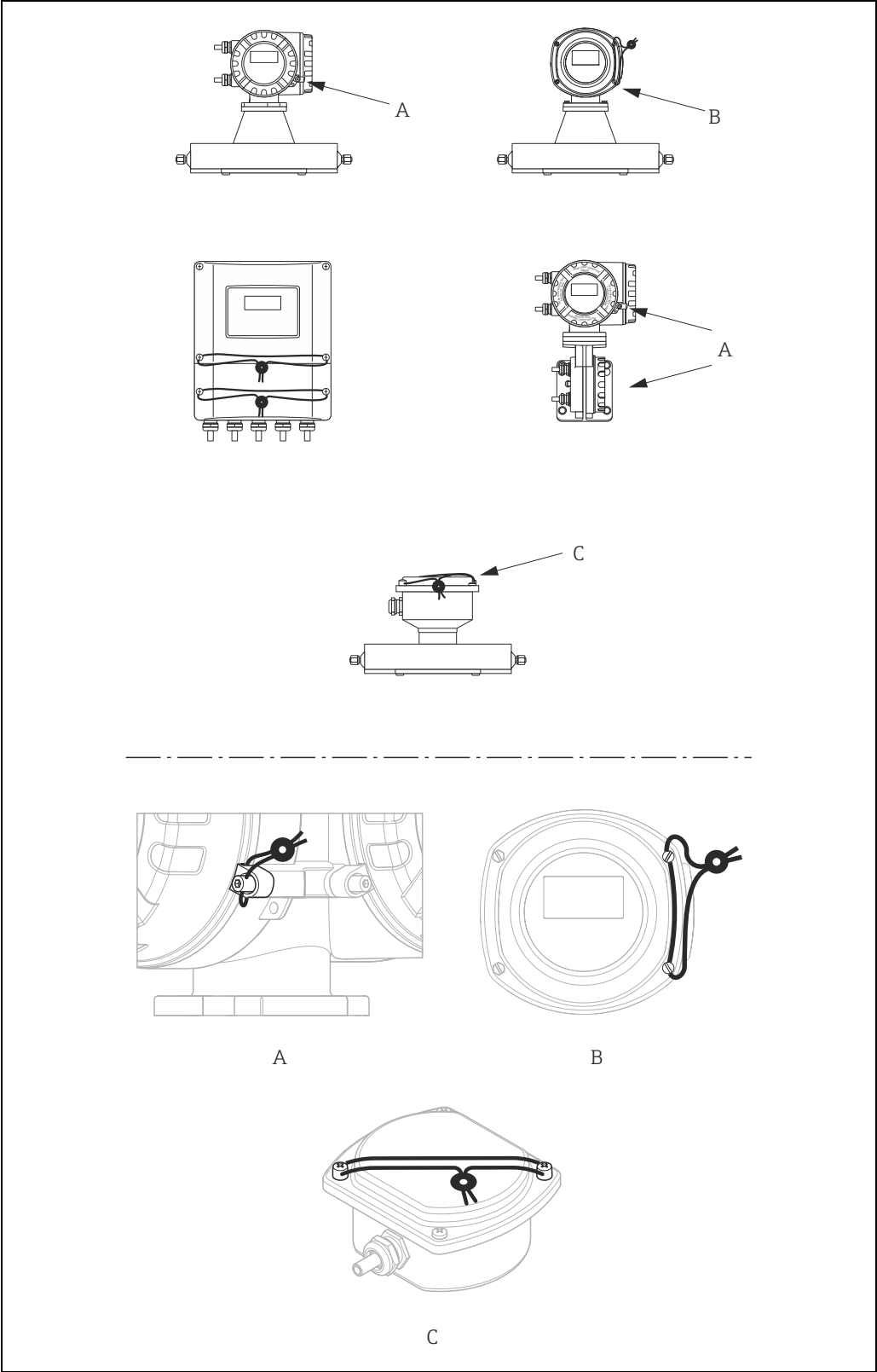
Note!

All issues should be clarified in advance with the authority responsible to ensure the successful verification of the measuring system.

Setting up custody transfer mode

A detailed description of the "setting up custody transfer mode" process is provided in the Operating Instructions supplied with the device.

Stamp points



a0003467

Examples of how to seal the various device versions.

Disabling custody transfer mode

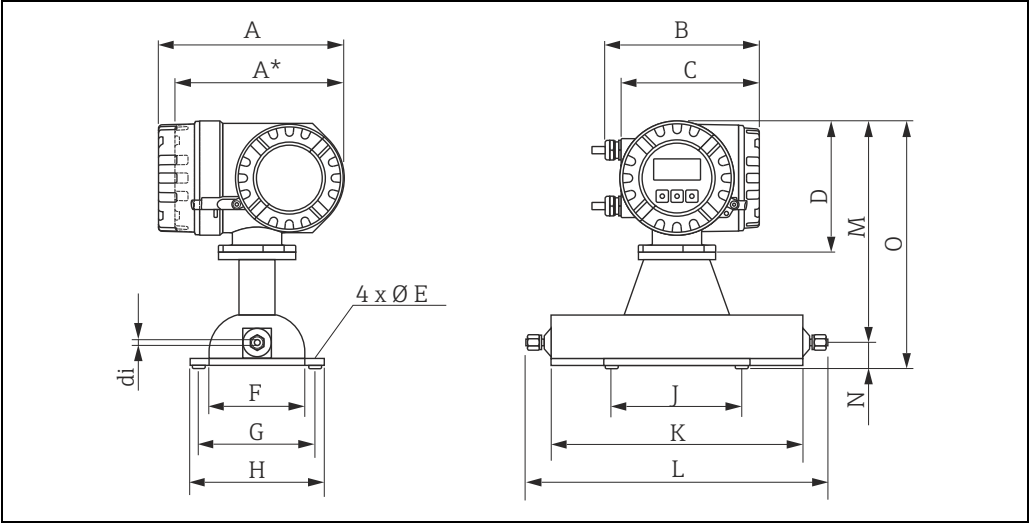
A detailed description of the "disabling custody transfer mode" process is provided in the Operating Instructions supplied with the device.

