Technical Information
Proline Promass F 200

Coriolis flowmeter

The robust flowmeter with genuine two-wire technology for demanding applications

Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Maximum measuring performance for liquids and gases under variable, challenging process conditions

Device properties
- Mass flow: Measured error ±0.1 %
- Nominal pressure of secondary containment up to 40 bar (580 psi)
- Nominal diameter: DN 8 to 80 (⅜ to 3")
- Two-wire technology
- Robust two-chamber housing
- System safety: global approvals (SIL, Ex)

Your benefits

- Maximum process safety – immune to harsh, variable ambient conditions
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no in/outlet run needs
- Convenient wiring – separate connection compartment
- Safe operation – no need to open device thanks to touch control display, backlighting
- Integrated verification – Heartbeat Technology™

Endress+Hauser
People for Process Automation

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Document information

Symbols used

Electrical symbols

Symbol	Meaning	Symbol	Meaning
⎓	Direct current	~	Alternating current
	Direct current and alternating current		**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.		**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
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3.…	Series of steps
A, B, C, ...	Views	**A-A, B-B, C-C, ...**	Sections
EX	Hazardous area	EX	Safe area (non-hazardous area)
≋➡	Flow direction		

Function and system design

Measuring principle

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

F_c = $2 \cdot \Delta m \, (v \cdot \omega)$

F_c = Coriolis force

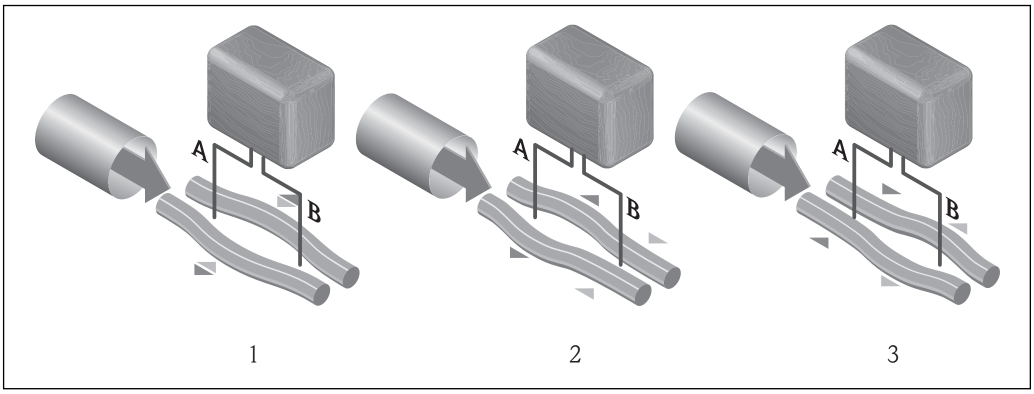
Δm = moving mass

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 rotational velocity ω, the 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).



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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 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 medium density. The microprocessor utilizes this relationship to obtain a density signal.

Volume measurement
Together with the measured mass flow, this is used to calculate the volume flow.

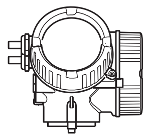
Temperature measurement
The temperature of the measuring tube is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output signal.

Measuring system

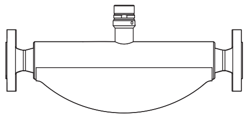
The device consists of a transmitter and a sensor.

One device version is available: compact version - transmitter and sensor form a mechanical unit.

Transmitter

Promass 200	Device versions and materials:
 A0013471	▪ Compact, aluminum coated: Aluminum, AlSi10Mg, coated ▪ Compact, hygienic, stainless: Hygienic version, for maximum corrosion resistance: stainless steel 1.4404 (316L) Configuration: ▪ External operation via four-line, illuminated local display with touch control and guided menus ("Make-it-run" wizards) for applications ▪ Via operating tools (e.g. FieldCare)

Sensor

Promass F	
 A0016507	▪ Excellent performance across a wide range of applications ▪ Simultaneous measurement of flow, volume flow, density and temperature (multivariable) ▪ Immune to process influences ▪ Nominal diameter range: DN 8 to 80 (⅜ to 3") ▪ Materials: – Sensor: stainless steel, 1.4301/1.4307 (304L); optional 1.4404 (316/316L) – Measuring tubes: stainless steel, 1.4539 (904L); 1.4404 (316/316L); Alloy C22, 2.4602 (UNS N06022) – Process connections: stainless steel, 1.4404 (316/316L); 1.4301(304); Alloy C22, 2.4602 (UNS N06022)

Safety

IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Input

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured 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	⅜	0 to 2 000	0 to 73.50
15	½	0 to 6 500	0 to 238.9
25	1	0 to 18 000	0 to 661.5
40	1½	0 to 45 000	0 to 1 654

DN		Measuring range full scale values $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
50	2	0 to 70 000	0 to 2 573
80	3	0 to 180 000	0 to 6 615

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	⅜	60
15	½	80
25	1	90
40	1½	90
50	2	90
80	3	110

To calculate the measuring range, use the *Applicator* sizing tool (→ 79)

Calculation example for gas
- Sensor: Promass F, 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 = 90 kg/m³ (for Promass F, DN 50)

Maximum possible full scale value:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x = 70\,000\ kg/h \cdot 60.3\ kg/m^3 : 90\ kg/m^3 = 46\,900\ kg/h$

Recommended measuring range

"Flow limit" section (→ 46)

Operable flow range

Over 1000 : 1.

Flow rates above the preset full scale value are not overridden by the electronics unit, with the result that the totalizer values are registered correctly.

Input signal

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow for gases, the automation system can continuously write the operating pressure to the measuring device. Endress+Hauser recommends the use of a pressure transmitter for absolute pressure, e.g. Cerabar M or Cerabar S.

Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section (→ 80)

It is recommended to read in external measured values to calculate the following measured variables:
- Mass flow
- Corrected volume flow

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:
- HART protocol
- Burst mode

Fieldbuses

The measured values can be written from the automation system to the measuring via:
- PROFIBUS PA
- FOUNDATION Fieldbus

Output

Output signal

Current output

Current output 1	4-20 mA HART (passive)
Current output 2	4-20 mA (passive)
Resolution	<1 µA
Damping	Adjustable: 0.0 to 999.9 s
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	▪ DC 35 V ▪ 50 mA For information on the Ex connection values (→ 🗎 11)
Voltage drop	▪ For ≤2 mA: 2 V ▪ For 10 mA: 8 V
Residual current	≤0.05 mA
Pulse output	
Pulse width	Adjustable: 5 to 2 000 ms
Maximum pulse rate	100 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow
Frequency output	
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1

Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value – Mass flow – Volume flow – Corrected volume flow – Density – Reference density – Temperature – Totalizer 1-3 ▪ Flow direction monitoring ▪ Status – Partially filled pipe detection – Low flow cut off

FOUNDATION Fieldbus

Signal encoding	Manchester Bus Powered (MBP)
Data transfer	31.25 KBit/s, Voltage mode

PROFIBUS PA

Signal encoding	Manchester Bus Powered (MBP)
Data transfer	31.25 KBit/s, Voltage mode

Signal on alarm

Depending on the interface, failure information is displayed as follows:

Current output

4-20 mA

Failure mode	Selectable (as per NAMUR recommendation NE 43): ▪ Minimum value: 3.6 mA ▪ Maximum value: 22 mA ▪ Defined value: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

HART

Device diagnostics	Device condition can be read out via HART Command 48

Pulse/frequency/switch output

Pulse output

Failure mode	Choose from: ▪ Actual value ▪ No pulses

Frequency output

Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value: 0 to 1 250 Hz

Switch output

Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

FOUNDATION Fieldbus

Status and alarm messages	Diagnostics in accordance with FF-912
Error current FDE (Fault Disconnection Electronic)	0 mA

PROFIBUS PA

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
Error current FDE (Fault Disconnection Electronic)	0 mA

Local display

Plain text display	With information on cause and remedial measures
Backlight	Additionally for device version with SD03 local display: red lighting indicates a device error.

ℹ Status signal as per NAMUR recommendation NE 107

Operating tool

- Via digital communication:
  - HART protocol
  - FOUNDATION Fieldbus
  - PROFIBUS PA
- Via service interface

Plain text display	With information on cause and remedial measures

ℹ Additional information on remote operation (→ 📖 71)

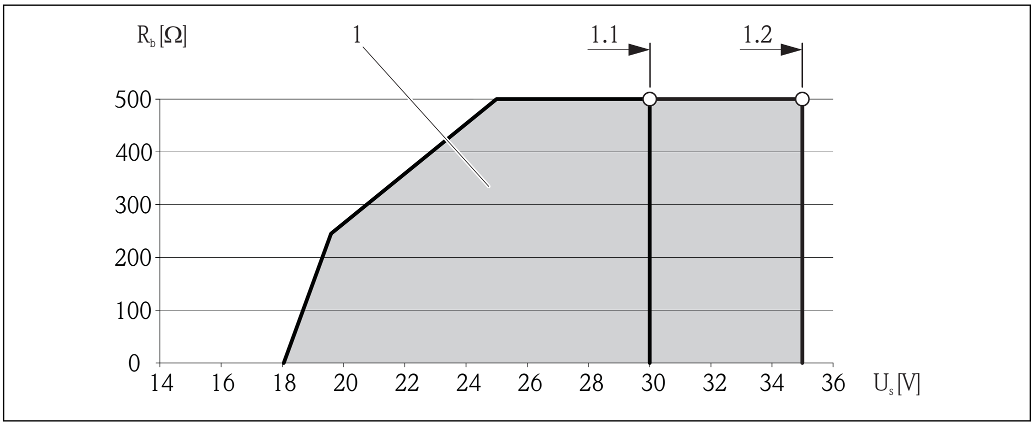
Load

Load for current output: 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

- 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: $R_B \leq 500\ \Omega$



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1 Operating range
1.1 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with Ex i and option C "4-20 mA HART + 4-20 mA analog"
1.2 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with non-Ex and Ex d

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 Ω

Ex connection data

Safety-related values

Ex d type of protection

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **C**	4-20mA HART	U_{nom} = DC 30 V U_{max} = 250 V
	4-20mA analog	
Option **E**	FOUNDATION Fieldbus	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

Order code for "Output"	Output type	Safety-related values
Option **G**	PROFIBUS PA	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

1) Internal circuit limited by R_i = 760.5 Ω

Ex nA type of protection

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **C**	4-20mA HART	U_{nom} = DC 30 V U_{max} = 250 V
	4-20mA analog	
Option **E**	FOUNDATION Fieldbus	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **G**	PROFIBUS PA	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

1) Internal circuit limited by R_i = 760.5 Ω

XP type of protection

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **C**	4-20mA HART	U_{nom} = DC 30 V U_{max} = 250 V
	4-20mA analog	
Option **E**	FOUNDATION Fieldbus	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

Order code for "Output"	Output type	Safety-related values
Option **G**	PROFIBUS PA	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]

1) Internal circuit limited by R_i = 760.5 Ω

Intrinsically safe values

Ex ia type of protection

Order code for "Output"	Output type	Intrinsically safe values	
Option **A**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **B**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **C**	4-20mA HART 4-20mA analog	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 30 nF	
Option **E**	FOUNDATION Fieldbus	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **G**	PROFIBUS PA	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	

Ex ic type of protection

<table>
<tr><th>Order code for "Output"</th><th>Output type</th><th colspan="2">Intrinsically safe values</th></tr>
<tr><td>Option **A**</td><td>4-20mA HART</td><td colspan="2">U_i = DC 35 V
I_i = n.a.
P_i = 1 W
L_i = 0 µH
C_i = 5 nF</td></tr>
<tr><td rowspan="2">Option **B**</td><td>4-20mA HART</td><td colspan="2">U_i = DC 35 V
I_i = n.a.
P_i = 1 W
L_i = 0 µH
C_i = 5 nF</td></tr>
<tr><td>Pulse/frequency/switch output</td><td colspan="2">U_i = DC 35 V
I_i = n.a.
P_i = 1 W
L_i = 0 µH
C_i = 6 nF</td></tr>
<tr><td rowspan="2">Option **C**</td><td>4-20mA HART</td><td colspan="2" rowspan="2">U_i = DC 30 V
I_i = n.a.
P_i = 1 W
L_i = 0 µH
C_i = 30 nF</td></tr>
<tr><td>4-20mA analog</td></tr>
<tr><td rowspan="2">Option **E**</td><td>FOUNDATION Fieldbus</td><td>STANDARD
U_i = 32 V
I_i = 300 mA
P_i = n.a.
L_i = 10 µH
C_i = 5 nF</td><td>FISCO
U_i = 17.5 V
I_i = n.a.
P_i = n.a.
L_i = 10 µH
C_i = 5 nF</td></tr>
<tr><td>Pulse/frequency/switch output</td><td colspan="2">U_i = 35 V
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P_i = 1 W
L_i = 0 µH
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</table>

IS type of protection

Order code for "Output"	Output type	Intrinsically safe values
Option **A**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF
Option **B**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF

Order code for "Output"	Output type	Intrinsically safe values	
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **C**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 30 nF	
	4-20mA analog		
Option **E**	FOUNDATION Fieldbus	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **G**	PROFIBUS PA	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	

Low flow cut off

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

Galvanic isolation

All outputs are galvanically isolated from one another.

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x54
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	▪ Min. 250 Ω ▪ Max. 500 Ω

Dynamic variables	Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature **Measured variables 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
Device variables	Read out the device variables: HART command 9 The device variables are permanently assigned.

FOUNDATION Fieldbus

Manufacturer ID	0x452B48
Ident number	0x1054
Device revision	1
DD revision **CFF revision**	Information and files under: ▪ www.endress.com ▪ www.fieldbus.org
Device Tester Version (ITK version)	6.1.1
ITK Test Campaign Number	IT094200
Link Master capability (LAS)	Yes
Choice of "Link Master" and "Basic Device"	Yes Factory setting: Basic Device
Node address	Factory setting: 247 (0xF7)
Supported functions	The following methods are supported: ▪ Restart ▪ ENP Restart ▪ Diagnostic
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4

Min. delay between PDU	8
Max. response delay	Min. 5

Transducer Blocks

Block	Contents	Output values
Setup Transducer Block (TRDSUP)	All parameters for standard commissioning.	No output values
Advanced Setup Transducer Block (TRDASUP)	All parameters for more accurate measurement configuration.	No output values
Display Transducer Block (TRDDISP)	Parameters for configuring the local display.	No output values
HistoROM Transducer Block (TRDHROM)	Parameters for using the HistoROM function.	No output values
Diagnostic Transducer Block (TRDDIAG)	Diagnostics information.	Process variables (AI Channel) ▪ Mass flow (11) ▪ Volume flow (9) ▪ Corrected volume flow (13) ▪ Density (14) ▪ Reference density (15) ▪ Temperature (7)
Expert Configuration Transducer Block (TRDEXP)	Parameters that require the user to have in-depth knowledge of the operation of the device in order to configure the parameters appropriately.	No output values
Expert Information Transducer Block (TRDEXPIN)	Parameters that provide information about the state of the device.	No output values
Service Sensor Transducer Block (TRDSRVS)	Parameters that can only be accessed by Endress+Hauser Service.	No output values
Service Information Transducer Block (TRDSRVIF)	Parameters that provide Endress+Hauser Service with information about the state of the device.	No output values
Total Inventory Counter Transducer Block (TRDTIC)	Parameters for configuring all the totalizers and the inventory counter.	Process variables (AI Channel) ▪ Totalizer 1 (16) ▪ Totalizer 2 (17) ▪ Totalizer 3 (18)
Heartbeat Technology Transducer Block (TRDHBT)	Parameters for the configuration and comprehensive information about the results of the verification.	No output values
Heartbeat Results 1 Transducer Block (TRDHBTR1)	Information about the results of the verification.	No output values
Heartbeat Results 2 Transducer Block (TRDHBTR2)	Information about the results of the verification.	No output values
Heartbeat Results 3 Transducer Block (TRDHBTR3)	Information about the results of the verification.	No output values
Heartbeat Results 4 Transducer Block (TRDHBTR4)	Information about the results of the verification.	No output values

Function blocks

Block	Number of blocks	Contents	Process variables (Channel)
Resource Block (RB)	1	This Block (extended functionality) contains all the data that uniquely identify the device; it is the equivalent of an electronic nameplate for the device.	–
Analog Input Block (AI)	6	This Block (extended functionality) receives the measurement data provided by the Sensor Block (can be selected via a channel number) and makes the data available for other blocks at the output. **Execution time:** 27 ms	▪ Temperature (7) ▪ Volume flow (9) ▪ Mass flow (11) ▪ Corrected volume flow (13) ▪ Density (14) ▪ Reference density (15) ▪ Totalizer 1 (16) ▪ Totalizer 2 (17) ▪ Totalizer 3 (18)
Discrete Input Block (DI)	1	This Block (standard functionality) receives a discrete value (e.g. indicator that measuring range has been exceeded) and makes the value available for other blocks at the output. **Execution time:** 19 ms	▪ Status switch output (101) ▪ Low flow cutoff (103) ▪ Empty pipe detection (104) ▪ Status verification (105)
PID Block (PID)	1	This Block (standard functionality) acts as a proportional-integral-differential controller and can be used universally for control in the field. It enables cascading and feedforward control. **Execution time:** 25 ms	–
Multiple Analog Output Block (MAO)	1	This Block (standard functionality) receives several analog values and makes them available for other blocks at the output. **Execution time:** 22 ms	Channel_0 (121) ▪ Value 1: Pressure ▪ Value 2 to 8: Not assigned The pressure must be transmitted to the device in the SI basic unit.
Multiple Digital Output Block (MDO)	1	This Block (standard functionality) receives several discrete values and makes them available for other blocks at the output. **Execution time:** 19 ms	Channel_DO (122) ▪ Value 1: Reset totalizer 1 ▪ Value 2: Reset totalizer 2 ▪ Value 3: Reset totalizer 3 ▪ Value 4: Flow override ▪ Value 5: Start heartbeat verification ▪ Value 6: Status switch output ▪ Value 7: Start zero point adjustment ▪ Value 8: Not assigned
Integrator Block (IT)	1	This Block (standard functionality) integrates a measured variable over time or totalizes the pulses from a Pulse Input Block. The Block can be used as a totalizer that totalizes until a reset, or as a batch totalizer whereby the integrated value is compared against a target value generated before or during the control routine and generates a binary signal when the target value is reached. **Execution time:** 21 ms	–

PROFIBUS PA

Manufacturer ID	0x11
Ident number	0x155F

Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org
Output values (from measuring device to automation system)	**Analog input 1 to 6** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature **Digital input 1 to 2** ▪ Partially filled pipe detection ▪ Low flow cut off ▪ Switch output **Totalizer 1 to 3** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow

Input values
(from automation system to measuring device)
	Analog output
	Pressure
	Digital output 1 to 3 (fixed assignment)
	▪ Digital output 1: switch positive zero return on/off
	▪ Digital output 2: switch switch output on/off
	▪ Digital output 3: Start verification
	Totalizer 1 to 3
	▪ Totalize
	▪ Reset and hold
	▪ Preset and hold
	▪ Operating mode configuration:
	  – Net flow total
	  – Forward flow total
	  – Reverse flow total

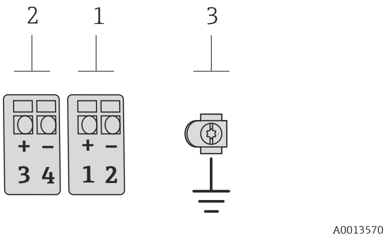
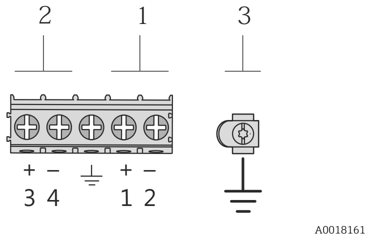
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Local display ▪ Via operating tools (e.g. FieldCare)

Power supply

Terminal assignment

Transmitter

Connection versions

	
Maximum number of terminals, without integrated overvoltage protection	*Maximum number of terminals, with integrated overvoltage protection*

1 Output 1 (passive): supply voltage and signal transmission
2 Output 2 (passive): supply voltage and signal transmission
3 Ground terminal for cable shield

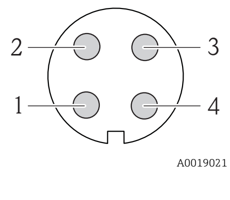
Order code for "Output"	Terminal numbers			
	Output 1		Output 2	
	1 (+)	2 (-)	3 (+)	4 (-)
Option **A**	4-20 mA HART (passive)		-	
Option **B** [1]	4-20 mA HART (passive)		Pulse/frequency/switch output (passive)	
Option **C** [1]	4-20 mA HART (passive)		4-20 mA analog (passive)	
Option **E** [1] [2]	FOUNDATION Fieldbus		Pulse/frequency/switch output (passive)	
Option **G** [1] [3]	PROFIBUS PA		Pulse/frequency/switch output (passive)	

1) Output 1 must always be used; output 2 is optional.
2) FOUNDATION Fieldbus with integrated reverse polarity protection.
3) PROFIBUS PA with integrated reverse polarity protection.

