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

Technical Information

Proline Promass E 200

Coriolis mass flow measuring system
Loop-powered flowmeter for seamless 2-wire integration (4–20 mA HART) – fulfilling industry requirements

Application

- Promass E 200 offers continuous process control and easy integration.
- Suitable for highly accurate measurement of liquids and gases.
- Coriolis measuring principle operates independently of fluid physical properties and is unaffected by process influences – i.e. stable under varying process conditions (e.g. pressure or density).

Device properties
- Fluid temperatures up to +140 °C (+284 °F)
- Maintenance-free, no mechanical wear and tear
- Communication via HART protocol
- Ex approvals accepted worldwide: models with intrinsically safe (Ex ia) or explosion-proof (Ex d) design
- Use for flow monitoring systems up to SIL 2 (single-channel) and up to SIL 3 (redundant wiring) to IEC 61508, certified by TÜV

Your benefits

Combines Coriolis flow measurement with genuine two-wire technology (4–20 mA HART)

Sizing – correct product selection
Applicator selection tool for correct and application-specific sizing

Installation – simple and efficient
- Compact design
- No special installation requirements necessary
- No inlet/outlet runs required
- Reduced wiring effort due to two-wire technology

Commissioning – reliable and intuitive
Guided parameterization ("Make-it-run" Wizards)

Operation – increased measurement availability
- Simultaneous measurement of mass, density, volume and temperature (multivariable)
- Immune to pipe vibrations
- Diagnostic capability
- HistoROM: automatic data backup

Life Cycle Management (W@M) for your plant

TI01009D/06/EN/14.11
71135108

Endress+Hauser
People for Process Automation

Table of contents

Document information

Document conventions

Electrical symbols

Symbol	Meaning
 A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	**Alternating current** A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.

Symbols in graphics

Symbol	Meaning
1, 2, 3,...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
 A0013441	Flow direction
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

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.

$F_c = 2 \cdot \Delta m\ (\nu \cdot \omega)$

F_c = Coriolis force

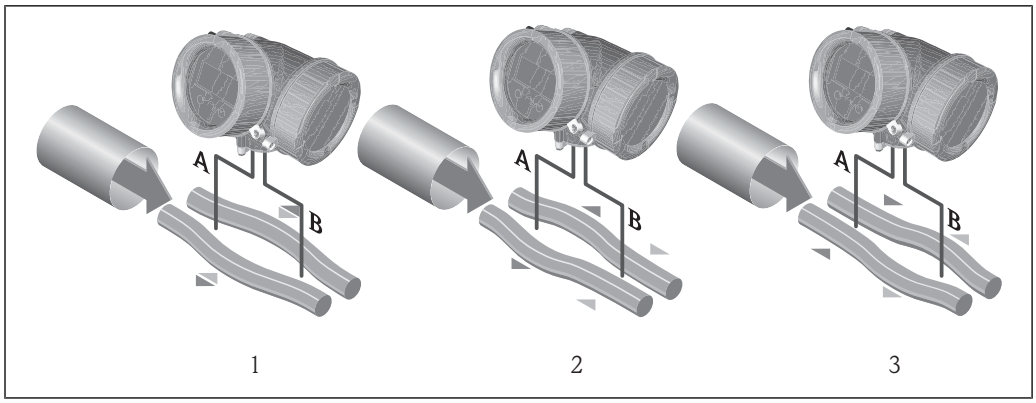
Δm = moving mass

ω = angular velocity

ν = radial velocity in rotating or oscillating system

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

In the sensor, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):
- At zero flow (when the fluid is at a standstill) the two tubes oscillate in phase (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



A0013463

The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

Density measurement
The measuring tubes are continuously excited at their resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tubes 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.

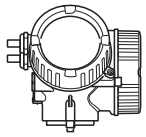
Volume measurement
The density value obtained can be used in conjunction with the measured mass flow to calculate the volume flow.

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

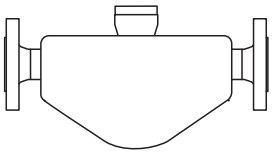
Measuring system

The device consists of a transmitter and a sensor. One device version is available:
Compact version: transmitter and sensor form a mechanical unit.

Transmitter

Promass 200  A0013471	■ Four-line local display ■ Operation with push buttons ■ Guided menus ("Make-it-run" wizards) for applications ■ Mass, density, volume and temperature measurement ■ Materials: – Stainless steel 1.4404/316L – AlSi10Mg

Sensor

Promass E  A0013472	■ Multipurpose sensor ■ Ideal substitute for volumetric flowmeters ■ Nominal diameter range: DN 8 to 50 mm (3/8 to 2 ") ■ Materials: – Sensor: stainless steel 1.4301/ASTM 304 – Measuring tubes: stainless steel EN 1.4539/ASTM 904L – Process connections: For all except flanges as per JIS B2220: Stainless steel 1.4404/316L For flanges as per JIS B2220: SUS 316L

Input

Measured variable

Measured process variables

- Mass flow
- Density
- Temperature

Calculated process variables

- Volume flow
- Corrected volume flow
- Reference density

Measuring range

Measuring ranges for liquids

DN		Measuring range full scale values $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
8	3/8	0 to 2 000	0 to 73.5
15	½	0 to 6 500	0 to 238
25	1	0 to 18 000	0 to 660
40	1 ½	0 to 45 000	0 to 1 650
50	2	0 to 70 000	0 to 2 570

Measuring ranges for gases

The full scale values depend on the density of the gas and can be calculated with the formula below:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x$

$\dot{m}_{max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{max(F)}$	Maximum full scale value for liquid [kg/h]

$\dot{m}_{max(G)} < \dot{m}_{max(F)}$	$\dot{m}_{max(G)}$ can never be greater than $\dot{m}_{max(F)}$
ρ_G	Gas density in [kg/m³] at operating conditions

DN		x
[mm]	[in]	[kg/m³]
8	3/8	85
15	½	110
25	1	125
40	1 ½	125
50	2	125

To calculate the measuring range, use the *Applicator* sizing tool (→ 41)

Calculation example for gas
- Sensor: Promass E, DN 50
- Gas: Air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range (liquid): 70 000 kg/h
- x = 125 kg/m³ (for Promass E DN 50)

Maximum possible full scale value:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x = 70\,000 \text{ kg/h} \cdot 60.3 \text{ kg/m}^3 : 125 \text{ kg/m}^3 = 33\,800 \text{ kg/h}$

Recommended measuring range

"Flow limit" section (→ 20)

Operable flow range

Greater than 1000 : 1. Flow rates above the preset full scale value do not overload the amplifier so the totalized values are registered correctly.

Output

Output signal

2-wire
- Current output 1: 4-20 mA HART, passive
- Current output 2: 4-20 mA, passive
- Lower-range value, full scale value and time constant (0.07 to 999 s) can be set

Signal on alarm

Depending on the interface, failure information is displayed as follows:
- Current output
  - Failsafe mode selectable (in accordance with NAMUR Recommendation NE 43):
    Minimum alarm: 3.6 mA
    Maximum alarm (= factory setting): 22 mA
  - Failsafe mode with user-selectable value: 3.59 to 22.5 mA
- Local display
  - Status signal (in accordance with NAMUR Recommendation NE 107)
  - Plain text display
- Operating tool via HART communication or service interface (CDI)
  - Status signal (in accordance with NAMUR Recommendation NE 107)
  - Plain text display

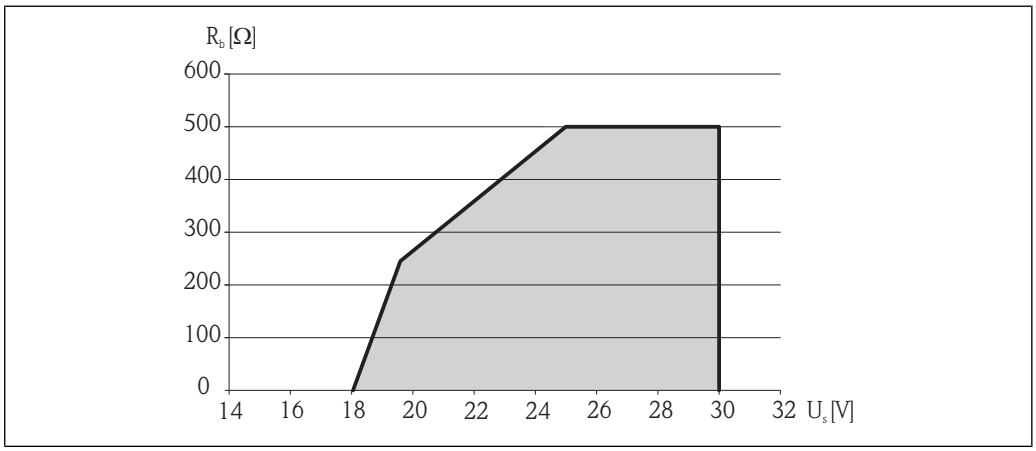
Load

0 to 500 Ω, depending on the external supply voltage of the power supply unit

Calculation of the maximum load

Depending on the supply voltage of the power supply unit (U_S), the maximum load (R_B) including line resistance must be observed to ensure adequate terminal voltage at the device. In doing so, observe the minimum terminal voltage (→ 8)

- For U_S = 18 to 18.9 V: $R_B \leq (U_S - 18\ V) : 0.0036\ A$
- For U_S = 18.9 to 24.5 V: $R_B \leq (U_S - 13.5\ V) : 0.022\ A$
- For U_S = 24.5 to 30 V: $R_B \leq 500\ \Omega$



1 Operating range

Sample calculation
Supply voltage of the power supply unit: U_S = 19 V
Maximum load: $R_B \leq (19\ V - 13.5\ V) : 0.022\ A = 250\ \Omega$

Ex connection data

Intrinsically signal circuits

Type of protection Ex ia

Order characteristic for "Output"	Signal circuits	Safety-related values
Option **C**	■ 4-20mA HART ■ 4-20mA	U_i = 30 V DC I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 30 nF

Type of protection Ex ic

Order characteristic for "Output"	Signal circuits	Safety-related values
Option **C**	■ 4-20mA HART ■ 4-20mA	U_i = 30 V DC I_i = n.a. P_i = n.a. L_i = 0 µH C_i = 30 nF

Low flow cut off

The switch points for low flow cut off are user-selectable.

Galvanic isolation

All circuits for the outputs are galvanically isolated from each other.

Protocol-specific data

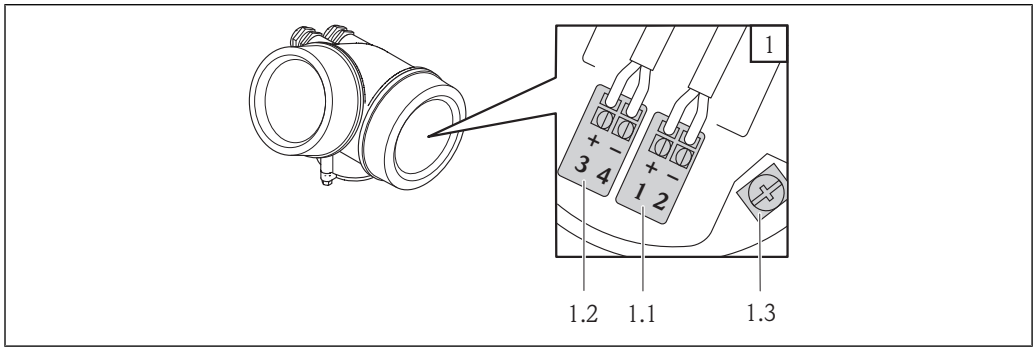
HART

Manufacturer ID	0x11
Device type ID	0x54
HART protocol revision	6.0
Device description files (DTM, DD)	Information and files under: www.endress.com

HART load	Min. 250 Ω
Dynamic variables	The measured values can be freely assigned to the dynamic variables. **Measured values for PV (primary dynamic variable)** ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature **Measured values for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3

Power supply

Terminal assignment



2 *Transmitter with maximum number of terminals*

1.1 Output 1 (passive output): supply voltage and signal transmission
1.2 Output 2 (passive output): supply voltage and signal transmission
1.3 Ground terminal for cable shield

Order characteristic for "Output"	Terminal numbers			
	Output 2 [1]		Output 1	
	3 (+)	4 (-)	1 (+)	2 (-)
Option **C**	4-20 mA		4-20 mA HART	

1) When using only one output: use output 1.

