Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promass 84A

Coriolis Mass Flow Measuring System
The single-tube system for highly accurate measurement of very small flows for custody transfer

Application
The Coriolis measuring principle operates independently of the physical fluid properties, such as viscosity and density.

- Suitable for continuous measurement, filling and dosing of very small flows.
- Extremely accurate, verified measurement of liquids and gases such as emulsions, additives, flavouring, insulin, gases for high pressure and low pressure
- Fluid temperatures up to +200 °C (+392 °F)
- Process pressures up to 400 bar (5800 psi)

Approvals for custody transfer:
- PTB, METAS, BEV, MID

Approvals for hazardous area:
- ATEX, FM, CSA, TIIS, IECEx, NEPSI

Approvals in the food industry/hygiene sector:
- 3A, FDA, EHEDG

Connection to the common process control system:
- HART, Modbus

Relevant safety aspects:
- Pressure Equipment Directive
- Purge connection or rupture disk (optional)

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

The **Proline transmitter concept** comprises:
- Modular device and operating concept resulting in a higher degree of efficiency
- Diagnostic ability and data back-up for increased process quality

The **Promass sensors**, tried and tested in over 100000 applications, offer:
- Multivariable flow measurement in compact design
- Insensitivity to vibrations thanks to balanced single-tube measuring system
- Immune from external piping forces due to robust design
- Easy installation without taking inlet and outlet runs into consideration

TI00068D/06/EN/13.12
71197527

Endress+Hauser
People for Process Automation

Table of contents

Function and system design 3
Measuring principle 3
Measuring system 4

Input 5
Measured variable 5
Measuring range in non-custody transfer mode 5
Measuring range in custody transfer mode 5
Operable flow range 5
Input signal 6

Output 6
Output signal 6
Signal on alarm 6
Load 6
low flow cut off 7
Galvanic isolation 7
Switching output 7

Power supply 7
Electrical connection measuring unit 7
Terminal assignment 8
Electrical connection remote version 8
Supply voltage 9
Switching on the power supply in custody transfer mode 9
Cable entries 9
Remote version cable specifications 9
Power consumption 9
Power supply failure 9
Potential equalisation 9

Performance characteristics 10
Reference operating conditions 10
Maximum measured error 10
Repeatability 11
Influence of medium temperature 11
Influence of medium pressure 11
Design fundamentals 11

Installation 12
Installation instructions 12
Inlet and outlet run 14
Length of connecting cable 14
System pressure 14

Environment 15
Ambient temperature range 15
Storage temperature 15
Ambient class 15
Degree of protection 15
Shock resistance 15
Vibration resistance 15
CIP cleaning 15
SIP cleaning 15
Electromagnetic compatibility (EMC) 15

Process 16
Medium temperature range 16
Medium pressure range (nominal pressure) 16
Rupture disk (optional) 16
Limiting flow 16
Pressure loss 17

Custody transfer measurement 19
Custody transfer variables 19
Suitability for custody transfer, metrological control, obligation to subsequent verification 19
Verification process 19
Stamp points 20

Mechanical construction 21
Design/dimensions 21
Weight 34
Material 34
Material load curves 35
Process connections 36

Human interface 37
Display elements 37
Operating elements 37
Language groups 37
Remote operation 37

Certificates and approvals 37
CE mark 37
C-Tick mark 37
Ex approval 37
Sanitary compatibility 37
Modbus RS485 certification 37
Other standards and guidelines 37
Pressure measuring device approval 38
Measuring Instruments Directive 38
Approval for custody transfer 38
Suitability for custody transfer measurement 38

Ordering Information 39

Accessories 39

Documentation 39

Registered trademarks 39

Function and system design

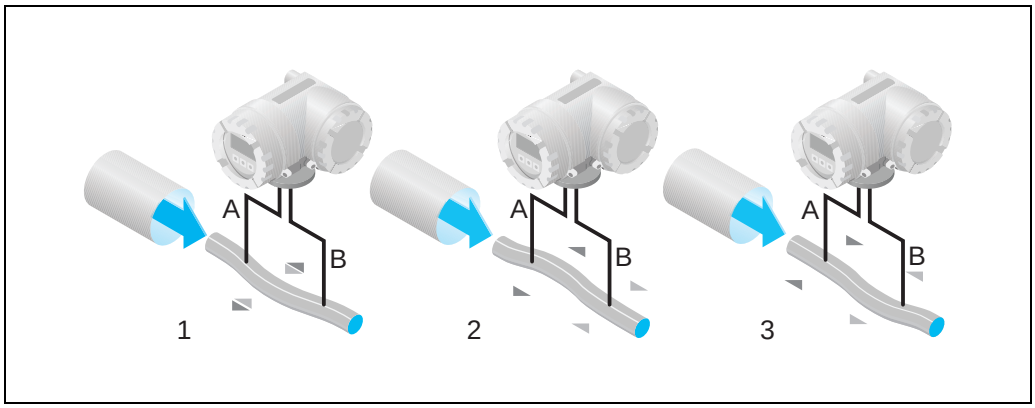
Measuring principle

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, 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).



a0003383

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 utilises this relationship to obtain a density signal.

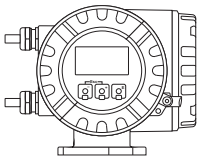
Temperature measurement

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.

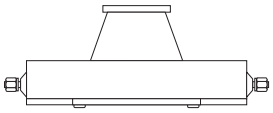
Measuring system

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)

Sensor

A  a0003679	■ Single-tube system for highly accurate measurement of very small flows ■ Nominal diameters DN 1 to 4 (1/24 to 1/8") ■ Material: Stainless steel EN 1.4539/ASTM 904L, EN 1.4404/ASTM 316L , Alloy C-22 DIN 2.4602 (process connection)

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]	[inch]	[kg/h]	[lb/min]
2	1/12"	0 to 100	0 to 3.7
4	1/8"	0 to 450	0 to 16.5

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:

$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} / 32$ [kg/m³]

$\dot{m}_{max(G)}$ = max. full scale value for gas [kg/h]
$\dot{m}_{max(F)}$ = max. full scale value for liquid [kg/h]
$\rho_{(G)}$ = gas density in [kg/m³] 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:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div 32$ [kg/m³] = 100 kg/h · 11.9 kg/m³ ÷ 32 kg/m³ = 37.2 kg/h

Recommended full scale values:

See information in the "Limiting flow" Section → 16

Measuring range in custody transfer mode

The following are example data for German PTB approval (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]	[inch]	[kg/min]	[lb/min]	[kg]	[lbs]
2	1/12"	0.1 to 2	0.221 to 4.41	0.05	0.110
4	1/8"	0.4 to 8	0.882 to 17.64	0.20	0.441

Measuring ranges for liquids in volume flow (also LPG)

Nominal Diameter		Range for mass flow (liquids) Q_{min} to Q_{max}		Smallest measured quantity	
[mm]	[inch]	[l/min]	[gal/min]	[l]	[gal]
2	1/12"	0.1 to 2	0.0264 to 0.528	0.05	0.0132
4	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 kΩ, 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 kΩ, 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 µA
- 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 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 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 → 8

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

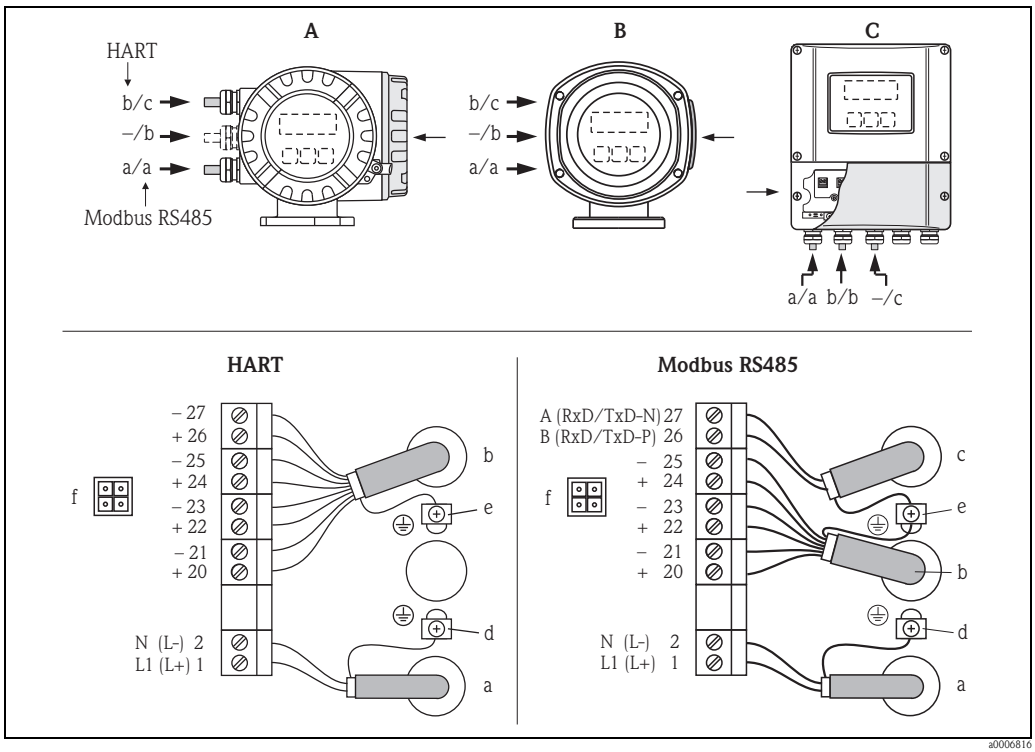
Load

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

Electrical connection measuring unit



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)

