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Technical Information

Proline Prosonic Flow B 200

Ultrasonic flow measuring system
For accurate, reliable biogas measurement under variable process conditions

Application

- The innovative, industry-optimized measuring device for biogas, digester gas and landfill gas
- Reliable biogas measurement without any restrictions: can be used with wet gas, variable gas compositions, low process pressures and low flow velocities.

Device properties:
- Medium temperature: 0 to 80 °C (32 to 176 °F)
- Process pressure: max. 10 bar (145 psi)
- Accuracy:
  – Volume flow: ±1.5 % o.r.
  – Methane: ±2 % abs. (optional)
- Nominal diameter: DN 50 to 200 (2 to 8 in)
- Stainless steel sensor (1.4404/316L or 1.4435/316L)
- Aluminum or stainless steel field housing
- Communication via HART protocol
- Available with pressure equipment directive approval (PED)
- Ex approvals accepted worldwide: ATEX, IECEx, $_{C}CSA_{US}$

Your benefits

The measuring device delivers accurate, reliable biogas measurements, even at low process pressures. Optional real-time measurement of the biogas methane fraction further optimizes process performance.

Sizing – correct product selection
Applicator – the reliable, easy-to-use tool for selecting and sizing measuring devices for every application

Installation – simple and efficient
- Short inlet and outlet runs
- Reduced wiring effort due to two-wire technology

Commissioning – reliable and intuitive
- Seamless system integration
- Guided parameterization – "Make-it-run" wizards

Operation – increased measurement availability
- Simultaneous measurement of volume flow and, optionally, methane fraction and temperature (multivariable)
- No pressure loss
- Diagnostic capability
- HistoROM: automatic data backup

Life Cycle Management (W@M) for your plant

TI01018D/06/EN/01.11
71147021

Endress+Hauser
People for Process Automation

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Document conventions

Document conventions

Electrical symbols

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

Symbols for certain types of information

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

Symbols in graphics

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

Function and system design

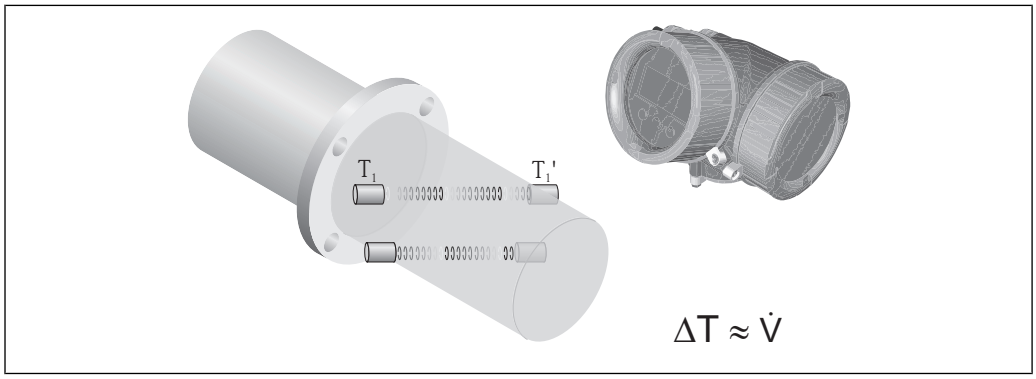
Measuring principle

A Prosonic Flow ultrasonic flowmeter measures the flow velocity in the measuring tube using two sensor arrangements located opposite one another. These are arranged at an angle in such a way that one sensor is mounted somewhat further downstream than the other sensor. The design is non-invasive and does not have any moving parts.

The flow signal is determined by alternately measuring the time of flight of an acoustic signal traveling from one sensor to the other, using the fact that sound travels faster in the direction of flow than against the direction of flow.

The volume flow is determined by performing sequential measurements between all the pairs of sensors in the arrangement. The sensor design ensures that only a short straight inlet run is required upstream of the measuring device following typical obstacles to flow, such as pipe bends in one or two planes.

Modern digital signal processing enables the constant analysis of the flow measurement values, reduces the system's sensitivity to multiphase flow conditions and increases measurement reliability.