Supply voltage

An external power supply is required for each output.

Various power supply units can be ordered from Endress+Hauser: see "Accessories" section (→ 40)

Order characteristic for "Output"	Minimum terminal voltage*	Maximum terminal voltage
Option **C**	For 4 mA: ≥ 18 V DC For 20 mA: ≥ 14 V DC	30 V DC
*External supply voltage of the power supply unit with load (→ 6)		

Power consumption

- Operation with output 1: 65 to 660 mW
- Operation with output 1 and 2: 130 to 1 320 mW

Current consumption

3.6 to 22 mA

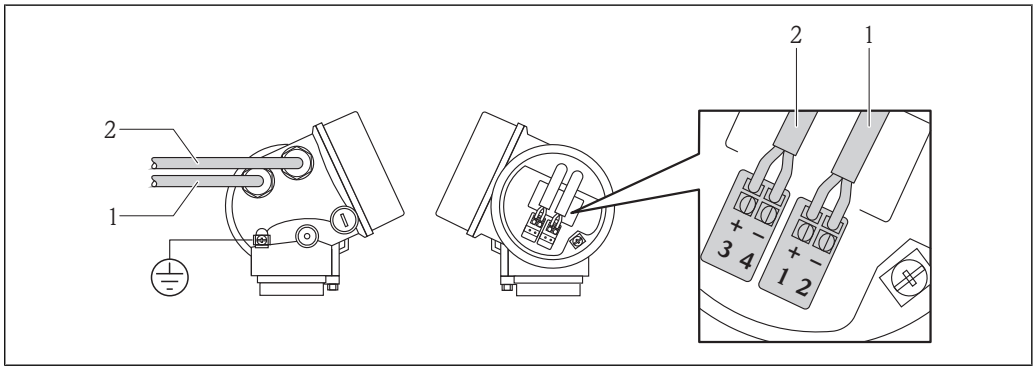
If the option **Defined value** is selected in the **Failure mode** parameter (→ 🖹 6): 3.59 to 22.5 mA

Power supply failure

- Totalizers stop at the last value measured.
- Configuration is retained in the HistoROM.
- Error messages (incl. total operated hours) are stored.

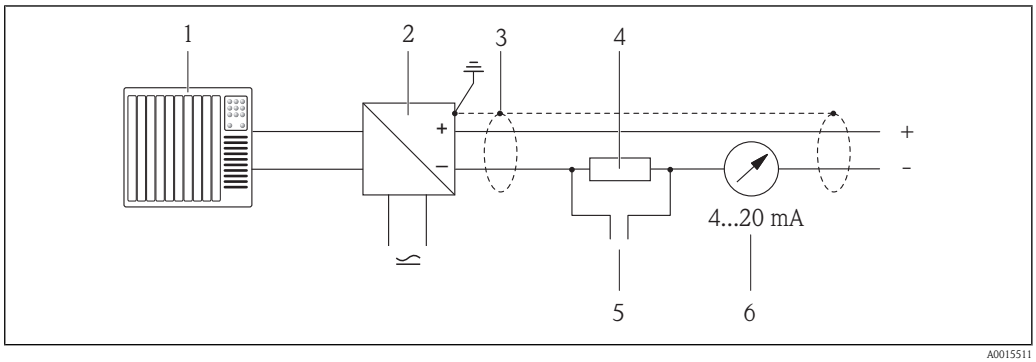
Electrical connection

Connecting the transmitter



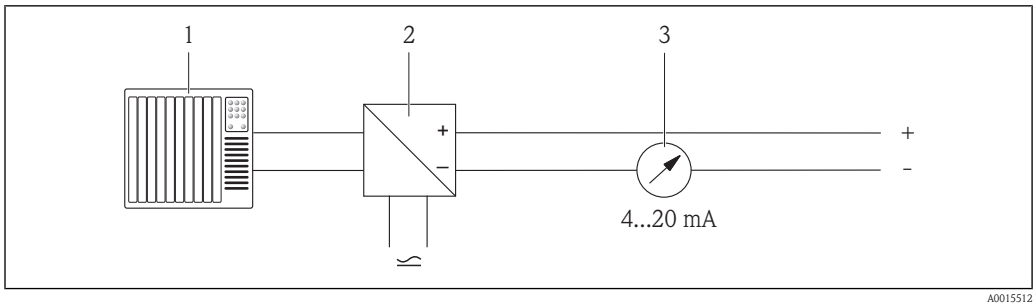
1 Cable entry for output 1
2 Cable entry for output 2

Connection examples



3 Connection example for 4-20 mA HART current output

1 PLC (programmable logic controller)
2 Active barrier for power supply (e.g. RN221N) (→ 🖹 8)
3 Observe cable specification (→ 🖹 10)
4 Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 🖹 6)
5 Connection for Field Communicator 375/475 or Commubox FXA191/195
6 Analog display unit: observe maximum load (→ 🖹 6)



4 Connection example for 4-20 mA current output

1 PLC (programmable logic controller)
2 Active barrier for power supply (e.g. RN221N) (→ 8)
3 Analog display unit: observe maximum load (→ 6)

Potential equalization

No special measures for potential equalization are required.

If the device is designed for hazardous areas, observe the information in the Ex documentation.

Terminals

Plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries

- Cable gland (not for Ex d): M20 × 1.5 with cable ∅ 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - For non-Ex and Ex: ½" NPT
  - For non-Ex and Ex (not for CSA Ex d/XP): G ½"
  - For Ex d: M20 × 1.5

Cable specification

- Permitted temperature range: –40 °C (–40 °F) to ≥ 80 °C (176 °F); at least ambient temperature + 20 K
- A normal device cable suffices if only the analog signal is used.
- A shielded cable is recommended if using the HART protocol. Observe grounding concept of the plant.

Performance characteristics

Reference operating conditions

- Error limits following ISO/DIN 11631
- Water with +15 to +45 °C (+59 to +113 °F) at 2 to 6 bar (29 to 87 psi)
- Specifications as per calibration protocol ±5 °C (±9 °F) and ±2 bar (±29 psi)
- Accuracy based on accredited calibration rigs that are traced to ISO 17025

To obtain measured errors, use the *Applicator* sizing tool (→ 41)

Maximum measured error

In addition to the values indicated, the measured error at the current output is typically ±4 µA.

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

Mass flow and volume flow (liquids)
±0.25 % o.r.

Mass flow (gases)
±0.75 % o.r.

Design fundamentals (→ 12)

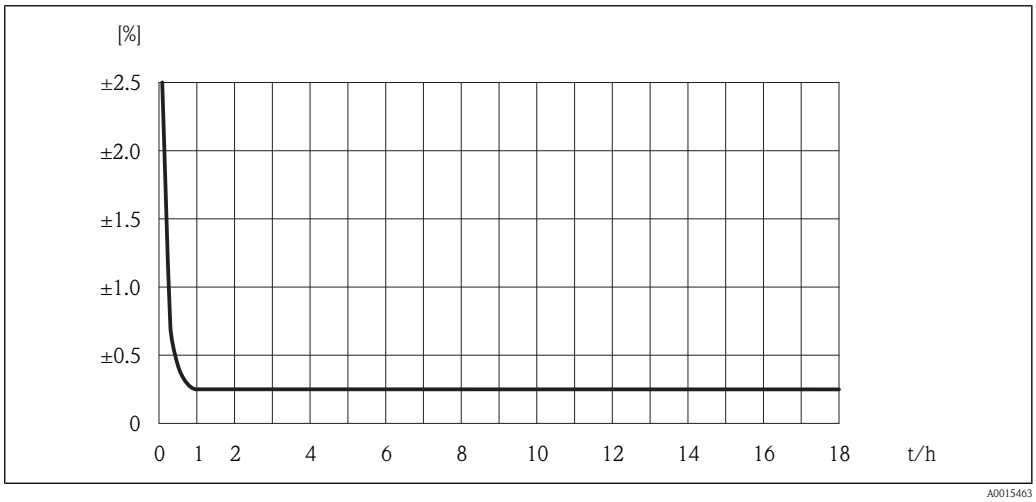
Density (liquids)
- Reference conditions: ±0.0005 g/cm³
- Field density calibration: ±0.0005 g/cm³
  (valid after a field density calibration under process conditions)
- Standard density calibration: ±0.02 g/cm³
  (valid over the entire temperature range and density range (→ 16))

Temperature
±0.5 °C ± 0.005 · T °C (±0.9 °F ± 0.005 · (T – 32) °F)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
8	3/8	0.24	0.0088
15	½	0.78	0.0287
25	1	2.16	0.0794
40	1½	5.40	0.1985
50	2	8.40	0.3087

Example for max. measured error



5 Maximum measured error in % o.r. (example: DN 25)

Design fundamentals (→ 12)

Flow values (example)

Turn down	Flow		Maximum measured error
	[kg/h]	[lb/min]	[% o.r.]
250 : 1	72	2.646	3
100 : 1	180	6.615	1.2
25 : 1	720	26.46	0.3
10 : 1	1 800	66.15	0.25
2 : 1	9 000	330.75	0.25

Repeatability

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

Mass flow and volume flow (liquids)
±0.125 % o.r.

Mass flow (gases)
±0.35 % o.r.

Design fundamentals (→ 12)

Density (liquids)
±0.00025 g/cm³

Temperature
±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0025 · (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: after 500 ms 95 % of the full scale value

Influence of ambient temperature

Current output (additional error, in relation to the span of 16 mA):
– Zero point (4 mA)
Average T_K: 0.02 %/10 K, max. 0.35 % over the entire temperature range –40 to +60 °C (–40 to +140 °F)
– Span (20 mA)
Average T_K: 0.05 %/10 K, max. 0.5 % over the entire temperature range –40 to +60 °C (–40 to +140 °F)

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 sensor is ±0.0002 % of the full scale value/°C (±0.0001 % of the full scale value/°F).

Influence of medium pressure

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

o.r. = of reading

DN		[% o.r./bar]
[mm]	[in]	
8	3/8	no influence
15	½	no influence
25	1	no influence
40	1½	no influence
50	2	–0.009

Design fundamentals

Dependent on the flow:
Flow ≥ zero point stability : (base accuracy : 100)
– Maximum measured error: ±base accuracy in % o.r.
– Repeatability: ±½ · base accuracy in % o.r.

Flow < zero point stability : (base accuracy : 100)
– Maximum measured error: ± (zero point stability : measured value) · 100 % o.r.
– Repeatability: ±2/3 · (zero point stability : measured value) · 100 % o.r.