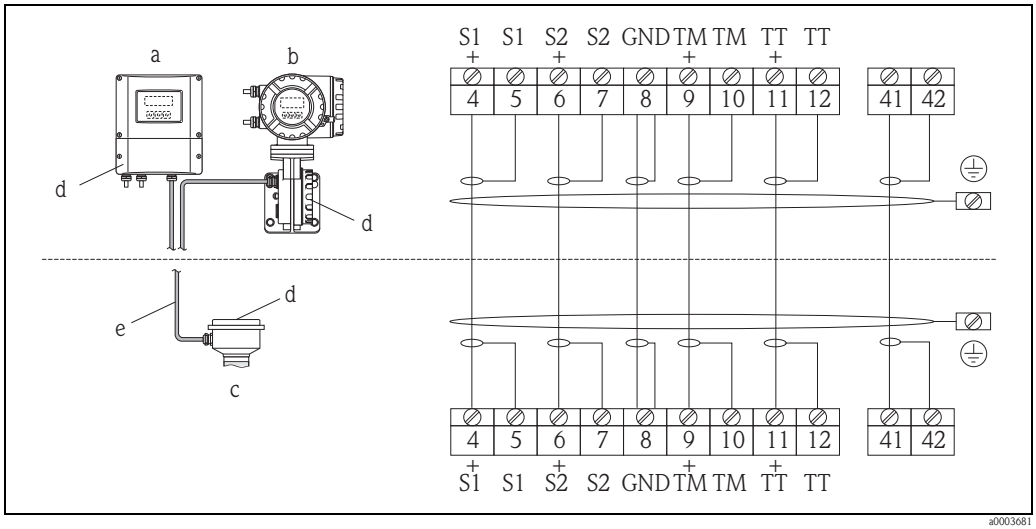
a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
– Terminal No. 1: L1 for AC, L+ for DC
– Terminal No 2: N for AC, L- for DC
b Signal cable: Terminal assignment → 8
c Fieldbus cable: Terminal assignment → 8
d Ground terminal for protective earth
e Ground terminal for Signal cable/ RS485 line
f Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)

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.

Order variant	Terminal No. (inputs/outputs) 20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
Fixed communication boards (permanent assignment)				
84***-**********S	–	–	Pulse/freq. output Ex i passive	Current output Ex i active, HART
84***-**********T	–	–	Pulse/freq. output Ex i, passive	Current output Ex i passive, HART
Flexible communication boards				
84***-**********D	Status input	Relay output	Pulse/frequency output	Current output HART
84***-**********M	Status input	Pulse/frequency output 2	Pulse/frequency output 1	Current output HART
84***-**********N	Current output	Pulse/frequency output	Status input	Modbus RS485
84***-**********Q	–	–	Status input	Modbus RS485
84***-**********1	Relay output	Pulse/frequency output 2	Pulse/frequency output 1	Current output HART
84***-**********2	Relay output	Current output 2	Pulse/frequency output	Current output 1 HART
84***-**********7	Relay output 2	Relay output 1	Status input	Modbus RS485

Electrical connection remote version



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

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

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.

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 mm^2 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.

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.

Potential equalisation

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

Performance characteristics

Reference operating conditions

- Error limits following ISO/DIN 11631
- Water, typically +20 to +30 °C (+68 to +86 °F); 2 to 4 bar (30 to 60 psi)
- Data according to calibration protocol ±5 °C (±9 °F) and ±2 bar (±30 psi)
- Accuracy based on accredited calibration rigs according to ISO 17025

Maximum measured error

The following values refer to the pulse/frequency output. Deviation at the current output is typically ±5 µA.
Design fundamentals → 🖹 11

o.r. = of reading

Mass flow and volume flow (liquids)

±0.10% o.r.

Mass flow (gases)

±0.50% o.r.

Density (liquids)

- ±0.0005 g/cc (under reference conditions)
- ±0.0005 g/cc (after field density calibration under process conditions)
- ±0.002 g/cc (after special density calibration)
- ±0.02 g/cc (over the entire measuring range of the sensor)

1 g/cc = 1 kg/l

Special density calibration (optional):
- Calibration range: 0.0 to 1.8 g/cc, +5 to +80 °C (+41 to +176 °F)
- Operation range: 0.0 to 5.0 g/cc, –50 to +200 °C (–58 to +392 °F)

Temperature

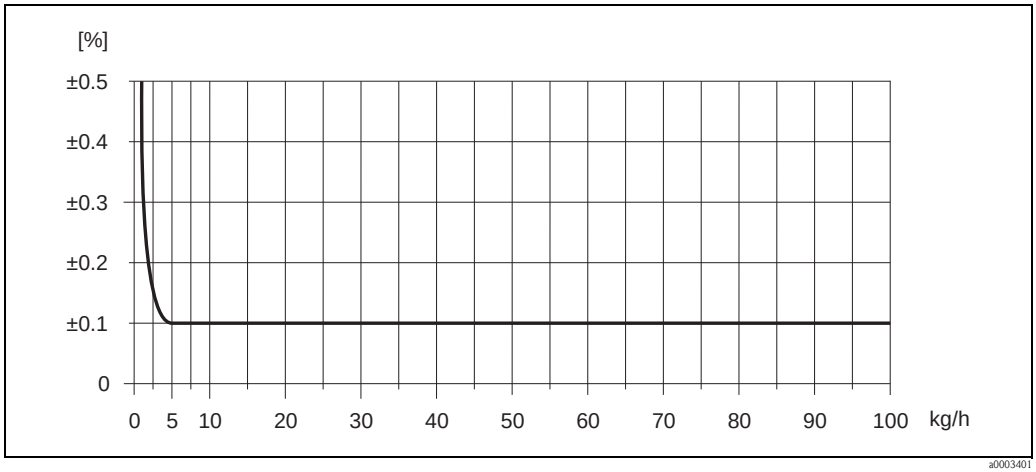
±0,5 °C ± 0.005 · T °C
(±1 °F ± 0.003 · (T – 32) °F)

T = medium temperature

Zero point stability

Nominal Diameter		Max. full scale value		Zero point stability	
[mm]	[inch]	[kg/h]	[lb/min]	[kg/h] or [l/h]	[lb/min]
2	1/12"	100	3.7	0.0050	0.00018
4	1/8"	450	16.5	0.0225	0.0008

Example for max. measured error



Max. measured error in % o.r. (example: Promass 84A / DN 2)

Flow values (example)

Design fundamentals → 🖹 11

Turn down	Flow		Max. measured error
	[kg/h]	[lb/min]	[% o.r.]
250:1	0.4	0.0147	1.250
100:1	1.0	0.0368	0.500
25:1	4.0	0.1470	0.125
10:1	10	0.3675	0.100
2:1	50	1.8375	0.100

o.r. = of reading

Repeatability

Design fundamentals → 🖹 11

o.r. = of reading

Mass flow and volume flow (liquids)

±0.05% o.r.

Mass flow (gases)

±0.25% o.r.

Density (liquids)

±0,00025 g/cc

1 g/cc = 1 kg/l

Temperature

±0.25 °C ± 0.0025 · T °C
(±1 °F ± 0.003 · (T – 32) °F)

T = medium 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 of the Promass sensor is ±0.0002% of the full scale value / °C (±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

Dependent on the flow:

- Flow ≥ Zero point stability ÷ (base accuracy ÷ 100)
  - Max. measured error: ±base accuracy in % o.r.
  - Repeatability: ± ½ · base accuracy in % o.r.
- Flow < Zero point stability ÷ (base 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

Base accuracy	
Mass flow liquids	0.10
Volume flow liquids	0.10
Mass flow gases	0.50

Installation

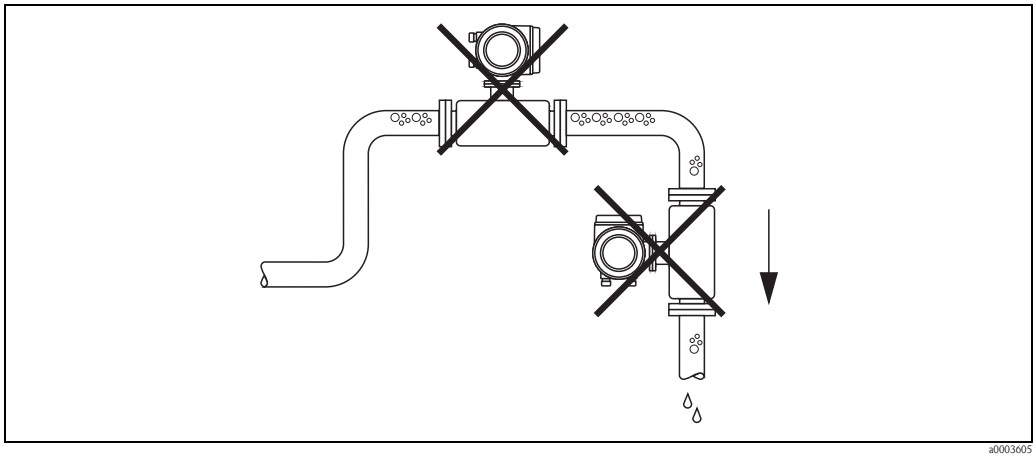
Installation instructions

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.

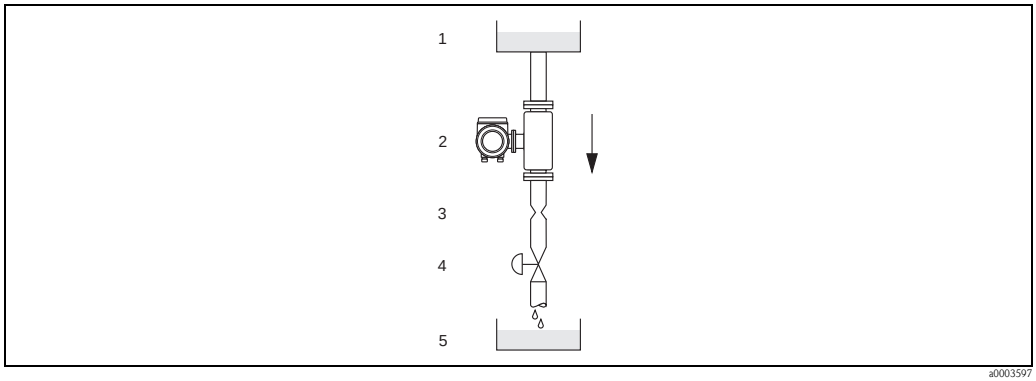
Mounting location

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.