Pin assignment, device plug

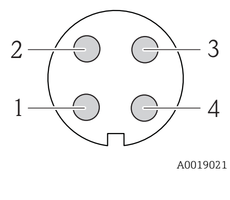
PROFIBUS PA

Device plug for signal transmission (device side)

	Pin		Assignment	Coding	Plug/socket
	1	+	PROFIBUS PA +	A	Plug
	2		Grounding		
	3	-	PROFIBUS PA –		
	4		Not assigned		

FOUNDATION Fieldbus

Device plug for signal transmission (device side)

	Pin		Assignment	Coding	Plug/socket
	1	+	Signal +	A	Plug
	2	-	Signal –		
	3		Not assigned		
	4		Grounding		

Supply voltage

Transmitter

An external power supply is required for each output.

Order code for "Output"	Minimum terminal voltage	Maximum terminal voltage
Option **A** [1] [2]: 4-20 mA HART	For 4 mA: ≥ DC 18 V For 20 mA: ≥ DC 14 V	DC 35 V
Option **B** [1] [2]: 4-20 mA HART, pulse/frequency/switch output	For 4 mA: ≥ DC 18 V For 20 mA: ≥ DC 14 V	DC 35 V
Option **C** [1] [2]: 4-20 mA HART + 4-20 mA analog	For 4 mA: ≥ DC 18 V For 20 mA: ≥ DC 14 V	DC 30 V
Option **E** [3]: FOUNDATION Fieldbus, pulse/frequency/ switch output	≥DC 9 V	DC 32 V
Option **G** [3]: PROFIBUS PA, pulse/frequency/switch output	≥DC 9 V	DC 32 V

1) External supply voltage of the power supply unit with load.
2) For device versions with SD03 local display: The terminal voltage must be increased by DC 2 V if backlighting is used.
3) For device version with SD03 local display: The terminal voltage must be increased by DC 0.5 V if backlighting is used.

For information about the load see (→ 🗎 11)

Various power supply units can be ordered from Endress+Hauser: see "Accessories" section (→ 🗎 80)

For information on the Ex connection values (→ 🗎 11)

Power consumption

Transmitter

Order code for "Output"	Maximum power consumption
Option **A**: 4-20 mA HART	770 mW
Option **B**: 4-20 mA HART, pulse/ frequency/switch output	▪ Operation with output 1: 770 mW ▪ Operation with output 1 and 2: 2 770 mW
Option **C**: 4-20 mA HART + 4-20 mA analog	▪ Operation with output 1: 660 mW ▪ Operation with output 1 and 2: 1 320 mW
Option **E**: FOUNDATION Fieldbus, pulse/ frequency/switch output	▪ Operation with output 1: 512 mW ▪ Operation with output 1 and 2: 2 512 mW
Option **G**: PROFIBUS PA, pulse/frequency/ switch output	▪ Operation with output 1: 512 mW ▪ Operation with output 1 and 2: 2 512 mW

For information on the Ex connection values (→ 🗎 11)

Current consumption

Current output

For every 4-20 mA or 4-20 mA HART current output: 3.6 to 22.5 mA

If the option **Defined value** is selected in the **Failure mode** parameter : 3.59 to 22.5 mA

PROFIBUS PA

16 mA

FOUNDATION Fieldbus

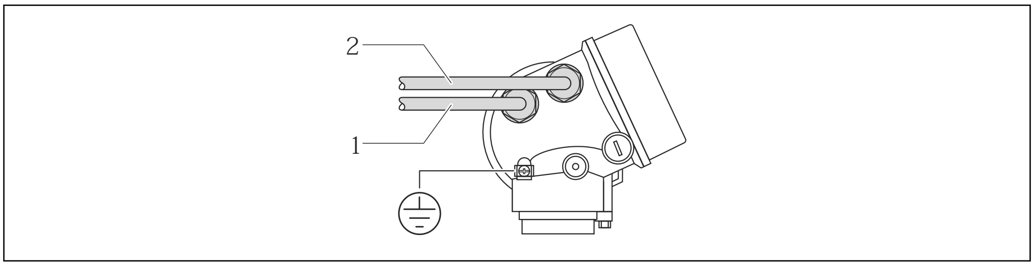
18 mA

Power supply failure

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

Electrical connection

Connecting the transmitter



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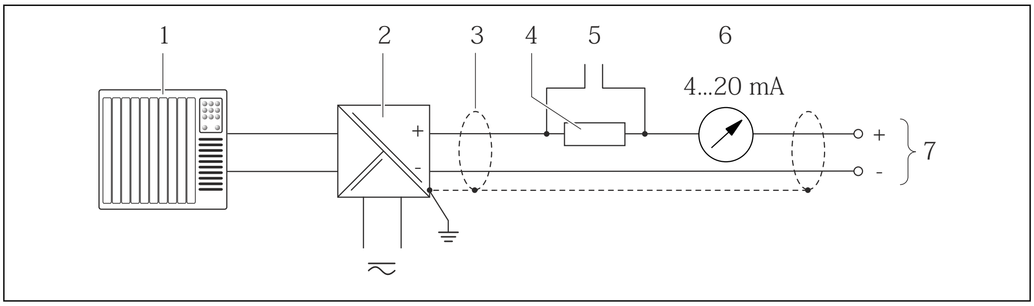
1 Cable entry for output 1
2 Cable entry for output 2

Connection examples

Current output 4-20 mA HART

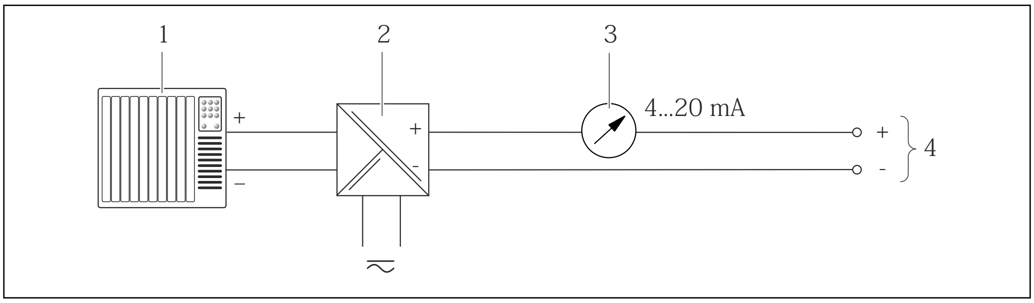


A0015511

1 Connection example for 4-20 mA HART current output (passive)

1 Automation system with current input (e.g. PLC)
2 Active barrier for power supply (e.g. RN221N) (→ 26)
3 Cable shield, observe cable specifications (→ 26)
4 Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 11)
5 Connection for HART operating devices
6 Analog display unit: observe maximum load (→ 11)
7 Transmitter

Current output 4-20 mA

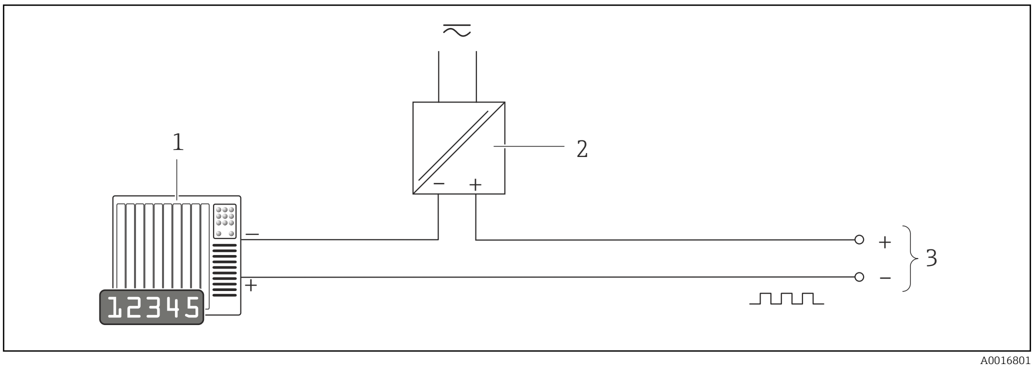


A0015512

2 Connection example for 4-20 mA current output (passive)

1 Automation system with current input (e.g. PLC)
2 Active barrier for power supply (e.g. RN221N)
3 Analog display unit: observe maximum load (→ 11)
4 Transmitter

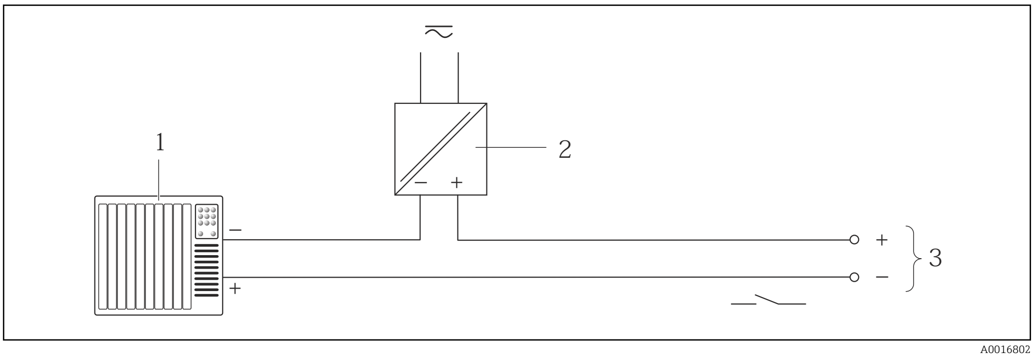
Pulse/frequency output



3 *Connection example for pulse/frequency output (passive)*

1 *Automation system with pulse/frequency input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: observe input values*

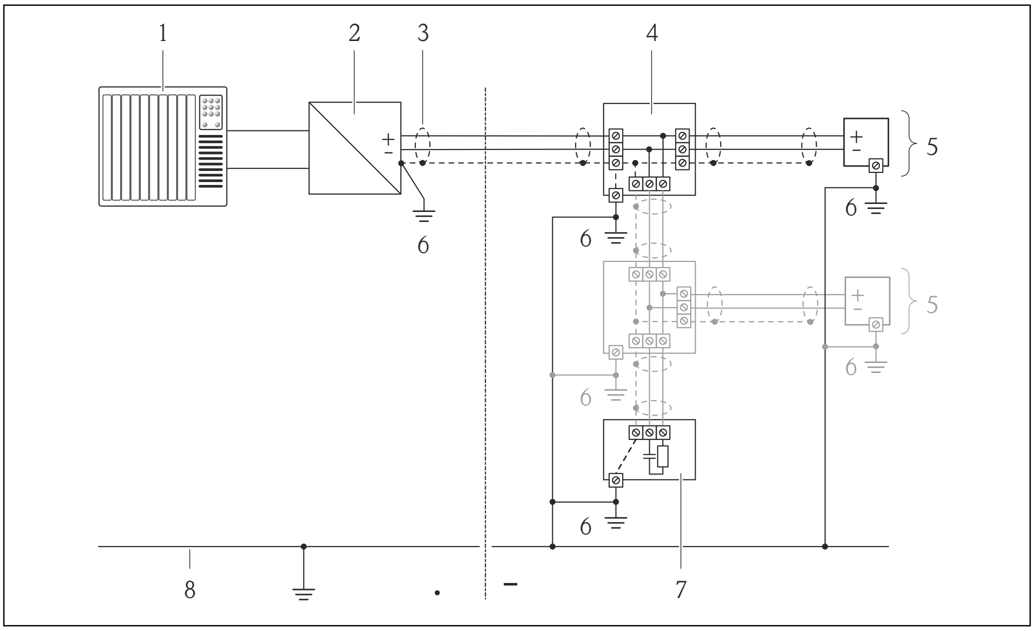
Switch output



4 *Connection example for switch output (passive)*

1 *Automation system with switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: observe input values*

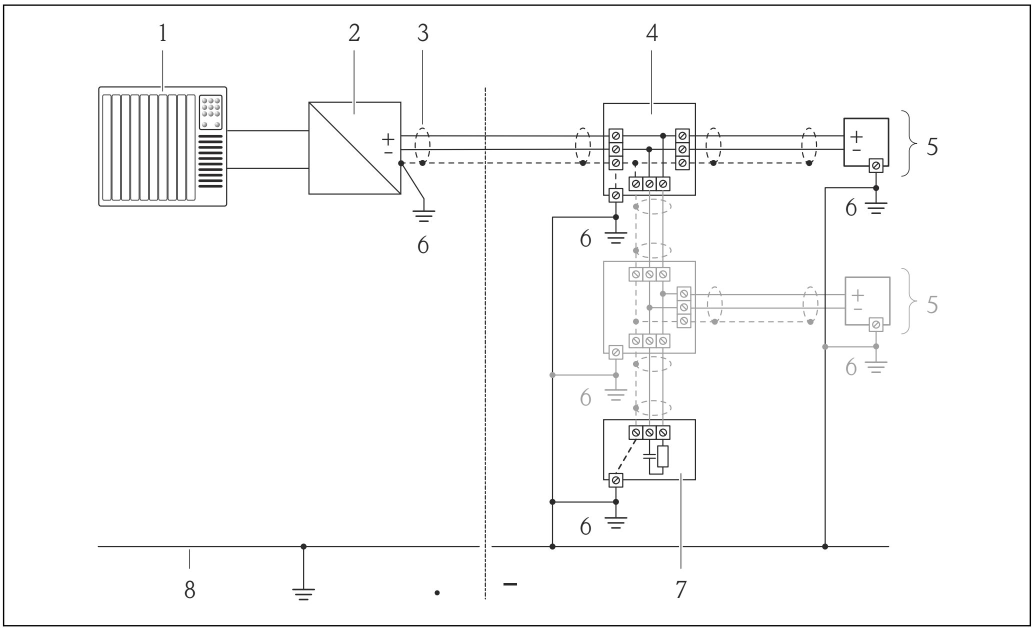
PROFIBUS-PA



5 Connection example for PROFIBUS-PA

1 *Control system (e.g. PLC)*
2 *Segment coupler PROFIBUS DP/PA*
3 *Cable shield*
4 *T-box*
5 *Measuring device*
6 *Local grounding*
7 *Bus terminator*
8 *Potential matching line*

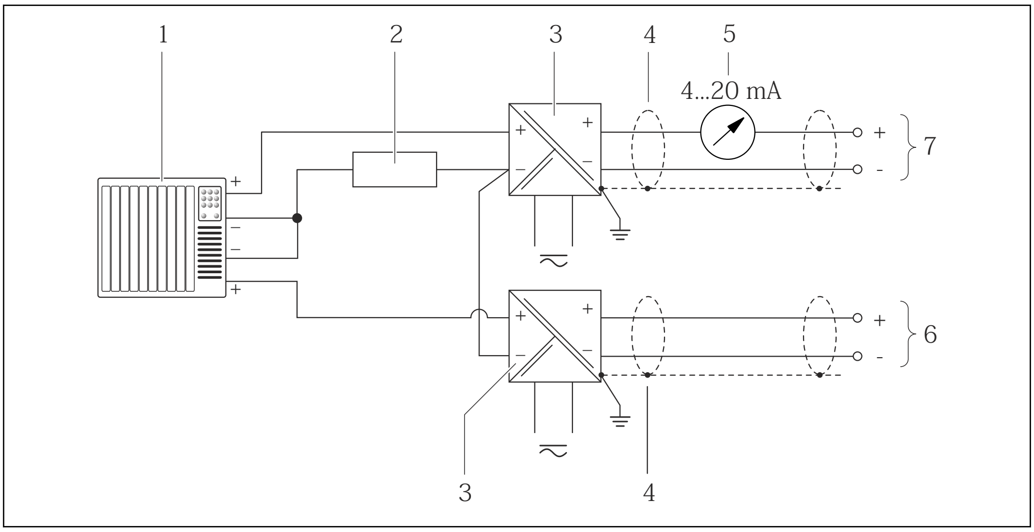
FOUNDATION Fieldbus



6 *Connection example for FOUNDATION Fieldbus*

1 *Control system (e.g. PLC)*
2 *Power Conditioner (FOUNDATION Fieldbus)*
3 *Cable shield*
4 *T-box*
5 *Measuring device*
6 *Local grounding*
7 *Bus terminator*
8 *Potential matching line*

HART input



7 *Connection example for HART input with a common negative*

1 *Automation system with HART output (e.g. PLC)*
2 *Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 11)*
3 *Active barrier for power supply (e.g. RN221N)*
4 *Cable shield, observe cable specifications (→ 26)*
5 *Analog display unit: observe maximum load (→ 11)*
6 *Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements (→ 7)*
7 *Transmitter*

Potential equalization

Requirements

No special measures for potential equalization are required.

For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

Terminals

- For device version without integrated overvoltage protection: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- For device version with integrated overvoltage protection: screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 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: NPT ½"
  - 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)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Signal cable

Current output

- For 4-20 mA: standard installation cable is sufficient.
- For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

FOUNDATION Fieldbus

Twisted, shielded two-wire cable.

For further information on planning and installing FOUNDATION Fieldbus networks see:
- Operating Instructions for "FOUNDATION Fieldbus Overview" (BA00013S)
- FOUNDATION Fieldbus Guideline
- IEC 61158-2 (MBP)

PROFIBUS PA

Twisted, shielded two-wire cable. Cable type A is recommended.

For further information on planning and installing PROFIBUS PA networks see:
- Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)
- PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline"
- IEC 61158-2 (MBP)

Overvoltage protection

The device can be ordered with integrated overvoltage protection for diverse approvals:
Order code for "Accessory mounted", option NA "Overvoltage protection"

Input voltage range	Values correspond to supply voltage specifications [1)]
Resistance per channel	2 ·0.5 Ω max
DC sparkover voltage	400 to 700 V
Trip surge voltage	<800 V
Capacitance at 1 MHz	<1.5 pF

Nominal discharge current (8/20 µs)	10 kA
Temperature range	−40 to +85 °C (−40 to +185 °F)

1) The voltage is reduced by the amount of the internal resistance $I_{min} \cdot R_i$

Depending on the temperature class, restrictions apply to the ambient temperature for device versions with overvoltage protection (→ 34)

Performance characteristics

Reference operating conditions

- Error limits based on ISO 11631
- Water with +15 to +45 °C (+59 to +113 °F) at2 to 6 bar (29 to 87 psi)
- Specifications as per calibration protocol
- Accuracy based on accredited calibration rigs that are traced to ISO 17025.

To obtain measured errors, use the *Applicator* sizing tool (→ 79)

Maximum measured error

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

Base accuracy

Mass flow and volume flow (liquids)
±0.10 %

Mass flow (gases)
±0.35 % o.r.

Design fundamentals (→ 30)

Density (liquids)
- Reference conditions:±0.0005 g/cm³
- Standard density calibration:±0.01 g/cm³
  (valid over the entire temperature range and density range)
- Wide-range density specification (order code for "Application package", option EF "Special density and concentration ") : ±0.001 g/cm³ (valid range for special density calibration: 0 to 2 g/cm³, +5 to +80 °C (+41 to +176 °F))

Temperature
±0.5 °C ± 0.005 · T °C (±0.9 °F ± 0.003 · (T − 32) °F)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
8	⅜	0.180	0.007
15	½	0.585	0.021
25	1	1.62	0.059
40	1½	4.05	0.149
50	2	6.30	0.231
80	3	16.2	0.617

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
8	2 000	200	100	40	20	4
15	6 500	650	325	130	65	13
25	18 000	1 800	900	360	180	36
40	45 000	4 500	2 250	900	450	90
50	70 000	7 000	3 500	1 400	700	140
80	180 000	18 000	9 000	3 600	1 800	360

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[inch]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
⅜	73.50	7.350	3.675	1.470	0.735	0.147
½	238.9	23.89	11.95	4.778	2.389	0.478
1	661.5	66.15	33.08	13.23	6.615	1.323
1½	1 654	165.4	82.70	33.08	16.54	3.308
2	2 573	257.3	128.7	51.46	25.73	5.146
3	6 615	661.5	330.8	132.3	66.15	13.23

Accuracy of outputs

o.r. = of reading

Current output

Accuracy	±10 µA

Pulse/frequency output

Accuracy	Max. ±100 ppm o.r.

Repeatability

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

Base repeatability

Mass flow and volume flow (liquids)
±0.05 % o.r.

Mass flow (gases)
±0.25 % o.r.

Design fundamentals (→ 30)

Density (liquids)
±0.00025 g/cm³

Temperature
±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0015 · (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

o.r. = of reading

Current output

Additional error, in relation to the span of 16 mA:

Temperature coefficient at zero point (4 mA)	0.02 %/10 K
Temperature coefficient with span (20 mA)	0.05 %/10 K

Pulse/frequency output

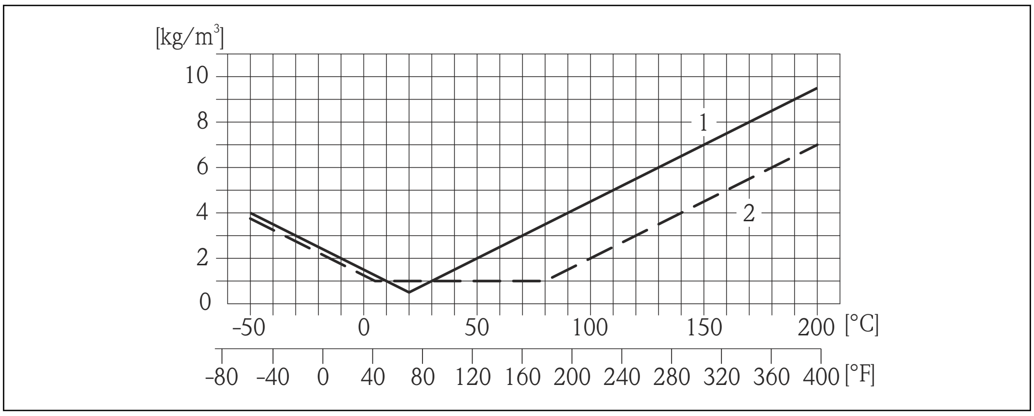
Temperature coefficient	Max. ±100 ppm o.r.