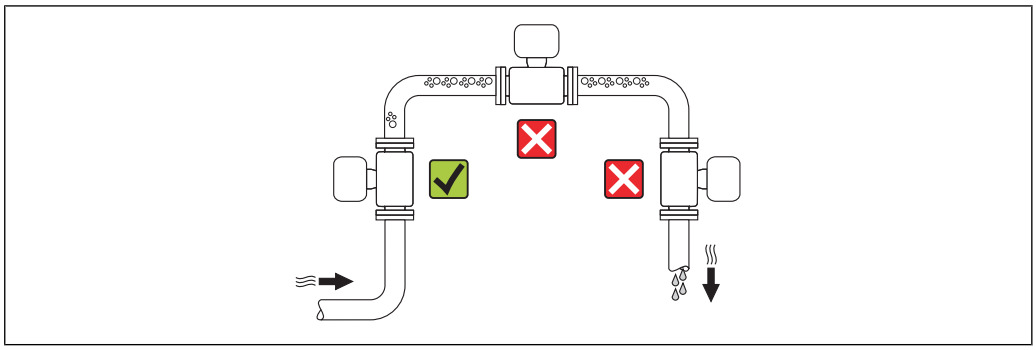
o.r. = of reading

Base accuracy for	[% o.r.]
Mass flow liquids	0.25
Volume flow liquids	0.25
Mass flow gases	0.75

Installation

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

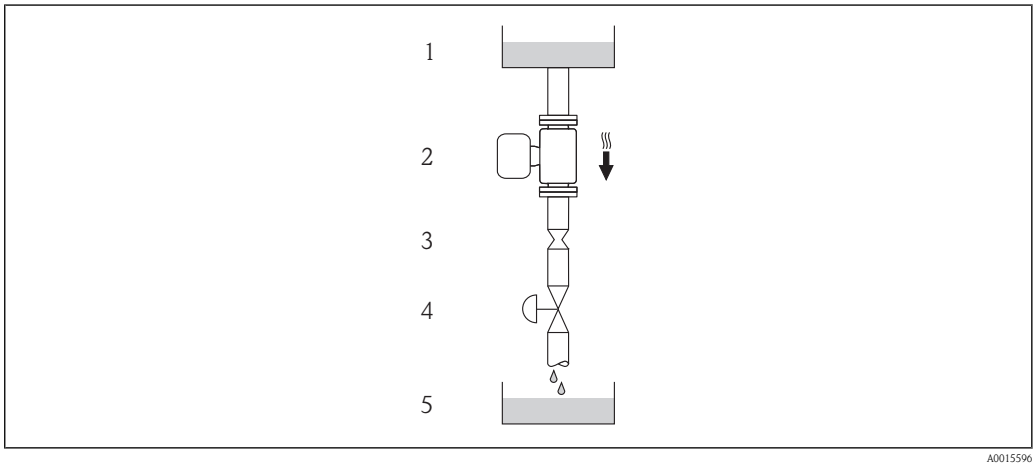
Mounting location



To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

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



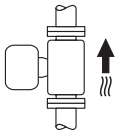
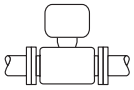
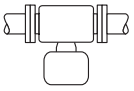
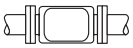
6 Installation in a down pipe (e.g. for batching applications)

1 Supply tank
2 Sensor
3 Orifice plate, pipe restriction
4 Valve
5 Batching tank

DN		Ø Orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
8	3/8	6	0.24
15	½	10	0.40
25	1	14	0.55
40	1½	22	0.87
50	2	28	1.10

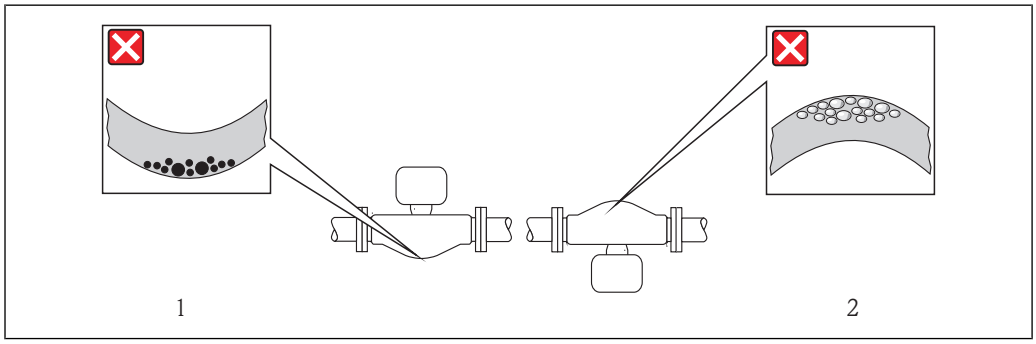
Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of fluid flow through the piping).

Orientation			Compact version
A	Vertical orientation	 A0015591	✓✓
B	Horizontal orientation, transmitter head up	 A0015589	✓✓ Exception:
C	Horizontal orientation, transmitter head down	 A0015590	✓✓ 1) Exception:
D	Horizontal orientation, transmitter head at side	 A0015592	✗

1) Applications with high process temperatures can increase the ambient temperature. This orientation is recommended to observe the maximum ambient temperature for the transmitter.

If a sensor is installed horizontally with a curved measuring tube, match the position of the sensor to the fluid properties.



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7 Orientation of sensor with curved measuring tube

1 Avoid this orientation for fluids with entrained solids: Risk of solids accumulating.
2 Avoid this orientation for outgassing fluids: Risk of gas accumulating.

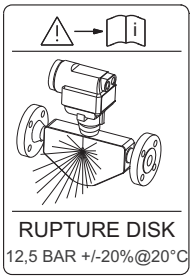
Inlet and outlet runs

No special precautions need to be taken for fittings which create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs (→ 21).

Special mounting instructions

Rupture disk

Make sure that the function and operation of the rupture disk is not impeded through the installation of the device. The position of the rupture disk is indicated by an adhesive label affixed over the disk. If the rupture disk is triggered, the adhesive label is torn and can thus be inspected visually.



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Environment

Ambient temperature range

Measuring device	–40 to +60 °C (–40 to +140 °F)
Local display	–20 to +60 °C (–4 to +140 °F), the readability of the display may be impaired at temperatures outside the temperature range.

► If operating outdoors:
Avoid direct sunlight, particularly in warm climatic regions.

Temperature tables

The following interdependencies between the permitted ambient and fluid temperatures apply when operating the device in hazardous areas:

Ex ia

SI units

Nominal diameter [mm]	T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
DN 08 to 50	35	50	95	130	140	140	140
DN 08 to 50	50	–	95	130	140	140	140
DN 08 to 50	60	–	–	130	140	140	140

US units

Nominal diameter [in]	T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
DN 3/8 to 2	95	122	203	266	284	284	284
DN 3/8 to 2	122	–	203	266	284	284	284
DN 3/8 to 2	140	–	–	266	284	284	284

Ex d, Ex nA, Ex ic

SI units

Nominal diameter [mm]	T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
DN 08 to 50	40	50	95	130	140	140	140
DN 08 to 50	55	–	95	130	140	140	140
DN 08 to 50	60	–	–	130	140	140	140

US units

Nominal diameter [in]	T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
DN 3/8 to 2	104	122	203	266	284	284	284
DN 3/8 to 2	131	–	203	266	284	284	284
DN 3/8 to 2	140	–	–	266	284	284	284

Storage temperature

–40 to +80 °C (–40 to +176 °F), preferably at +20 °C (+68 °F)

Climate class

DIN EN 60068-2-38 (test Z/AD)

Degree of protection

Standard: IP 66 and IP 67 (NEMA 4X) for transmitter and sensor

With open housing: IP 20 (NEMA 1), also degree of protection of the display module

Shock resistance

According to IEC 68-2-31

Vibration resistance

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

Interior cleaning

- Sterilization in place (SIP)
- Cleaning in place (CIP)

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21).

Details are provided in the Declaration of Conformity.

Process

Medium temperature range

Sensor
–40 to +140 °C (–40 to +284 °F)

Seals
No internal seals

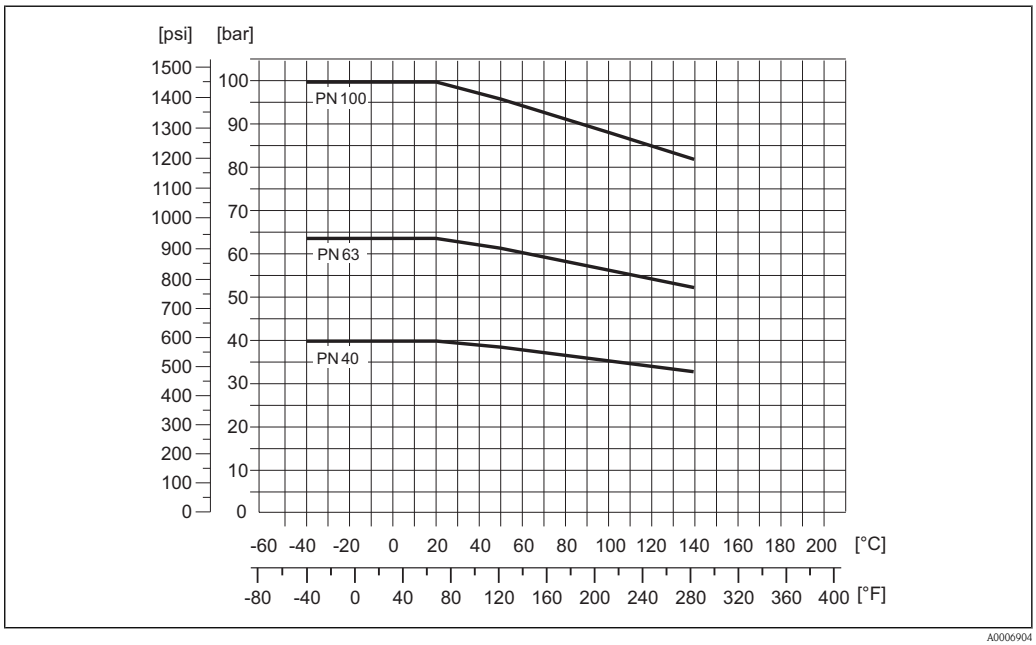
Medium density

0 to 2000 kg/m^3 (0 to 125 lb/cf)

Pressure-temperature ratings

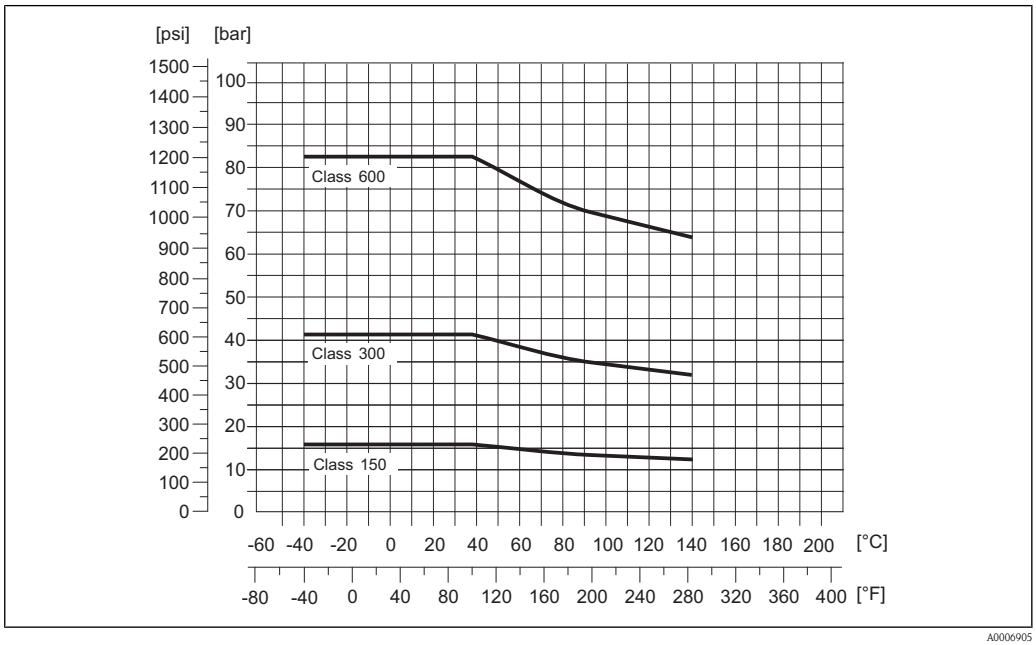
The following material load diagrams refer to the entire device and not just the process connection.