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.



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

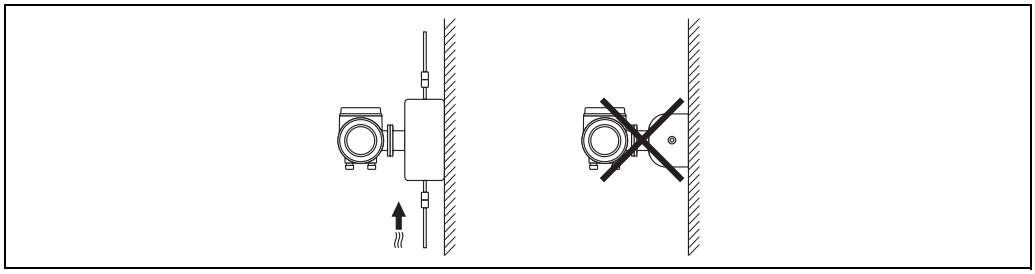
Nominal Diameter		∅ Orifice plate, pipe restriction	
[mm]	[inch]	[mm]	[inch]
2	1/12"	1.5	0.06
4	1/8"	3.0	0.12

Orientation Promass A

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).

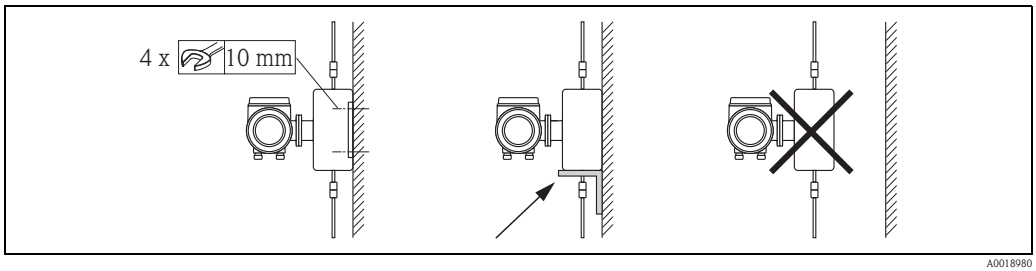


A0018978

Special installation instructions for Promass A

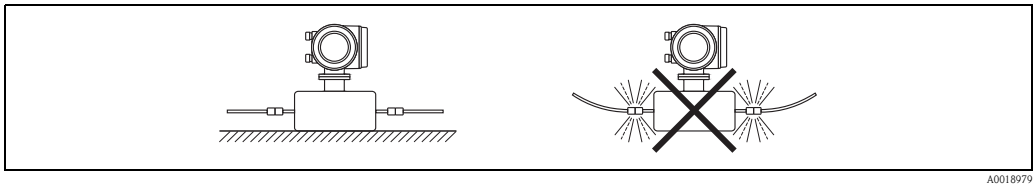
Caution!
Risk of measuring pipe fracture if sensor installed incorrectly!
The sensor may not be installed in a pipe as a freely suspended sensor:
- Using the base plate, mount the sensor directly on the floor, the wall or the ceiling.
- Support the sensor on a firmly mounted support base (e.g. angle 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



A0018980

Horizontal
We recommend the following installation version when mounting horizontally:
- Measuring device standing on a firm support base



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.

Caution!
- 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 $d \geq 0.35$ mm (≥ 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.

Zero point adjustment

All devices are calibrated to state-of-the-art technology. The zero point determined in this way is imprinted on the nameplate of the device. Calibration takes place under reference conditions → 10.
For this reason, Promass generally does **not** require zero point adjustment!

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

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

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

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 68-2-31

Vibration resistance

Acceleration up to 1g, 10 to 150 Hz, following IEC 68-2-6

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

Medium pressure range (nominal pressure)

Threaded joints

- Standard versions: max. 160 bar (2300 psi)
- High pressure versions: max. 400 bar (6000 psi)

Flanges

- DIN PN 40 to 100
- ASME Cl 150, Cl 300
- JIS 10K, 20K

Pressure ranges of secondary containment:

25 bar (362 psi)

Warning!
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 or rupture disk (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 detection (Dimensions → 32).

Rupture disk (optional)

Further information → 33

Limiting flow

See "Measuring range" section → 5

Select nominal diameter by optimising 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 → 5

Pressure loss

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

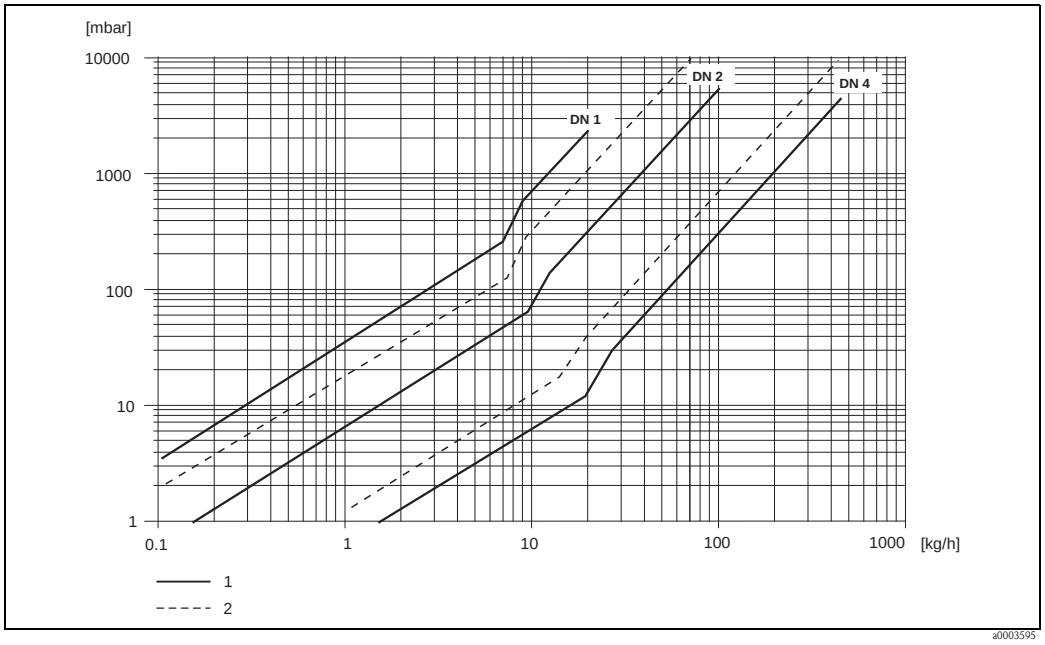
Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ a0003381
$Re \geq 2300$ [1]	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.75} \cdot \rho^{-0.75}$ a0003380
$Re < 2300$	$\Delta p = K1 \cdot \nu \cdot \dot{m}$ a0003379

- Δp = pressure loss [mbar]
- ν = kinematic viscosity [m^2/s]
- $\dot{m}$ = mass flow [kg/s]
- ρ = density [kg/m^3]
- d = inside diameter of measuring tubes [m]
- K to K1 = konstant (depends on nominal diameter)

[1] To compute the pressure loss for gases, always use the formula for $Re \geq 2300$.

Pressure loss coefficients

DN	Standard version			High pressure version		
	d [m]	K	K1	d [m]	K	K1
2	$1.8 \cdot 10^{-3}$	$1.6 \cdot 10^{10}$	$2.4 \cdot 10^{10}$	$1.4 \cdot 10^{-3}$	$5.4 \cdot 10^{10}$	$6.6 \cdot 10^{10}$
4	$3.5 \cdot 10^{-3}$	$9.4 \cdot 10^{8}$	$2.3 \cdot 10^{9}$	$3.0 \cdot 10^{-3}$	$2.0 \cdot 10^{9}$	$4.3 \cdot 10^{9}$



Pressure loss diagram for water

1 Standard version
2 High pressure version

Pressure loss (US units)

Pressure loss is dependent on fluid properties nominal diameter. Consult Endress+Hauser for Applicator PC software to determine pressure loss in US units. All important instrument data is contained in the Applicator software programm in order to optimize the design of measuring system. The software is used for following calculations:

- Nominal diameter of the sensor with fluid characteristics such as viscosity, density, etc.
- Pressure loss downstream of the measuring point.
- Converting mass flow to volume flow, etc.
- Simultaneous display of various meter size.
- Determining measuring ranges.

The Applicator runs on any IBM compatible PC with windows.

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.