Mechanical construction

Design/dimensions

Dimensions	
Field housing compact version, powder-coated die-cast aluminium	→  25
Transmitter compact version, stainless steel field housing	→  26
Transmitter connection housing remote version (II2G, zone 1)	→  26
Transmitter wall-mount housing (non hazardous area and II3G, zone 2)	→  27
Connection housing remote version	→  28
Process connection in SI units	
4-VCO-4 coupling (welded)	→  29
Tri-Clamp ½", DIN 11866 line C, 3A (welded)	→  29
4-VCO-4 coupling with mounting kit: DN 15 flange according to EN1092-1 (DIN 2501) 4-VCO-4 coupling with mounting kit: ½" flange according to ASME B16.5 4-VCO-4 coupling with mounting kit: JIS B220, DN 15 flange	→  31
4-VCO-4 coupling with mounting kit: NPTF, ¼"	→  32
4-VCO-4 coupling with mounting kit: Swagelok ⅛" or ¼"	→  33
Process connection in US units	
4-VCO-4 coupling (welded)	→  34
Tri-Clamp ½", DIN 11866 line C, 3A (welded)	→  35
4-VCO-4 coupling with mounting kit: DN 15 flange according to EN1092-1 (DIN 2501) 4-VCO-4 coupling with mounting kit: ½" flange according to ASME B16.5 4-VCO-4 coupling with mounting kit: JIS B220, DN 15 flange	→  36
4-VCO-4 coupling with mounting kit: NPTF, ¼"	→  37
4-VCO-4 coupling with mounting kit: Swagelok ⅛" or ¼"	→  38
Purge connections, pressure vessel monitoring	→  39

Field housing compact version, powder-coated die-cast aluminium



Dimensions in SI units

DN	A	A*	B	C	D	E	F	G	H	J	K	L	M	N	O	U/di
2	227	207	187	168	160	Ø6,5	120	145	165	160	310	¹⁾	273	32	305	¹⁾
4	227	207	187	168	160	Ø6,5	150	175	195	220	435	¹⁾	283	32	315	¹⁾

* Blind version (without display)

¹⁾ depends on the process connection

Dimensions for the holes (e) on the baseplate for a table, a wall or post mounting: dimensions G × J

All dimensions in [mm]

Dimensions in US units

DN	A	A*	B	C	D	E	F	G	H	J	K	L	M	N	O	U/di
1/12"	8.94	8.15	7.68	6.61	6.30	Ø0.26	4.72	5.71	6.50	6.30	12.2	¹⁾	10.7	1.26	12.0	¹⁾
1/8"	8.94	8.15	7.68	6.61	6.30	Ø0.26	5.90	6.89	7.68	8.67	17.1	¹⁾	11.1	1.26	12.4	¹⁾

* Blind version (without display)

¹⁾ depends on the process connection

Dimensions for the holes (e) on the baseplate for a table, a wall or post mounting: dimensions G × J

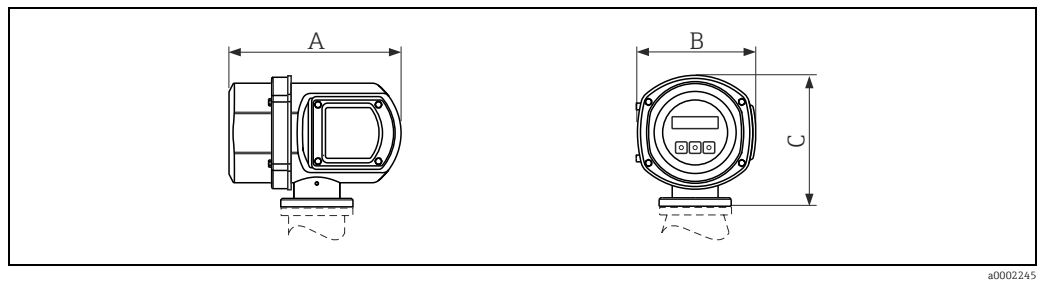
All dimensions in [in]



Note!

Dimensions for transmitter II2G, zone 1 → 26.

Transmitter compact version, stainless steel field housing

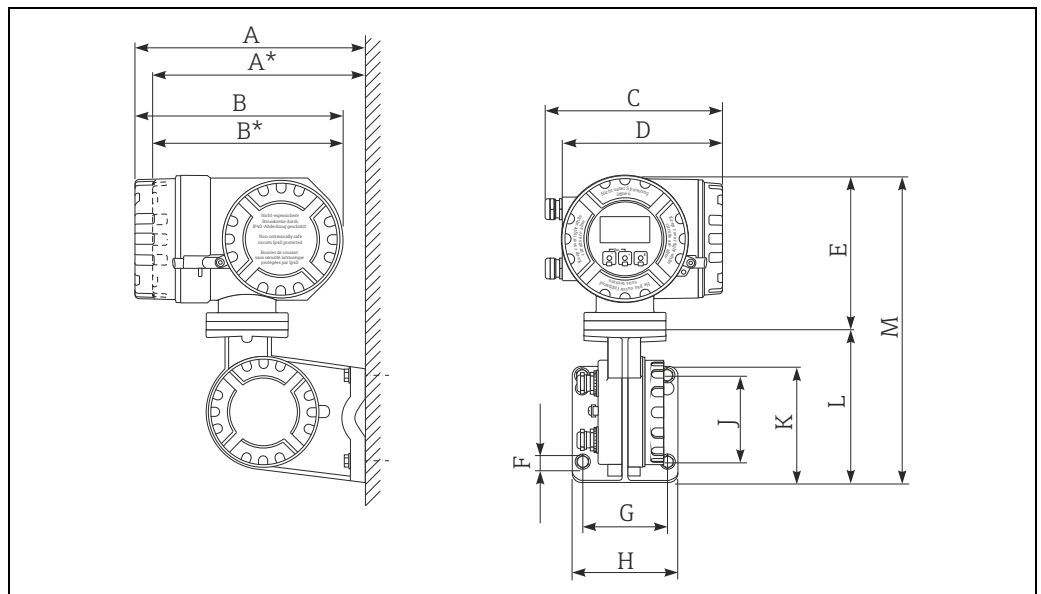


a0002245

Dimensions in SI and US units

A		B		C	
[mm]	[in]	[mm]	[in]	[mm]	[in]
225	8.86	153	6.02	168	6.61

Transmitter connection housing remote version (II2G, zone 1)



a0006999

Dimensions in SI units

A	A*	B	B*	C	D	E	F Ø	G	H	J	K	L	M
265	242	240	217	206	186	178	8.6 (M8)	100	130	100	144	170	348

* Blind version (without display)

All dimensions in [mm]