Influence of medium temperature

Mass flow and volume flow
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).

Density
When there is a difference between the density calibration temperature and the process temperature, the typical measured error of the sensor is
±0.00005 g/cm³ /°C (±0.000025 g/cm³ /°F). Field density calibration is possible.

Wide-range density specification (special density calibration)
If the process temperature is outside the valid range (→ 27) the measured error is
±0.00005 g/cm³ /°C (±0.000025 g/cm³ /°F)



1 *Field density calibration, for example at +20 °C (+68 °F)*
2 *Special density calibration*

Temperature
±0.005 · T °C (±0.005 · (T – 32) °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]	[% o.r./psi]
[mm]	[in]		
8	3/8	no influence	
15	½	no influence	
25	1	no influence	

DN		[% o.r./bar]	[% o.r./psi]
[mm]	[in]		
40	1½	–0.003	–0.0002
50	2	–0.008	–0.0006
80	3	–0.009	–0.0006

Design fundamentals

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

BaseAccu = base accuracy in % o.r., BaseRepeat = base repeatability in % o.r.

MeasValue = measured value; ZeroPoint = zero point stability

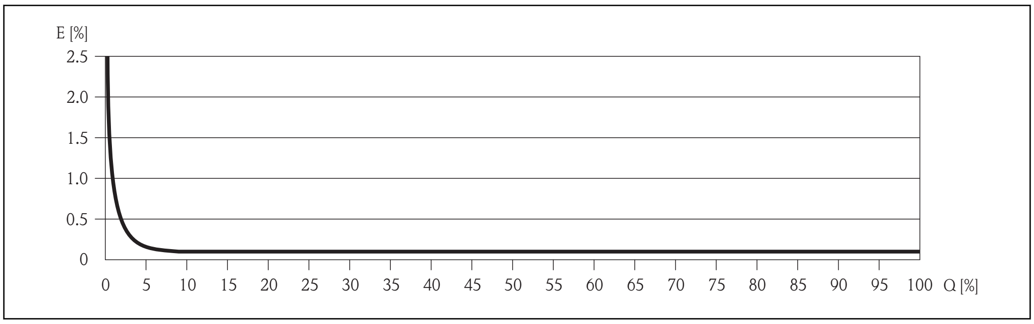
Calculation of the maximum measured error as a function of the flow rate

Flow rate	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021332	$\pm$ BaseAccu A0021339
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021333	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021334

Calculation of the maximum repeatability as a function of the flow rate

Flow rate	Maximum repeatability in % o.r.
$\geq \frac{4/3 \cdot \text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021341	$\pm$ ½ · BaseAccu A0021343
$< \frac{4/3 \cdot \text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021342	$\pm 2/3 \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021344

Example for max. measured error



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E Error: Maximum measured error as % o.r. (example)
Q Flow rate as %

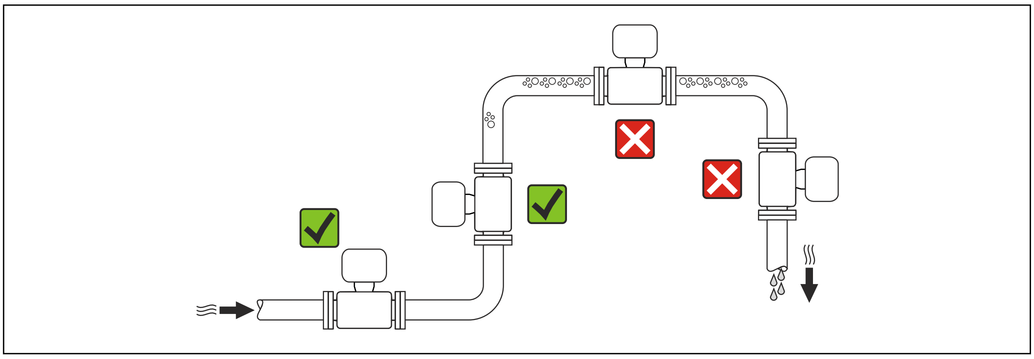
Design fundamentals (→ 30)

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.



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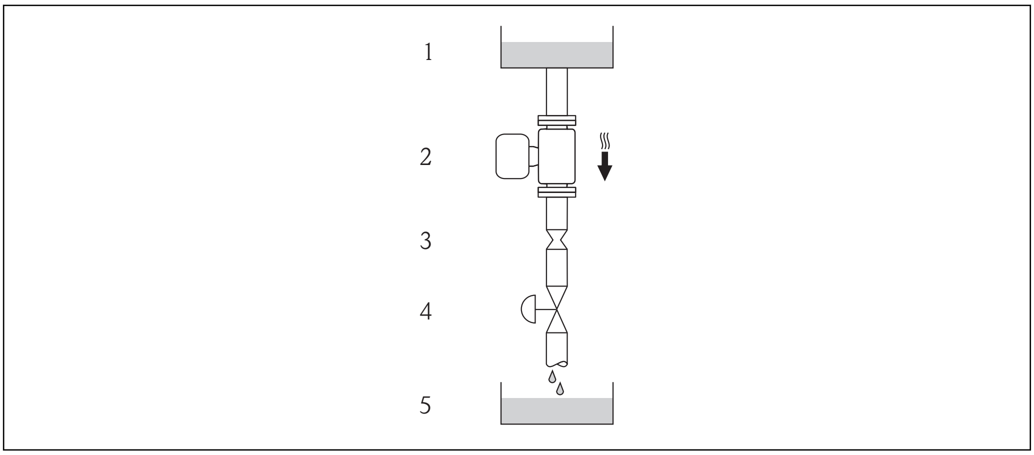
Installation in down pipes

However, the following installation suggestion allows for installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



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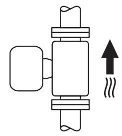
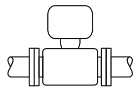
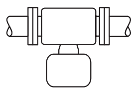
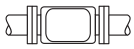
8 Installation in a down pipe (e.g. for batching applications)

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	⅜	6	0.24
15	½	10	0.40
25	1	14	0.55
40	1½	22	0.87
50	2	28	1.10
80	3	50	1.97

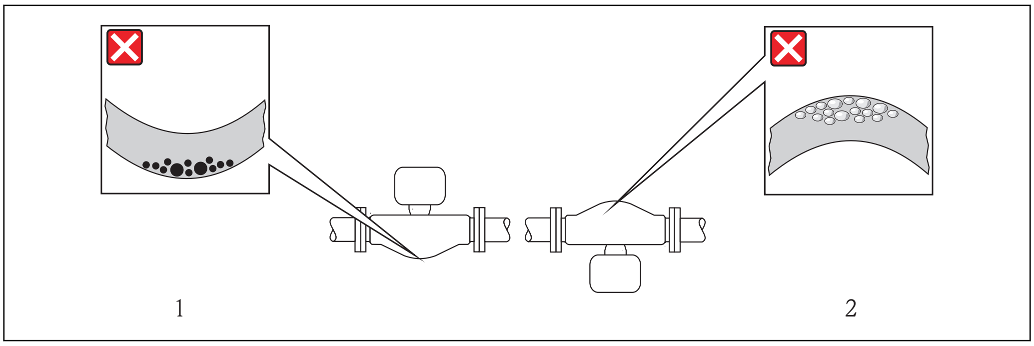
Orientation

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

Orientation			Recommendation
A	Vertical orientation	 A0015591	✓✓
B	Horizontal orientation, transmitter head up	 A0015589	✓✓ [1] Exception: (→ 9, 32)
C	Horizontal orientation, transmitter head down	 A0015590	✓✓ [2] Exception: (→ 9, 32)
D	Horizontal orientation, transmitter head at side	 A0015592	✗

1) Applications with low process temperatures may reduce the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

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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9 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 (→ 46).

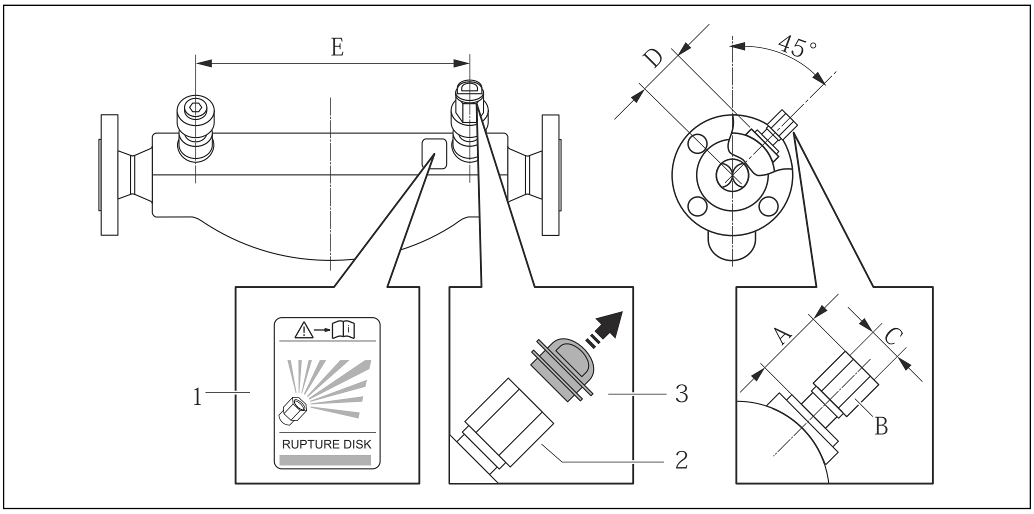
Special mounting instructions

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 on a sticker beside it. For additional information that is relevant to the process (→ 46).

The existing connecting nozzles are not intended for the purpose of rinsing or pressure monitoring, but instead serve as the mounting location for the rupture disk.

However, by means of the connection available on the rupture disk holder, the escaping fluid (in case of a disk rupture) can be collected by connecting a suitable relief system.



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

DN		A		B	C	D		E	
[mm]	[in]	[mm]	[in]	[in]	[in]	[mm]	[in]	[mm]	[in]
8	⅜	Approx.42	Approx.1.65	AF 1	½ NPT	62	2.44	216	8.50
15	½	Approx.42	Approx.1.65	AF 1	½ NPT	62	2.44	220	8.66
25	1	Approx.42	Approx.1.65	AF 1	½ NPT	62	2.44	260	10.24
40	1½	Approx.42	Approx.1.65	AF 1	½ NPT	67	2.64	310	12.20
50	2	Approx.42	Approx.1.65	AF 1	½ NPT	79	3.11	452	17.78
80	3	Approx.42	Approx.1.65	AF 1	½ NPT	101	3.98	560	22.0

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions (→ 📄 27). Therefore, a zero point adjustment in the field is generally not required.

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

Environment

Ambient temperature range

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.

ℹ Weather protection covers can be ordered from Endress+Hauser: see "Accessories" section (→ 📄 78)

Temperature tables

In the following tables, the following interdependencies between the maximum medium temperature T_m for T1 to T6 and the maximum ambient temperature T_a apply when operating the device in hazardous areas.

Order code for "Output", option A "4-20mA HART"

- Ex ia, Ex ic, Ex nA, Ex d
- $_C$CSA$_{US}$ IS, $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40 1)	50	95 2)	130 3)	150 4)	150 5)	150 5)
60 1)	–	95 2)	130 3)	150 4)	150 5)	150 5)

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval codes IB, ID, IH, IJ, I4, BB, BD, BH, BJ, B2, C2, C5: T_a = T_a - 2 °C
2) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
3) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
4) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
5) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104 1)	122	203 2)	266 3)	302 4)	302 5)	302 5)
140 1)	–	203 2)	266 3)	302 4)	302 5)	302 5)

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval codes IB, ID, IH, IJ, I4, BB, BD, BH, BJ, B2, C2, C5: T_a = T_a - 3.6 °F
2) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
3) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
4) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
5) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F

Order code for "Output", option B "4-20mA HART, pulse/frequency/switch output"

- Ex ia, Ex ic
- $_C$CSA$_{US}$ IS

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
35 1) 2)	50	95 3)	130 4)	150 5)	150 6)	150 6)
50 7) 2)	–	95 3)	130 4)	150 5)	150 6)	150 6)
60	–	–	130 4)	150 5)	150 6)	150 6)

1) T_a = 40 °C for pulse/frequency/switch output P_i ≤ 0.85 W
2) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6: T_a = T_a - 2 °C
3) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
4) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
5) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
6) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C
7) T_a = 55 °C for pulse/frequency/switch output P_i ≤ 0.85 W

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
95 [1) 2)]	122	203 [3)]	266 [4)]	302 [5)]	302 [6)]	302 [6)]
122 [7) 2)]	–	203 [3)]	266 [4)]	302 [5)]	302 [6)]	302 [6)]
140	–	–	266 [4)]	302 [5)]	302 [6)]	302 [6)]

1) T_a = 104 °F for pulse/frequency/switch output $P_i \leq 0.85$ W
2) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6: $T_a = T_a - 3.6$ °F
3) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
4) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
5) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
6) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F
7) T_a = 131 °F for pulse/frequency/switch output $P_i \leq 0.85$ W

Order code for "Output", option B "4-20mA HART, pulse/frequency/switch output"
- Ex d, Ex nA
- $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	50	95 [1)]	130 [2)]	150 [3)]	150 [4)]	150 [4)]
50 [5)]	–	95 [1)]	130 [2)]	150 [3)]	150 [4)]	150 [4)]
60	–	–	130 [2)]	150 [3)]	150 [4)]	150 [4)]

1) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
2) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
3) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
4) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C
5) T_a = 55 °C for pulse/frequency/switch output $P_i \leq 0.85$ W

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	122	203 [1)]	266 [2)]	302 [3)]	302 [4)]	302 [4)]
122 [5)]	–	203 [1)]	266 [2)]	302 [3)]	302 [4)]	302 [4)]
140	–	–	266 [2)]	302 [3)]	302 [4)]	302 [4)]

1) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
2) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
3) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
4) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F
5) T_a = 131 °F for pulse/frequency/switch output $P_i \leq 0.85$ W

Order code for "Output", option C "4-20mA HART, 4-20mA analog"
- Ex ia
- $_C$CSA$_{US}$ IS

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
35 [1)]	50	95 [2)]	130 [3)]	150 [4)]	150 [5)]	150 [5)]
50 [1)]	–	95 [2)]	130 [3)]	150 [4)]	150 [5)]	150 [5)]
60	–	–	130 [3)]	150 [4)]	150 [5)]	150 [5)]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6: $T_a = T_a$ - 2 °C
2) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
3) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
4) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
5) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
95 [1)]	122	203 [2)]	266 [3)]	302 [4)]	302 [5)]	302 [5)]
122	–	203 [2)]	266 [3)]	302 [4)]	302 [5)]	302 [5)]
140	–	–	266 [3)]	302 [4)]	302 [5)]	302 [5)]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6: $T_a = T_a$ - 3.6 °F
2) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
3) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
4) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
5) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F

Order code for "Output", option C "4-20mA HART, 4-20mA analog"
- Ex ic, Ex d, Ex nA
- $_{C}CSA_{US}$ XP, $_{C}CSA_{US}$ NI

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40 [1)]	50	95 [2)]	130 [3)]	150 [4)]	150 [5)]	150 [5)]
55 [1)]	–	95 [2)]	130 [3)]	150 [4)]	150 [5)]	150 [5)]
60	–	–	130 [3)]	150 [4)]	150 [5)]	150 [5)]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval codes ID, IG, IH, BD, BH, C4, C7: $T_a = T_a$ - 2 °C
2) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
3) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
4) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
5) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104 [1)]	122	203 [2)]	266 [3)]	302 [4)]	302 [5)]	302 [5)]
131	–	203 [2)]	266 [3)]	302 [4)]	302 [5)]	302 [5)]
140	–	–	266 [3)]	302 [4)]	302 [5)]	302 [5)]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval codes ID, IG, IH, BD, BH, C4, C7: T_a = T_a - 3.6 °F
2) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
3) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
4) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
5) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F

Order code for "Output", option E "FOUNDATION Fieldbus, pulse/frequency/switch output" and option G "PROFIBUS PA, pulse/frequency/switch output"

- Ex ia, Ex ic
- $_C$CSA$_{US}$ IS

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40 [1) 5)]	50	95 [2)]	130 [3)]	150 [6)]	150 [7)]	150 [7)]
55 [4) 5)]	–	95 [2)]	130 [3)]	150 [6)]	150 [7)]	150 [7)]
60	–	–	130 [3)]	150 [6)]	150 [7)]	150 [7)]

1) T_a = 50 °C without pulse/frequency/switch output
2) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
3) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
4) T_a = 60 °C without pulse/frequency/switch output
5) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6: T_a = T_a - 2 °C
6) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
7) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104 [1) 5)]	122	203 [2)]	266 [3)]	302 [6)]	302 [7)]	302 [7)]
104 [4) 5)]	–	203 [2)]	266 [3)]	302 [6)]	302 [7)]	302 [7)]
140	–	–	266 [3)]	302 [6)]	302 [7)]	302 [7)]

1) T_a = 122 °F without pulse/frequency/switch output
2) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
3) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
4) T_a = 131 °F without pulse/frequency/switch output
5) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6: T_a = T_a - 3.6 °F
6) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
7) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F

Order code for "Output", option E "FOUNDATION Fieldbus, pulse/frequency/switch output" and option G "PROFIBUS PA, pulse/frequency/switch output"

- Ex d, Ex nA
- $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40 1)	50	95 2)	130 3)	150 4)	150 5)	150 5)
55 6) 7)	–	95 2)	130 3)	150 4)	150 5)	150 5)
60	–	–	130 3)	150 4)	150 5)	150 5)

1) T_a = 50 °C without pulse/frequency/switch output
2) The following applies for sensors with a nominal diameter DN 80: T_m = 85 °C
3) The following applies for sensors with a nominal diameter DN 80: T_m = 110 °C
4) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 170 °C
5) The following applies for specified sensors with a maximum medium temperature T_m = 200 °C: T_m = 200 °C
6) T_a = 60 °C without pulse/frequency/switch output
7) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approvals ID, IH, BD, BH: $T_a = T_a$ - 2 °C

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104 1)	122	203 2)	266 3)	302 4)	302 5)	302 5)
104 6) 7)	–	203 2)	266 3)	302 4)	302 5)	302 5)
140	–	–	266 3)	302 4)	302 5)	302 5)

1) T_a = 122 °F without pulse/frequency/switch output
2) The following applies for sensors with a nominal diameter DN 3": T_m = 185 °F
3) The following applies for sensors with a nominal diameter DN 3": T_m = 230 °F
4) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 338 °F
5) The following applies for specified sensors with a maximum medium temperature T_m = 392 °F: T_m = 392 °F
6) T_a = 131 °F without pulse/frequency/switch output
7) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approvals ID, IH, BD, BH: $T_a = T_a$ - 3.6 °F

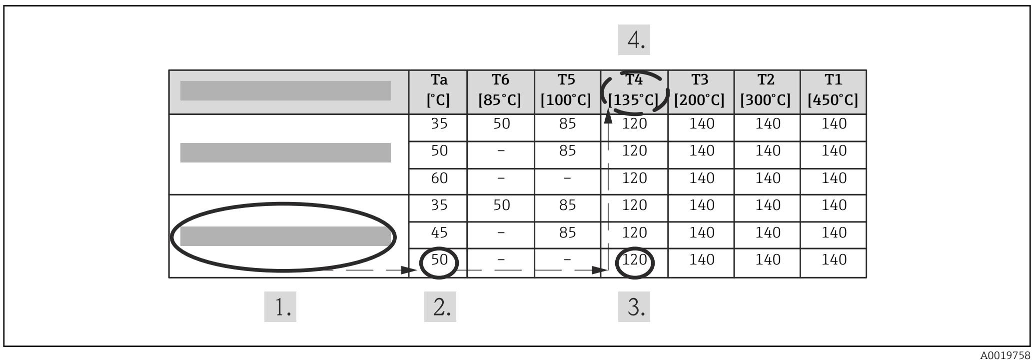
Explosion hazards arising from gas and dust

Determining the temperature class and surface temperature with the temperature table

- In the case of gas: Determine the temperature class as a function of the ambient temperature T_a and the medium temperature T_m.
- In the case of dust: Determine the maximum surface temperature as a function of the maximum ambient temperature T_a and the maximum medium temperature T_m.

Example

- Measured maximum ambient temperature: T_{ma} = 47 °C
- Measured maximum medium temperature: T_{mm} = 108 °C



10 *Procedure for determining the maximum surface temperature*

1. Select device (optional).

2. In the column for the maximum ambient temperature T_a select the temperature that is immediately greater than or equal to the measured maximum ambient temperature T_{ma} that is present.
   - ↳ T_a = 50 °C.