Flange connection according to EN 1092-1 (DIN 2501)



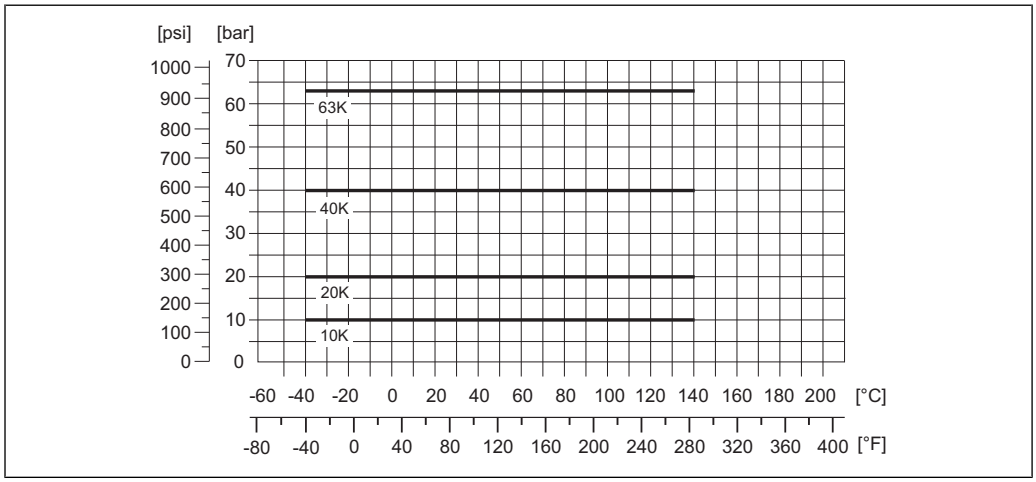
8 With flange material 1.4404/316L

Flange connection according to ASME B16.5



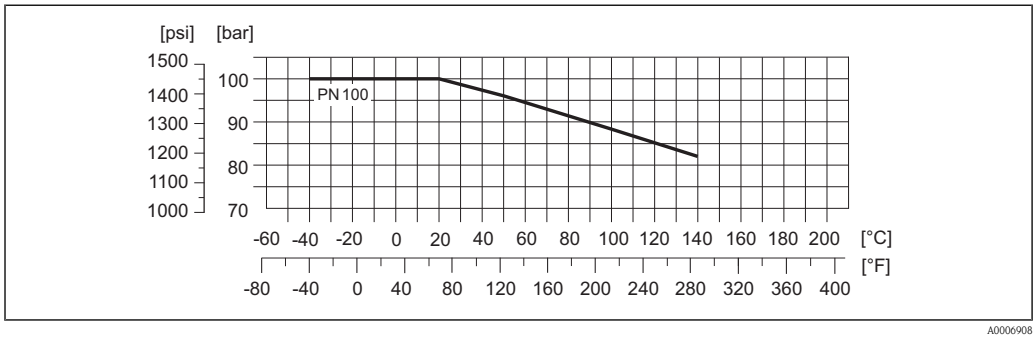
9 With flange material 1.4404/316L

Flange connection to JIS B2220



10 With flange material SUS 316L

VCO process connection

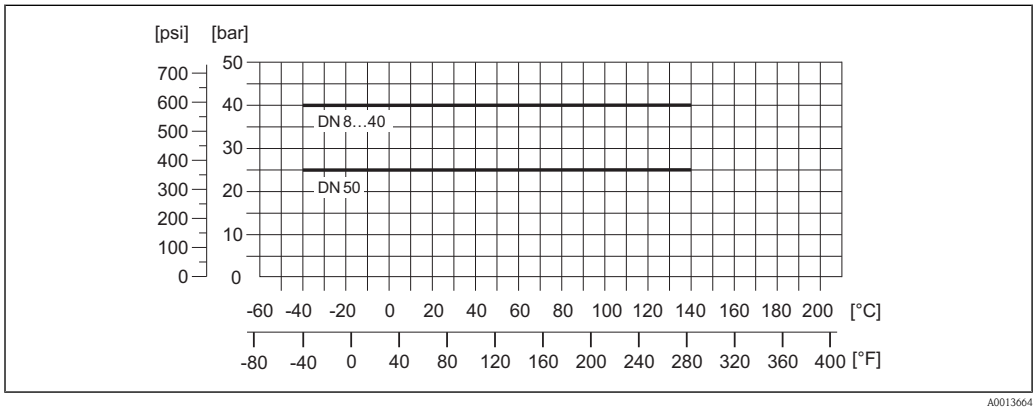


11 With connection material 1.4404/316L

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.

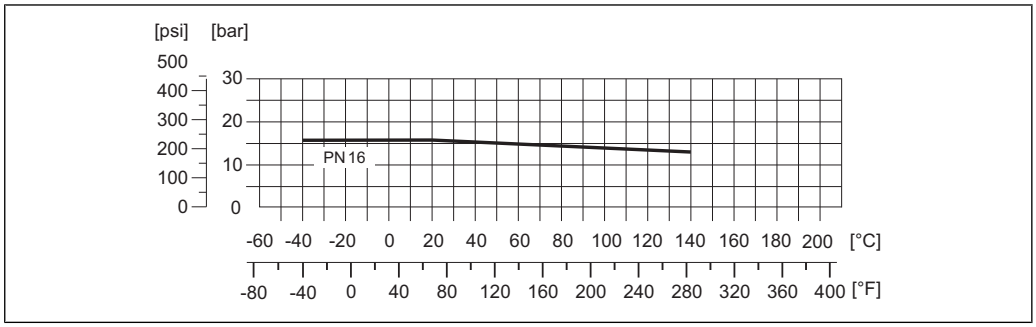
Process connection to DIN 11851



12 With connection material 1.4404/316L

DIN 11851 allows for applications up to +140 °C (+284 °F) if suitable sealing materials are used. Take this into account when selecting seals and mating parts as these components can limit the pressure and temperature range.

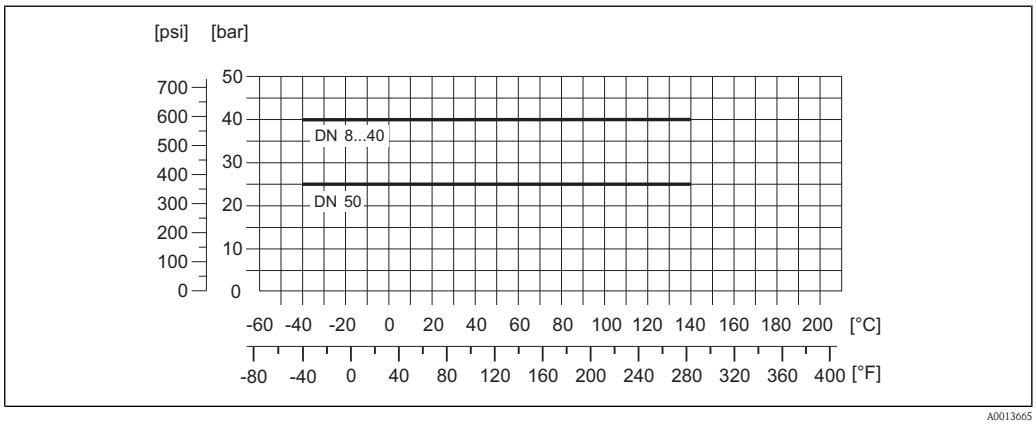
Process connection to SMS 1145



13 With connection material 1.4404/316L

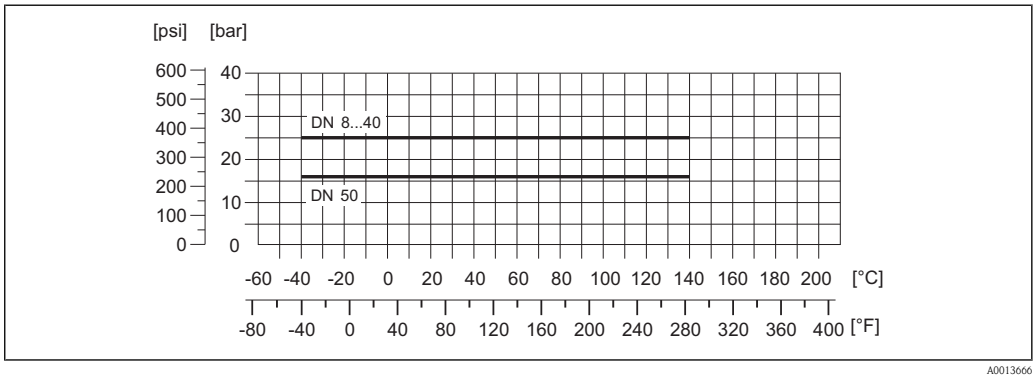
SMS 1145 allows for applications up to 6 bar (87 psi) if suitable sealing materials are used. Take this into account when selecting seals and mating parts as these components can limit the pressure and temperature range.

DIN 11864-1 Form A (threaded hygienic connection)



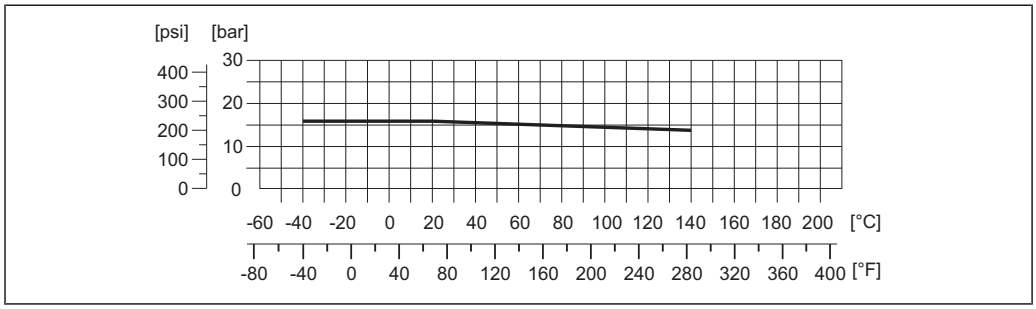
14 With connection material 1.4404/316L

Flange connection to DIN 11864-2 Form A (flat flange with groove)



15 With connection material 1.4404/316L

Threaded hygienic connection to ISO 2853



16 With flange material 1.4404/316L

Secondary containment pressure range

The housing of the sensor is filled with dry nitrogen and protects the internal electronics and mechanics. It does not perform a secondary containment function.
Reference value for the pressure loading capacity of the sensor housing: 15 bar (217.5 psi)

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.

Rupture disks cannot be combined with the separately available heating jacket (→ 40).

Flow limit

Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.

For an overview of the measuring range full scale values, see the "Measuring range" section (→ 5)

- The minimum recommended full scale value is approx. 1/20 of the maximum 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 liquids 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

To calculate the pressure loss, use the *Applicator* sizing tool (→ 41)

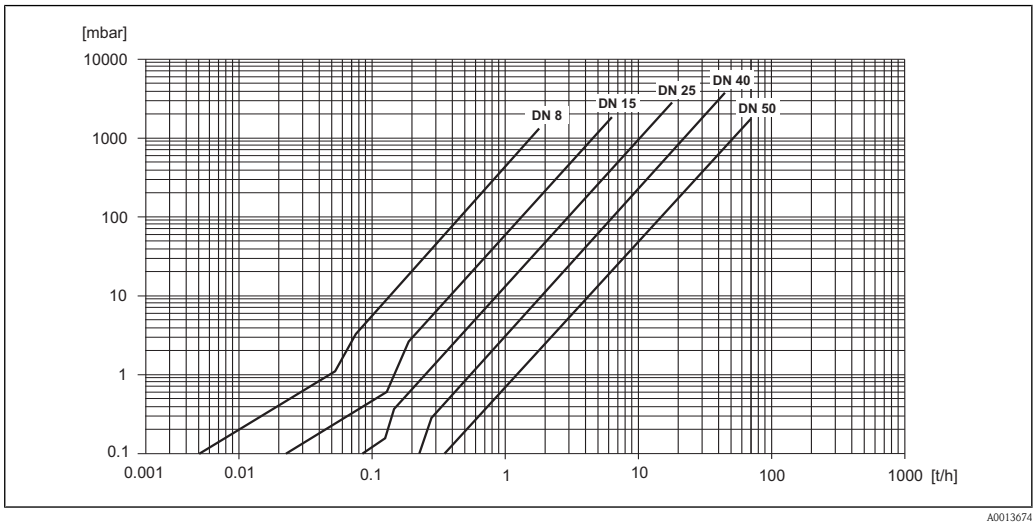
Pressure loss in SI units

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

Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ A0004623
Re ≥ 2300 *	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$ A0004626
Re < 2300	$\Delta p = K1 \cdot \nu \cdot \dot{m} + \frac{K2 \cdot \nu^{0.25} \cdot \dot{m}^2}{\rho}$ A0004628
Δp = pressure loss [mbar] ν = kinematic viscosity [m^2/s] g = mass flow [kg/s]	ρ = fluid density [kg/m^3] d = inside diameter of measuring tubes [m] K to K2 = constants (depending on nominal diameter)
* To calculate the pressure loss for gases, always use the formula for Re ≥ 2300.	