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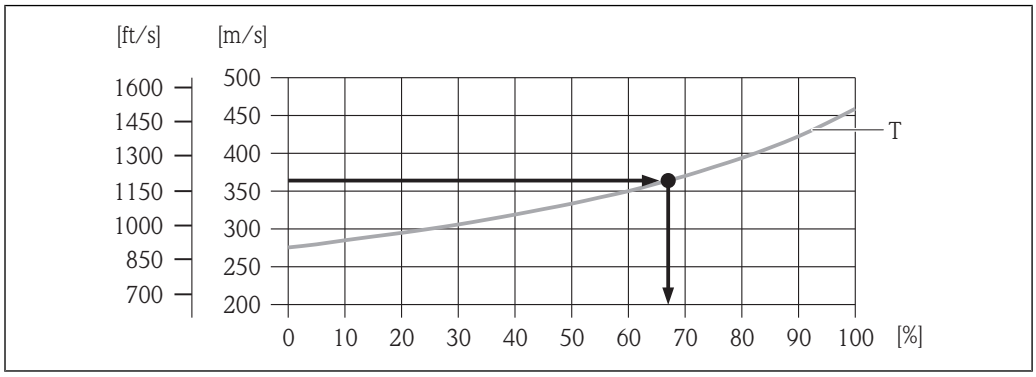
Direct measurement of the methane fraction (CH_4)

The sound velocity, temperature and chemical composition of a gas are directly related to one another. If two of these characteristic quantities are known, the third can be calculated. The higher the gas temperature or the methane fraction, the higher the sound velocity in biogas, for example.

Since the measuring device accurately measures both the sound velocity and the current gas temperature, the methane fraction can be calculated directly and displayed on site without the need for an additional measuring instrument (→ 1, 4).

The relative humidity of biogas is usually 100 %. Thus, the water content can be determined by the temperature measurement and can be compensated for.

The measuring device is unique in its ability to measure the methane fraction directly, making it possible to monitor the gas flow and gas quality 24/7. In this way, operators of a biogas plant, for example, can react swiftly and specifically to problems in the digestion process.



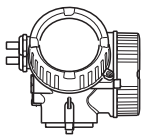
A0016160

1 *Calculation of the methane fraction [%] based on the sound velocity [m/s (ft/s)] and a temperature T of 40 °C (104 °F), for example*

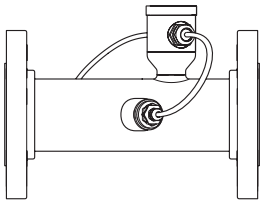
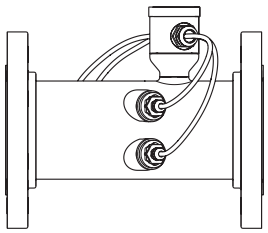
Measuring system

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

Transmitter

Prosonic Flow B 200  A0013471	Materials: ■ Stainless steel 1.4404/316L ■ Aluminum coating AlSi10Mg Measured variables: Volume and, optionally, methane fraction and temperature Configuration: ■ Four-line local display ■ Operation with push buttons ■ Guided menus ("Make-it-run" wizards) for applications

Sensor

Prosonic Flow B *Single-path version: DN 50 (2"), DN 80 (3")*  A0015826 *Two-path version: DN 100 to 200 (4 to 8")*  A0015452	■ Designed exclusively to measure: – Biogas (RH > 70 %) – Coal gas – Air – Methane – Nitrogen – Gas with a very high methane fraction ■ Range of nominal diameter: DN 50 to 200 (2 to 8") ■ Materials: – Sensor: Stainless steel 1.4404/316L, cold worked Stainless steel 1.4435/316L, cold worked – Process connections: Stainless steel 1.4301/304, Stainless steel 1.4306/304L, Stainless steel 1.4404/316L, Steel S235JR, Carbon steel A105

Input

Measured variable

Direct measured variables

Volume flow

Calculated measured variables

Corrected volume flow

Optional measured variables (can be ordered)

Order characteristic for "Sensor version", option 2
- Corrected methane volume flow
- Energy flow
- Methane fraction
- Calorific value
- Wobbe index
- Temperature

Measuring range

Nominal diameter		Velocity		Effective volume flow	
[mm]	[in]	[m/s]	[ft/s]	[m³/h]	[ft³/h]
50	2	1 to 30	3.28 to 98.4	9 to 269	316 to 9495
80	3	1 to 30	3.28 to 98.4	20 to 611	720 to 21592
100	4	1 to 30	3.28 to 98.4	34 to 1032	1215 to 36443
150	6	1 to 30	3.28 to 98.4	76 to 2290	2695 to 80862
200	8	1 to 30	3.28 to 98.4	131 to 3925	4620 to 138596

The values in the table should only be regarded as reference values.