     The row showing the maximum medium temperature is determined.
3. Select the maximum medium temperature T_m of this row, which is larger or equal to the measured maximum medium temperature T_{mm}.
   - ↳ The column with the temperature class for gas is determined: 108 °C ≤ 120°C → T4.
4. The maximum temperature of the temperature class determined corresponds to the maximum surface temperature for dust: T4 = 135 °C

Storage temperature

All components apart from the display modules:
−40 to +80 °C (−40 to +176 °F), preferably at +20 °C (+68 °F)

Display modules

−40 to +80 °C (−40 to +176 °F)

Climate class

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

Degree of protection

Transmitter
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Sensor
IP66/67, type 4X enclosure

Device plugs
IP67, only in screwed situation

Shock resistance

As per IEC/EN 60068-2-31

Vibration resistance

Acceleration up to 1 g, 10 to 150 Hz, based on IEC/EN 60068-2-6

Interior cleaning

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

Electromagnetic compatibility (EMC)

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

For details refer to the Declaration of Conformity.

Process

Medium temperature range

Sensor
- −50 to +150 °C (−58 to +302 °F)
- −50 to +200 °C (−58 to +392 °F) with extended temperature (order code for "Measuring tube mat.", option SD, SE, SF, TH)

Seals
No internal seals

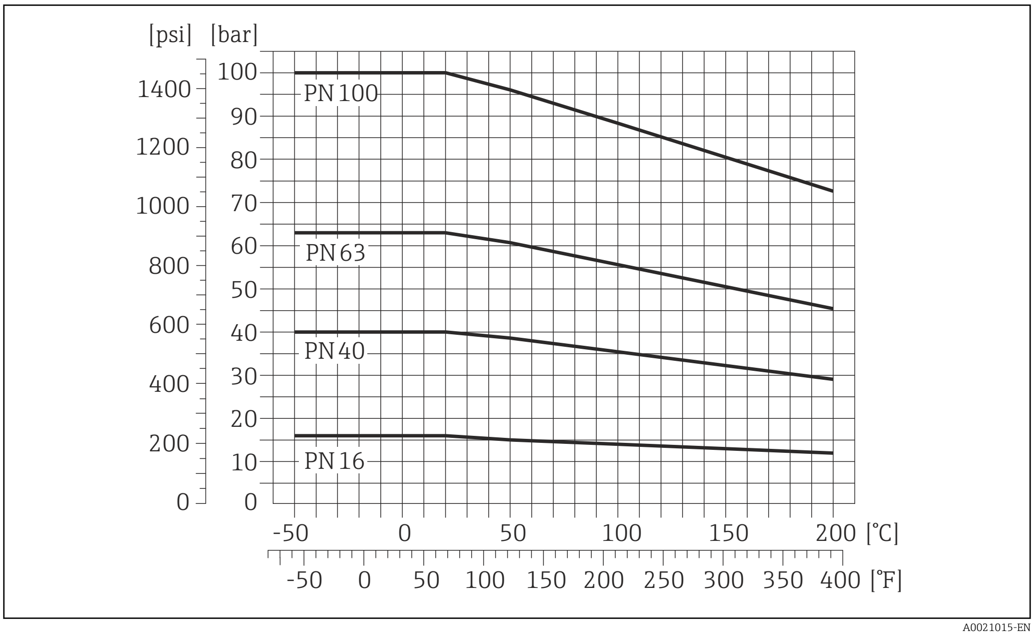
Density

0 to 2 000 kg/m³ (0 to 125 lb/cf)

Pressure-temperature ratings

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

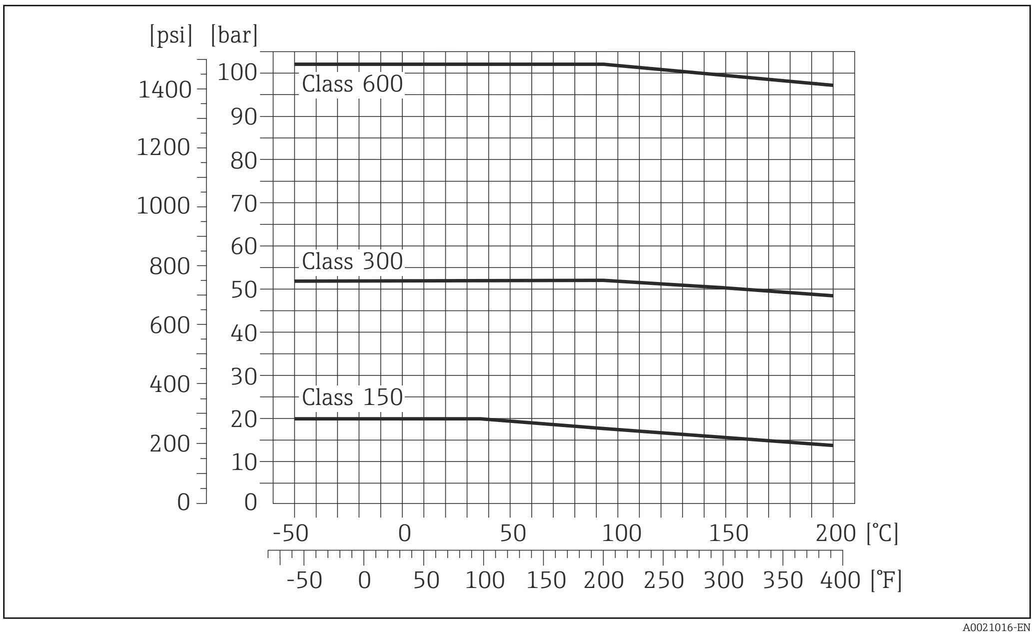
Flange connection according to EN 1092-1 (DIN 2501)



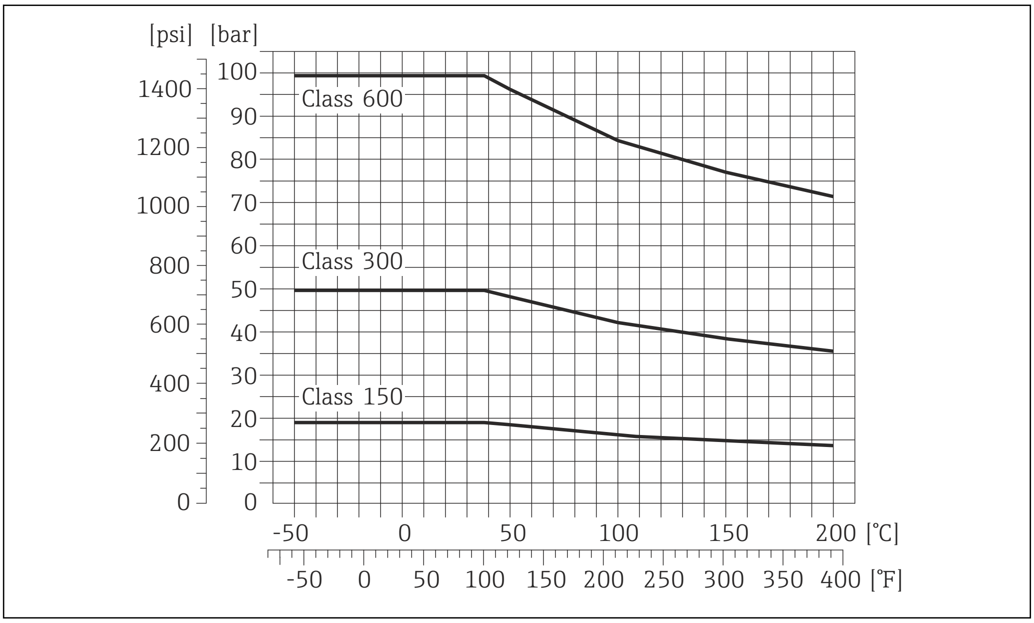
11 *With flange material 1.4404 (F316/F316L), Alloy C22*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

Flange connection according to ASME B16.5



12 *With flange material Alloy C22*

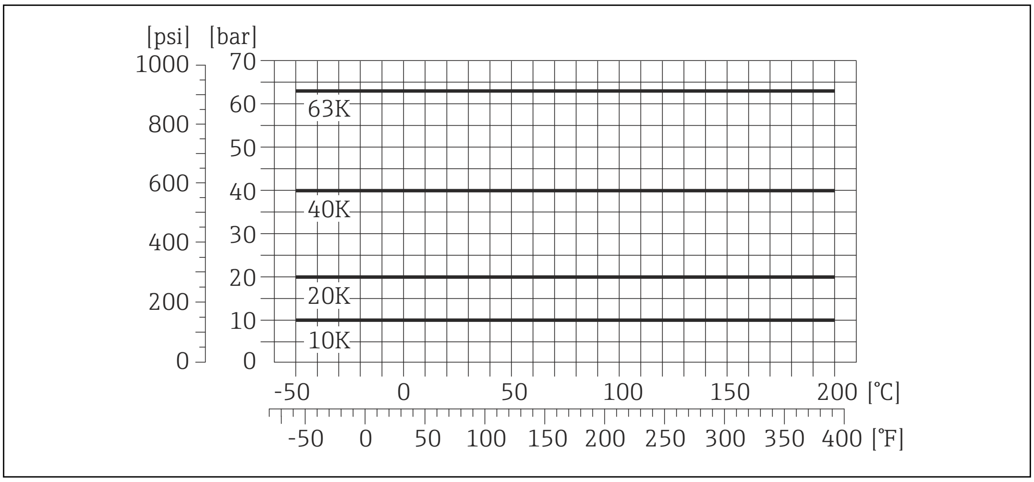


A0021017-EN

13 *With flange material 1.4404 (F316/F316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

Flange connection according to JIS B2220

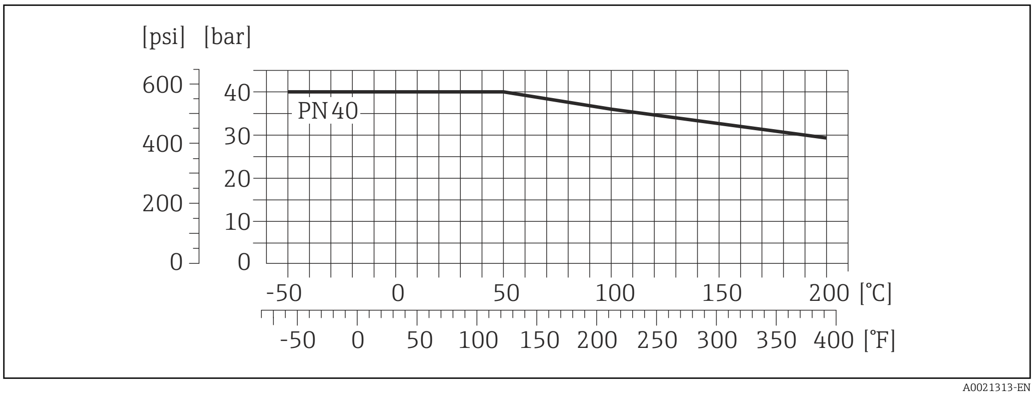


A0021018-EN

14 *With flange material 1.4404 (F316/F316L), Alloy C22*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

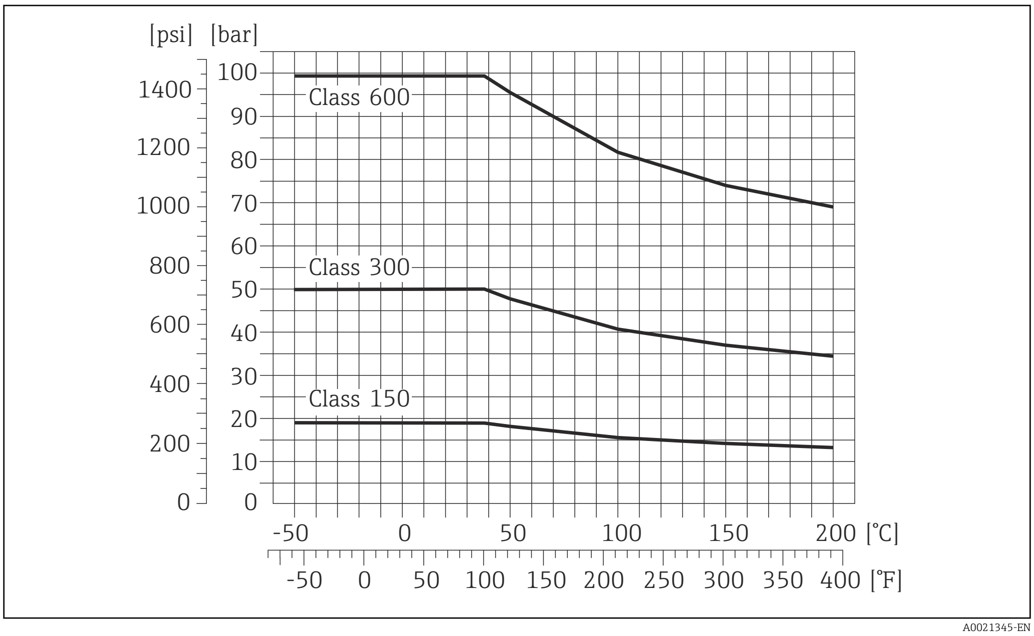
Lap joint flange according to EN 1092-1 (DIN 2501)



15 *With flange material 1.4301 (F304); wetted parts Alloy C22*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option TH

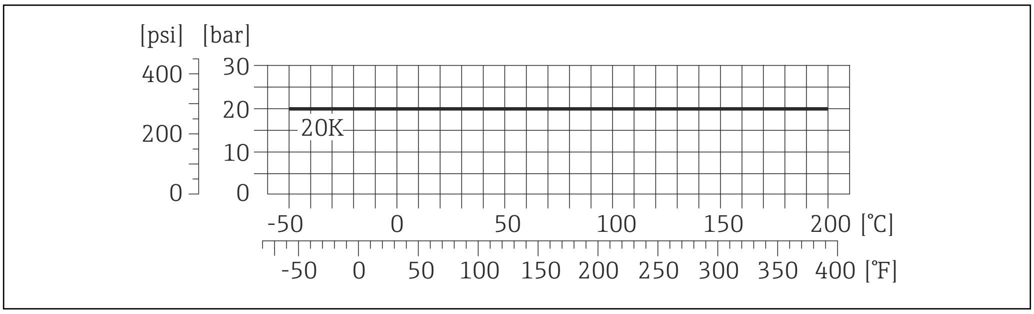
Lap joint flange according to ASME B16.5



16 *With flange material 1.4301 (F304); wetted parts Alloy C22*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option TH

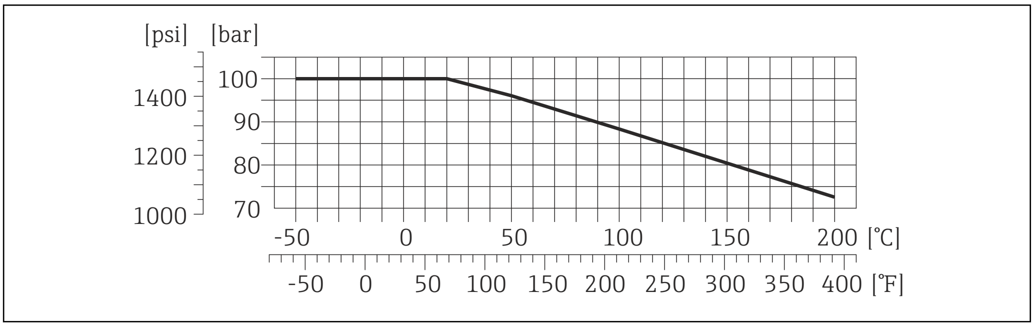
Lap joint flange according to JIS B2220



17 *With flange material 1.4301 (F304); wetted parts Alloy C22*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option TH

VCO process connection



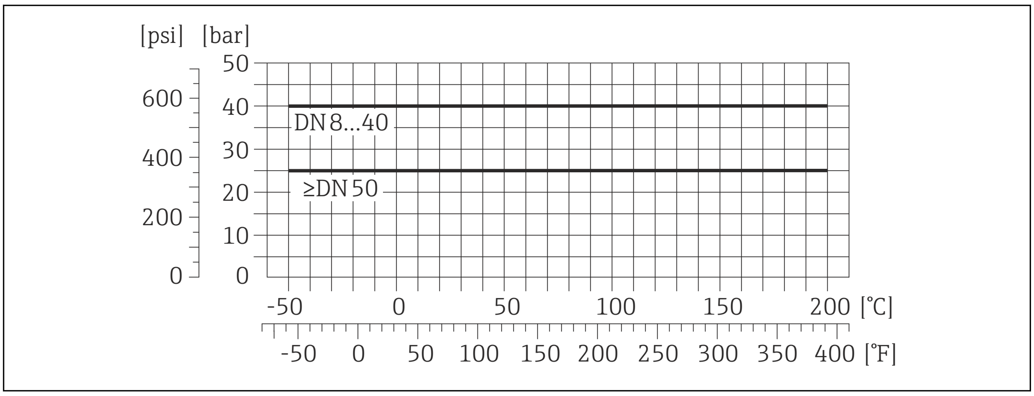
18 *With connection material 1.4404 (316/316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

Tri-Clamp

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

Process connection to DIN 11851

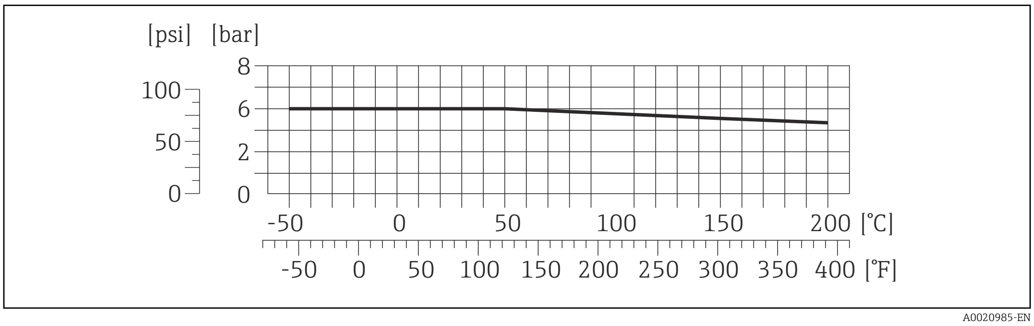


19 *With connection material 1.4404 (316/316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

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

Process connection to SMS 1145

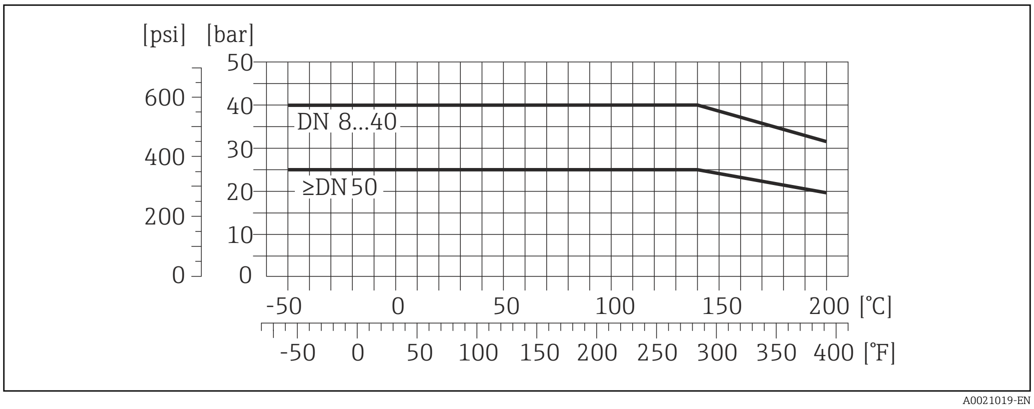


20 *With connection material 1.4404 (316/316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

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

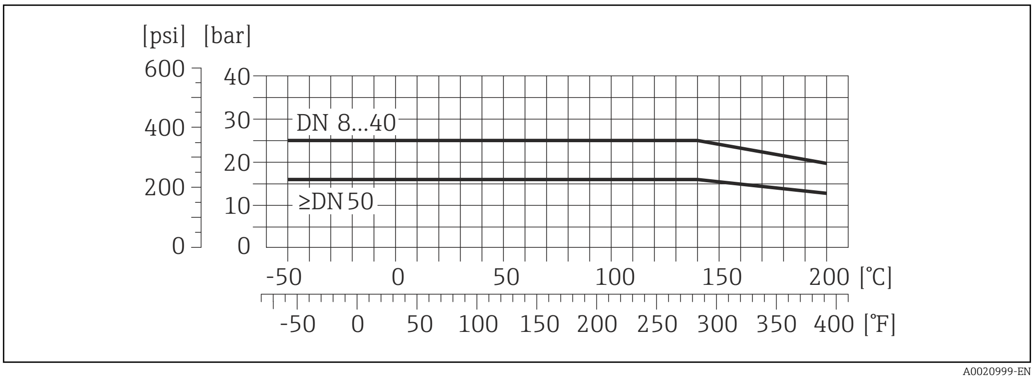
Aseptic threaded adapter as per DIN 11864-1 Form A



21 *With connection material 1.4404 (316/316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

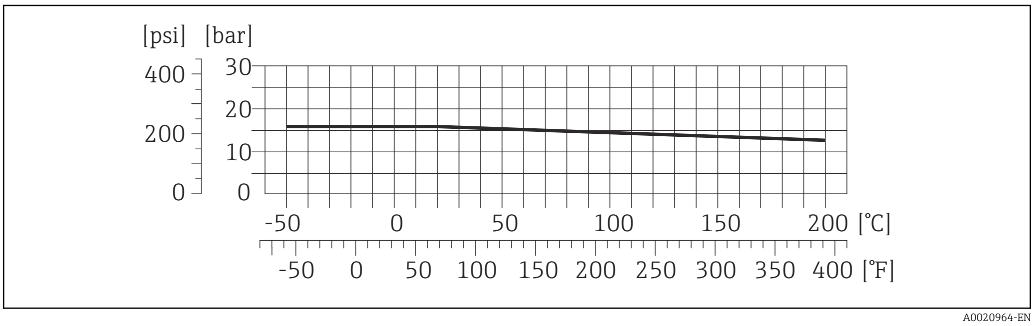
Aseptic flange connection according to DIN 11864-2 Form A



22 *With connection material 1.4404 (316/316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

Threaded hygienic connection to ISO 2853



23 *With connection material 1.4404 (316/316L)*

The pressure-temperature rating for the temperature range +150 to +200 °C (+302 to +392 °F) applies only to the order code for "Measuring tube material", option SD, SE, SF, TH

Secondary containment pressure rating

The sensor housing is filled with dry nitrogen and protects the electronics and mechanics inside.