Caution!
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)
- **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:

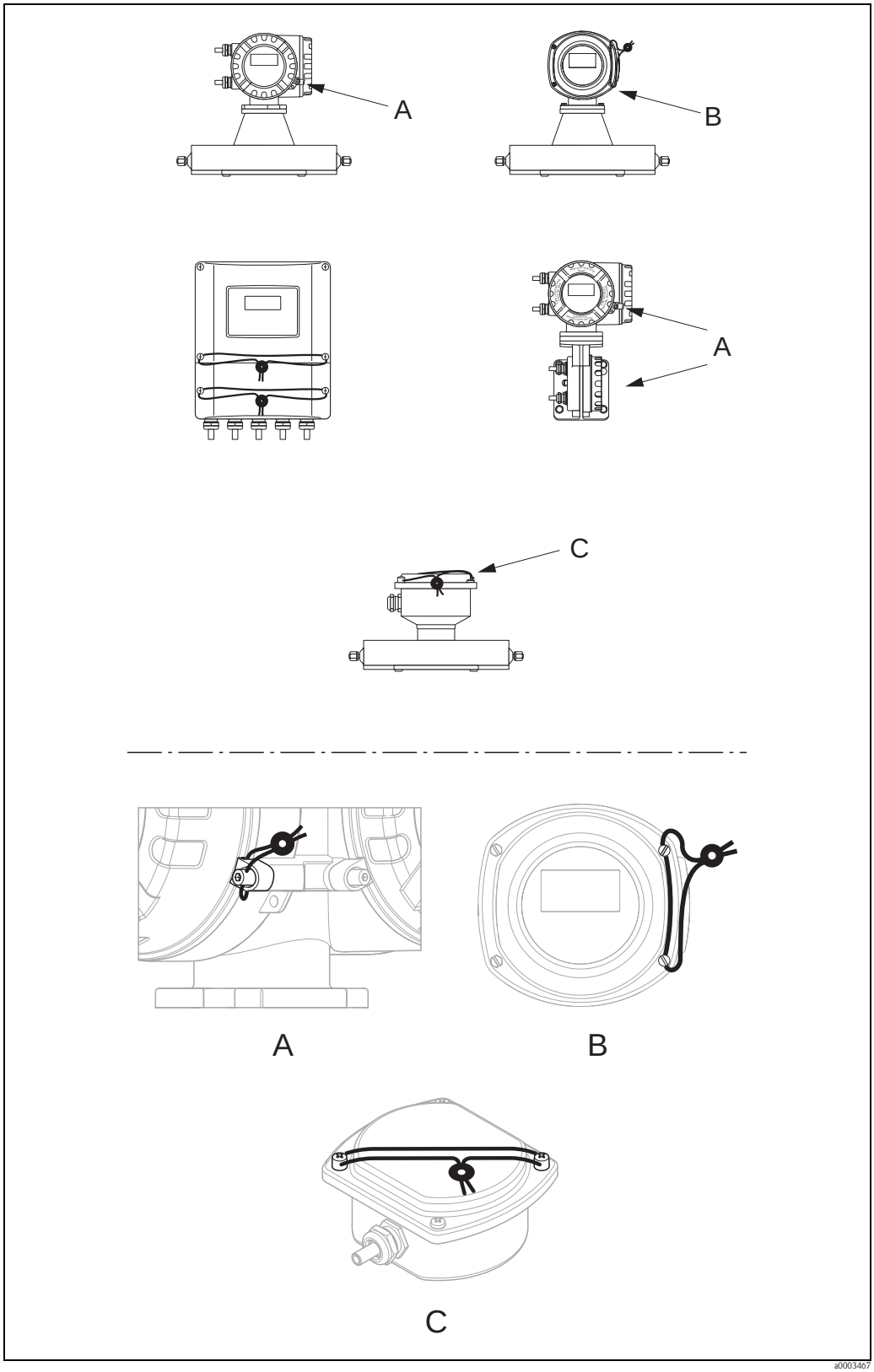
- Scales or container with a reading unit with a load or volumetric capacity that corresponds to the operation of the system at Q_{max} for one minute. The resolution of the scales display or the reading unit must be at least 0.1 % of the minimum measured quantity.
- Unit for removing the medium being 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 ½ 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



Examples of how to seal the various device versions.

Disabling custody transfer mode

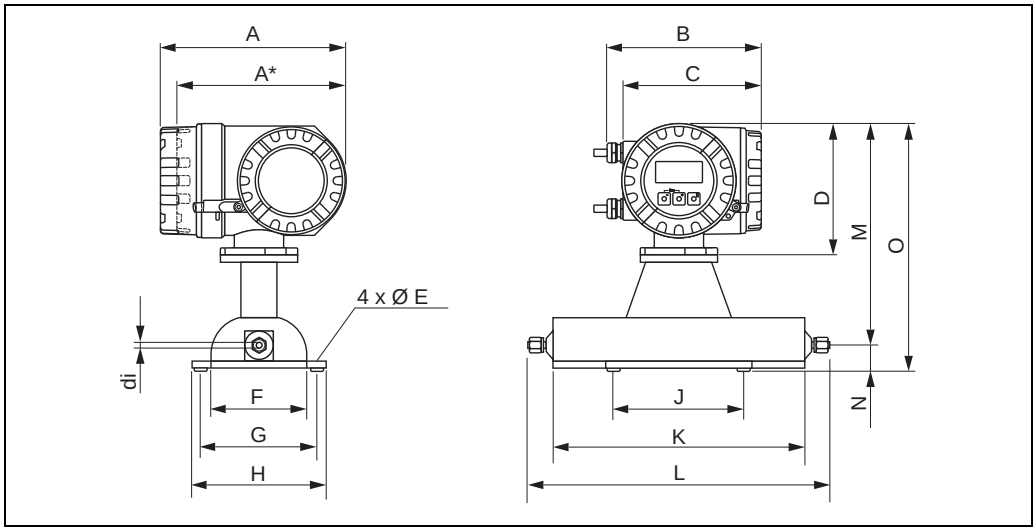
A detailed description of the "disabling custody transfer mode" process is provided in the Operating Instructions supplied with the device.

Mechanical construction

Design/dimensions

Dimensions	
Field housing compact version, powder-coated die-cast aluminium	→ 22
Transmitter compact version, stainless steel field housing	→ 23
Transmitter connection housing remote version (II2G/zone 1)	→ 23
Transmitter wall-mount housing (non hazardous area and II3G/zone 2)	→ 24
Connection housing remote version	→ 25
Process connection in SI units	
4-VCO-4-connection (welded)	→ 26
1/2" Tri-Clamp connection (welded)	→ 26
4-VCO-4-connection with mounting kit: DN 15 flange	→ 27
4-VCO-4-connection with mounting kit: 1/4" NPT-F	→ 28
4-VCO-4-connection with mounting kit: 1/8" or 1/4" SWAGELOK	→ 28
Process connection in US units	
4-VCO-4-connection (welded)	→ 29
½" Tri-Clamp connection (welded)	→ 29
4-VCO-4-connection with mounting kit: DN 15 flange	→ 30
4-VCO-4-connection with mounting kit: ¼" NPT-F	→ 31
4-VCO-4-connection with mouting kit: 1/8" or ¼" SWAGELOK	→ 31
Purge connections / pressure vessel monitoring	→ 32
Rupture disc	→ 33

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



A0007021

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	∅ 6,5	120	145	165	160	310	1)	273	32	305	1)
4	227	207	187	168	160	∅ 6,5	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]

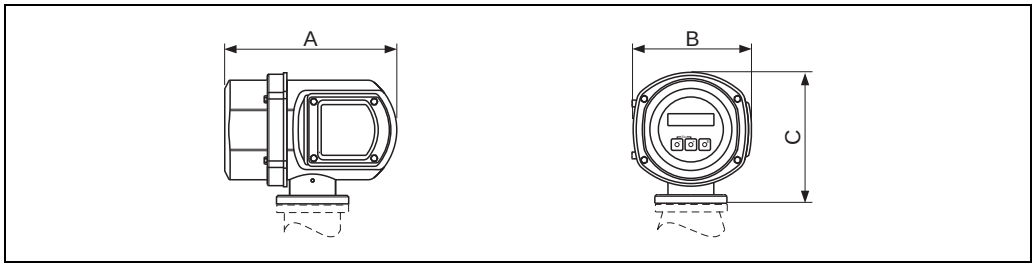
Dimensions in US units

DN	A	A*	B	C	D	E	F	G	H	J	K	L	M	N	O	U/di
2	8.94	8.15	7.68	6.61	6.30	∅ 0.26	4.72	5.71	6.50	6.30	12.2	1)	10.7	1.26	12.0	1)
4	8.94	8.15	7.68	6.61	6.30	∅ 0.26	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 [inch]

Note!
Dimensions for transmitter II2G/zone 1 → 🗎 23.

Transmitter compact version, stainless steel field housing

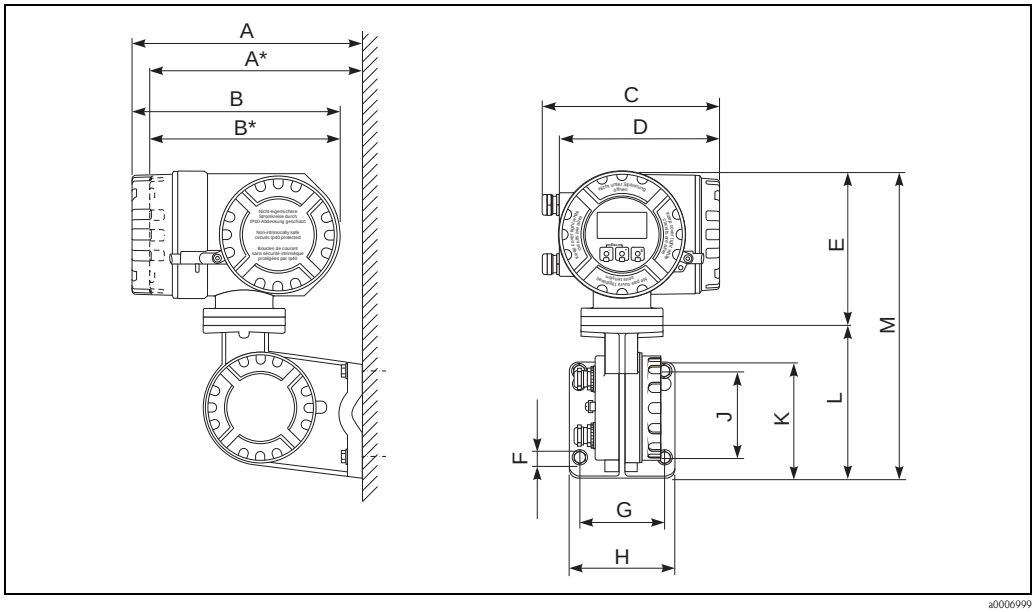


a0002245

Dimensions in SI and US units

A		B		C	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
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 ∅	G	H	J	K	L	M
265	242	240	217	206	186	178	8.6 (M8)	100	130	100	144	170	348