Pressure loss coefficients

DN		d	K	K1	K2
[mm]	[in]	[m]			
8	3/8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$7.91 \cdot 10^{7}$	$2.10 \cdot 10^{7}$
15	½	$8.30 \cdot 10^{-3}$	$7.62 \cdot 10^{6}$	$1.73 \cdot 10^{7}$	$2.13 \cdot 10^{6}$
25	1	$12.00 \cdot 10^{-3}$	$1.89 \cdot 10^{6}$	$4.66 \cdot 10^{6}$	$6.11 \cdot 10^{5}$
40	1½	$17.60 \cdot 10^{-3}$	$4.42 \cdot 10^{5}$	$1.35 \cdot 10^{6}$	$1.38 \cdot 10^{5}$
50	2	$26.00 \cdot 10^{-3}$	$8.54 \cdot 10^{4}$	$4.02 \cdot 10^{5}$	$2.31 \cdot 10^{4}$



17 *Pressure loss diagram for water*

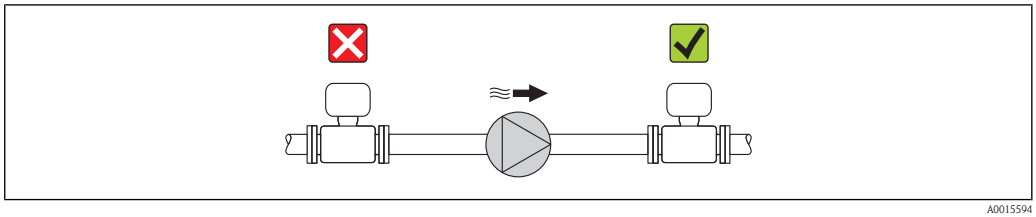
Pressure loss in US units

Pressure loss depends on the fluid properties and the nominal diameter.

System pressure

It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas. This can be prevented when system pressure is sufficiently high.

For this reason, the following mounting locations are recommended:
- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of vacuum)



Thermal insulation

For some fluids, it is important to keep the radiated heat from the sensor to the transmitter to a minimum. A wide range of materials can be used to provide the required thermal insulation.

Ensure that only up to 20 mm (0.79 in) of the transmitter neck is insulated so that the transmitter head is completely free.

Heating

Some fluids require suitable measures to avoid loss of heat at the sensor.

Heating options
- Electrical heating, e.g. with electric band heaters
- Via pipes carrying hot water or steam
- Via heating jackets

Heating jackets for the sensor can be ordered as accessories from Endress+Hauser (→ 40).

Vibrations

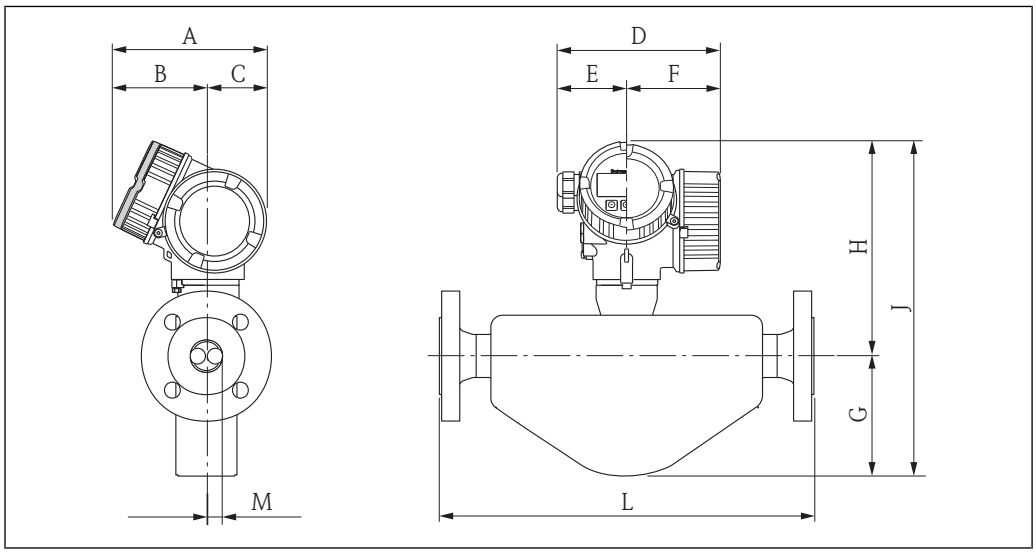
The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

Mechanical construction

Design, dimensions

Compact version

Order characteristic for "Housing", option B,C



A0013552

Dimensions in SI units for version without overvoltage protection

DN [mm]	A [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [2] [mm]	J [2] [mm]	L [mm]	M [mm]
8	162	102	60	165	75	90	93	211	304	[3]	5.35
15	162	102	60	165	75	90	105	213	318	[3]	8.30
25	162	102	60	165	75	90	106	218	324	[3]	12.0
40	162	102	60	165	75	90	121	224	345	[3]	17.6
50	162	102	60	165	75	90	169.5	240	409.5	[3]	26.0

1) for version without local display: values - 7 mm
2) for version without local display: values - 10 mm
3) dependent on respective process connection

Dimensions in US units for version without overvoltage protection

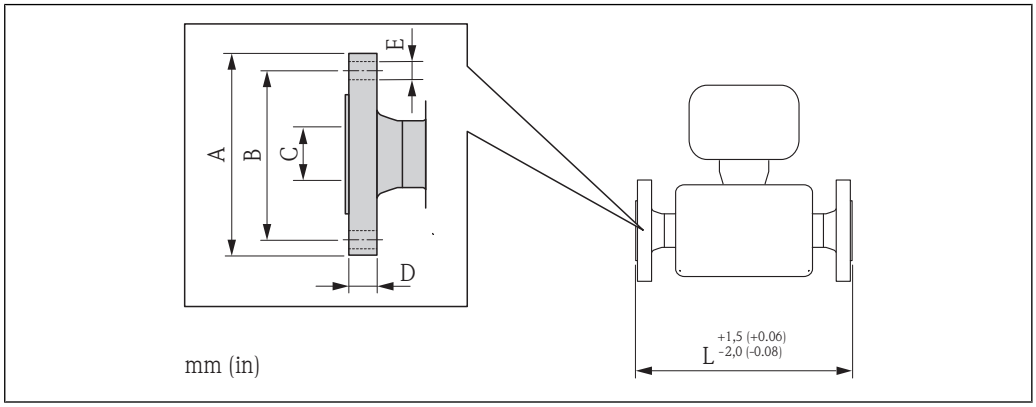
DN [in]	A [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [2] [in]	J [2] [in]	L [in]	M [in]
3/8	6.38	4.02	2.36	6.50	2.95	3.54	3.66	8.31	11.97	[3]	0.21
½	6.38	4.02	2.36	6.50	2.95	3.54	4.13	8.39	12.52	[3]	0.33
1	6.38	4.02	2.36	6.50	2.95	3.54	4.17	8.58	12.76	[3]	0.47

DN [in]	A [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [2] [in]	J [2] [in]	L [in]	M [in]
1½	6.38	4.02	2.36	6.50	2.95	3.54	4.76	8.82	13.58	3)	0.69
2	6.38	4.02	2.36	6.50	2.95	3.54	6.67	9.45	16.12	3)	1.02

1) for version without local display: values - 0.28 in
2) for version without local display: values - 0.39 in
3) dependent on respective process connection

Process connections in SI units

Flange connections EN (DIN)



Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95	65	17.3	16	4 × ∅14	232
15	95	65	17.3	16	4 × ∅14	279/510 [2]
25	115	85	28.5	18	4 × ∅14	329/600 [2]
40	150	110	43.1	18	4 × ∅18	445
50	165	125	54.5	20	4 × ∅18	556/715 [2]

1) Flange with groove according to EN 1092-1 Form D (DIN 2512N) available
2) Installation length in accordance with NAMUR Recommendation NE 132 optionally available

Flange according to EN 1092-1 (DIN 2501) / PN 40 (with DN 25-flanges): 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	115	85	28.5	18	4 × ∅14	329
15	115	85	28.5	18	4 × ∅14	329

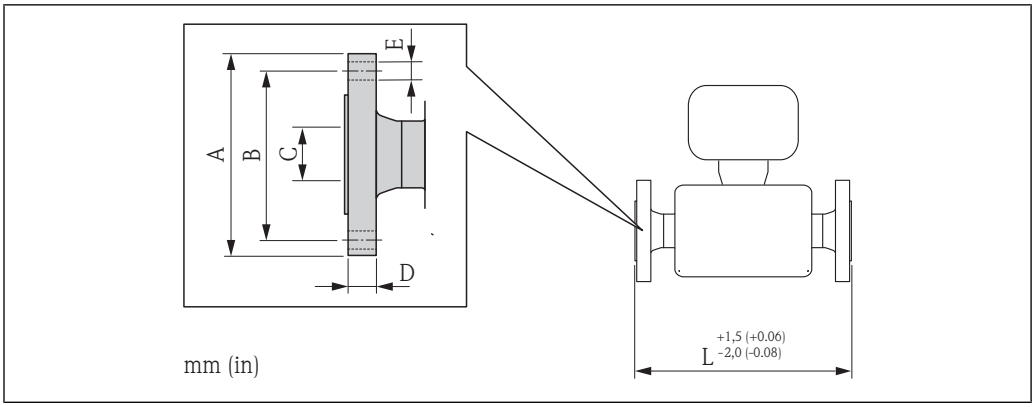
Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 63: 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 0.8 to 3.2 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	180	135	54.5	26	4 × ∅22	565

1) Flange with groove according to EN 1092-1 Form D (DIN 2512N) available

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 100: 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 0.8 to 3.2 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	105	75	17.3	20	4 × ∅14	261
15	105	75	17.3	20	4 × ∅14	295
25	140	100	28.5	24	4 × ∅18	360
40	170	125	42.5	26	4 × ∅22	486
50	195	145	53.9	28	4 × ∅26	581

1) Flange with groove according to EN 1092-1 Form D (DIN 2512N) available

Flange connections ASME B16.5

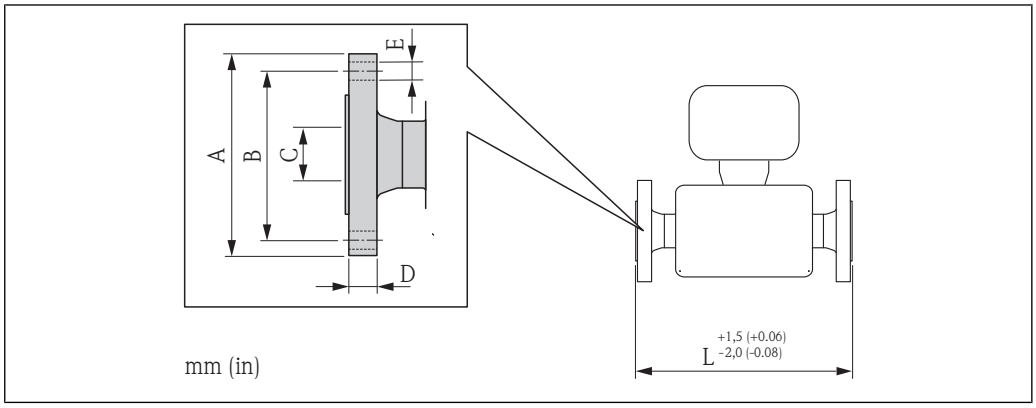


Flange according to ASME B16.5 / Cl 150: 1.4404/316L						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	88.9	60.5	15.7	11.2	4 × ∅15.7	232
15	88.9	60.5	15.7	11.2	4 × ∅15.7	279
25	108.0	79.2	26.7	14.2	4 × ∅15.7	329
40	127.0	98.6	40.9	17.5	4 × ∅15.7	445
50	152.4	120.7	52.6	19.1	4 × ∅19.1	556

Flange according to ASME B16.5 / Cl 300: 1.4404/316L						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95.2	66.5	15.7	14.2	4 × ∅15.7	232
15	95.2	66.5	15.7	14.2	4 × ∅15.7	279
25	123.9	88.9	26.7	17.5	4 × ∅19.0	329
40	155.4	114.3	40.9	20.6	4 × ∅22.3	445
50	165.1	127.0	52.6	22.3	8 × ∅19.0	556

Flange according to ASME B16.5 / Cl 600: 1.4404/316L						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95.3	66.5	13.9	20.6	4 × ∅15.7	261
15	95.3	66.5	13.9	20.6	4 × ∅15.7	295
25	124.0	88.9	24.3	23.9	4 × ∅19.1	380
40	155.4	114.3	38.1	28.7	4 × ∅22.4	496
50	165.1	127.0	49.2	31.8	8 × ∅19.1	583