The following secondary containment pressure rating is only valid for a fully welded sensor housing and/or a device equipped with closed purge connections (never opened/as delivered).

DN		Secondary containment pressure rating (designed with a safety factor ≥ 4)		Secondary containment burst pressure	
[mm]	[in]	[bar]	[psi]	[bar]	[psi]
8	⅜	40	580	255	3695
15	½	40	580	200	2900
25	1	40	580	280	4060
40	1½	40	580	180	3610
50	2	40	580	195	2825
80	3	25	362	105	1520

If there is a risk of measuring tube failure due to process characteristics, e.g. with corrosive fluids, we recommend the use of sensors whose secondary containment is equipped with special pressure monitoring connections (order code for "Sensor option", option CH "Purge connection").

With the help of these connections, the fluid collected in the secondary containment can be bled off in the event of tube failure. This is especially important in high-pressure gas applications. These connections can also be used for gas purging (gas detection).

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

If a device fitted with purge connections is connected to the purge system, the maximum nominal pressure is determined by the purge system itself or by the device, depending on which component has the lower nominal pressure.

If, on the other hand, the device is fitted with a rupture disk, the rupture disk is decisive for the maximum nominal pressure (→ 46).

Dimensions: (→ 66)

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 (order code for "Sensor option", option CA "rupture disk"). Special mounting instructions: (→ 32)

Rupture disks cannot be combined with the separately available heating jacket (→ 77) (→ 78).

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 (→ 6)

- 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
- A low full scale value must be selected for abrasive media (such as liquids with entrained solids): flow velocity < 1 m/s (< 3 ft/s).
- For gas measurement the following rules apply:
  - The flow velocity in the measuring tubes should not exceed half the sonic velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula (→ 7)

Pressure loss

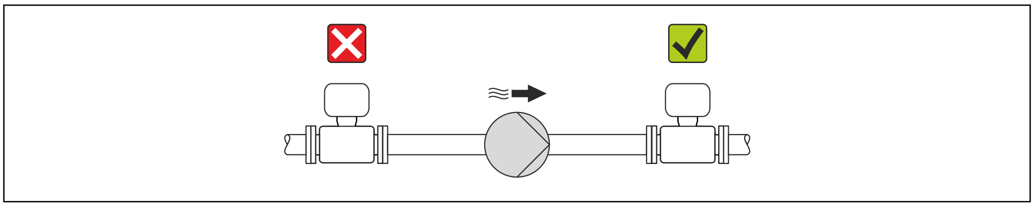
To calculate the pressure loss, use the *Applicator* sizing tool (→ 79)

Promass F with reduced pressure loss: order code for "Sensor option", option CE "Reduced pressure loss"

System pressure

It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas. This is prevented by means of a sufficiently high system pressure.

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



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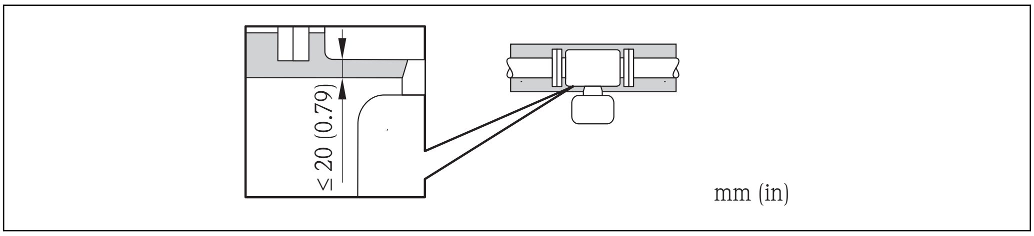
Thermal insulation

In the case of some fluids, it is important that the heat radiated from the sensor to the transmitter is kept to a minimum. A wide range of materials can be used for the required 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.



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t	Insulation thickness
T_m	Medium temperature
$T_{40(104)}$	Maximum recommended insulation thickness at an ambient temperature of T_a = 40 °C (104 °F)
$T_{60(140)}$	Maximum recommended insulation thickness at an ambient temperature of T_a = 60 °C (140 °F)

Maximum recommended insulation thickness for the extended temperature range and insulation
For the extended temperature range, version with long extension neck, order code for "Measuring tube material", option SD, SE, SF, TH or extension neck for insulation, order code for "Sensor option", option CG:

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 (→ 77).

NOTICE

Danger of overheating when heating
- Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F)
- Ensure that convection takes place on a sufficiently large scale at the transmitter neck.
- Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

Vibrations

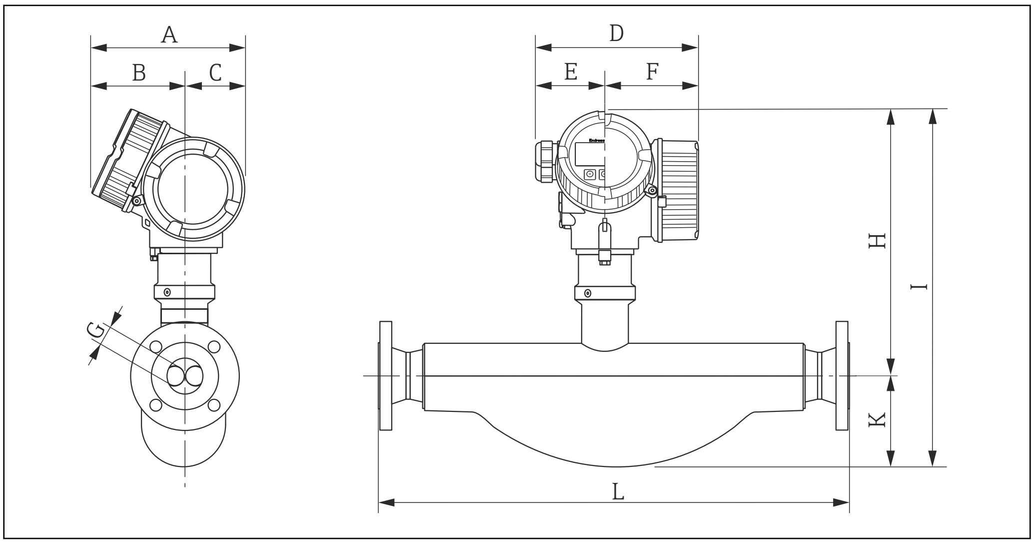
The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

Mechanical construction

Design, dimensions

Compact version

Order code for "Housing", options B "GT18 two-chamber, 316L", C "GT20 two-chamber aluminum coated"



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Dimensions SI units

DN [mm]	A [mm]	B 1) [mm]	C [mm]	D 2) [mm]	E [mm]	F 2) [mm]	G [mm]	H 3) [mm]	I 3) [mm]	K [mm]	L [mm]
8	162	102	60	165	75	90	5.35	268	343	75	4)
15	162	102	60	165	75	90	8.30	268	343	75	4)
25	162	102	60	165	75	90	12.0	268	343	75	4)
40	162	102	60	165	75	90	17.6	273	378	105	4)
50	162	102	60	165	75	90	26.0	283	424	141	4)
80	162	102	60	165	75	90	40.5	302	502	200	4)

1) For version without local display: values - 7 mm
2) For versions with overvoltage protection (OVP): values + 8 mm
3) For version without local display: values - 10 mm
4) dependent on respective process connection

Dimensions US units

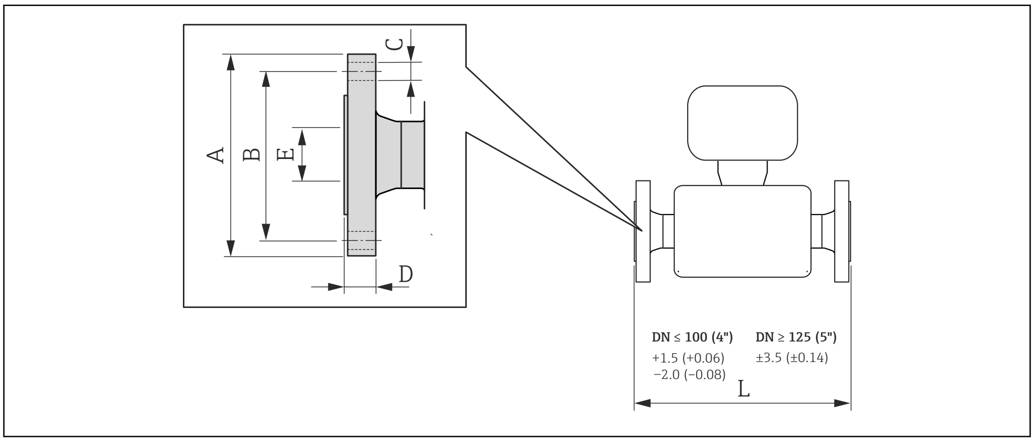
DN [in]	A [in]	B 1) [in]	C [in]	D 2) [in]	E [in]	F 2) [in]	G [in]	H 3) [in]	I 3) [in]	K [in]	L [in]
⅜	6.38	4.02	2.36	6.50	2.95	3.54	0.21	10.55	13.5	2.95	4)
½	6.38	4.02	2.36	6.50	2.95	3.54	0.33	10.55	13.5	2.95	4)
1	6.38	4.02	2.36	6.50	2.95	3.54	0.47	10.55	13.5	2.95	4)
1½	6.38	4.02	2.36	6.50	2.95	3.54	0.69	10.75	14.88	4.13	4)

DN [in]	A [in]	B [1] [in]	C [in]	D [2] [in]	E [in]	F [2] [in]	G [in]	H [3] [in]	I [3] [in]	K [in]	L [in]
2	6.38	4.02	2.36	6.50	2.95	3.54	1.02	11.14	16.69	5.55	[4]
3	6.38	4.02	2.36	6.50	2.95	3.54	1.59	11.89	19.76	7.87	[4]

1) For version without local display: values - 0.28 in
2) For versions with overvoltage protection (OVP): values + 0.31 in
3) For version without local display: values - 0.39 in
4) dependent on respective process connection

Process connections in SI units

Flange connections EN (DIN)



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24 *Engineering unit mm (in)*

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N 1)), PN 40: 1.4404 (F316/F316L) (order code for "Process connection", option D2S), Alloy C22 (order code for "Process connection", option D2C) 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 2)	95	65	4 × Ø14	16	17.3	370/510 3)
15	95	65	4 × Ø14	16	17.3	404/510 3)
25	115	85	4 × Ø14	18	28.5	440/600 3)
40	150	110	4 × Ø18	18	43.1	550
50	165	125	4 × Ø18	20	54.5	715/715 3)
80	200	160	8 × Ø18	24	82.5	840/915 3)

1) Flange with groove according to EN 1092-1 Form D (DIN 2512N) available (order code for "Process connection", option D6S), Alloy C22 (order code for "Process connection", option D6C)
2) DN 8 with DN 15 flanges as standard
3) Installation length in accordance with NAMUR recommendation NE 132 optionally available (order code for "Process connection", option D2N or D6N (with groove))

Flange according to EN 1092-1 (DIN 2501), PN 40 (with DN 25 flanges): 1.4404 (F316/F316L) (order code for "Process connection", option R2S) 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	4 × Ø14	18	28.5	440
15	115	85	4 × Ø14	18	28.5	440

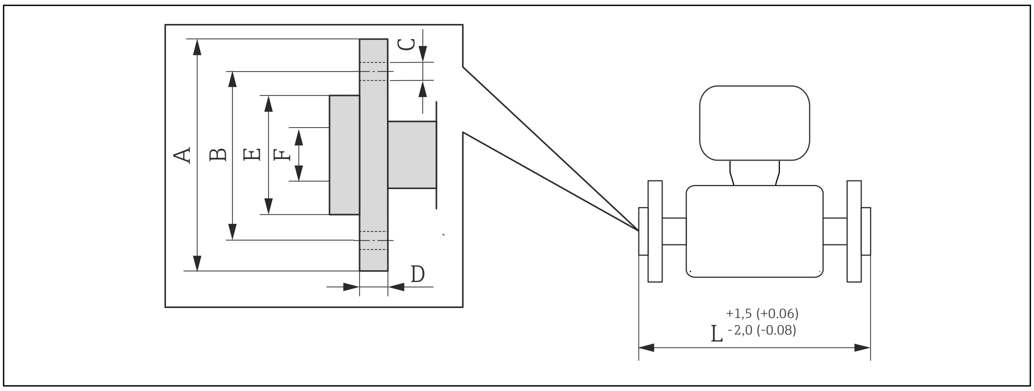
Flange according to EN 1092-1 (DIN 2501 / DIN 2512N 1)), PN 63: 1.4404 (F316/F316L) (order code for "Process connection", option D3S), Alloy C22 (order code for "Process connection", option D3C) Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	180	135	4 × Ø22	26	54.5	724
80	215	170	8 × Ø22	28	81.7	875

1) Flange with groove according to EN 1092-1 Form D (DIN 2512N) available (order code for "Process connection", option D7S), Alloy C22 (order code for "Process connection", option D7C)

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N 1)), PN 100: 1.4404 (F316/F316L) (order code for "Process connection", option D4S), Alloy C22 (order code for "Process connection", option D4C) Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8 2)	105	75	4 × Ø14	20	17.3	400
15	105	75	4 × Ø14	20	17.3	420
25	140	100	4 × Ø18	24	28.5	470
40	170	125	4 × Ø22	26	42.5	590
50	195	145	4 × Ø26	28	53.9	740
80	230	180	8 × Ø26	32	80.9	885

1) Flange with groove according to EN 1092-1 Form D (DIN 2512N) available (order code for "Process connection", option D8S), Alloy C22 (order code for "Process connection", option D8C)
2) DN 8 with DN 15 flanges as standard

Lap joint flange



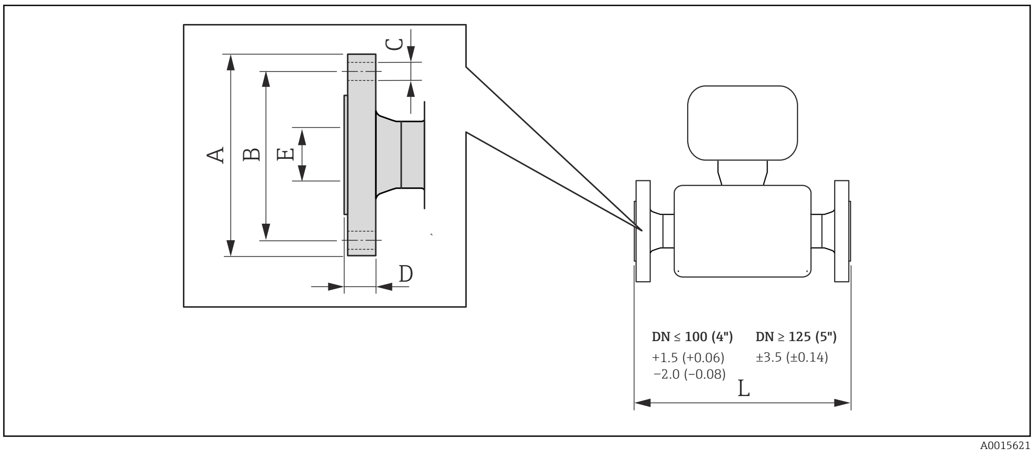
25 *Engineering unit mm (in)*

Lap joint flange according to EN 1092-1 (DIN 2501 / DIN 2512N), PN 40: 1.4301 (F304) (order code for "Process connection", option DAC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} 1) [mm]
8 2)	95	65	4 x Ø14	14.5	45	17.3	370	0
15	95	65	4 x Ø14	14.5	45	17.3	404	0

Lap joint flange according to EN 1092-1 (DIN 2501 / DIN 2512N), PN 40: 1.4301 (F304) (order code for "Process connection", option DAC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} 1) [mm]
25	115	85	4 x Ø14	16.5	68	28.5	444	+4
40	150	110	4 x Ø18	21	88	43.1	560	+10
50	165	125	4 x Ø18	23	102	54.5	719	+4
80	200	160	8 x Ø18	29	138	82.5	848	+8

1) Difference to installation length of the welding neck flange (order code for "Process connection", option D2C)
2) DN 8 with DN 15 flanges as standard

Flange connections ASME B16.5



26 *Engineering unit mm (in)*

Flange according to ASME B16.5, Cl 150: 1.4404 (F316/F316L) (order code for "Process connection", option AAS), Alloy C22 (order code for "Process connection", option AAC) Surface roughness (flange): Ra 3.2 to 6.3 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8 1)	90	60.3	4 × Ø15.7	11.2	15.7	370
15	90	60.3	4 × Ø15.7	11.2	15.7	404
25	110	79.4	4 × Ø15.7	14.2	26.7	440
40	125	98.4	4 × Ø15.7	17.5	40.9	550
50	150	120.7	4 × Ø19.1	19.1	52.6	715
80	190	152.4	4 × Ø19.1	23.9	78.0	840

1) DN 8 with DN 15 flanges as standard

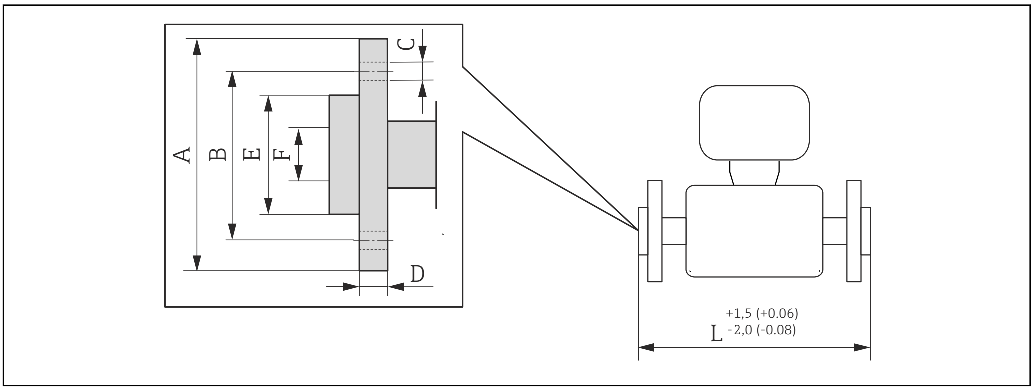
Flange according to ASME B16.5, Cl 300: 1.4404 (F316/F316L) (order code for "Process connection", option ABS), Alloy C22 (order code for "Process connection", option ABC) Surface roughness (flange): Ra 3.2 to 6.3 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8 [1)]	95	66.7	4 × Ø15.7	14.2	15.7	370
15	95	66.7	4 × Ø15.7	14.2	15.7	404
25	125	88.9	4 × Ø19.1	17.5	26.7	440
40	155	114.3	4 × Ø22.3	20.6	40.9	550
50	165	127	8 × Ø19.1	22.3	52.6	715
80	210	168.3	8 × Ø22.3	28.4	78.0	840

1) DN 8 with DN 15 flanges as standard

Flange according to ASME B16.5, Cl 600: 1.4404 (F316/F316L) (order code for "Process connection", option ACS), Alloy C22 (order code for "Process connection", option ACC) Surface roughness (flange): Ra 3.2 to 6.3 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8 [1)]	95	66.7	4 × Ø15.7	20.6	13.9	400
15	95	66.7	4 × Ø15.7	20.6	13.9	420
25	125	88.9	4 × Ø19.1	23.9	24.3	490
40	155	114.3	4 × Ø22.3	28.7	38.1	600
50	165	127	8 × Ø19.1	31.8	49.2	742
80	210	168.3	8 × Ø22.3	38.2	73.7	900

1) DN 8 with DN 15 flanges as standard

Lap joint flange



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27 *Engineering unit mm (in)*