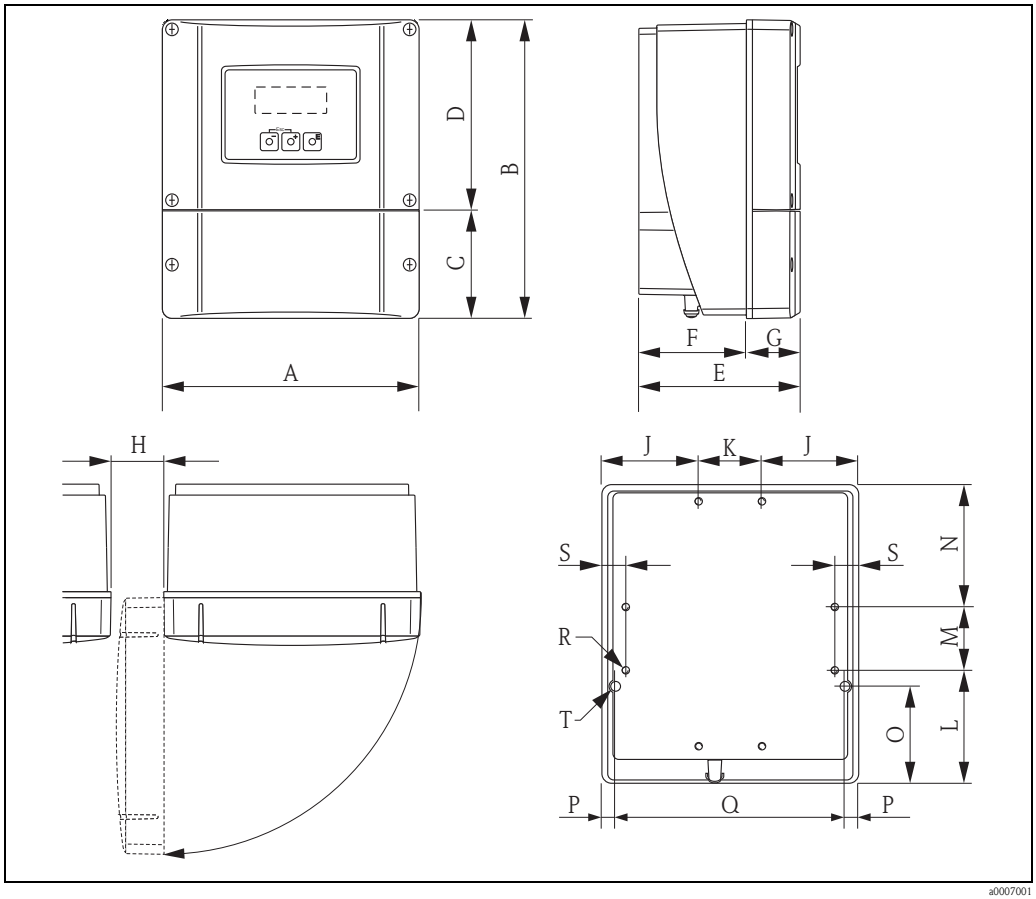
* Blind version (without display)
All dimensions in [mm]

Dimensions in US units

A	A*	B	B*	C	D	E	F ∅	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 [inch]

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



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	

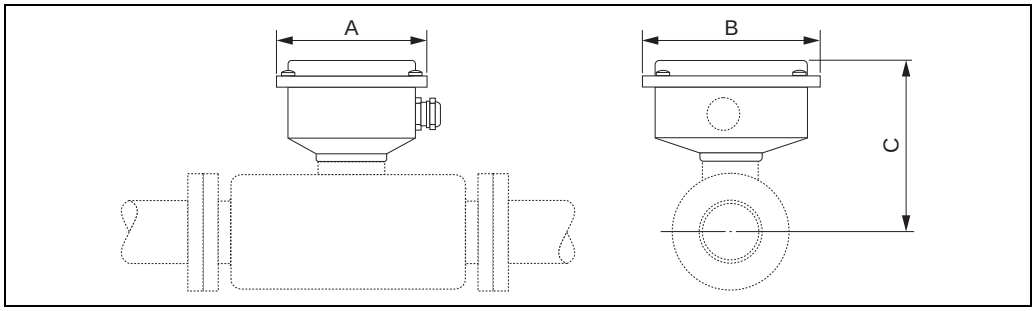
[1] Fixing bolt for wall assembly: M6 (screw head max. 10.5 mm)
All dimensions in [mm]

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 × ∅ 0.26	

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

Connection housing remote version



Dimensions in SI units

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

All dimensions in [mm]

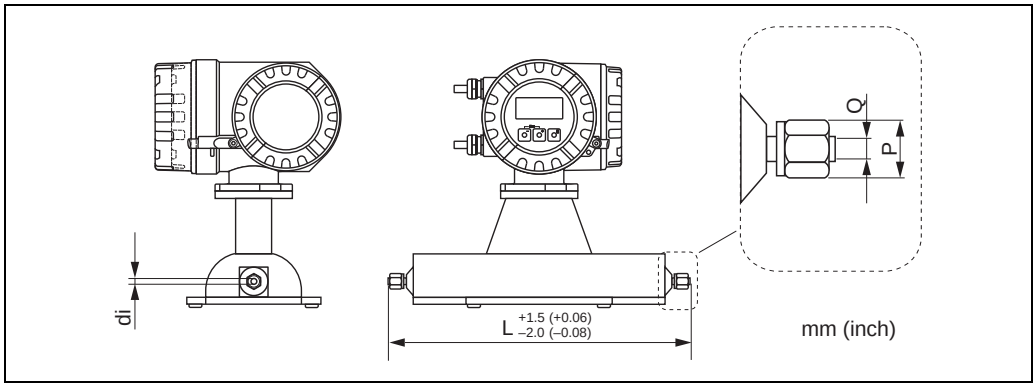
Dimensions in US units

DN	A	B	C
1/12"	4.67	5.41	4.72
1/8"	4.67	5.41	5.12

All dimensions in [inch]

Process connections in SI units

4-VCO-4-connection (welded)

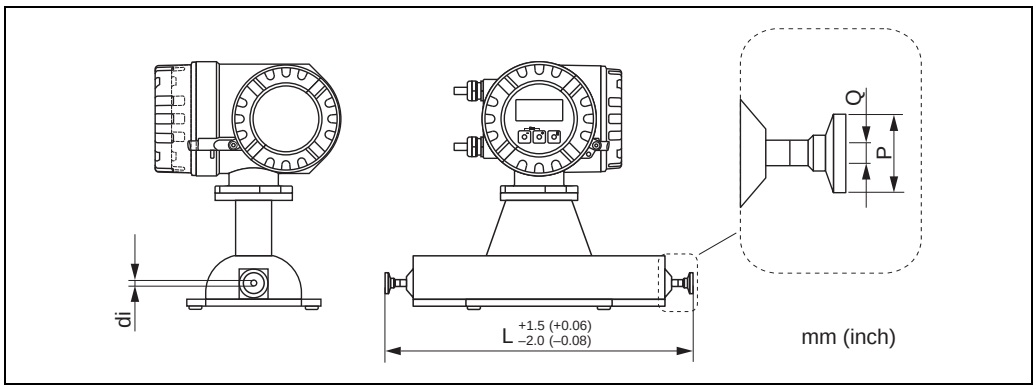


a0003165

4-VCO-4-connection: 1.4539/904L, Alloy C-22			
DN	L	P	Q / di
2 [1]	372	AF 11/16"	1.8
2 [2]	372	AF 11/16"	1.4
4 [1]	497	AF 11/16"	3.5
4 [2]	497	AF 11/16"	3.0

[1] 3A version can be supplied (Ra ≤ 0.4 µm/240 grit). Only for 1.4539/904L
[2] High pressure version
All dimensions in [mm]

1/2" Tri-Clamp connection (welded)

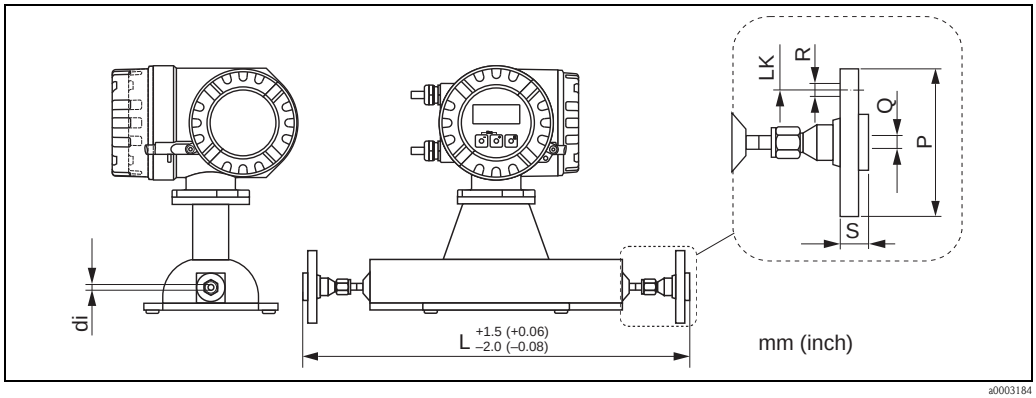


a0003183

½" Tri-Clamp connection / 3A version [1]: 1.4539/904L				
DN	L	P	Q	di
2	378	25	9.5	1.8
4	503	25	9.5	3.5

[1] 3A version (Ra ≤ 0.8 µm/150 grit. option: Ra ≤ 0.4 µm/240 grit)
All dimensions in [mm]