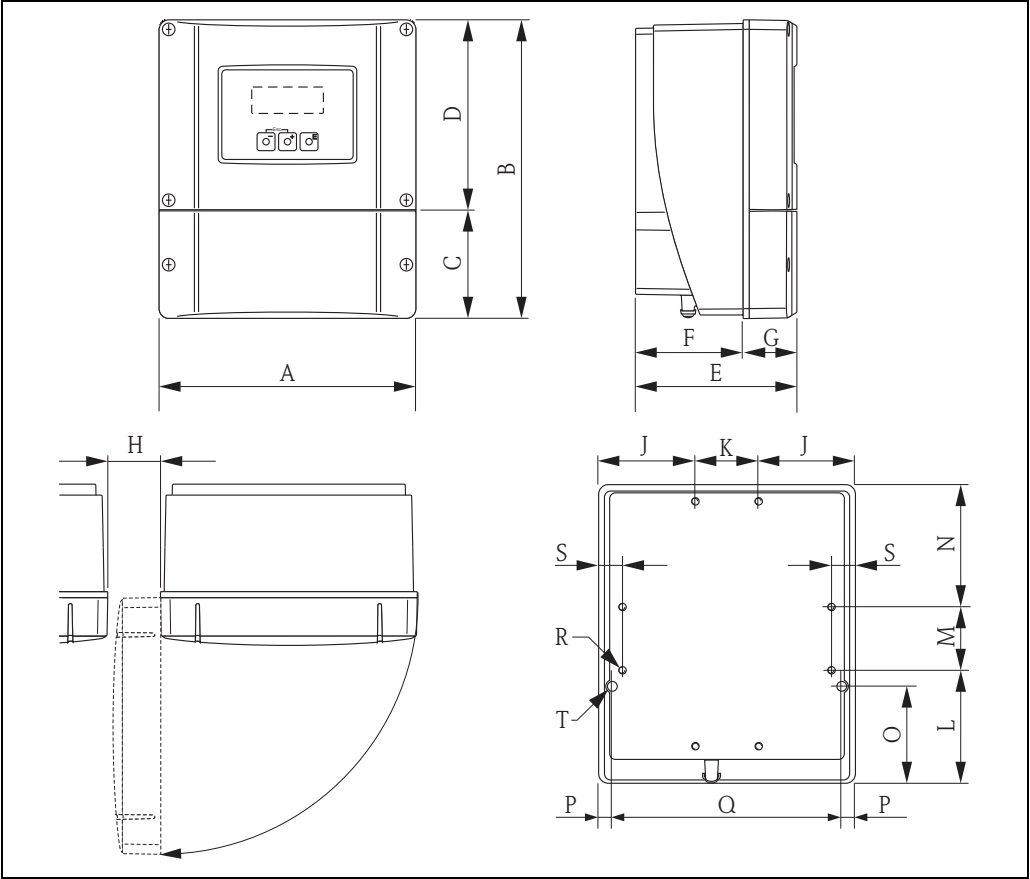
Dimensions in US units

A	A*	B	B*	C	D	E	F Ø	G	H	J	K	L	M
10.4	9.53	9.45	8.54	8.11	7.32	7.01	0.34 (M8)	3.94	5.12	3.94	5.67	6.69	13.7

* Blind version (without display)

All dimensions in [in]

Transmitter wall-mount housing (non hazardous area and II3G, zone 2)



a0007001

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 × Ø 6.5	

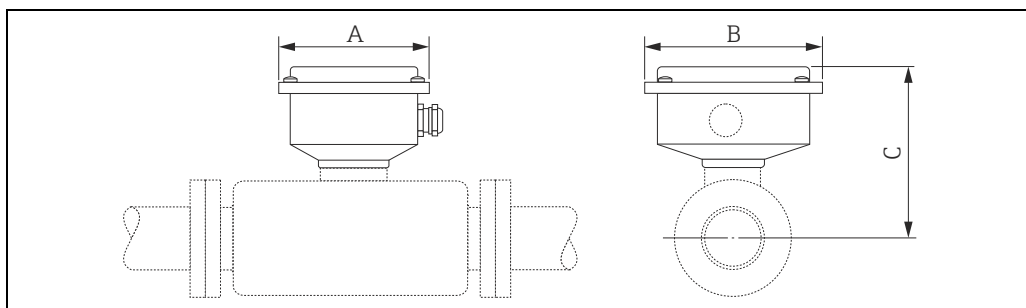
¹⁾ Fixing bolt for wall assembly: M6 (screw head max. 10.5 mm)
All dimensions in [mm]

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 × Ø 0.26	

¹⁾ Fixing bolt for wall assembly: M6 (screw head max. 0.41 inch)
All dimensions in [in]

Connection housing remote version



a0002516

Dimensions in SI units

DN	A	B	C
2	118.5	137.5	120
4	118.5	137.5	130

All dimensions in [mm]

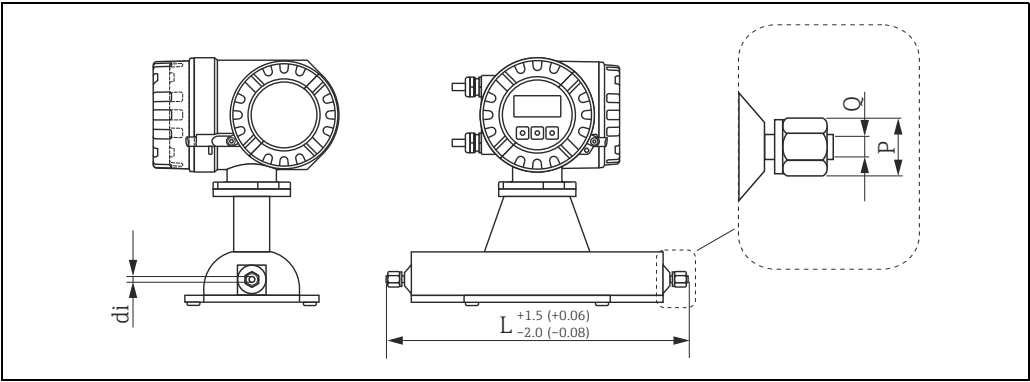
Dimensions in US units

DN	A	B	C
$\frac{1}{12}$ "	4.67	5.41	4.72
$\frac{1}{8}$ "	4.67	5.41	5.12

All dimensions in [in]

Process connections in SI units

4-VCO-4 coupling (welded)