Lap joint flange according to ASME B16.5, Cl 150: 1.4301 (F304) (order code for "Process connection", option ADC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} 1) [mm]
8 2)	90	60.3	4 × Ø15.7	15	35.1	15.7	370	0
15	90	60.3	4 × Ø15.7	15	35.1	15.7	404	0
25	110	79.4	4 × Ø15.7	16	50.8	26.7	440	0
40	125	98.4	4 × Ø15.7	15.9	73.2	40.9	550	0
50	150	120.7	4 × Ø19.1	19	91.9	52.6	715	0
80	190	152.4	4 × Ø19.1	22.3	127.0	78.0	840	0

1) Difference to installation length of the welding neck flange (order code for "Process connection", option AAC)
2) DN 8 with DN 15 flanges as standard

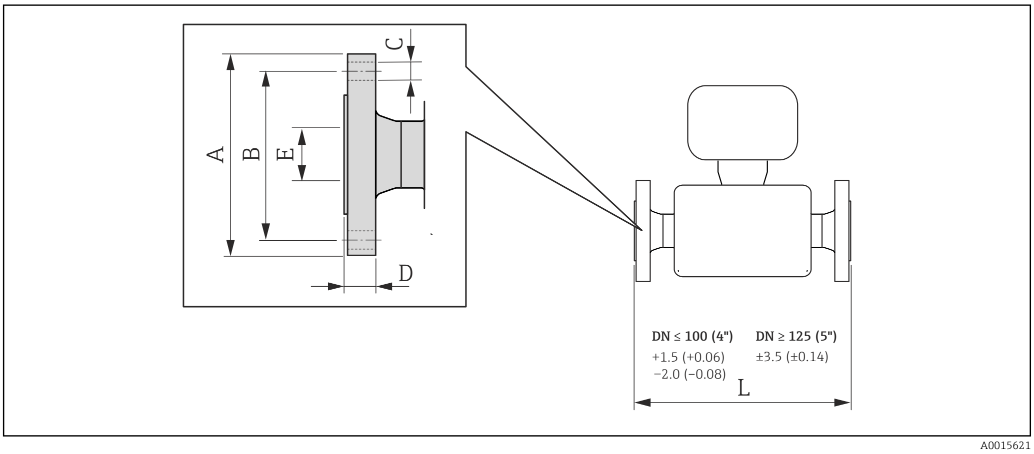
Lap joint flange according to ASME B16.5, Cl 300: 1.4301 (F304) (order code for "Process connection", option AEC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} 1) [mm]
8 2)	95	66.7	4 × Ø15.7	16.5	35.1	15.7	376	+6
15	95	66.7	4 × Ø15.7	16.5	35.1	15.7	406	+2
25	125	88.9	4 × Ø19.1	21.0	50.8	26.7	450	+10
40	155	114.3	4 × Ø22.3	23.0	73.2	40.9	564	+14
50	165	127	8 × Ø19.1	25.5	91.9	52.6	717	+2
80	210	168.3	8 × Ø22.3	31.0	127.0	78.0	852.6	+12.6

1) Difference to installation length of the welding neck flange (order code for "Process connection", option ABC)
2) DN 8 with DN 15 flanges as standard

Lap joint flange according to ASME B16.5, Cl 600: 1.4301 (F304) (order code for "Process connection", option AFC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} 1) [mm]
8 2)	95	66.7	4 × Ø15.7	17.0	35.1	13.9	400	0
15	95	66.7	4 × Ø15.7	17.0	35.1	13.9	420	0
25	125	88.9	4 × Ø19.1	21.5	50.8	24.3	490	0
40	155	114.3	4 × Ø22.3	25.0	73.2	38.1	600	0
50	165	127	8 × Ø19.1	28.0	91.9	49.2	742	0
80	210	168.3	8 × Ø22.3	35.0	127.0	73.7	900	0

1) Difference to installation length of the welding neck flange (order code for "Process connection", option ACC)
2) DN 8 with DN 15 flanges as standard

Flange connections JIS



28 *Engineering unit mm (in)*

Flange JIS B2220, 10K: 1.4404 (F316/F316L) (order code for "Process connection", option NDS), Alloy C22 (order code for "Process connection", option NDC) Surface roughness (flange): Ra 3.2 to 6.3 µm						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
50	155	120	4 × Ø19	16	50	715
80	185	150	8 × Ø19	18	80	832

Flange JIS B2220, 20K: 1.4404 (F316/F316L) (order code for "Process connection", option NES), Alloy C22 (order code for "Process connection", option NEC) Surface roughness (flange): Ra 1.6 to 3.2 µm						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
8 [1)]	95	70	4 × Ø15	14	15	370
15	95	70	4 × Ø15	14	15	404
25	125	90	4 × Ø19	16	25	440
40	140	105	4 × Ø19	18	40	550
50	155	120	8 × Ø19	18	50	715
80	200	160	8 × Ø23	22	80	832

1) DN 8 with DN 15 flanges as standard

Flange JIS B2220, 40K: 1.4404 (F316/F316L) (order code for "Process connection", option NGS), Alloy C22 (order code for "Process connection", option NGC) Surface roughness (flange): Ra 1.6 to 3.2 µm						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
8 [1)]	115	80	4 × Ø19	20	15	400
15	115	80	4 × Ø19	20	15	425
25	130	95	4 × Ø19	22	25	485
40	160	120	4 × Ø23	24	38	600

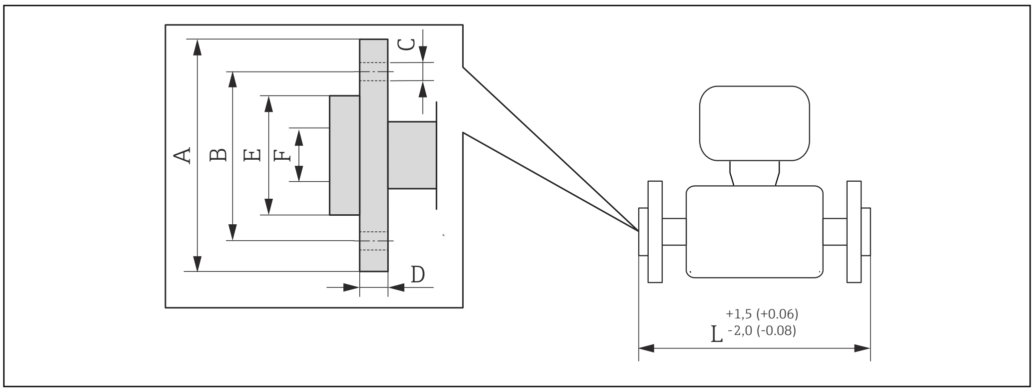
Flange JIS B2220, 40K: 1.4404 (F316/F316L) (order code for "Process connection", option NGS), Alloy C22 (order code for "Process connection", option NGC) Surface roughness (flange): Ra 1.6 to 3.2 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	165	130	8 × Ø19	26	50	760
80	210	170	8 × Ø23	32	75	890

1) DN 8 with DN 15 flanges as standard

Flange JIS B2220, 63K: 1.4404 (F316/F316L) (order code for "Process connection", option NHS), Alloy C22 (order code for "Process connection", option NHC) Surface roughness (flange): Ra 1.6 to 3.2 µm						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8 [1)]	120	85	4 × Ø19	23	12	420
15	120	85	4 × Ø19	23	12	440
25	140	100	4 × Ø23	27	22	494
40	175	130	4 × Ø25	32	35	620
50	185	145	8 × Ø23	34	48	775
80	230	185	8 × Ø25	40	73	915

1) DN 8 with DN 15 flanges as standard

Lap joint flange



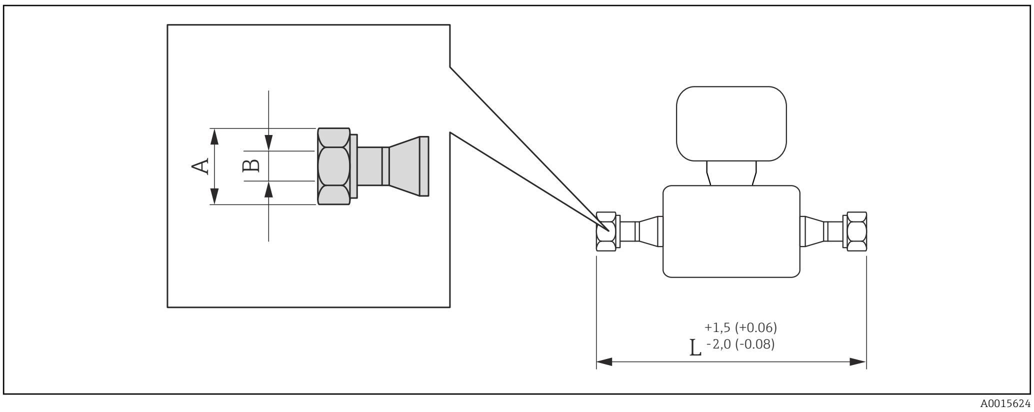
29 *Engineering unit mm (in)*

Lap joint flange JIS B2220, 20K: 1.4301 (F304) (order code for "Process connection", option NIC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} [1)] [mm]
8 [2)]	95	70	4 × Ø15	14	51	15	370	0
15	95	70	4 × Ø15	14	51	15	404	0
25	125	90	4 × Ø19	18.5	67	25	440	0
40	140	105	4 × Ø19	18.5	81	40	550	0

Lap joint flange JIS B2220, 20K: 1.4301 (F304) (order code for "Process connection", option NIC); wetted parts Alloy C22 Surface roughness (flange): Ra 3.2 to 12.5 µm								
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	L [mm]	L_{diff} 1) [mm]
50	155	120	8 × Ø19	23	96	50	715	0
80	200	160	8 × Ø23	29	132	80	844	+12

1) Difference to installation length of the welding neck flange (order code for "Process connection", option NEC)
2) DN 8 with DN 15 flanges as standard

VCO connections

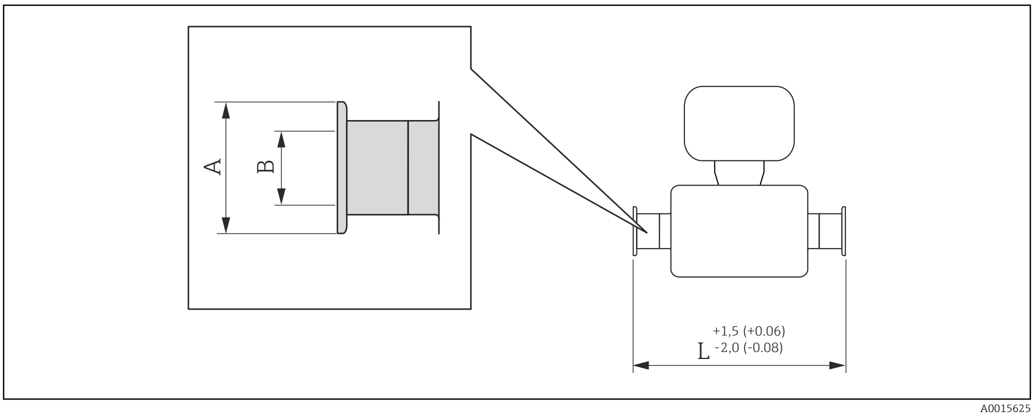


30 *Engineering unit mm (in)*

VCO connections: 1.4404 (316/316L)			
DN [mm]	A [in]	B [mm]	L [mm]
8 1)	AF 1	10.2	390
15 2)	AF 1½	15.7	430

1) 8-VCO-4 (½"): Order code for "Process connection", option CVS
2) 12-VCO-4 (¾"): Order code for "Process connection", option CWS

Tri-Clamp

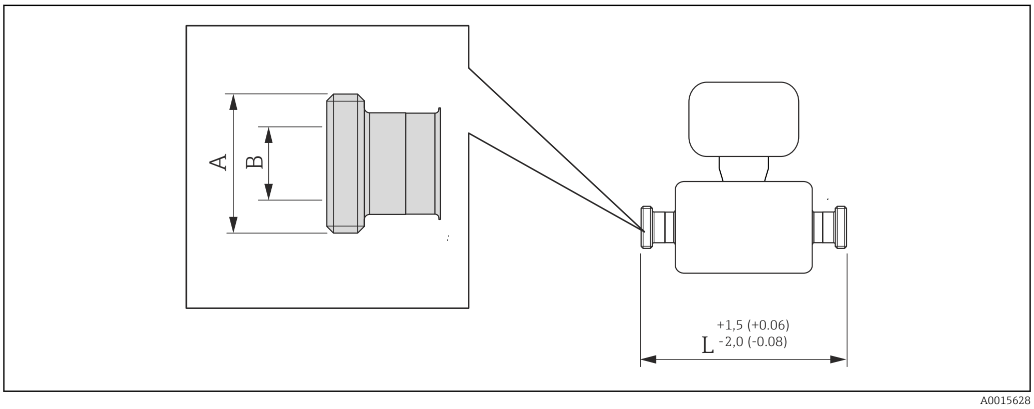


31 *Engineering unit mm (in)*

1", 1½", 2" Tri-Clamp for pipe size: 1.4404 (316/316L) (order code for "Process connection", option FTS)				
DN [mm]	Clamp [in]	A [mm]	B [mm]	L [mm]
8	1	50.4	22.1	367
15	1	50.4	22.1	398
25	1	50.4	22.1	434
40	1½	50.4	34.8	560
50	2	63.9	47.5	720
80	3	90.9	72.9	900
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 μm Ra ≤ 0.4 μm (order code for "Measuring tube material", option SB, SC, SE, SF)				

½"-Tri-Clamp: 1.4404 (316/316L) (order code for "Process connection", option FDW)				
DN [mm]	Clamp [in]	A [mm]	B [mm]	L [mm]
8	½	25.0	9.5	367
15	½	25.0	9.5	398
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 μm Ra ≤ 0.4 μm (order code for "Measuring tube material", option SB, SC, SE, SF)				

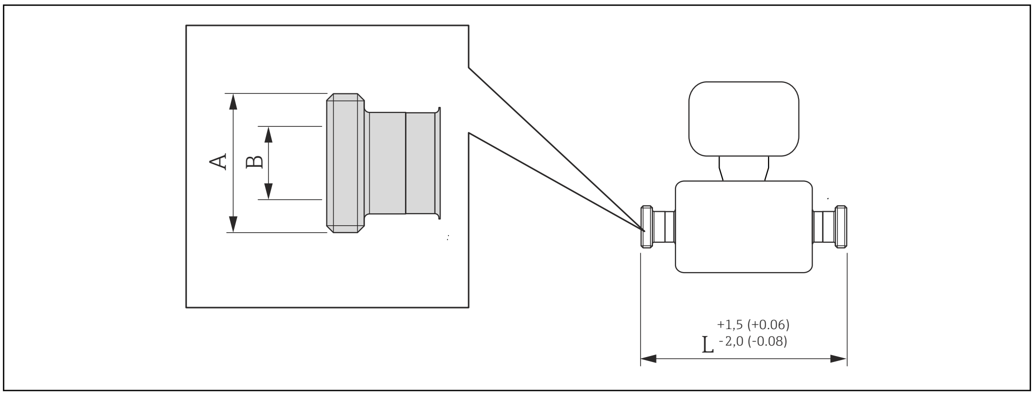
DIN 11851 thread



32 *Engineering unit mm (in)*

DIN 11851 thread: 1.4404 (316/316L) (order code for "Process connection", option FMW)			
DN [mm]	A [in]	B [mm]	L [mm]
8	Rd 34 × ⅛	16	367
15	Rd 34 × ⅛	16	398
25	Rd 52 × ⅙	26	434
40	Rd 65 × ⅙	38	560
50	Rd 78 × ⅙	50	720
80	Rd 110 × ¼	81	900
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 μm (order code for "Measuring tube material", option SB, SE)			

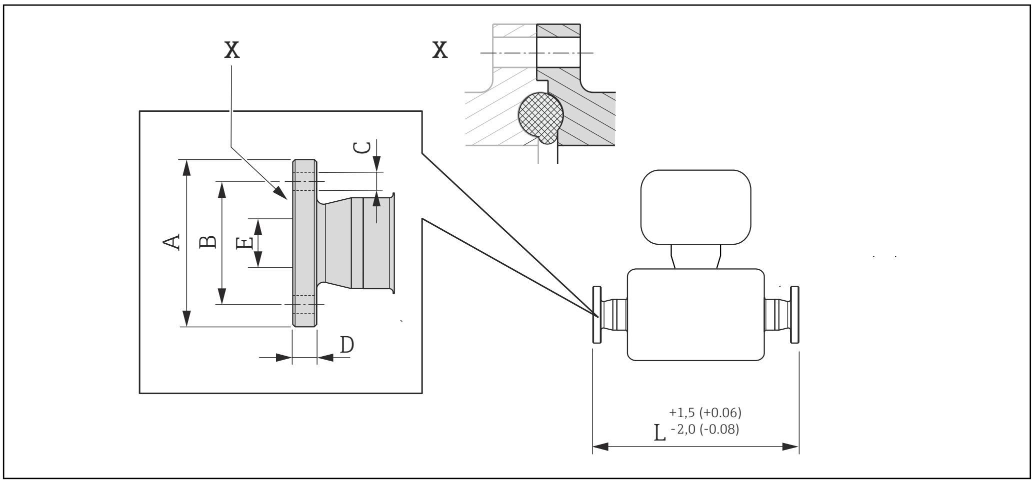
DIN11864-1A thread



33 *Engineering unit mm (in)*

DIN11864-1A thread, DIN11866 line A: 1.4404 (316/316L) (order code for "Process connection", option FLW)			
DN [mm]	**A [in]**	**B [mm]**	**L [mm]**
8	Rd 28 × ⅛	10	367
15	Rd 34 × ⅛	16	398
25	Rd 52 × ⅛	26	434
40	Rd 65 × ⅙	38	560
50	Rd 78 × ⅙	50	720
80	Rd 110 × ¼	81	900
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 µm Ra ≤ 0.4 µm (order code for "Measuring tube material", option SB, SC, SE, SF)			

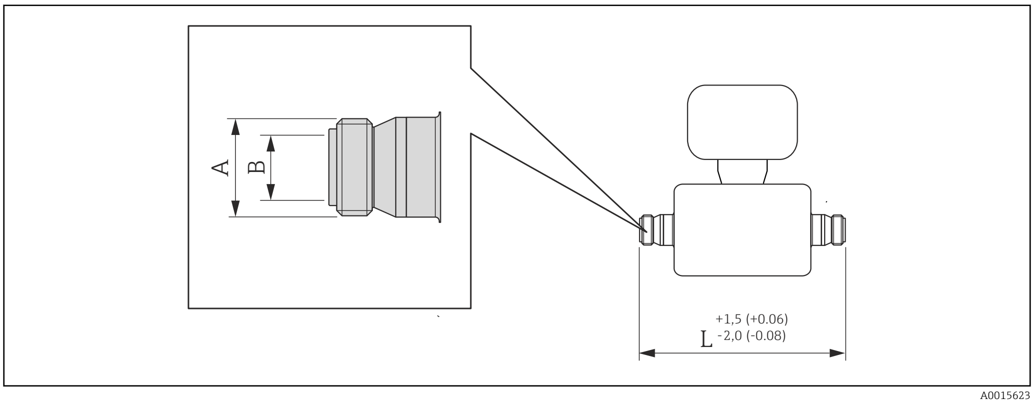
DIN11864-2A flange



34 *Detail X: Asymmetrical process connection; the part shown in gray is provided by the supplier. Engineering unit mm (in).*

DIN11864-2A flange, DIN11866 line A, flange with notch: 1.4404 (316/316L) (order code for "Process connection", option KCS)						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	54	37	4 × Ø9	10	10	387
15	59	42	4 × Ø9	10	16	418
25	70	53	4 × Ø9	10	26	454
40	82	65	4 × Ø9	10	38	560
50	94	77	4 × Ø9	10	50	720
80	133	112	8 × Ø11	12	81	900
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 µm Ra ≤ 0.4 µm (order code for "Measuring tube material", option SB, SC, SE, SF)						

ISO 2853 thread

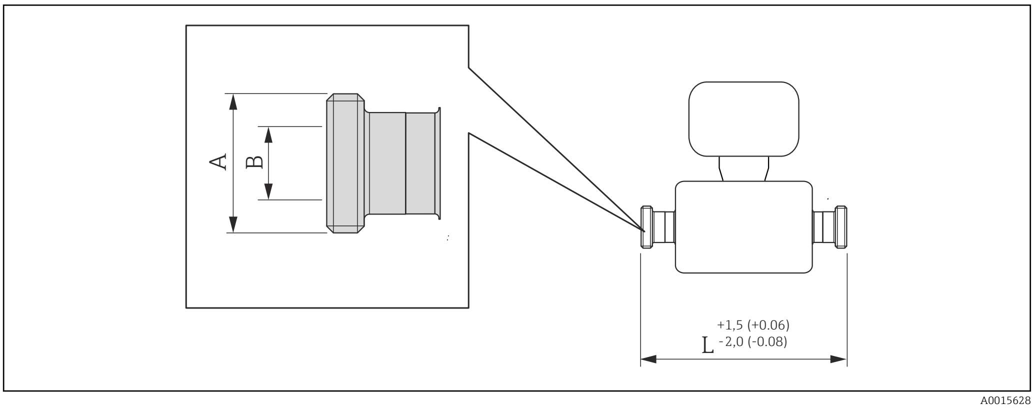


35 *Engineering unit mm (in)*

ISO 2853 thread, ISO 2037: 1.4404 (316/316L) (order code for "Process connection", option JSF)			
DN [mm]	A 1) [mm]	B [mm]	L [mm]
8	37.13	22.6	367
15	37.13	22.6	398
25	37.13	22.6	434
40	52.68	35.6	560
50	64.16	48.6	720
80	91.19	72.9	900
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 µm Ra ≤ 0.4 µm (order code for "Measuring tube material", option SB, SC, SE, SF)			