4-VCO-4-connection with mounting kit: DN 15 flange



Mounting kit DN 15 flange EN 1092-1 (DIN 2501) PN 40: 1.4539/904L, Alloy C-22								
DN	PN	L	P	Q	R	S	LK	di
2	40	475	95	17.3	4 × Ø 14	28	65	1.8
4	40	600	95	17.3	4 × Ø 14	28	65	3.5

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

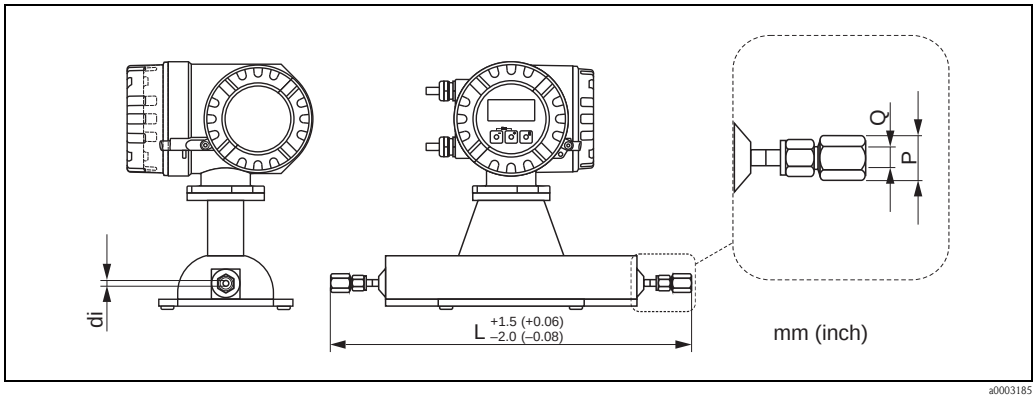
Mounting kit ½" flange (ASME): 1.4539/904L, Alloy C-22								
DN	ASME	L	P	Q	R	S	LK	di
2	Cl 150	475	88.9	15.7	4 × Ø 15.7	17.7	60.5	1.8
2	Cl 300	475	95.2	15.7	4 × Ø 15.7	20.7	66.5	1.8
4	Cl 150	600	88.9	15.7	4 × Ø 15.7	17.7	60.5	3.5
4	Cl 300	600	95.2	15.7	4 × Ø 15.7	20.7	66.5	3.5

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

Monting kit DN 15 flange (JIS): 1.4539/904L, Alloy C-22								
DN	JIS	L	P	Q	R	S	LK	di
2	10K	475	95	15.0	4 × Ø 15	28	70	1.8
2	20K	475	95	15.0	4 × Ø 15	14	70	1.8
4	10K	600	95	15.0	4 × Ø 15	28	70	3.5
4	20K	600	95	15.0	4 × Ø 15	14	70	3.5

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

4-VCO-4-connection with mounting kit: 1/4" NPT-F

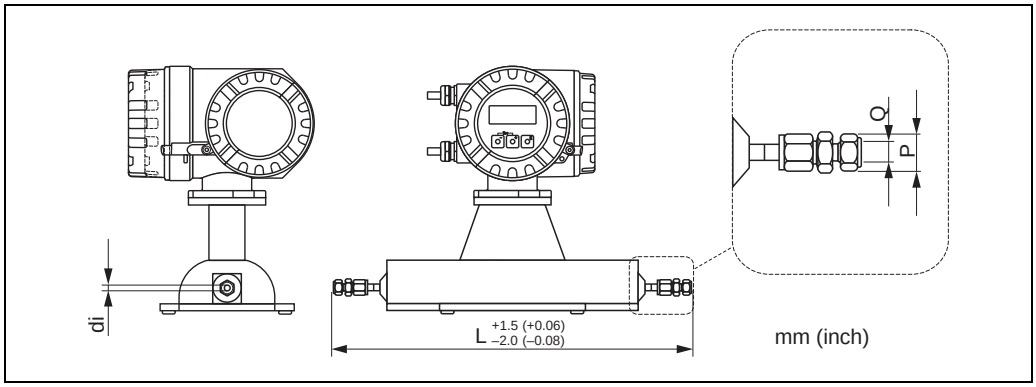


a0003185

Monting kit ¼" NPT-F connection: 1.4539/904L, Alloy C-22				
DN	L	P	Q	di
2	443	SW ¾"	¼" NPT	1.8
2[1)]	443	SW ¾"	¼" NPT	1.4
4	568	SW ¾"	¼" NPT	3.5
4[1)]	568	SW ¾"	¼" NPT	3.0

High pressure version only available as 1.4539/904L; All dimensions in [mm]

4-VCO-4-connection with mounting kit: 1/8" or 1/4" SWAGELOK



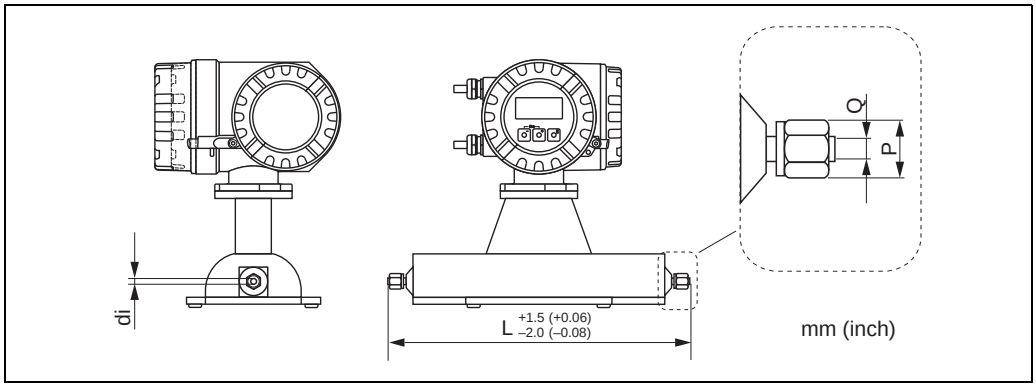
a0003186

Mounting kit SWAGELOK connection: 1.4539/904L				
DN	L	P	Q	di
2	441.6	SW 7/16"	1/8"	1.8
2	446.6	SW 9/16"	¼"	1.8
2[1)]	441.6	SW 7/16"	1/8"	1.4
2[1)]	446.6	SW 9/16"	¼"	1.4
4	571.6	SW 9/16"	¼"	3.5
4[1)]	571.6	SW 9/16"	¼"	3.0

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

Process connection in US units

4-VCO-4-connection (welded)

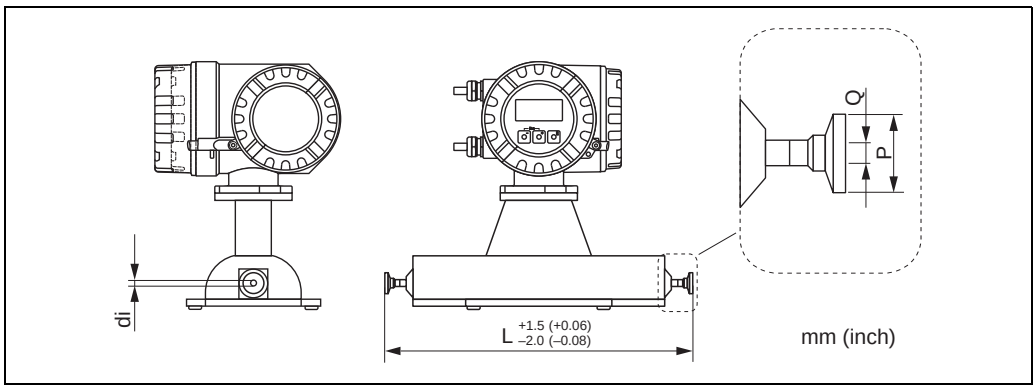


a0003165-en

4-VCO-4-connection: 1.4539/904L, Alloy C-22			
DN	L	P	Q / di
1/12" [1]	14.6	AF 11/16"	0.07
1/12" [2]	14.6	AF 11/16"	0.06
1/8" [1]	19.6	AF 11/16"	0.14
1/8" [2]	19.6	AF 11/16"	0.12

[1] 3A version can be supplied (Ra ≤ 0.4 µm/240 grit). Only for 1.4539/904L
[2] High pressure version
All dimensions in [inch]

½" Tri-Clamp connection (welded)

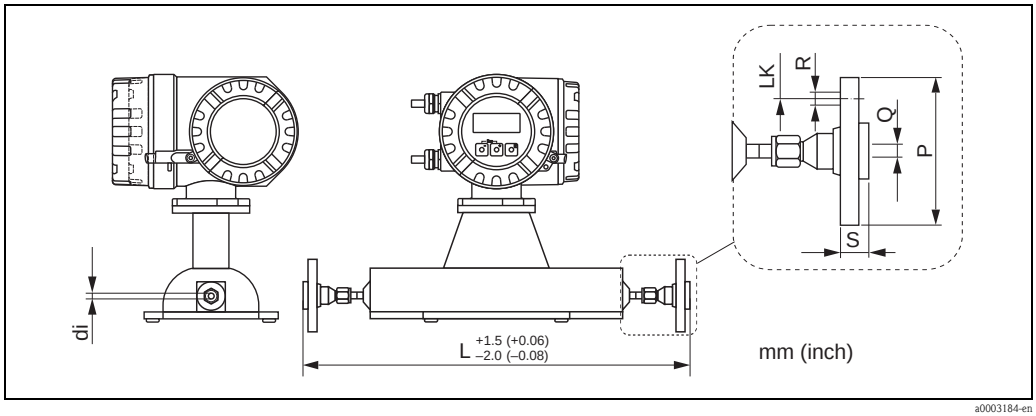


a0003183-en

½" Tri-Clamp connection / 3A version [1]: 1.4539/904L				
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