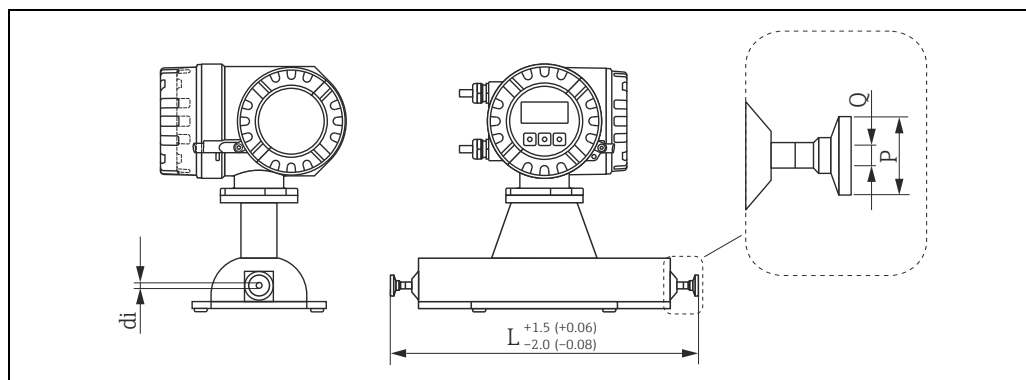
A0022125

Engineering unit mm (in)

4-VCO-4 coupling (welded): 1.4539 (904L); Alloy C22			
Order code for "process connection", option SVW			
4-VCO-4 coupling (welded): 1.4539 (904L), Ra ≤ 0,4 µm/240 grit			
Order code for "process connection", option PPD			
DN	L	P	Q / di
2	372	AF 11/16"	1.8
2 ¹⁾	372	AF 11/16"	1.4
4	497	AF 11/16"	3.5
4 ¹⁾	497	AF 11/16"	3.0

¹⁾ High-pressure version
All dimensions in [mm]

Tri-Clamp ½", DIN 11866 line C, 3A (welded)



A0022126

Engineering unit mm (in)

Tri-Clamp ½", 3A: 1.4539 (904L), Ra ≤ 0,4 µm/240 grit
 Order code for "process connection", option SPD
 Tri-Clamp, ½", 3A: 1.4539 (904L), Ra ≤ 0,8 µm/150 grit
 Order code for "process connection", option STA

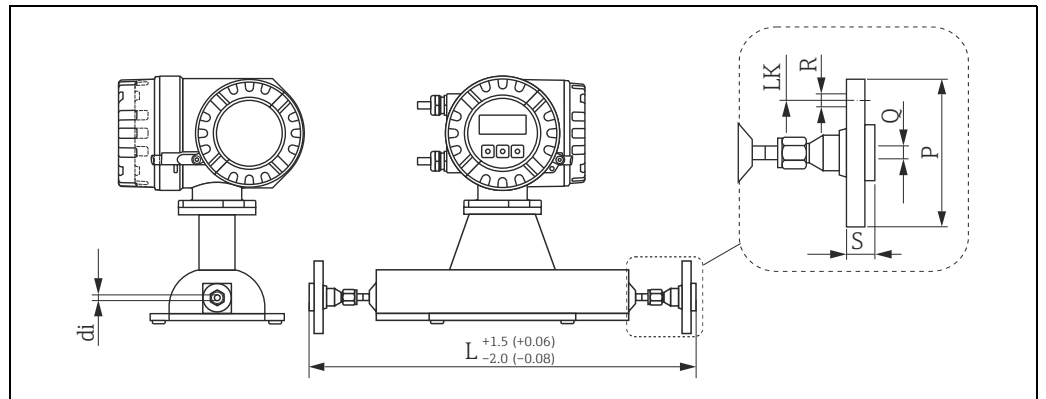
DN	L	P	Q	di
2	378	25	9.5	1.8
4	503	25	9.5	3.5

All dimensions in [mm]

4-VCO-4 coupling with mounting kit: DN 15 flange according to EN1092-1 (DIN 2501)

4-VCO-4 coupling with mounting kit: ½" flange according to ASME B16.5

4-VCO-4 coupling with mounting kit: JIS B220, DN 15 flange



A0022127

Engineering unit mm (in)

4-VCO-4 coupling with mounting kit DN 15 flange according to EN 1092-1 (DIN 2501), PN 40: 1.4539 (904L); Alloy C22

DN	PN	L	P	Q	R	S	LK	di
2	40	475	95	17.3	4 × Ø14	28	65	1.8
4	40	600	95	17.3	4 × Ø14	28	65	3.5

Loose flanges (not wetted) made of stainless steel, 1.4404 (F316/F316L)

All dimensions in [mm]

4-VCO-4 coupling with mounting kit: ½" flange according to ASME B16.5: 1.4539 (904L); Alloy C22

DN	ASME	L	P	Q	R	S	LK	di
2	Cl 150	475	88.9	15.7	4 × Ø15.7	17.7	60.5	1.8
2	Cl 300	475	95.2	15.7	4 × Ø15.7	20.7	66.5	1.8
4	Cl 150	600	88.9	15.7	4 × Ø15.7	17.7	60.5	3.5
4	Cl 300	600	95.2	15.7	4 × Ø15.7	20.7	66.5	3.5

Loose flanges (not wetted) made of stainless steel, 1.4404 (F316/F316L)

All dimensions in [mm]

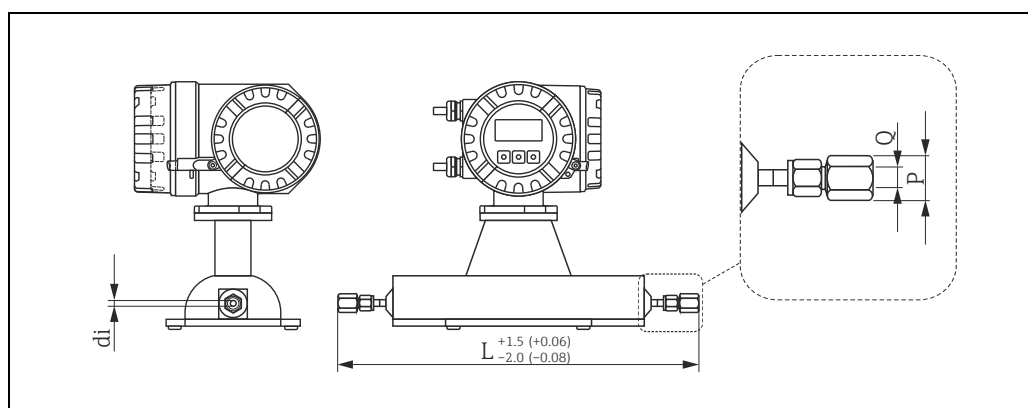
4-VCO-4 coupling with mounting kit: JIS B220, DN 15 flange: 1.4539 (904L); Alloy C22