1) Max. thread diameter as per ISO 2853 Annex A

SMS 1145 thread

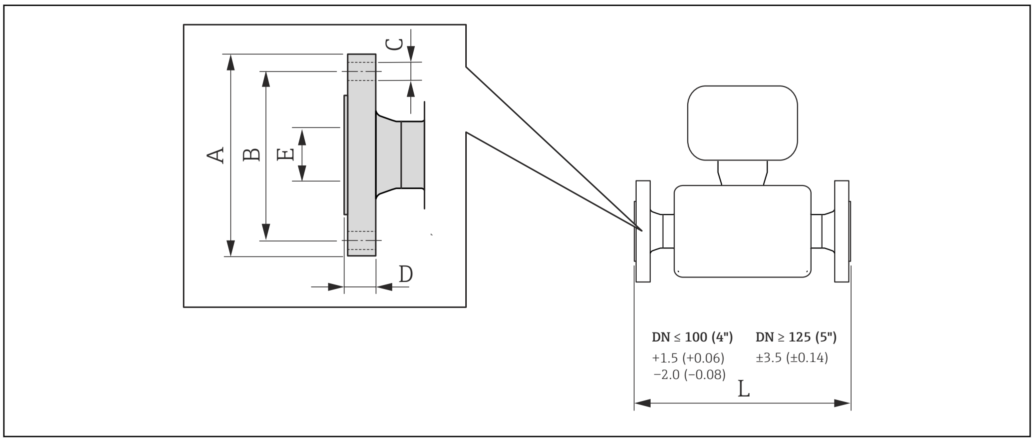


36 *Engineering unit mm (in)*

SMS1145 thread: 1.4404 (316/316L) (order code for "Process connection", option SCS)			
DN [mm]	**A [in]**	**B [mm]**	**L [mm]**
8	Rd 40 × 1⁄6	22.6	367
15	Rd 40 × 1⁄6	22.6	398
25	Rd 40 × 1⁄6	22.6	434
40	Rd 60 × 1⁄6	35.6	560
50	Rd 70 × 1⁄6	48.6	720
80	Rd 98 × 1⁄6	72.9	900
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 0.8 µm (order code for "Measuring tube material", option SB, SE)			

Process connections in US units

Flange connections ASME B16.5



37 *Engineering unit mm (in)*

Flange according to ASME B16.5, Cl 150: 1.4404 (F316/F316L) (order code for "Process connection", option AAS), Alloy C22 (order code for "Process connection", option AAC) Surface roughness (flange): Ra 125 to 250 µin						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [in]**
³⁄₈ 1)	3.54	2.37	4 × Ø0.62	0.44	0.62	14.57
½	3.54	2.37	4 × Ø0.62	0.44	0.62	15.91
1	4.33	3.13	4 × Ø0.62	0.56	1.05	17.32
1½	4.92	3.87	4 × Ø0.62	0.69	1.61	21.65
2	5.91	4.75	4 × Ø0.75	0.75	2.07	28.15
3	7.48	6.00	4 × Ø0.75	0.94	3.07	33.07

1) DN ³⁄₈" with DN ½" flanges as standard

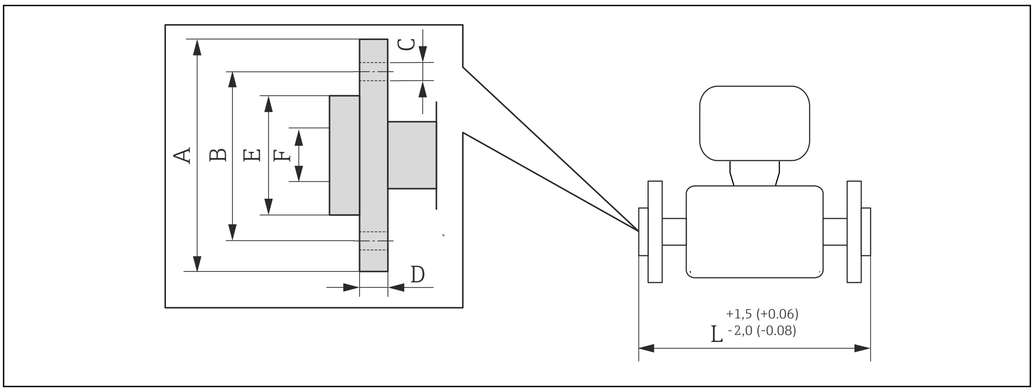
Flange according to ASME B16.5, Cl 300: 1.4404 (F316/F316L) (order code for "Process connection", option ABS), Alloy C22 (order code for "Process connection", option ABC) Surface roughness (flange): Ra 125 to 250 µin						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [in]**
³⁄₈ 1)	3.74	2.63	4 × Ø0.62	0.56	0.62	14.57
½	3.74	2.63	4 × Ø0.62	0.56	0.62	15.91
1	4.92	3.50	4 × Ø0.75	0.69	1.05	17.32
1½	6.10	4.50	4 × Ø0.88	0.81	1.61	21.65
2	6.50	5.00	8 × Ø0.75	0.88	2.07	28.15
3	8.27	6.63	8 × Ø0.88	1.12	3.07	33.07

1) DN ³⁄₈" with DN ½" flanges as standard

Flange according to ASME B16.5, Cl 600: 1.4404 (F316/F316L) (order code for "Process connection", option ACS), Alloy C22 (order code for "Process connection", option ACC) Surface roughness (flange): Ra 125 to 250 µin						
DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
³⁄₈ 1)	3.74	2.63	4 × Ø0.62	0.81	0.55	15.75
½	3.74	2.63	4 × Ø0.62	0.81	0.55	16.54
1	4.92	3.50	4 × Ø0.75	0.94	0.96	19.29
1½	6.10	4.50	4 × Ø0.88	1.13	1.50	23.62
2	6.50	5.00	8 × Ø0.75	1.25	1.94	29.21
3	8.27	6.63	8 × Ø0.88	1.50	2.90	35.43

1) DN ³⁄₈" with DN ½" flanges as standard

Lap joint flange



38 *Engineering unit mm (in)*

Lap joint flange according to ASME B16.5, Cl 150: 1.4301 (F304) (order code for "Process connection", option ADC); wetted parts Alloy C22 Surface roughness (flange): Ra 125 to 492 µin								
DN [inch]	A [inch]	B [inch]	C [inch]	D [inch]	E [inch]	F [inch]	L [inch]	L_{diff} 1) [inch]
³⁄₈ 2)	3.54	2.37	4 × Ø0.62	0.59	1.38	0.62	14.57	0
½	3.54	2.37	4 × Ø0.62	0.59	1.38	0.62	15.91	0
1	4.33	3.13	4 × Ø0.62	0.63	2.00	1.05	17.32	0
1½	4.92	3.87	4 × Ø0.62	0.63	2.88	1.61	21.65	0
2	5.91	4.75	4 × Ø0.75	0.75	3.62	2.07	28.15	0
3	7.48	6.00	4 × Ø0.75	0.88	5.00	3.07	33.07	0

1) Difference to installation length of the welding neck flange (order code for "Process connection", option AAC)
2) DN ³⁄₈" with DN ½" flanges as standard

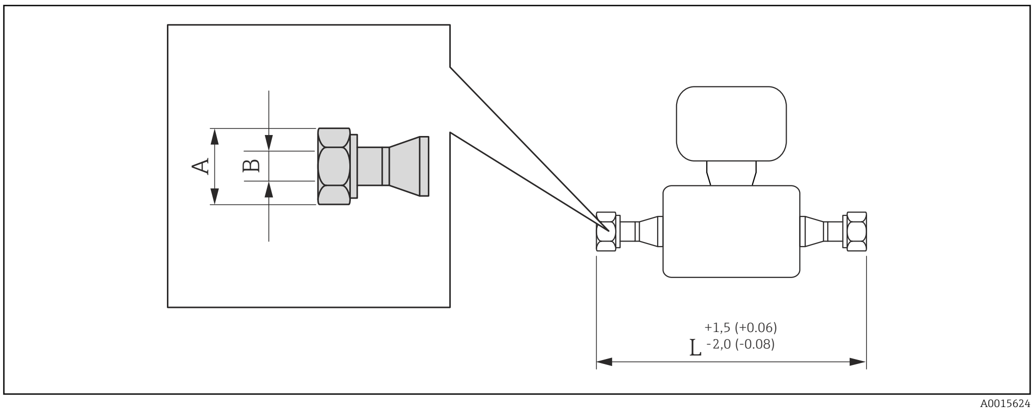
Lap joint flange according to ASME B16.5, Cl 300: 1.4301 (F304) (order code for "Process connection", option AEC); wetted parts Alloy C22 Surface roughness (flange): Ra 125 to 492 µin								
DN [inch]	A [inch]	B [inch]	C [inch]	D [inch]	E [inch]	F [inch]	L [inch]	L_{diff} [1)] [inch]
⅜ [2)]	3.74	2.63	4 × Ø0.62	0.65	1.38	0.62	14.80	+0.23
½	3.74	2.63	4 × Ø0.62	0.65	1.38	0.62	15.98	+0.07
1	4.92	3.50	4 × Ø0.75	0.83	2.00	1.05	17.72	+0.40
1½	6.10	4.50	4 × Ø0.88	0.91	2.88	1.61	22.20	+0.55
2	6.50	5.00	8 × Ø0.75	1.00	3.62	2.07	28.23	+0.08
3	8.27	6.63	8 × Ø0.88	1.22	5.00	3.07	33.57	+0.50

1) Difference to installation length of the welding neck flange (order code for "Process connection", option ABC)
2) DN ⅜" with DN ½" flanges as standard

Lap joint flange according to ASME B16.5, Cl 600: 1.4301 (F304) (order code for "Process connection", option AFC); wetted parts Alloy C22 Surface roughness (flange): Ra 125 to 492 µin								
DN [inch]	A [inch]	B [inch]	C [inch]	D [inch]	E [inch]	F [inch]	L [inch]	L_{diff} [1)] [inch]
⅜ [2)]	3.74	2.63	4 × Ø0.62	0.67	1.38	0.55	15.75	0
½	3.74	2.63	4 × Ø0.62	0.67	1.38	0.55	16.54	0
1	4.92	3.50	4 × Ø0.75	0.85	2.00	0.96	19.29	0
1½	6.10	4.50	4 × Ø0.88	0.98	2.88	1.50	23.62	0
2	6.50	5.00	8 × Ø0.75	1.10	3.62	1.94	29.21	0
3	8.27	6.63	8 × Ø0.88	1.38	5.00	2.9	35.43	0

1) Difference to installation length of the welding neck flange (order code for "Process connection", option ACC)
2) DN ⅜" with DN ½" flanges as standard

VCO connections

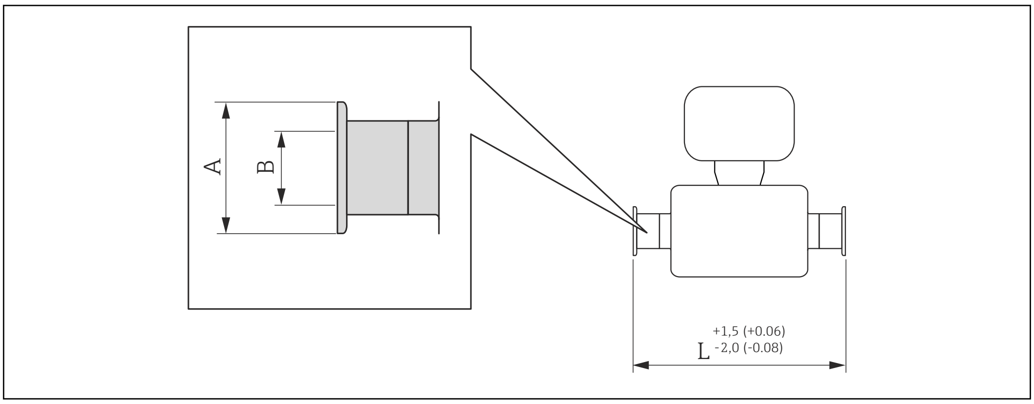


39 *Engineering unit mm (in)*

VCO connections: 1.4404 (316/316L)			
DN [mm]	A [in]	B [in]	L [in]
⅜ 1)	AF 1	0.40	9.92
½ 2)	AF 1½	0.62	12.01

1) 8-VCO-4 (½"): Order code for "Process connection", option CVS
2) 12-VCO-4 (¾"): Order code for "Process connection", option CWS

Tri-Clamp

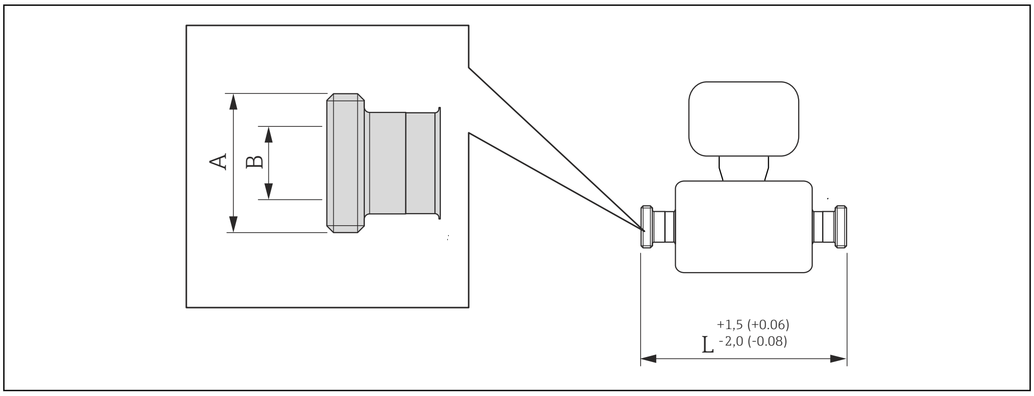


 40 *Engineering unit mm (in)*

1", 1½", 2" Tri-Clamp for pipe size: 1.4404 (316/316L) (order code for "Process connection", option FTS)				
DN [in]	Clamp [in]	A [in]	B [in]	L [in]
⅜	1	1.98	0.87	14.4
½	1	1.98	0.87	15.7
1	1	1.98	0.87	17.1
1½	1½	1.98	1.37	22.0
2	2	2.52	1.87	28.3
3	3	3.58	2.87	35.4
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 32 µin Ra ≤ 16 µin (order code for "Measuring tube material", option SB, SC, SE, SF)				

½"-Tri-Clamp: 1.4404 (316/316L) (order code for "Process connection", option FDW)				
DN [in]	Clamp [in]	A [in]	B [in]	L [in]
⅜	½	0.98	0.37	14.4
½	½	0.98	0.37	15.7
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 32 µin Ra ≤ 16 µin (order code for "Measuring tube material", option SB, SC, SE, SF)				

SMS 1145 thread



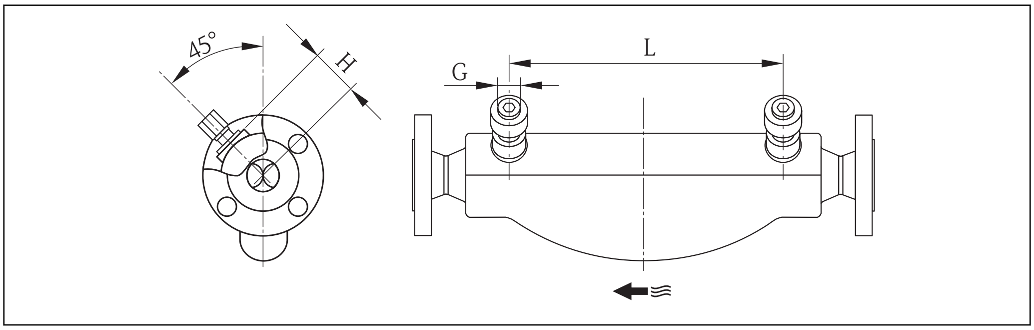
41 *Engineering unit mm (in)*

SMS 1145 thread: 1.4404 (316/316L) (order code for "Process connection", option SCS)			
DN [in]	**A [in]**	**B [in]**	**L [in]**
⅜	Rd 40 × ⅙	0.904	14.68
½	Rd 40 × ⅙	0.904	15.92
1	Rd 40 × ⅙	0.904	17.36
1½	Rd 60 × ⅙	1.424	22.40
2	Rd 70 × ⅙	1.944	28.80
3	Rd 98 × ⅙	2.916	36.00
3A version available (order code for "Additional approval", option LP) in combination with Ra ≤ 32 µin (order code for "Measuring tube material", option SB, SE)			

Accessories

Purge connections / secondary containment monitoring

Order code for "Sensor options", option CH



DN		G	H		L	
[mm]	[in]	[in]	[mm]	[in]	[mm]	[in]
8	⅜	½ NPT	62	2.44	216	8.50
15	½	½ NPT	62	2.44	220	8.66
25	1	½ NPT	62	2.44	260	10.24
40	1½	½ NPT	67	2.64	310	12.20

DN		G	H		L	
[mm]	[in]	[in]	[mm]	[in]	[mm]	[in]
50	2	½ NPT	79	3.11	452	17.78
80	3	½ NPT	101	3.98	560	22.0

Weight

Compact version

Weight in SI units

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

DN [mm]	Weight [kg]	
	Order code for "Housing", option C Aluminum coated	Order code for "Housing", option B 1.4404 (316L)
8	9	11.5
15	10	12.5
25	12	14.5
40	17	19.5
50	28	30.5
80	53	55.5

Weight in US units

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

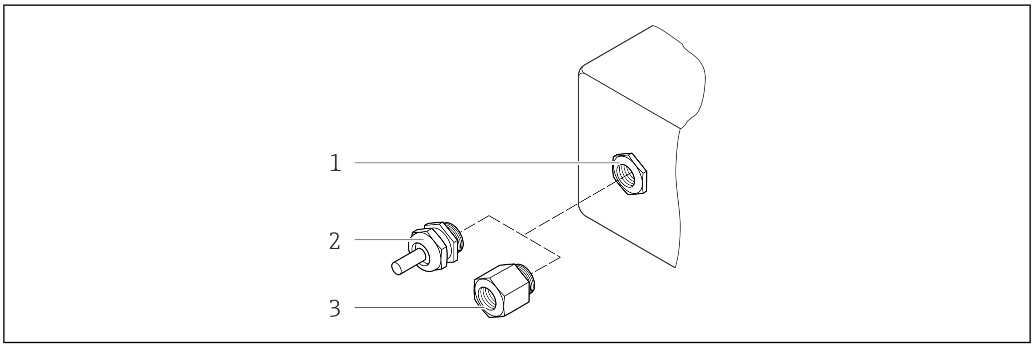
DN [in]	Weight [lbs]	
	Order code for "Housing", option C Aluminum coated	Order code for "Housing", option B 1.4404 (316L)
3/8	20	25
½	22	28
1	26	32
1½	37	43
2	62	67
3	117	122

Materials

Transmitter housing

- Order code for "Housing", option **B**: stainless steel 1.4404 (316L)
- Order code for "Housing", option **C**: aluminum, AlSi10Mg, coated
- Window material: glass

Cable entries/cable glands



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42 *Possible cable entries/cable glands*

1 *Cable entry in transmitter housing, wall-mount housing or connection housing with internal thread M20 x 1.5*
2 *Cable gland M20 x 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*

Order code for "Housing", option B "GT18 two-chamber, 316L"

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	▪ Non-Ex ▪ Ex ia ▪ Ex ic ▪ Ex nA ▪ Ex tb	Stainless steel ,1.4404
Adapter for cable entry with internal thread G ½"	For non-Ex and Ex (except for CSA Ex d/XP)	Stainless steel, 1.4404 (316L)
Adapter for cable entry with internal thread NPT ½"	For non-Ex and Ex	

Order Code for "Housing", Option C "GT20 two-chamber, aluminum-coated"

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	▪ Non-Ex ▪ Ex ia ▪ Ex ic	Plastic
	Adapter for cable entry with internal thread G ½"	Nickel-plated brass
Adapter for cable entry with internal thread NPT ½"	For non-Ex and Ex (except for CSA Ex d/XP)	Nickel-plated brass
Thread NPT ½" via adapter	For non-Ex and Ex	

Device plug

Order code for "Housing", option I "Plug M12x1"

Electrical connection	Material
Plug M12x1	▪ Socket: stainless steel, 1.4401/316 ▪ Contact housing: plastic, PUR, black ▪ Contacts: metal, CuZn, gold-plated ▪ Threaded connection seal: NBR