Flange connections JIS



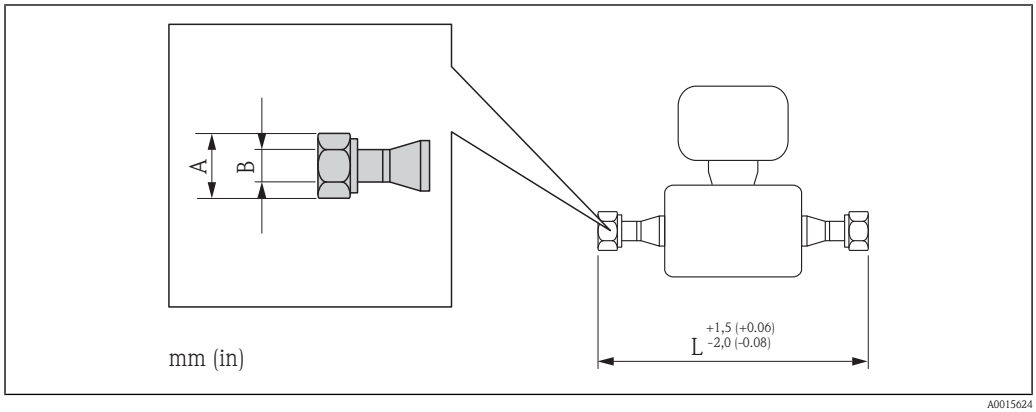
Flange JIS B2220 / 10K: SUS 316L						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	155	120	50	16	4 × ∅19	556

Flange JIS B2220 / 20K: SUS 316L						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95	70	15	14	4 × ∅15	232
15	95	70	15	14	4 × ∅15	279
25	125	90	25	16	4 × ∅19	329
40	140	105	40	18	4 × ∅19	445
50	155	120	50	18	8 × ∅19	556

Flange JIS B2220 / 40K: SUS 316L						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
8	115	80	15	20	4 × ∅19	261
15	115	80	15	20	4 × ∅19	300
25	130	95	25	22	4 × ∅19	375
40	160	120	38	24	4 × ∅23	496
50	165	130	50	26	8 × ∅19	601

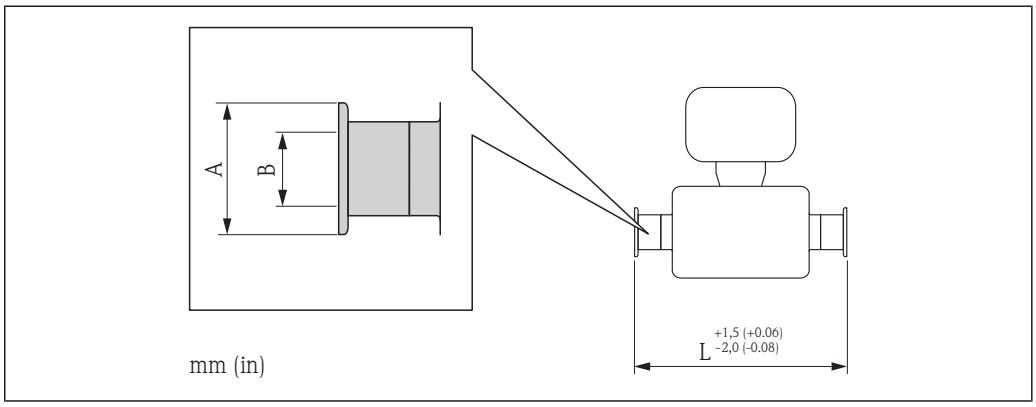
Flange JIS B2220 / 63K: SUS 316L						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
8	120	85	12	23	4 × ∅19	282
15	120	85	12	23	4 × ∅19	315
25	140	100	22	27	4 × ∅23	383
40	175	130	35	32	4 × ∅25	515
50	185	145	48	34	8 × ∅23	616

VCO connections



VCO connections: 1.4404/316L			
DN [mm]	**A [in]**	**B [mm]**	**L [mm]**
8	AF 1	10.2	252
15	AF 1½	15.7	305

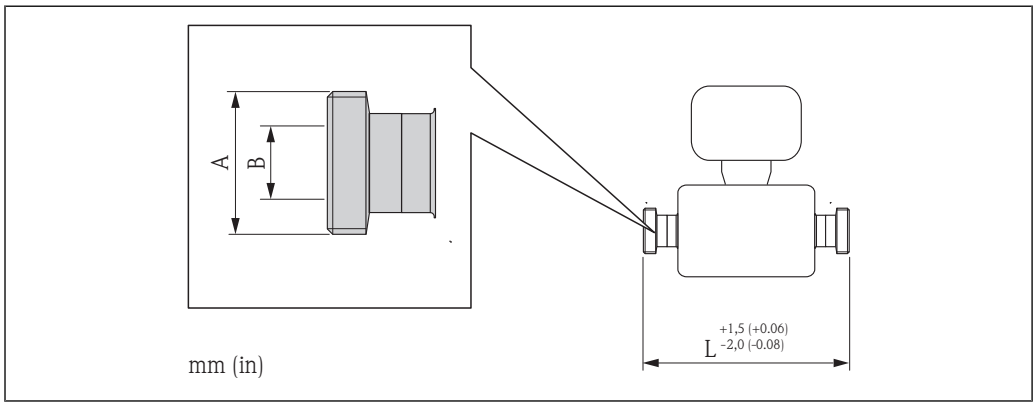
Tri-Clamp



1", 1½", 2" -Tri-Clamp: 1.4404/316L				
DN [mm]	**Clamp [in]**	**A [mm]**	**B [mm]**	**L [mm]**
8	1	50.4	22.1	229
15	1	50.4	22.1	273
25	1	50.4	22.1	324
40	1½	50.4	34.8	456
50	2	63.9	47.5	562
3A version also available (Ra ≤ 0.8 µm)				

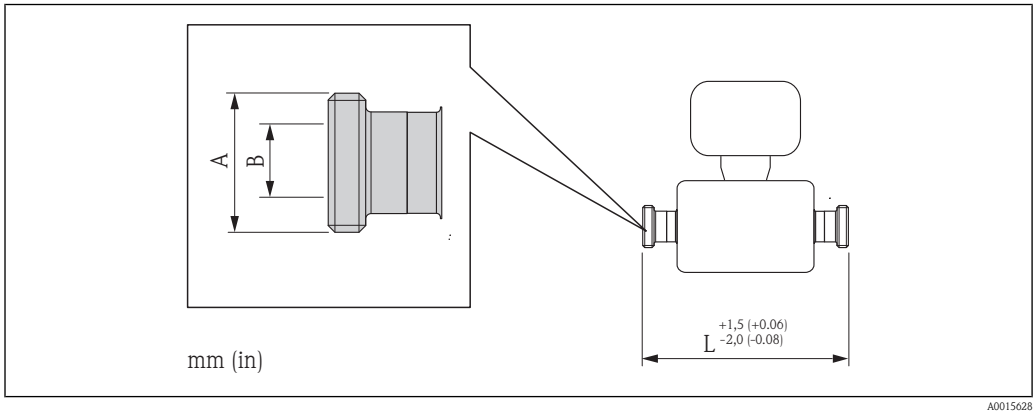
½"-Tri-Clamp: 1.4404/316L				
DN [mm]	**Clamp [in]**	**A [mm]**	**B [mm]**	**L [mm]**
8	½	25.0	9.5	229
15	½	25.0	9.5	273
3A version also available (Ra ≤ 0.8 µm)				

DIN 11851 (threaded hygienic connection)



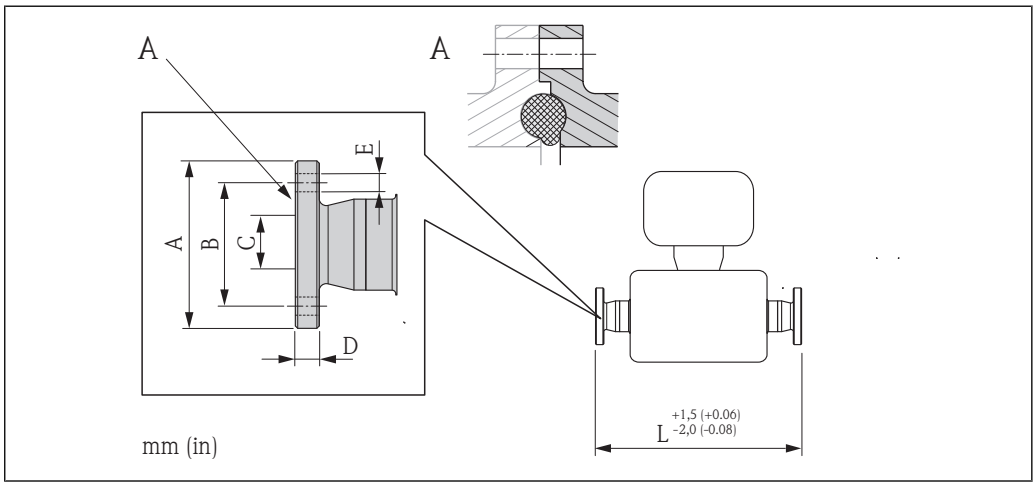
Threaded hygienic connection DIN 11851: 1.4404/316L			
DN [mm]	**A [in]**	**B [mm]**	**L [mm]**
8	Rd 34 × 1/8	16	229
15	Rd 34 × 1/8	16	273
25	Rd 52 × 1/6	26	324
40	Rd 65 × 1/6	38	456
50	Rd 78 × 1/6	50	562
3A version also available (Ra ≤ 0.8 µm)			

DIN 11864-1 Form A (threaded hygienic connection)



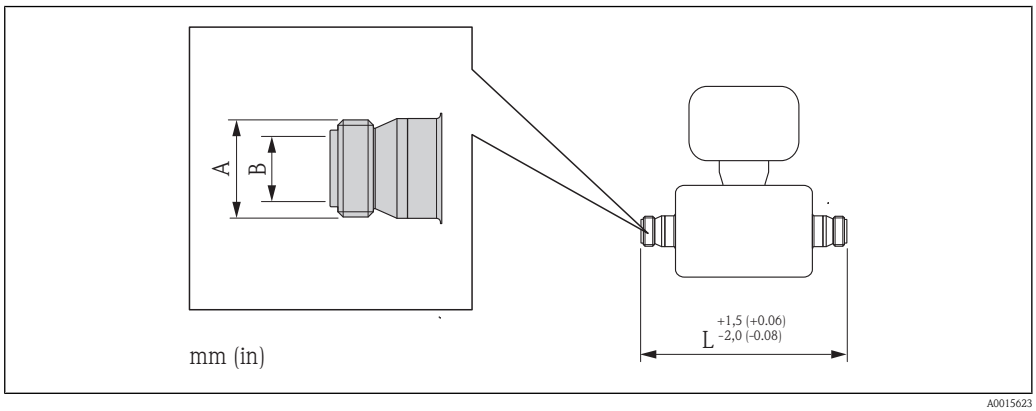
Threaded hygienic connection DIN 11864-1 Form A: 1.4404/316L			
DN [mm]	**A [in]**	**B [mm]**	**L [mm]**
8	Rd 28 × 1/8	10	229
15	Rd 34 × 1/8	16	273
25	Rd 52 × 1/6	26	324
40	Rd 65 × 1/6	38	456
50	Rd 78 × 1/6	50	562
3A version also available (Ra ≤ 0.8 µm)			

DIN 11864-2 Form A (flat flange with groove)



DIN 11864-2 Form A (flat flange with groove): 1.4404/316L						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
8	54	37	10	10	4 × ∅9	249
15	59	42	16	10	4 × ∅9	293
25	70	53	26	10	4 × ∅9	344
40	82	65	38	10	4 × ∅9	456
50	94	77	50	10	4 × ∅9	562
3A version also available (Ra ≤ 0.8 µm)						

ISO 2853 (threaded hygienic connection)