DN	JIS	L	P	Q	R	S	LK	di
2	10K	475	95	15.0	4 × Ø15	28	70	1.8
2	20K	475	95	15.0	4 × Ø15	14	70	1.8
4	10K	600	95	15.0	4 × Ø15	28	70	3.5
4	20K	600	95	15.0	4 × Ø15	14	70	3.5

Loose flanges (not wetted) made of stainless steel, 1.4404 (F316/F316L)

All dimensions in [mm]

4-VCO-4 coupling with mounting kit: NPTF, 1/4"



A0022128

Engineering unit mm (in)

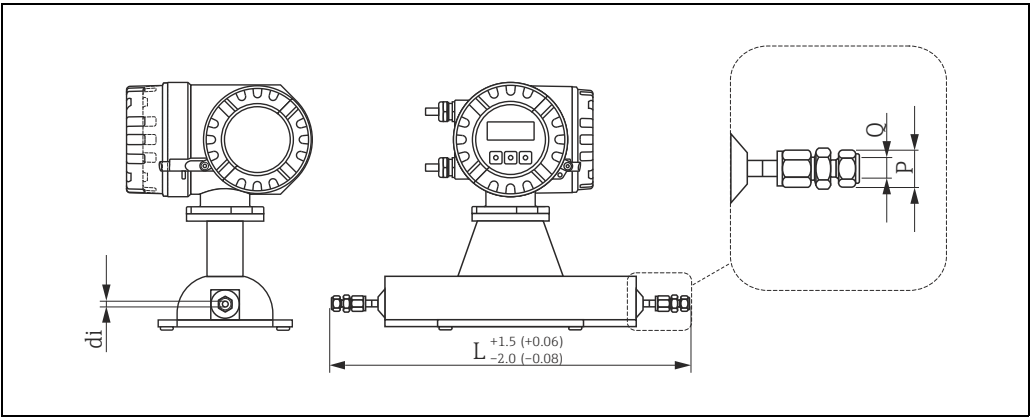
4-VCO-4 coupling with mounting kit: NPTF, 1/4": 1.4539 (904L); Alloy C22

DN	L	P	Q	di
2	443	AF 3/4"	1/4" NPT	1.8
2 ¹⁾	443	AF 3/4"	1/4" NPT	1.4
4	568	AF 3/4"	1/4" NPT	3.5
4 ¹⁾	568	AF 3/4"	1/4" NPT	3.0

¹⁾ High-pressure version only available as 1.4539 (904L)

All dimensions in [mm]

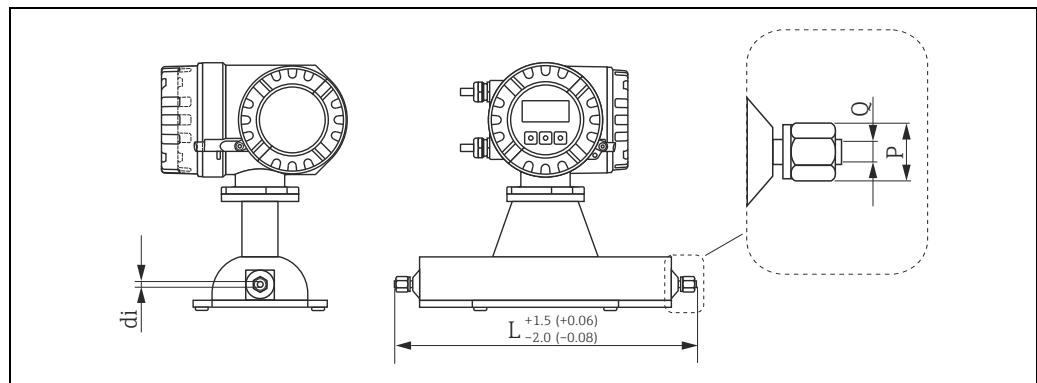
4-VCO-4 coupling with mounting kit: Swagelok 1/8" or 1/4"



Engineering unit mm (in)

4-VCO-4 coupling with mounting kit: Swagelok 1/8" or 1/4" : 1.4539 (904L)				
DN	L	P	Q	di
2	441.6	AF 7/16"	1/8"	1.8
2	446.6	AF 9/16"	1/4"	1.8
2 ¹⁾	441.6	AF 7/16"	1/8"	1.4
2 ¹⁾	446.6	AF 9/16"	1/4"	1.4
4	571.6	AF 9/16"	1/4"	3.5
4 ¹⁾	571.6	AF 9/16"	1/4"	3.0

¹⁾ High-pressure version
All dimensions in [mm]

Process connection in US units*4-VCO-4 coupling (welded)*

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Engineering unit mm (in)

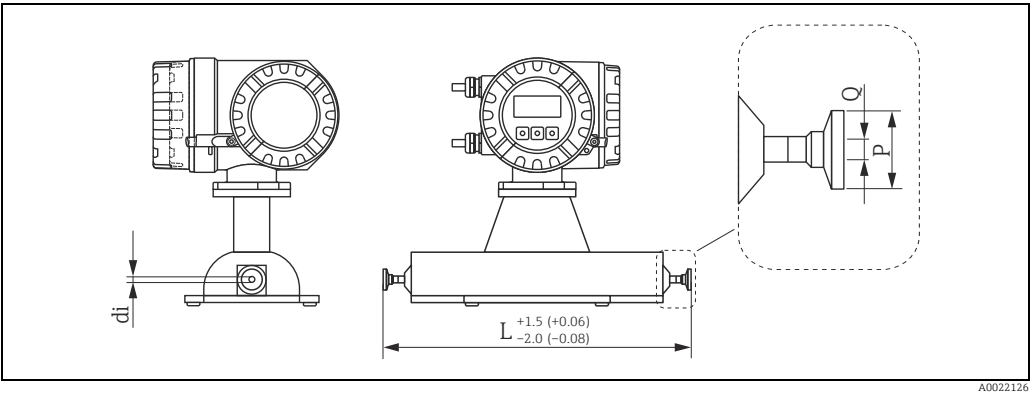
4-VCO-4 coupling (welded): 1.4539 (904L); Alloy C22
Order code for "process connection", option SVW
4-VCO-4 coupling (welded): 1.4539 (904L), Ra ≤ 16 µin/240 grit
Order code for "process connection", option PPD