Sensor housing

- Acid and alkali-resistant outer surface
- Stainless steel, 1.4301/1.4307 (304L)
  Optional stainless steel, 1.4404 (316/316L)

Measuring tubes

- DN 8 to 80 (3/8 to 3"): stainless steel, 1.4539 (904L); manifold: stainless steel, 1.4404 (316/316L)
- DN 8 to 80 (3/8 to 3"): stainless steel, Alloy C22, 2.4602 (UNS N06022); manifold: Alloy C22, 2.4602 (UNS N06022)

Process connections

- Flanges according to EN 1092-1 (DIN2501) / according to ASME B 16.5 / as per JIS B2220:
  - Stainless steel, 1.4404 (F316/F316L)
  - Stainless steel, Alloy C22, 2.4602 (UNS N06022)
  - Lap joint flanges: stainless steel, 1.4301 (F304); wetted parts Alloy C22
- All other process connections:
  Stainless steel, 1.4404 (316/316L)

List of all available process connections (→ 69)

Surface quality (parts in contact with medium)

- Not polished
- Ra_{max} = 0.8 µm (32 µin)
- Ra_{max} = 0.4 µm (16 µin)

Seals

Welded process connections without internal seals

Accessories

Weather protection cover

Stainless steel 1.4404 (316L)

Process connections

- Flanges:
  - EN 1092-1 (DIN 2501)
  - EN 1092-1 (DIN 2512N)
  - Namur lengths in accordance with NE 132
  - ASME B16.5
  - JIS B2220
- VCO connections
- Tri-Clamp (OD tubes)
- Threaded hygienic connection:
  - DIN 11851
  - SMS 1145
  - ISO 2853
  - DIN 11864-1 Form A
- Flange:
  DIN 11864-2 Form A

For information on the materials of the process connections (→ 69)

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnostics
- Expert level

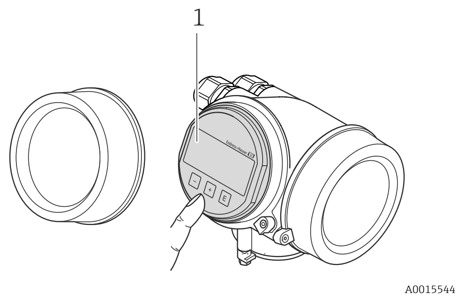
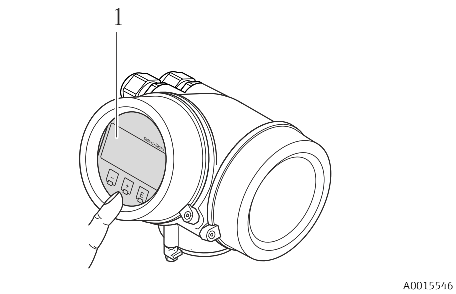
Quick and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

Reliable operation
- Operation in the following languages:
  - Via local display:
    English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Swedish, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech
  - Via "FieldCare" operating tool:
    English, German, French, Spanish, Italian, Chinese, Japanese
- Uniform operating philosophy applied to device and operating tools
- If replacing the electronic module, transfer the device configuration via the integrated memory (integrated HistoROM) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostics increase measurement availability
- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Local operation

Via display module

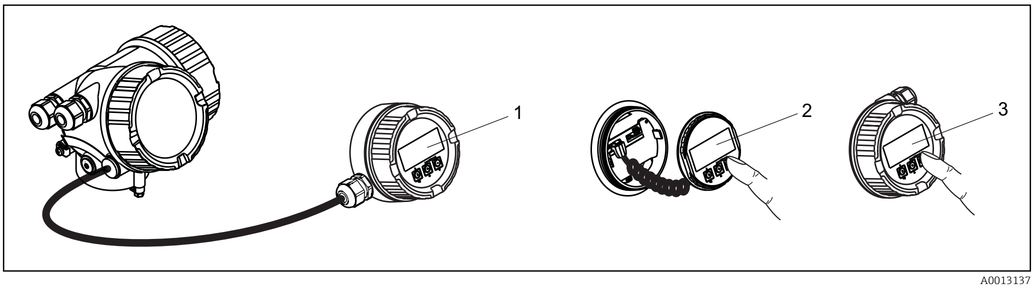
Order code for "Display; Operation", option **C** "SD02"	Order code for "Display; Operation", option **E** "SD03"
	
1 *Operation with pushbuttons*	1 *Operation with touch control*

Display elements
- 4-line display
- With order code for "Display; operation", option **E**:
  White background lighting; switches to red in event of device errors
- Format for displaying measured variables 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
- With order code for "Display; operation", option **C**:
  Local operation with 3 push buttons: ⊕, ⊖, Ⓔ
- With order code for "Display; operation", option **E**:
  External operation via touch control; 3 optical keys: ⊕, ⊖,Ⓔ
- 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.

Via remote display and operating module FHX50



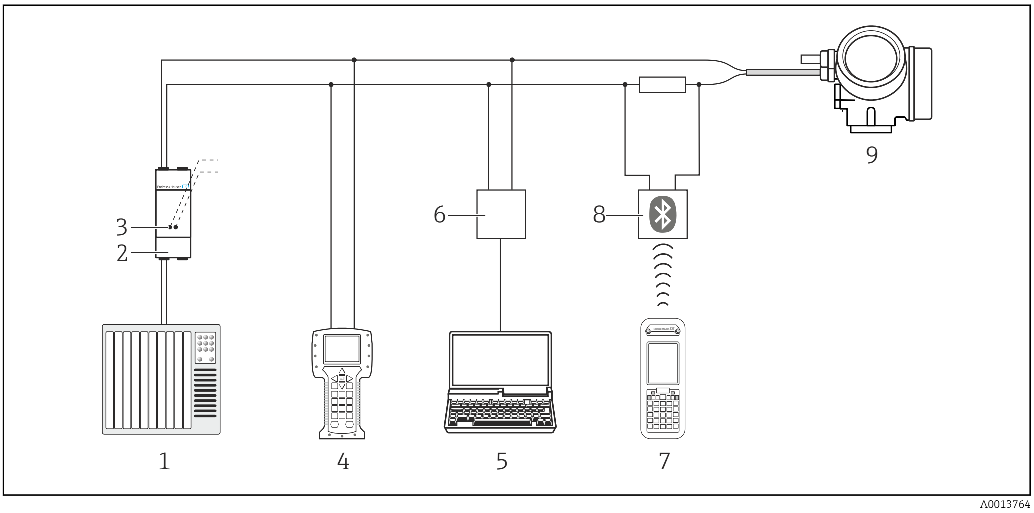
43 *Operating options via FHX50*

1 Housing of remote display and operating module FHX50
2 SD02 display and operating module, push buttons: cover must be opened for operation
3 SD03 display and operating module, optical buttons: operation possible through cover glass

Remote operation

Via HART protocol

This communication interface is available in device versions with a HART output.

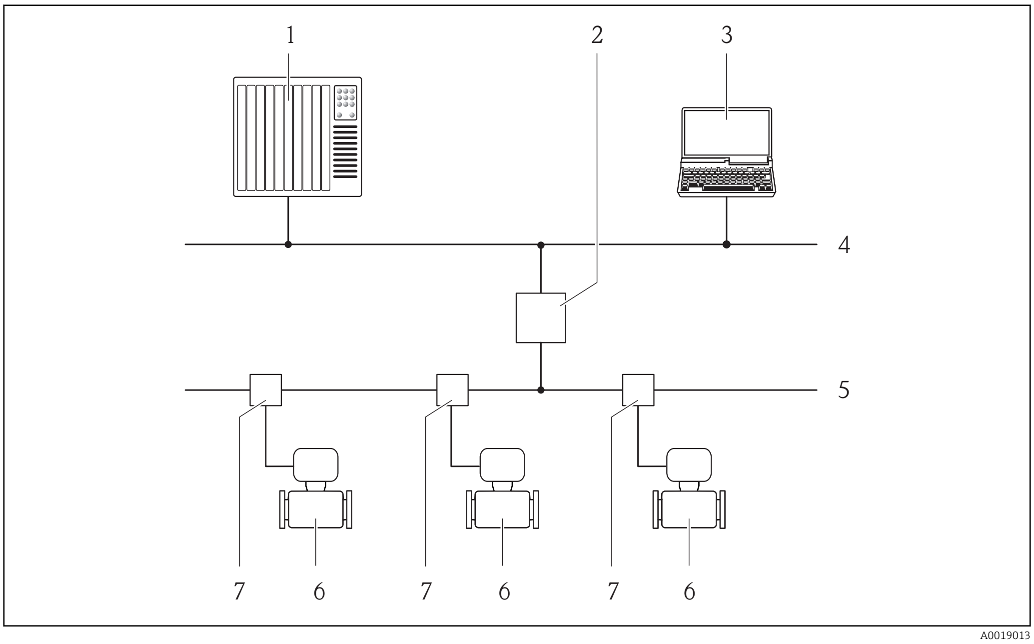


44 *Options for remote operation via HART protocol*

1 Control system (e.g. PLC)
2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
3 Connection for Commubox FXA195 and Field Communicator 475
4 Field Communicator 475
5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
6 Commubox FXA195 (USB)
7 Field Xpert SFX350 or SFX370
8 VIATOR Bluetooth modem with connecting cable
9 Transmitter

Via PROFIBUS PA network

This communication interface is available in device versions with PROFIBUS PA.

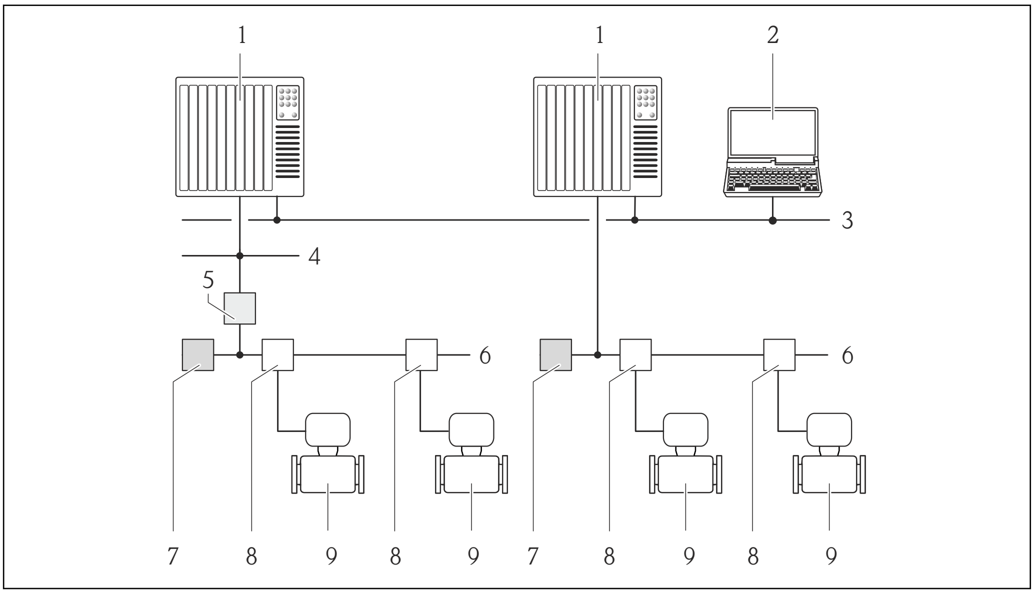


45 *Options for remote operation via PROFIBUS PA network*

1 *Automation system*
2 *Segment coupler PROFIBUS DP/PA*
3 *Computer with PROFIBUS network card*
4 *PROFIBUS DP network*
5 *PROFIBUS PA network*
6 *Measuring device*
7 *T-box*

Via FOUNDATION Fieldbus network

This communication interface is available in device versions with FOUNDATION Fieldbus.



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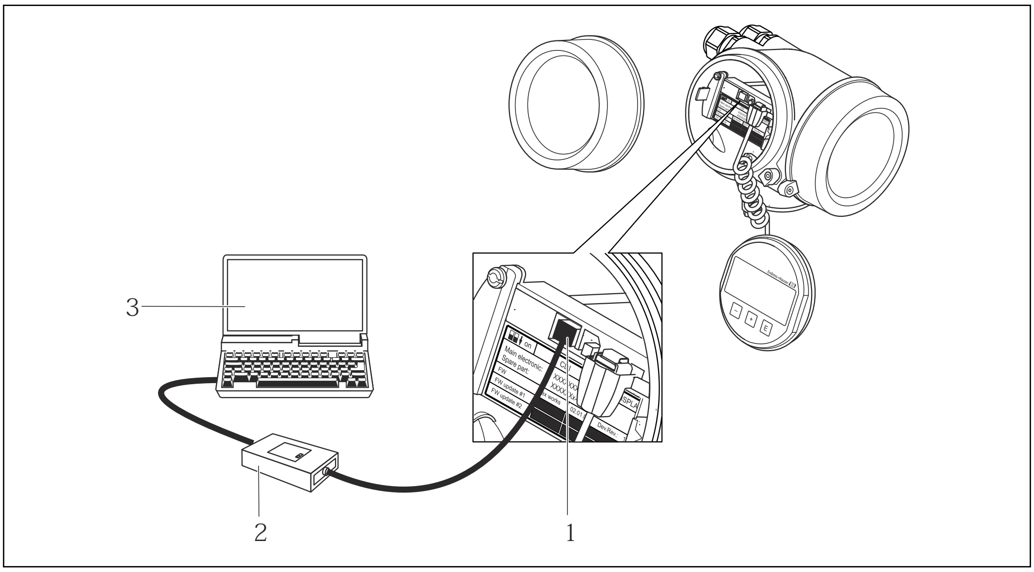
46 *Options for remote operation via FOUNDATION Fieldbus network*

1 *Automation system*
2 *Computer with FOUNDATION Fieldbus network card*
3 *Industry network*
4 *High Speed Ethernet FF-HSE network*
5 *Segment coupler FF-HSE/FF-H1*
6 *FOUNDATION Fieldbus FF-H1 network*
7 *Power supply FF-H1 network*
8 *T-box*
9 *Measuring device*

Service interface

Via service interface (CDI)



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

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 or Ex d[ia] IIB T6...T1 Gb [1]
II1/2G	Ex d[ia] IIC T6...T1 Ga/Gb or Ex d[ia] IIB T6...T1 Ga/Gb [1]
II1/2G, II2D	Ex d[ia] IIC T6...T1 Ga/Gb or Ex d[ia] IIB T6...T1 Ga/Gb [1] Ex tb IIIC Txx °C Db

1) For sensors with nominal diameter DN 80

Ex ia

Category (ATEX)	Type of protection
II2G	Ex ia IIC T6...T1 Gb or Ex ia IIB T6...T1 Gb [1]
II1/2G	Ex ia IIC T6...T1 Ga/Gb or Ex ia IIB T6...T1 Ga/Gb [1]
II1/2G, II2D	Ex ia IIC T6...T1 Ga/Gb or Ex ia IIB T6...T1 Ga/Gb [1] Ex tb IIIC Txx °C Db

1) For sensors with nominal diameter DN 80

Ex nA

Category (ATEX)	Type of protection
II3G	Ex nA IIC T6 to T1 Gc

Ex ic

Category (ATEX)	Type of protection
II3G	Ex ic IIC T6…T1 Gc or Ex ic IIB T6…T1 Gc [1]
II1/3G	Ex ic[ia] IIC T6…T1 Ga/Gc or Ex ic[ia] IIB T6…T1 Ga/Gc [1]

1) For sensors with nominal diameter DN 80

$_{C}$CSA$_{US}$

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

IS (Ex i) and XP (Ex d)
Class I, II, III Division 1 Groups ABCDEFG
For sensors with nominal diameter DN 80: Class I, II, III Division 1 Groups CDEFG

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

Hygienic compatibility

- 3A approval
- EHEDG-tested

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

Functional Safety Manual with information on the SIL device

FOUNDATION Fieldbus certification

FOUNDATION Fieldbus interface

The measuring device is certified and registered by the Fieldbus FOUNDATION. The measuring system meets all the requirements of the following specifications:
- Certified in accordance with FOUNDATION Fieldbus H1
- Interoperability Test Kit (ITK), revision version 6.1.1 (certificate available on request)
- Physical Layer Conformance Test
- The device can also be operated with certified devices of other manufacturers (interoperability)

Certification PROFIBUS

PROFIBUS interface

The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications:
- Certified in accordance with PROFIBUS PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

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. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.

- With the PED/G1/x (x = category) 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 medium:
  - Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to0.5 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 provided by enclosures (IP code)
- IEC/EN 60068-2-6
  Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal).
- IEC/EN 60068-2-31
  Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices.
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use
- 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 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
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications
- NAMUR NE 132
  Coriolis mass meter
- NACE MR0103
  Materials resistant to sulfide stress cracking in corrosive petroleum refining environments.
- NACE MR0175/ISO 15156-1
  Materials for use in H2S-containing Environments in Oil and Gas Production.

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser web site: www.endress.com → Choose your country → Products → Select measuring technology, software or components → Select product (picklists: measurement method, product family etc.) → Device support (right-hand column): Configure the selected product → The Product Configurator for the selected product is opened.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

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

Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. 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.

Detailed information on the application packages:
Special Documentation on the device (→ 📄 81)

Diagnostics functions

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. 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.

Heartbeat Technology

Package	Description
Heartbeat Verification	**Heartbeat Verification:** Makes it possible to check the device functionality on demand when the device is installed, without having to interrupt the process. ▪ Access via onsite operation or other operating interfaces, such as FieldCare for instance. ▪ Documentation of device functionality within the framework of manufacturer specifications, for proof testing for instance. ▪ End-to-end, traceable documentation of the verification results, including report. ▪ Makes it possible to extend calibration intervals in accordance with operator's risk assessment.

Accessories

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

Device-specific accessories

For the transmitter

Accessories	Description
Promass 200 transmitter	Transmitter for replacement or for stock. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Display / operation ▪ Housing ▪ Software For details, see Installation Instructions EA00104D
Remote display FHX50	FHX50 housing to accommodate a display module . ▪ FHX50 housing suitable for: – SD02 display module (push buttons) – SD03 display module (touch control) ▪ Housing material: – Plastic PBT – 316L ▪ Length of connecting cable: up to max. 60 m (196 ft) (cable lengths available for order: 5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)) The measuring device can be ordered with the FHX50 housing and a display module. The following options must be selected in the separate order codes: ▪ Order code for measuring device, feature 030: Option L or M "Prepared for FHX50 display" ▪ Order code for FHX50 housing, feature 050 (device version): Option A "Prepared for FHX50 display" ▪ Order code for FHX50 housing, depends on the desired display module in feature 020 (display, operation): – Option C: for an SD02 display module (push buttons) – Option E: for an SD03 display module (touch control) The FHX50 housing can also be ordered as a retrofit kit. The measuring device display module is used in the FHX50 housing. The following options must be selected in the order code for the FHX50 housing: ▪ Feature 050 (measuring device version): option B "Not prepared for FHX50 display" ▪ Feature 020 (display, operation): option A "None, existing displayed used" For details, see Special Documentation SD01007F
Overvoltage protection for 2-wire devices	Ideally, the overvoltage protection module should be ordered directly with the device. See product structure, characteristic 610 "Accessory mounted", option NA "Overvoltage protection". Separate order necessary only if retrofitting. ▪ OVP10: For 1-channel devices (characteristic 020, option A): ▪ OVP20: For 2-channel devices (characteristic 020, options B, C, E or G) For details, see Special Documentation SD01090F.
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 Special Documentation SD00333F

For the sensor

Accessories	Description
Heating jacket	Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids. If using oil as a heating medium, please consult with Endress+Hauser. Heating jackets cannot be used with sensors fitted with a rupture disk. For details, see Operating Instructions BA00132D

Communication-specific accessories

Accessories	Description
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 the "Technical Information" document TI405C/07
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
Wireless HART adapter SWA70	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 SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

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 throughout 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 relevant measured 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	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
Cerabar M	The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value. For details, see "Technical Information" TI00426P, TI00436P and Operating Instructions BA00200P, BA00382P
Cerabar S	The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value. For details, see "Technical Information" TI00383P and Operating Instructions BA00271P

Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The CD-ROM provided for the device (depending on the device version, the CD-ROM might not be part of the delivery!)
- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

Standard documentation

Brief Operating Instructions

Measuring device	Documentation code
Promass F 200	KA01122D

Operating Instructions

Measuring device	Documentation code		
	HART	PROFIBUS PA	FOUNDATION Fieldbus
Promass F 200	BA01112D	BA01113D	BA01315D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex i	XA00144D
ATEX/IECEx Ex d	XA00143D
ATEX/IECEx Ex nA	XA00145D
cCSAus IS	XA00151D
cCSAus XP	XA00152D
INMETRO Ex i	XA01300D
INMETRO Ex d	XA01305D
INMETRO Ex nA	XA01306D
NEPSI Ex i	XA00156D
NEPSI Ex d	XA00155D
NEPSI Ex nA	XA00157D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD00142D
Functional Safety Manual	SD00147D
Heartbeat Technology	SD01300D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Specified for each individual accessory

Registered trademarks

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

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™ Fieldbus
Registration-pending trademark of the Fieldbus Foundation, Austin, Texas, USA

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

Applicator®, FieldCare®, Field Xpert™, HistoROM®, Heartbeat Technology™
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