[1] 3A version can be supplied (Ra ≤ 0.8 µm/150 grit. option: Ra ≤ 0.4 µm/240 grit)
All dimensions in [inch]

4-VCO-4-connection with mounting kit: DN 15 flange



Mounting kit DN 15 flange EN 1092-1 (DIN 2501) PN 40: 1.4539/904L, Alloy C-22								
DN	PN	L	P	Q	R	S	LK	di
1/12"	40	19	3.8	0.692	4 × Ø 0.56	1.12	2.6	0.07
1/8"	40	24	3.8	0.692	4 × Ø 0.56	1.12	2.6	0.14

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

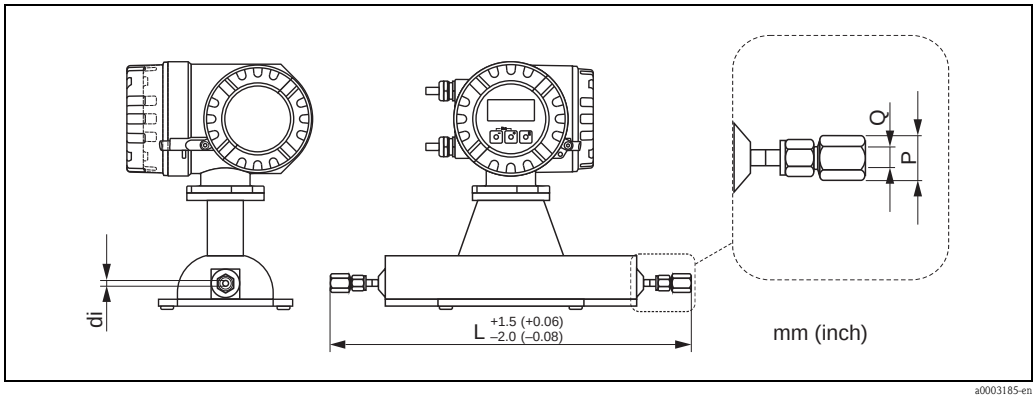
Mounting kit DN 15 flange (JIS): 1.4539/904L, Alloy C-22								
DN	JIS	L	P	Q	R	S	LK	di
1/12"	10K	19	3.8	0.6	4 × Ø 0.6	1.12	2.8	0.07
1/12"	20K	19	3.8	0.6	4 × Ø 0.6	0.56	2.8	0.07
1/8"	10K	24	3.8	0.6	4 × Ø 0.6	1.12	2.8	0.14
1/8"	20K	24	3.8	0.6	4 × Ø 0.6	0.56	2.8	0.14

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

Mounting kit ½" flange (ASME): 1.4539/904L, Alloy C-22								
DN	ASME	L	P	Q	R	S	LK	di
1/12"	Cl 150	19	3.5	0.62	4 × Ø 0.62	0.70	2.38	0.07
1/12"	Cl 300	19	3.7	0.62	4 × Ø 0.62	0.81	2.62	0.07
1/8"	Cl 150	24	3.5	0.62	4 × Ø 0.62	0.70	2.38	0.14
1/8"	Cl 300	24	3.7	0.62	4 × Ø 0.62	0.81	2.62	0.14

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

4-VCO-4-connection with mounting kit: ¼" NPT-F

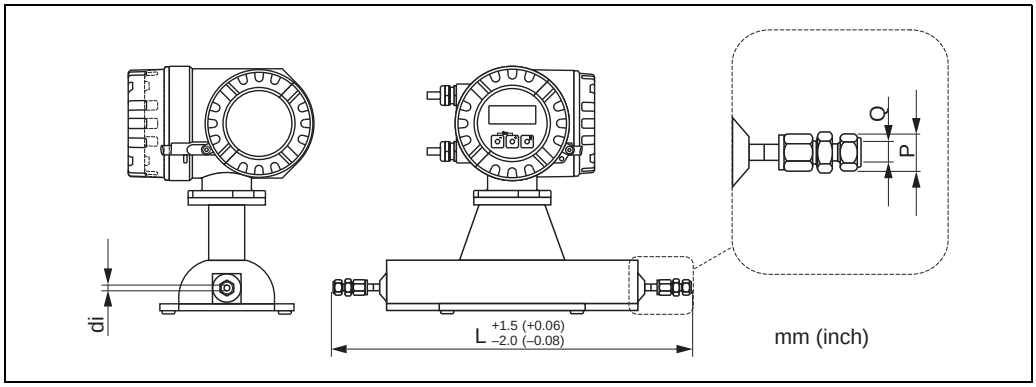


a0003185-en

Mounting kit ¼" NPT-F connection: 1.4539/904L, Alloy C-22				
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 [inch]

4-VCO-4-connection with mouting kit: 1/8" or ¼" SWAGELOK



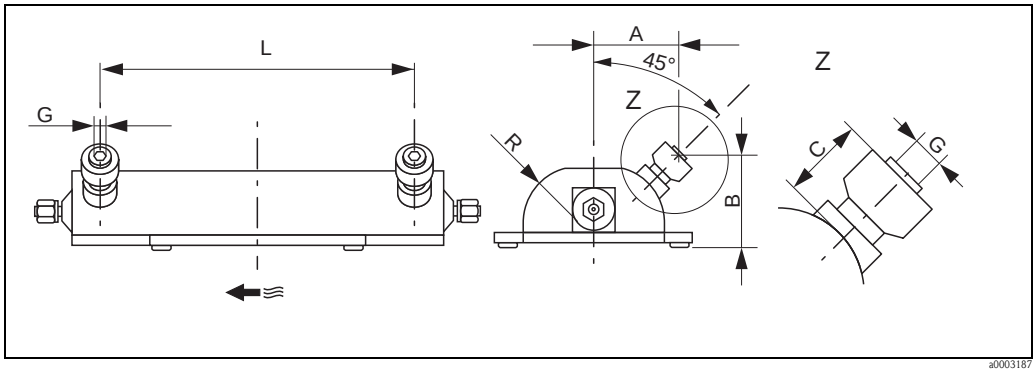
a0003186-en

Mounting kit SWAGELOK connection: 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 diemnsions in [inch]

Purge connections / pressure vessel monitoring

Caution!
The pressure vessel 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 gauge pressure to purge. Maximum pressure: 5 bar (72.5 psi).



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
1/12"	2.8	3.0	1.3	½" NPT	5.12	1.85
1/8"	3.2	3.3	1.3	½" NPT	7.58	2.34

All dimensions in [inch]

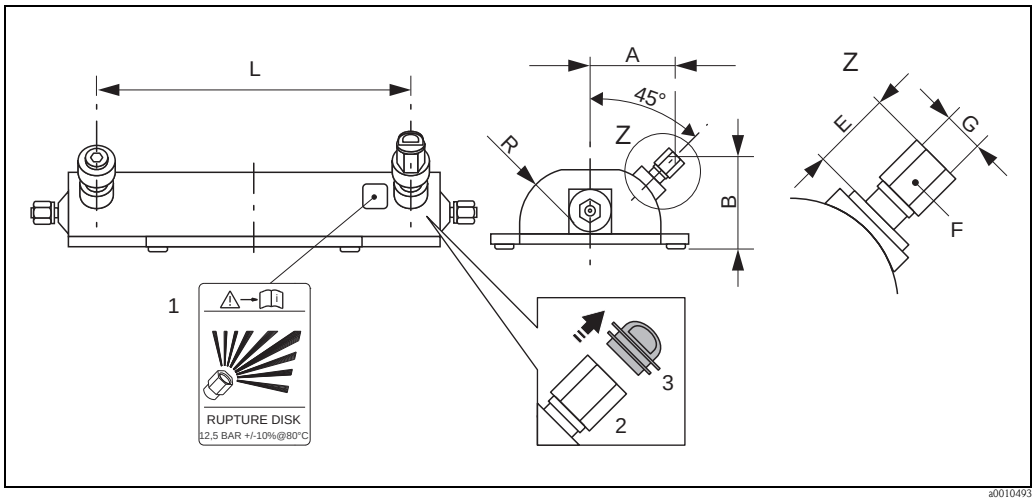
Rupture disc

Sensor housings with integrated rupture disks are optionally available.

Warning!
- Make sure that the function and operation of the rupture disk is not impeded through the installation. Triggering overpressure in the housing as stated on the indication label. Take adequate precautions to ensure that no damage occurs, and risk to human life is ruled out, if the rupture disk is triggered.
  Rupture disk: Burst pressure 10 to 15 bar (145 to 217 psi).
- Please note that the housing can no longer assume a secondary containment function if a rupture disk is used.
- It is not permitted to open the connections or remove the rupture disk.

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

Note!
- Before commissioning, please remove the transport protection of the rupture disk.
- Please note the indication labels.