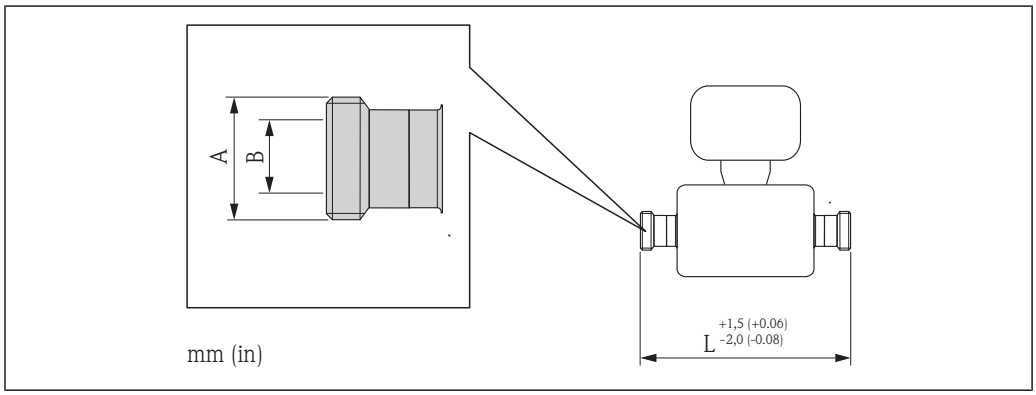


Threaded hygienic connection ISO 2853: 1.4404/316L			
DN [mm]	**A [1)] [mm]**	**B [mm]**	**L [mm]**
8	37.13	22.6	229
15	37.13	22.6	273
25	37.13	22.6	324

Threaded hygienic connection ISO 2853: 1.4404/316L			
DN [mm]	**A [1] [mm]**	**B [mm]**	**L [mm]**
40	50.68	35.6	456
50	64.16	48.6	562

1) Max. thread diameter to ISO 2853 Annex A; 3A version also available (Ra ≤ 0.8 µm)

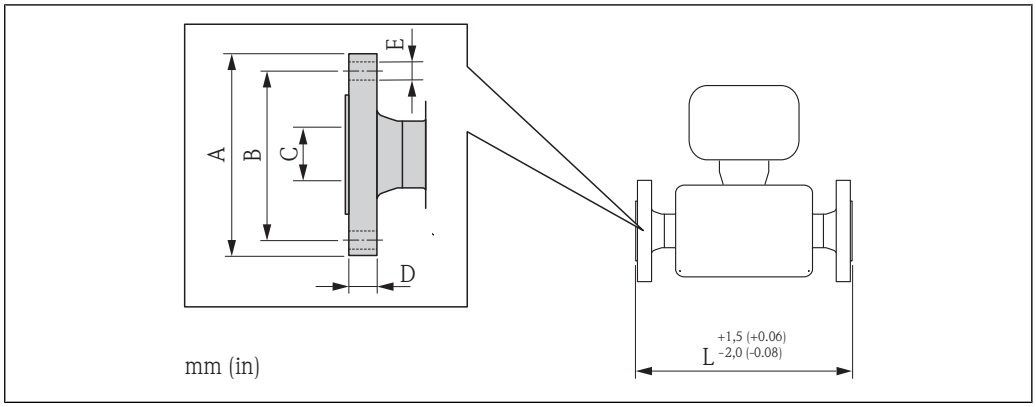
SMS 1145 (threaded hygienic connection)



Threaded hygienic connection SMS 1145: 1.4404/316L			
DN [mm]	**A [in]**	**B [mm]**	**L [mm]**
8	Rd 40 × 1/6	22.5	229
15	Rd 40 × 1/6	22.5	273
25	Rd 40 × 1/6	22.5	324
40	Rd 60 × 1/6	35.5	456
50	Rd 70 × 1/6	48.5	562
3A version also available (Ra ≤ 0.8 µm)			

Process connections in US units

Flange connections ASME B16.5

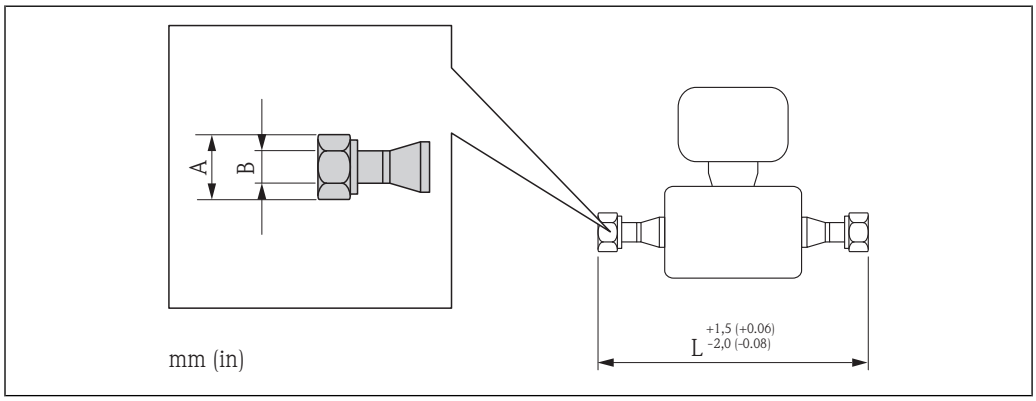


Flange according to ASME B16.5 / Cl 150: 1.4404/316L						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [in]**
3/8	3.50	2.38	0.62	0.44	4 × ∅0.62	9.13
½	3.50	2.38	0.62	0.44	4 × ∅0.62	10.98
1	4.25	3.12	1.05	0.56	4 × ∅0.62	12.95
1½	5.00	3.88	1.61	0.69	4 × ∅0.62	17.52
2	6.00	4.75	2.07	0.75	4 × ∅0.75	21.89

Flange according to ASME B16.5 / Cl 300: 1.4404/316L						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [in]**
3/8	3.75	2.62	0.62	0.56	4 × ∅0.62	9.13
½	3.75	2.62	0.62	0.56	4 × ∅0.62	10.98
1	4.88	3.50	1.05	0.69	4 × ∅0.75	12.95
1½	6.12	4.50	1.61	0.81	4 × ∅0.88	17.52
2	6.50	5.00	2.07	0.88	8 × ∅0.75	21.89

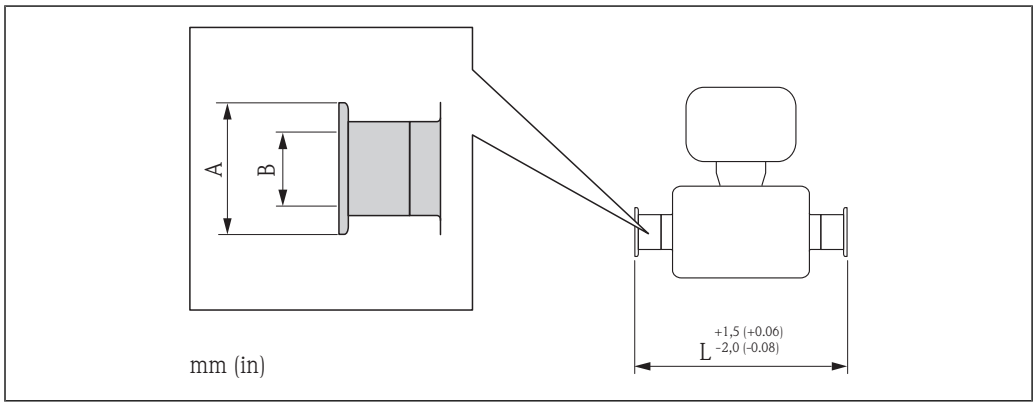
Flange according to ASME B16.5 / Cl 600: 1.4404/316L						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [in]**
3/8	3.75	2.62	0.55	0.81	4 × ∅0.62	10.28
½	3.75	2.62	0.55	0.81	4 × ∅0.62	11.61
1	4.88	3.50	0.96	0.94	4 × ∅0.75	14.96
1½	6.12	4.50	1.50	1.13	4 × ∅0.88	19.53
2	6.50	5.00	1.94	1.25	8 × ∅0.75	22.95

VCO connections



VCO connections: 1.4404/316L			
DN [in]	**A [in]**	**B [in]**	**L [in]**
3/8	1 AF	0.40	9.92
½	1½ AF	0.62	12.01

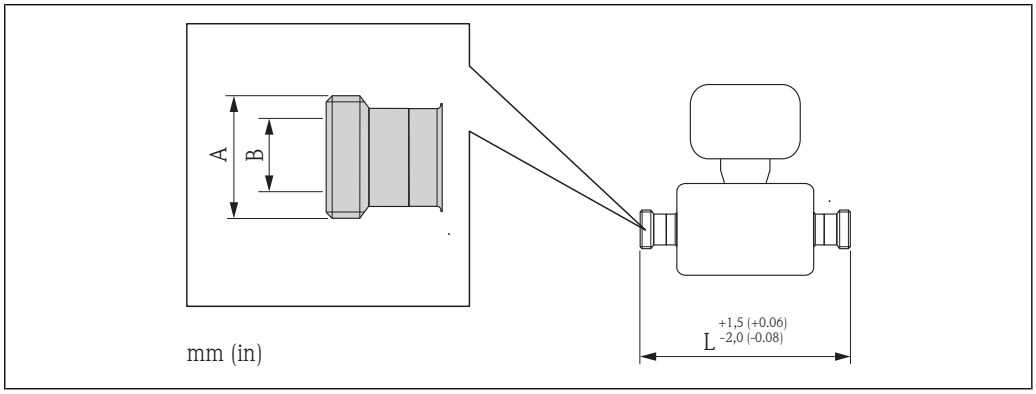
Tri-Clamp



1", 1½", 2" -Tri-Clamp: 1.4404/316L				
DN [in]	**Clamp [in]**	**A [in]**	**B [in]**	**L [in]**
3/8	1	1.98	0.87	9.02
½	1	1.98	0.87	10.75
1	1	1.98	0.87	12.76
1½	1½	1.98	1.37	17.95
2	2	2.52	1.87	22.13
3A version also available (Ra ≤ 32 µin)				

½"-Tri-Clamp: 1.4404/316L				
DN [in]	**Clamp [in]**	**A [in]**	**B [in]**	**L [in]**
3/8	½	0.98	0.37	9.02
½	½	0.98	0.37	10.75
3A version also available (Ra ≤ 32 µin)				

SMS 1145 (threaded hygienic connection)



Threaded hygienic connection SMS 1145: 1.4404/316L			
DN [in]	**A [in]**	**B [in]**	**L [in]**
3/8	Rd 40 × 1/6	0.89	9.02
½	Rd 40 × 1/6	0.89	10.75
1	Rd 40 × 1/6	0.89	12.76
1½	Rd 60 × 1/6	1.40	17.95
2	Rd 70 × 1/6	1.91	22.13
3A version also available (Ra ≤ 32 µin)			

Weight

Weight in SI units

Compact version

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

DN [mm]	Weight [kg]	
	Order characteristic for "Housing", option C Aluminum coating	**Order characteristic for "Housing" option B 1.4404/316L**
8	6	8.5
15	6.5	9
25	8	10.5
40	13	15.5
50	22	24.5

Weight in US units

Compact version

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

DN [in]	Weight [lbs]	
	Order characteristic for "Housing" option C Aluminum coating	Order characteristic for "Housing" option B 1.4404/316L
3/8	13.2	18.7
½	14.3	19.8
1	17.6	23.2
1 ½	28.7	34.2
2	48.5	54.0

Materials

Transmitter housing

- Order characteristic for "Housing", option C: powder coated die-cast aluminum AlSi10Mg
- Order characteristic for "Housing", option B: stainless steel 1.4404/316L
- Window material: glass

Cable entries

Order characteristic for "Housing", option C

Electrical connection	Type of protection	Material
Cable gland M20 × 1.5	■ Non-Ex ■ Ex ia ■ Ex ic	Plastic
	■ Ex nA ■ Ex t	Nickel-plated brass
Thread G ½" via adapter	For non-Ex and Ex (except for CSA Ex d/XP)	Nickel-plated brass
Thread ½" NPT via adapter	For non-Ex and Ex	
Thread M20 × 1.5	Ex d	

Order characteristic for "Housing", option B

Electrical connection	Type of protection	Material
Cable gland M20 × 1.5	■ Non-Ex ■ Ex ia ■ Ex ic ■ Ex nA ■ Ex t	Stainless steel 1.4404
Thread G ½" via adapter	For non-Ex and Ex (except for CSA Ex d/XP)	Stainless steel 1.4404/316L
Thread ½" NPT via adapter	For non-Ex and Ex	
Thread M20 × 1.5	Ex d	

Sensor housing

- Acid and alkali-resistant outer surface
- Stainless steel 1.4301/304

Measuring tubes

- Stainless steel EN 1.4539 / ASTM 904L
- Surface quality:
  - Ra_{max} = 0.8 µm (32 µin)
  - Ra_{max} = 0.4 µm (16 µin)

Process connections

- For all process connections (except flanges as per JIS B2220):
  Stainless steel 1.4404/316L
- For flanges as per JIS B2220:
  Stainless steel SUS 316L