To calculate the measuring range, use the *Applicator* sizing tool (→ 31)

Recommended measuring range

"Flow limit" section (→ 16)

Operable flow range

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

Input signal

To increase the accuracy of certain measured variables, a measured pressure value can be used instead of a fixed operating pressure. For this purpose, the measuring device continuously reads in the operating pressure from a pressure transmitter (e.g. Cerabar M or Cerabar S) via the HART protocol.

The pressure transmitter must support the following protocol-specific functions:
- HART protocol
- Burst mode

- Various pressure transmitters can be ordered from Endress+Hauser: see "Accessories" section (→ 32)
- Please comply with the special mounting instructions if using pressure transmitters (→ 13)

External pressure compensation is recommended to calculate the following measured variables:
- Corrected volume flow
- Corrected methane volume flow

Output

Output signal

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

Signal on alarm

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

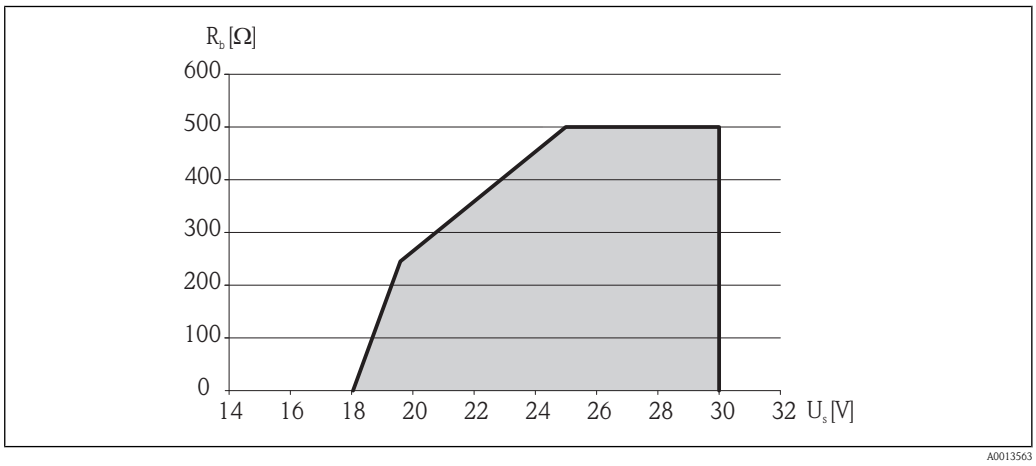
Load

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

Calculation of the maximum load

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

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



2 Operating range

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

Ex connection data

Intrinsically signal circuits

Type of protection Ex ia

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

Low flow cut off

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

Galvanic isolation

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

Protocol-specific data

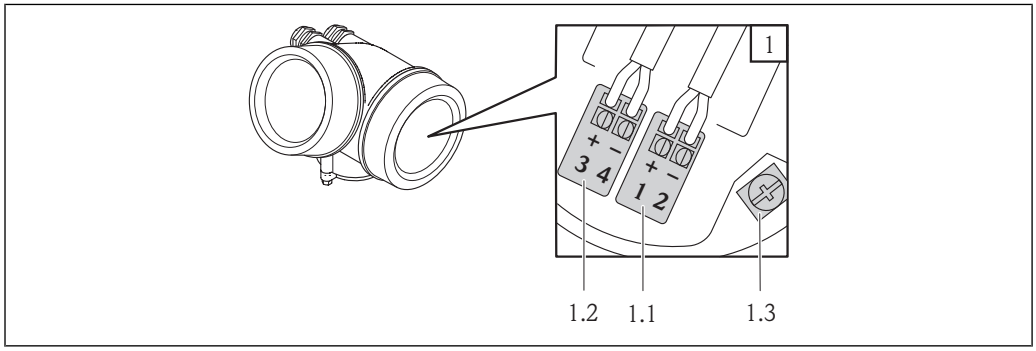
HART

Manufacturer ID	0x11
Device type ID	0x5A
HART protocol revision	6.0
Device description files (DTM, DD)	Information and files under: www.endress.com