Rupture disk (optional)

1 Indication label for the rupture disk
2 ½" NPT internal screw thread with 1" width across flat
3 Transport protection

Dimensions in SI units

DN	A	B	C	E	F	G	L	R
2	70.0	77.0	33.0	ca. 42	SW 1"	½" NPT	130.0	47.0
4	81.5	83.0	33.0	ca. 42	SW 1"	½" NPT	192.5	59.5

All dimension in [mm]

Dimensions in US units

DN	A	B	C	E	F	G	L	R
1/12"	2.8	3.0	1.3	ca. 1.65	AF 1"	½" NPT	5.12	1.85
1/8"	3.2	3.3	1.3	ca. 1.65	AF 1"	½" NPT	7.58	2.34

All dimensions in [inch]

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 [inch]	1/12"	1/8"
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
- Compact version: powder coated die-cast aluminium
- Stainless steel housing: stainless steel 1.4301/ASTM 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
EN 1092-1 (DIN 2501) / ASME B16.5 / JIS B2220 Mounting kit for flanges	Stainless steel 1.4539/904L Alloy C-22 2.4602/N 06022
EN 1092-1 (DIN 2501) / ASME B16.5 / JIS B2220 Loose flanges	Stainless steel 1.4404/316L
VCO coupling	Stainless steel 1.4539/904L Alloy C-22 2.4602/N 06022
Tri-Clamp (OD tubes), 1/2"	Stainless steel 1.4539/904L
Mounting kit for SWAGELOK (1/4", 1/8")	Stainless steel 1.4401/316
Mounting kit for NPT-F (1/4")	Stainless steel 1.4539/904L Alloy C-22 2.4602/N 06022

Measuring tube(s)

- Stainless steel 1.4539/904L
- Alloy C-22 2.4602/N 06022

Seals

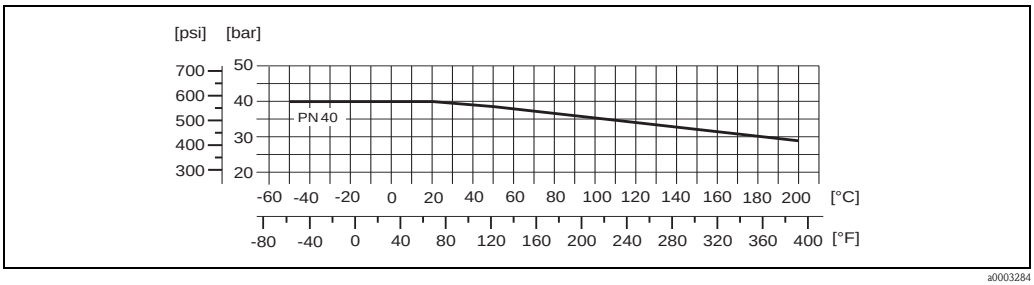
Welded process connections without internal seals

Material load curves

Warning!
The following material load curves refer to the entire sensor (not just the process connection).

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

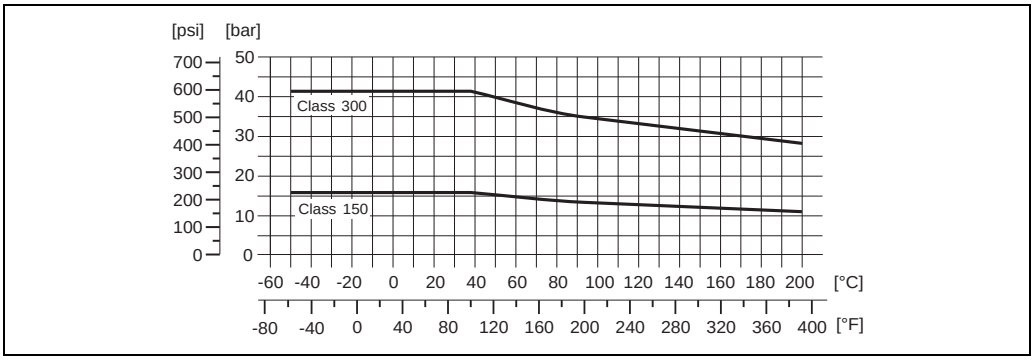
Wetted parts (flange, measuring tube): 1.4539/904L, Alloy C-22
Loose flanges (not wetted): 1.4404/316L



a0003284

Flange connections to ASME B16.5 (mounting kit)

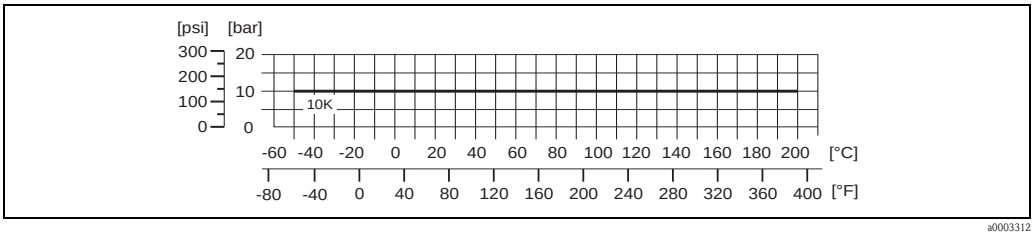
Wetted parts (flange, measuring tube): 1.4539/904L, Alloy C-22
Loose flanges (not wetted): 1.4404/316L



a0003285

Flange connections to JIS B2220 (mounting kit)

Wetted parts (flange, measuring tube): 1.4539/904L, Alloy C-22
Loose flanges (not wetted): 1.4404/316L



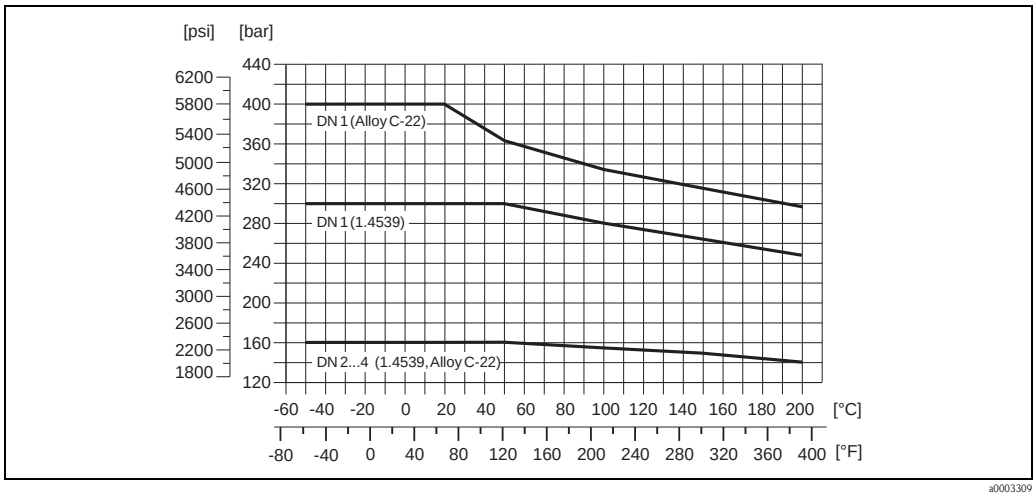
a0003312

Tri-Clamp process connection

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.

Process connection 4-VCO-4, 1/4" NPT-F, SWAGELOK

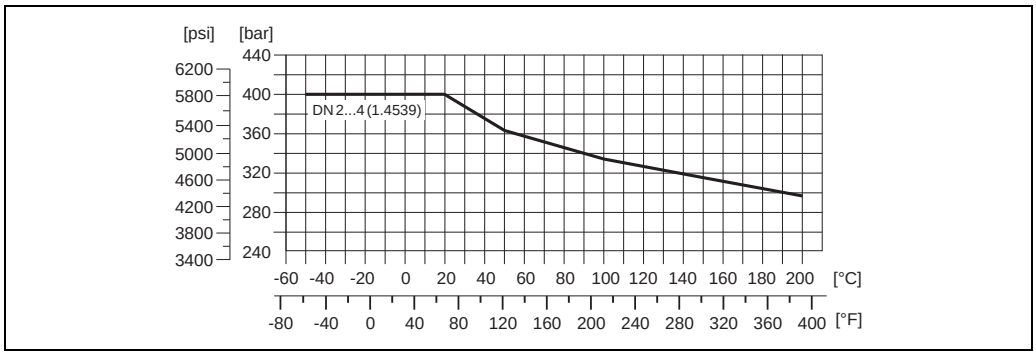
- 4-VCO-4-coupling (welded): 1.4539/904L, Alloy C-22
- 1/4" NPT threaded adapter (screwed, mounting kit): 1.4539/904L, Alloy C-22
- 1/4" or 1/8" SWAGELOK threaded joint (screwed, mounting kit): 1.4401/316



a0003309

Process connections for high-pressure version (DN 2 to 4)

- 4-VCO-4-coupling (welded): 1.4539/904L
- 1/4" NPT threaded adapter (screwed, mounting kit): 1.4539/904L
- 1/4" or 1/8" SWAGELOK threaded joint (screwed, mounting kit): 1.4401/316



a0003310

Process connections

- Welded process connections
  - 4-VCO-4 coupling
  - 1/2" Tri-Clamp
- Screwed on process connections
  - flanges EN 1092-1 (DIN 2501), ASME, JIS
  - 1/4" NPT threaded adapter
  - 1/8" or 1/4" SWAGELOK threaded joints

Human interface

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 (−, +, 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 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.

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

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 of greater or less than 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
- BEV, Austria

Information on custody transfer measurement → 🖹 19 ("Custody transfer measurement" Section)

Suitability for custody transfer measurement

PTB/METAS/BEV approval

PTB, METAS and BEV approval for determining the mass and volume of liquids, other than water, and of fuel gases.

Sensor	DN		PTB /METAS /BEV approval			
			Liquids other than water			High pressure gas
Promass	[mm]	[inch]	Mass	Volume	Density	(CNG) Mass
A	2 to 4	1/12" to 1/8"	YES	YES	YES	NO

MID approval, Annex MI-002 (gas meter)

The device is qualified to OIML R137/D11.

Sensor	DN		MID Type Examination Certificate MI-002 (Europe)		
			Fuel gases up to 100 bar (1450 psi)		
Promass	[mm]	[inch]	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)		
			Liquids other than water		
Promass	[mm]	[inch]	Mass	Volume	Density
A	2 to 4	1/12" to 1/8"	YES	YES	YES

Ordering Information

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

Accessories

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

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

Registered trademarks

KALREZ® and VITON®
Registered trademarks of Firma E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP ®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

SWAGELOK®
Registered trademark of Swagelok & Co., Solon, USA

HART®
Registered trademark of HART Communication Foundation, Austin, USA

Modbus®
Registered trademark of the Modbus organization

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, FieldCare®, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

Endress+Hauser

People for Process Automation

TI00068D/06/EN/13.12
71197527
FM+SGML 10.0 ProMoDo