List of all available process connections (→ 35)

Seals

Welded process connections without internal seals

Accessories

Protective cover

Stainless steel 1.4301

Process connections

- Flanges:
  - EN 1092-1 (DIN 2501)
  - ASME B16.5
  - JIS B2220
- VCO connections
- Tri-Clamp
- Threaded hygienic connection:
  - DIN 11851
  - SMS 1145
  - ISO 2853
  - DIN 11864-1 Form A
- Flat flange with groove:
  DIN 11864-2 Form A

For information on the materials of the process connections (→ 35)

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Quick and safe commissioning

- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

Reliable operation

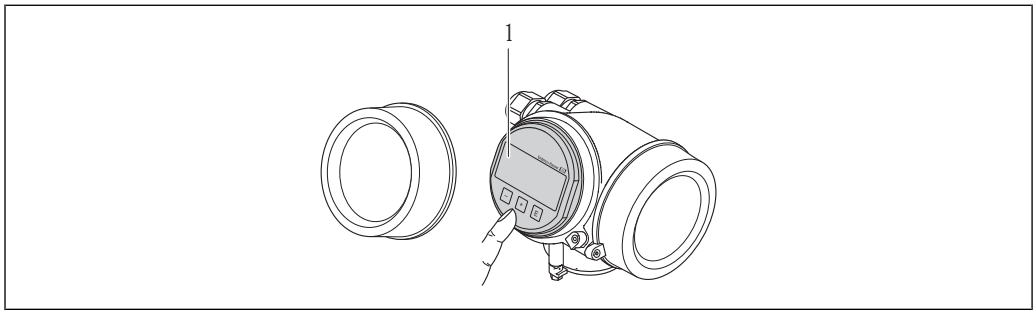
- Local operation in the following languages:
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Japanese, Bahasa (Indonesian), Vietnamese, Czech
- Standardized operation at the device and in the operating tools
- Data storage device (HistoROM) for process and measuring device data with event logbook available at all times - even if electronics modules are replaced

Efficient diagnostics increase measurement reliability

- Remedy information is integrated in plain text
- Diverse simulation options and line recorder functions

Local operation

Order characteristic for "Display; Operation", option C



A0015544

1 Operation with pushbuttons

Display elements

- 4-line display
- Format for displaying measured values and status variables can be individually configured
- Permitted ambient temperature for the display: –20 to +60 °C (–4 to +140 °F)
  The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements

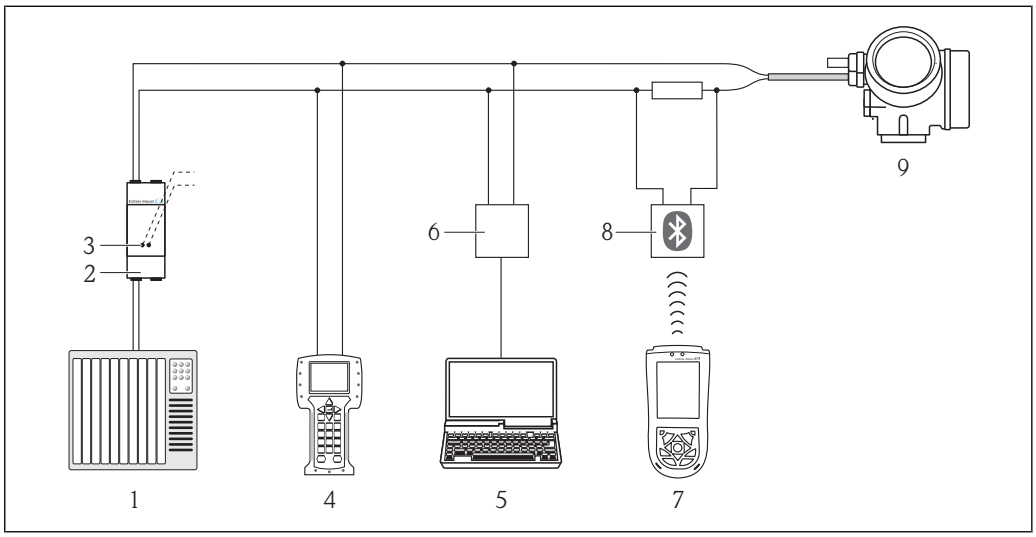
- Local operation with 3 push buttons (⊕, ⊖, ℮)
- Operating elements also accessible in various hazardous areas

Additional functionality

- Data backup function
  The device configuration can be saved in the display module.
- Data comparison function
  The device configuration saved in the display module can be compared to the current device configuration.
- Data transfer function
  The transmitter configuration can be transmitted to another device using the display module.

Remote operation

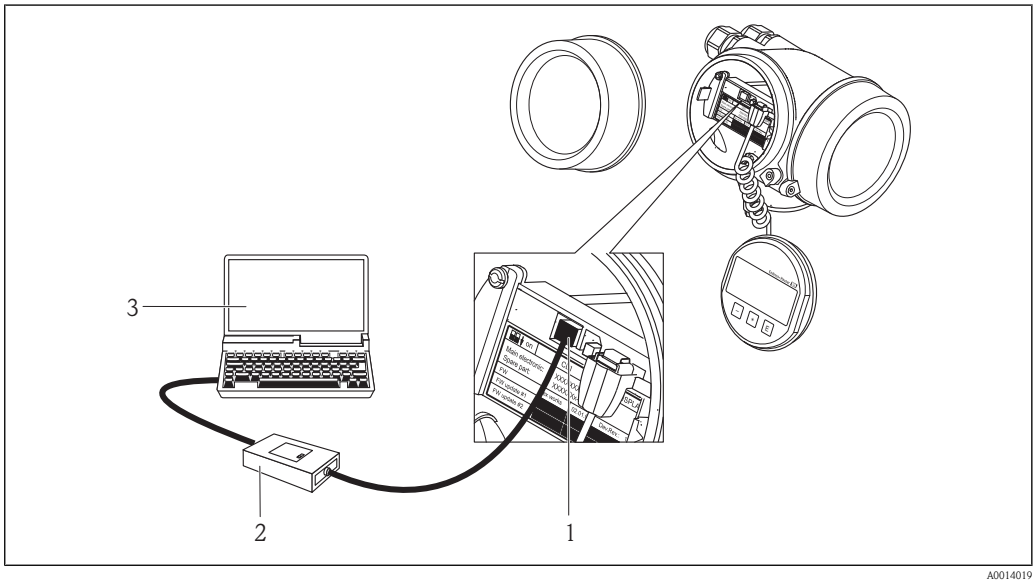
Via HART protocol



18 Options for remote operation via HART protocol

1 PLC (programmable logic controller)
2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
3 Connection for Commubox FXA191, FXA195 and Field Communicator 375, 475
4 Field Communicator 375, 475
5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
6 Commubox FXA191 (RS232) or FXA195 (USB)
7 Field Xpert SFX100
8 VIATOR Bluetooth modem with connecting cable
9 Transmitter

Via service interface (CDI)



1 Service interface (CDI) of the measuring device (= Endress+Hauser Common Data Interface)
2 Commubox FXA291
3 Computer with "FieldCare" operating tool

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-Tick symbol

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.

The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

ATEX/IECEx

Currently, the following versions for use in hazardous areas are available:

Ex d

Category (ATEX)	Type of protection
II2G	Ex d[ia] IIC T6-T1 Gb
II1/2G	Ex ia/d IIC T6-T1 Ga/Gb
II1/2G, II2D	Ex ia/d IIC T6-T1 Ga/Gb Ex t IIIC T* Db

Ex ia

Category (ATEX)	Type of protection
II1/2G	Ex ia IIC T6-T1 Ga/Gb
II2G	Ex ia IIC T6-T1 Gb
II1/2G, II2D	Ex ia IIC T6-T1 Ga/Gb Ex t IIIC T* Db

Ex nA

Category (ATEX)	Type of protection
II3G	Ex nA[ic] IIC T6-T1 Gc

Ex ic

Category (ATEX)	Type of protection
II1/3G	Ex ic[ia] IIC T6-T1 Ga/Gc
II3G	Ex ic IIC T6-T1 Gc

$_{C}CSA_{US}$

Currently, the following versions for use in hazardous areas are available:

NI (Ex nA, Ex nL)
- Class I Division 2 Groups ABCD; NIFW*
- Class II Division 1 Groups EFG and Class III

IS (Ex i) and XP (Ex d)
- Class I Division 1 Groups ABCD; Entity*
- Class II Division 1 Groups EFG and Class III

*= Entity and NIFW parameters according to control drawings

Hygienic compatibility

3A approval

Functional safety

The measuring device can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture) and SIL 3 (multichannel architecture with homogeneous redundancy) and is independently evaluated and certified by the TÜV in accordance with IEC 61508.

The following types of monitoring in safety equipment are possible:
- Mass flow
- Volume flow
- Density

The Manual for Functional Safety with all information about the SIL device is available from your Endress +Hauser distributor.

Pressure Equipment Directive

The devices can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order. This is not possible or required for devices with nominal diameters of DN 25 (1 in) or smaller.

- With the PED/G1/III marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC.
- Devices bearing this marking (PED) are suitable for the following types of fluid:
  – Fluids in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to 0.5 bar (7.3 psi)
  – Unstable gases
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.

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
  Emissions in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- IEC 61508
  Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 32
  Data Retention in the Event of a Power Failure in Field and Control Instruments with Microprocessors
- 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
- NAMUR NE 80
  The Application of the Pressure Equipment Directive to Process Control Devices
- NAMUR NE 105
  Specifications for Integrating Fieldbus Devices in Engineering Tools for Field Devices
- NAMUR NE 107
  Status classification as per NE107
- NAMUR NE 131
  Requirements for field devices for standard applications
- NAMUR NE 132
  Coriolis mass meter

Ordering information

Your Endress+Hauser sales center can provide detailed ordering information and information on the extended order code.

Application packages

Package	Description
HistoROM extended function	Comprises extended functions concerning the event log and the activation of the measured value memory. Event log: ■ Memory volume is extended from 20 message entries (basic version) to up to 100 entries. ■ Message entries are visualized via the local display or FieldCare. Data logging (line recorder): ■ Memory capacity for up to 1000 measured values is activated. ■ 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. ■ Data logging is visualized via the local display or FieldCare.

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

About the transmitter

Accessories	Description
Promass 200 transmitter	Transmitter for replacement or for stock. Use the order code to define the following specifications: ■ Approvals ■ Degree of protection / version ■ Display / operation ■ Software ■ Output For details, see Installation Instructions EA00104D
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight or extreme cold in winter. For details, see Installation Instructions SD00333F

About the sensor

Accessories	Description
Heating jacket	Is used to stabilize the temperature of the fluids in the sensor. Water, steam and other non-corrosive liquids are permitted as the fluid. Contact Endress +Hauser if oil is used as the heating fluid. Heating jackets cannot be used with sensors fitted with a rupture disk. For details, see Operating Instructions BA00099D

Communication-specific accessories

Accessories	Description
Commubox FXA191 HART	For intrinsically safe HART communication with FieldCare via the RS232C interface. For details, see "Technical Information" TI00237F
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F

Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
WirelessHART adapter	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

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.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S

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 SD card or USB stick. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R
RN221N	Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission. For details, see "Technical Information" TI00073R and Operating Instructions BA00202R
RNS221	Power supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R

Documentation

The document types listed are available:
- On the CD supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Standard documentation

Device type	Communication	Document type	Documentation code
8E2B**-	----	Brief Operating Instructions	KA00050D
	HART	Operating Instructions	BA01027D
	HART	Description of Device Parameters	GP01010D

Supplementary device-dependent documentation

Device type	Document type	Approval	Documentation code
8E2B**-	Safety Instructions	ATEX/IECEx Ex d	XA00143D
		ATEX/IECEx Ex i	XA00144D
		ATEX/IECEx Ex nA, Ex ic	XA00145D
		cCSAus IS	XA00151D
		cCSAus XP	XA00152D
	Information on the Pressure Equipment Directive		SD00144D
	Functional Safety Manual		SD00147D
	Installation Instructions		Specified for each individual accessory (→ 40)

Registered trademarks

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

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

Applicator®, FieldCare®, Field Xpert™, HistoROM®
Registered or registration-pending trademarks of the Endress+Hauser Group

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