DN	L	P	Q / di
1/12"	14.6	AF 11/16"	0.07
1/12" ¹⁾	14.6	AF 11/16"	0.06
1/8"	19.6	AF 11/16"	0.14
1/8" ¹⁾	19.6	AF 11/16"	0.12

¹⁾ High-pressure version

All dimensions in [mm]

Tri-Clamp 1/2", DIN 11866 line C, 3A (welded)



Engineering unit mm (in)

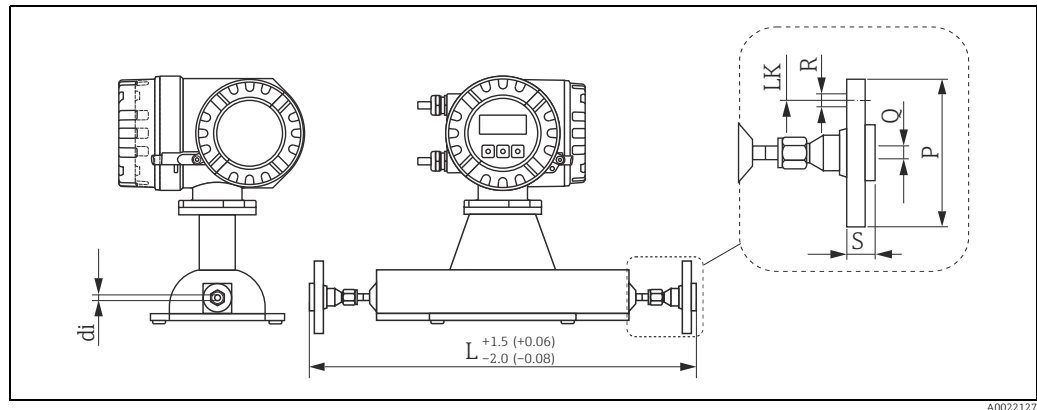
Tri-Clamp 1/2", 3A: 1.4539 (904L), Ra ≤ 0,4 µm/240 grit				
Order code for "process connection", option SPD				
Tri-Clamp, 1/2", 3A: 1.4539 (904L), Ra ≤ 0,8 µm/150 grit				
Order code for "process connection", option SPD				
DN	L	P	Q	di
1/12"	14.9	0.98	0.37	0.07
1/8"	19.8	0.98	0.37	0.14

All dimensions in [in]

4-VCO-4 coupling with mounting kit: DN 15 flange according to EN1092-1 (DIN 2501)

4-VCO-4 coupling with mounting kit: 1/2" flange according to ASME B16.5

4-VCO-4 coupling with mounting kit: JIS B220, DN 15 flange



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Engineering unit mm (in)

4-VCO-4 coupling with mounting kit DN 15 flange according to EN 1092-1 (DIN 2501), PN 40: 1.4539 (904L); Alloy C22

DN	PN	L	P	Q	R	S	LK	di
1/12"	40	18.7	3.8	0.692	4 × Ø 0.56	1.12	2.6	0.07
1/8"	40	23.6	3.8	0.692	4 × Ø 0.56	1.12	2.6	0.14

Loose flanges (not wetted) made of stainless steel, 1.4404 (F316/F316L)

All dimensions in [in]

4-VCO-4 coupling with mounting kit: 1/2" flange according to ASME B16.5: 1.4539 (904L); Alloy C22

DN	ASME	L	P	Q	R	S	LK	di
1/12"	CI 150	18.7	3.5	0.62	4 × Ø0.62	0.70	2.38	0.07
1/12"	CI 300	18.7	3.7	0.62	4 × Ø0.62	0.81	2.62	0.07
1/8"	CI 150	23.6	3.5	0.62	4 × Ø0.62	0.70	2.38	0.14
1/8"	CI 300	23.6	3.7	0.62	4 × Ø0.62	0.81	2.62	0.14

Loose flanges (not wetted) made of stainless steel, 1.4404 (F316/F316L)

All dimensions in [in]

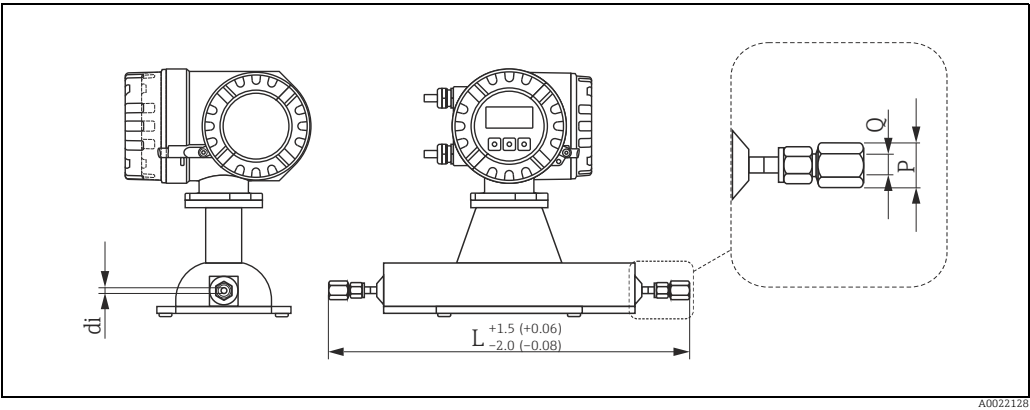
4-VCO-4 coupling with mounting kit: JIS B220, DN 15 flange: 1.4539 (904L); Alloy C22

DN	JIS	L	P	Q	R	S	LK	di
1/12"	10K	18.7	3.8	0.6	4 × Ø0.6	1.12	2.8	0.07
1/12"	20K	18.7	3.8	0.6	4 × Ø0.6	0.56	2.8	0.07
1/8"	10K	23.6	3.8	0.6	4 × Ø0.6	1.12	2.8	0.14
1/8"	20K	23.6	3.8	0.6	4 × Ø0.6	0.56	2.8	0.14

Loose flanges (not wetted) made of stainless steel, 1.4404 (F316/F316L)

All dimensions in [in]

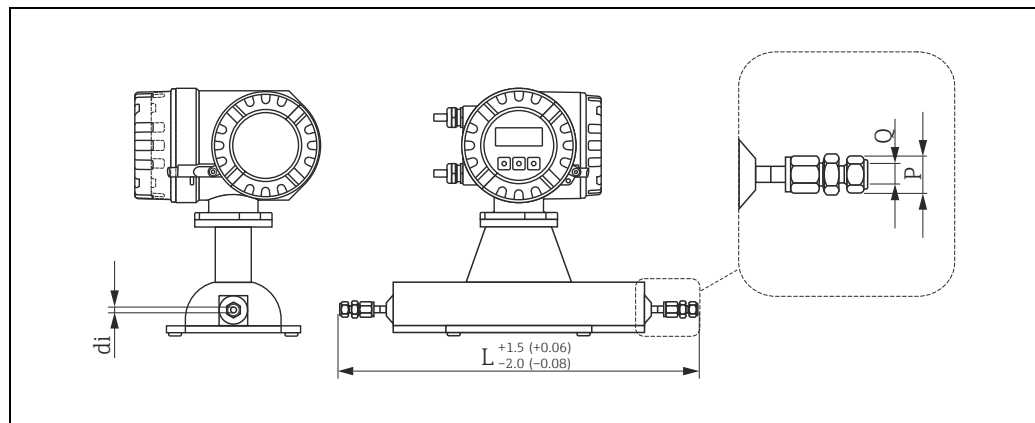
4-VCO-4 coupling with mounting kit: NPTF, 1/4"



4-VCO-4 coupling with mounting kit: NPTF, 1/4": 1.4539 (904L); Alloy C22				
DN	L	P	Q	di
1/12"	14.9	AF 3/4"	1/4" NPT	0.07
1/12" ¹⁾	14.9	AF 3/4"	1/4" NPT	0.06
1/8"	22.4	AF 3/4"	1/4" NPT	0.14
1/8" ¹⁾	22.4	AF 3/4"	1/4" NPT	0.12

¹⁾ High-pressure version only available as 1.4539 (904L)
All dimensions in [in]

4-VCO-4 coupling with mounting kit: Swagelok 1/8" or 1/4"



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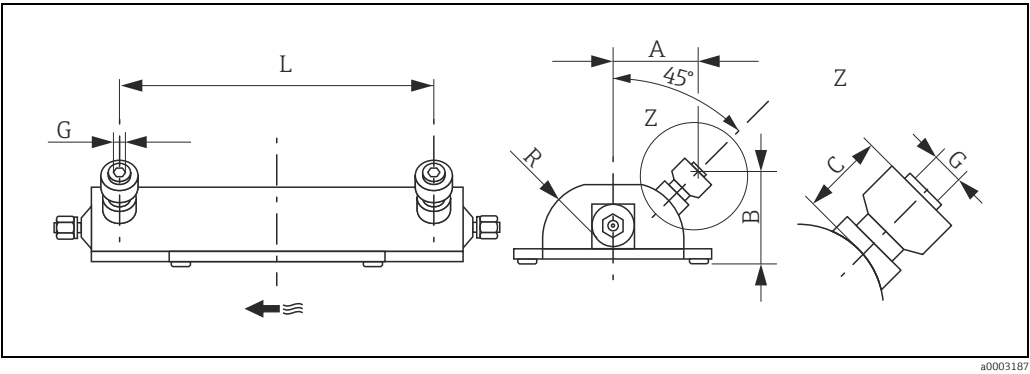
Engineering unit mm (in)

4-VCO-4 coupling with mounting kit: Swagelok 1/8" or 1/4" : 1.4539 (904L)				
DN	L	P	Q	di
1/12"	17.4	AF 7/16"	1/8"	0.07
1/12"	17.4	AF 9/16"	1/4"	0.07
1/12" ¹⁾	17.4	AF 7/16"	1/8"	0.06
1/12" ¹⁾	17.4	AF 9/16"	1/4"	0.06
1/8"	22.4	AF 9/16"	1/4"	0.14
1/8" ¹⁾	22.4	AF 9/16"	1/4"	0.12

¹⁾ High-pressure version

All dimensions in [in]

Purge connections, pressure vessel monitoring



Dimensions in SI units

DN	A	B	C	G	L	R
2	70.0	77.0	33.0	½" NPT	130.0	47.0
4	81.5	83.0	33.0	½" NPT	192.5	59.5

All dimensions in [mm]

Dimensions in US units

DN	A	B	C	G	L	R
½"	2.8	3.0	1.3	½" NPT	5.12	1.85
¾"	3.2	3.3	1.3	½" NPT	7.58	2.34

All dimensions in [in]

Weight

- Compact version: see tables below
- Remote version
 - Transmitter: see the tables below
 - Wall-mount housing: 5 kg (11 lbs)

Weight in SI units

DN [mm]	2	4
Compact version	11	15
Remote version	9	13

All values (weight) refer to devices with EN/DIN PN 40 flanges.
Weight information in [kg]

Weight in US units

DN [in]	½"	¾"
Compact version	24	33
Remote version	20	29

All values (weight) refer to devices with EN/DIN PN 40 flanges.
Weight information in [lbs]

Material**Transmitter housing**

Compact version

- Powder coated die-cast aluminium
- Stainless steel housing: stainless steel, 1.4301 (304)
- Window material: glass or polycarbonate

Remote version

- Remote field housing: powder coated die-cast aluminium
- Wall-mount housing: powder coated die-cast aluminium
- Window material: glass

Sensor housing, containment

- Acid and alkali-resistant outer surface
- Stainless steel, 1.4301 (304)

Connection housing, sensor (remote version)

- Stainless steel, 1.4301 (304)

Process connections

Process connection	Material
4-VCO-4 coupling	Stainless steel, 1.4539 (904L); Alloy C22
Tri-Clamp ½", DIN 11866 line C, 3A	Stainless steel, 1.4539 (904L)
Mounting kit: flange according to EN1092-1 (DIN 2501) Mounting kit: flange according to ASME B16.5 Mounting kit: JIS B2220, flange	Stainless steel, 1.4539 (904L); Alloy C22 Loose flange (not wetted): stainless steel, 1.4404 (F316/316L)
Mounting kit: NPTF threaded adapter ¼"	Stainless steel, 1.4539 (904L); Alloy C22
Mounting kit: Swagelok threaded joint ¼" or ⅛"	Stainless steel, 1.4401 (316/316L)

Measuring tubes

- Stainless steel, 1.4539 (904L)
- Alloy C22

Seals

Welded process connections without internal seals

Process connections

- Welded process connections
 - 4-VCO-4 coupling
 - Tri-Clamp ½", DIN 11866 line C, 3A
- Screwed on process connections (mounting kits)
 - Flange according to EN1092-1 (DIN 2501)
 - Flange according to ASME B16.5
 - JIS B2220, flange
 - NPTF threaded adapter ¼"
 - Swagelok threaded joint ¼" or ⅛"

Surface roughness

All data relate to parts in contact with fluid.

- Not polished
- $Ra_{max} = 0,8 \mu m$ (32 μin) mechanically polished
- $Ra_{max} = 0,4 \mu m$ (16 μin) mechanically polished

Operability

Local operation	Display elements ■ Liquid-crystal display: backlit, four lines with 16 characters per line ■ Selectable display of different measured values and status variables ■ At ambient temperatures below -20°C (-4°F) the readability of the display may be impaired. Operating elements ■ Local operation with three optical keys (□ ⊕ ⊞) ■ 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 and Czech ■ South and Eastern Asia (SEA): English, Japanese, Indonesian ■ China (CN): English, Chinese The language group is changed using the "FieldCare" operating program.
Remote operation	Operation via HART, Modbus RS485

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 mark	The measuring system is in conformity with the EMC requirements of the Australian Communication and Media Authority (ACMA).
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI) can be supplied by your Endress+Hauser Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.
Sanitary compatibility	■ 3A approval ■ EHEDG-tested
Modbus RS485 certification	The measuring device meets all the requirements of the Modbus/TCP conformity and integration test and has the "Modbus/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the "Modbus/TCP Conformance Test Laboratory" of the University of Michigan.
Pressure measuring device approval	The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary. ■ With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC. ■ Devices with this identification (with PED) are suitable for the following types of fluid: – Fluids of Group 1 and 2 with a steam pressure greater than, or smaller and equal to 0.5 bar (7.3 psi) – Unstable gases ■ Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.

Measuring Instruments Directive

Measuring Instruments Directive 2004/22/EG (MID)

Annex MI-002 (gas meter)

The measuring device is approved as gas meter for use under legal control (in commercial transactions) acc. the European Measuring Instruments Directive, Annex MI-002 (DE-08-MI002-PTB014).

Annex MI-005 (liquids other than water)

- This flowmeter which is a suitable component in measuring systems subject to legal metrology controls in accordance with Annex MI-005 of the European Measuring Instruments Directive 2004/22/EC (MID)

Note: According to the Measuring Instruments Directive, however, only the complete measuring system is licensable, covered by an EC type-examination certificate and bears conformity marking.

- This flowmeter is qualified to OIML R117-1 and has an MID Evaluation Certificate (1) which confirms compliance with the essential requirements of the Measuring Instruments Directive. The Evaluation Certificate results from the WELMEC (cooperation between the legal metrology services of the member states of the European Union and EFTA) towards voluntary modular approval for measuring systems in accordance with Annex MI-005 (measuring systems for the continuous and dynamic measurement of quantities of liquids other than water) of the Measuring Instruments Directive 2004/22/EC.

Approval for custody transfer

Promass 84 is a flowmeter suitable for custody transfer measurement for liquids (other than water) and gases.

The requirements of the following test centres are taken into consideration:

- PTB, Germany
- METAS, Switzerland
- NMi, Netherlands
- BEV, Austria

Information on custody transfer measurement →  21 ("Custody transfer measurement" Section)

Suitability for custody transfer measurement

MID approval, Annex MI-002 (gas meter)

The device is qualified to OIML R137/D11.

Sensor	DN		MID Type Examination Certificate MI-002 (Europe)		
Promass	[mm]	[in]	Fuel gases up to 100 bar (1450 psi)		
			Mass	Volume	Density
A	2 to 4	1/12" to 1/8"	YES	YES*	NO

* at pure gases only (invariable gas density)

MID approval, Annex MI-005 (liquids other than water)

The device is qualified to OIML R117-1.

Sensor	DN		OIML R117-1/MID Evaluation Certificate (Europe)		
Promass	[mm]	[in]	Liquids other than water		
			Mass	Volume	Density
A	2 to 4	1/12" to 1/8"	YES	YES	YES

Other standards and guidelines

- EN 60529
Degrees of protection by housing (IP code)
- EN 61010-1
Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures
- IEC/EN 61326
"Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment

- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal
- NAMUR NE 53
Software of field devices and signal-processing devices with digital electronics

Ordering Information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide



Note!

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories

For the Transmitter

Accessories	Description
Mounting set for transmitter	Mounting set for wall-mount housing (remote version). Suitable for: ■ Wall mounting ■ Pipe mounting ■ Installation in control panel Mounting set for aluminium field housing: Suitable for pipe mounting (3/4" to 3")

For the Sensor

Accessories	Description
Heating jacket	Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids. If using oil as a heating medium, please consult with Endress+Hauser. Heating jackets cannot be used with sensors fitted with a rupture disk. For details, see Operating Instructions BA00099D
Post mounting set for the sensor	Post mounting set for the Promass A
Mounting set for the sensor	Mounting set for Promass A, comprising: ■ 2 process connections ■ Seals
Set of seals for sensor	For regular replacement of the seals of the Promass A sensors. Set consists of two seals.

Communication-specific accessories

Accessories	Description
HART Communicator Field Xpert handheld terminal	Handheld terminal for remote parameterization and for obtaining measured values via the current output HART (4 to 20 mA). Contact your Endress +Hauser representative for more information.
Commubox FXA195 HART	The Commubox FXA195 connects intrinsically safe smart transmitters with the HART protocol with the USB port of a personal computer. This enables remote operation of the transmitter with operating software (e.g. FieldCare). Power is supplied to the Commubox via the USB port.

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections ■ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ■ Via the Internet: https://wapps.endress.com/applicator ■ On CD-ROM for local PC installation
W@M	Life cycle management for your plant. W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: ■ Via the Internet: www.endress.com/lifecyclemanagement ■ On CD-ROM for local PC installation
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.
FXA193	Service interface from the measuring device to the PC for operation via FieldCare.

System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.

Documentation

- Flow measuring technology (FA00005D)
- Technical Information
 - Promass 84F (TI00103D)
 - Promass 84O (TI00113DD)
 - Promass 84X (TI00111DD)
- Operating Instructions/Description of Device Function
 - Promass 84 (BA00109D/BA00110D)
 - Promass 84 Modbus (BA00129D/BA00130D)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IECEx, NEPSI

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