HART load	Min. 250 Ω
Dynamic variables	The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ■ Volume flow ■ Corrected volume flow ■ Corrected methane volume flow ■ Energy flow ■ Methane fraction ■ Calorific value ■ Wobbe index ■ Temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ■ Volume flow ■ Corrected volume flow ■ Corrected methane volume flow ■ Energy flow ■ Methane fraction ■ Calorific value ■ Wobbe index ■ Temperature ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3

Power supply

Terminal assignment



3 Transmitter with maximum number of terminals

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

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

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

Supply voltage

An external power supply is required for each output.

Various power supply units can be ordered from Endress+Hauser: see "Accessories" section (→ 32)

Order characteristic for "Output"	Minimum terminal voltage[1)]	Maximum terminal voltage
Option **C**	For 4 mA: ≥ DC 18 V For 20 mA: ≥ DC 14 V	DC 30 V

1) External supply voltage of the power supply unit with load (→ 7)

Power consumption

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

Current consumption

3.6 to 22 mA

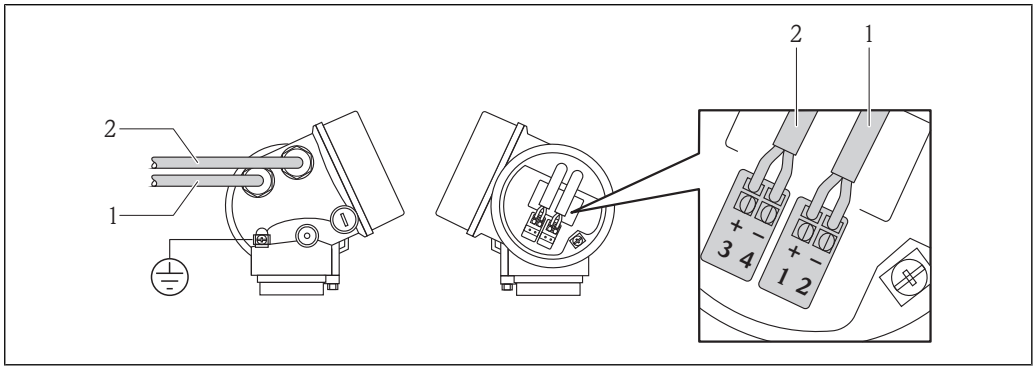
If the option **Defined value** is selected in the **Failure mode** parameter (→ 6): 3.59 to 22.5 mA

Power supply failure

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

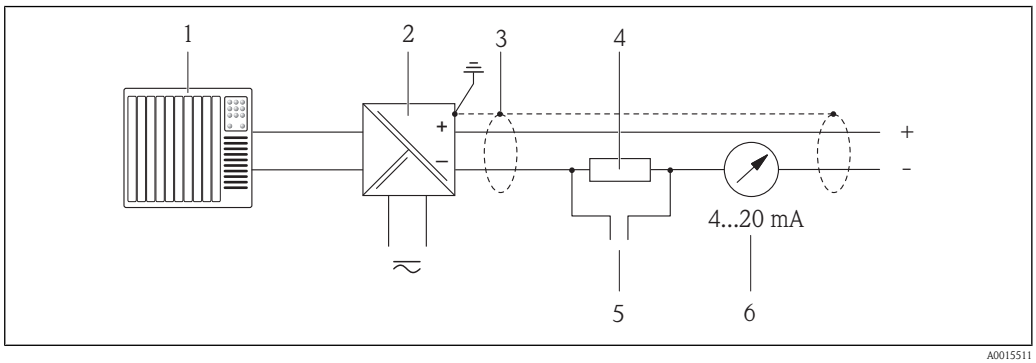
Electrical connection

Connecting the transmitter



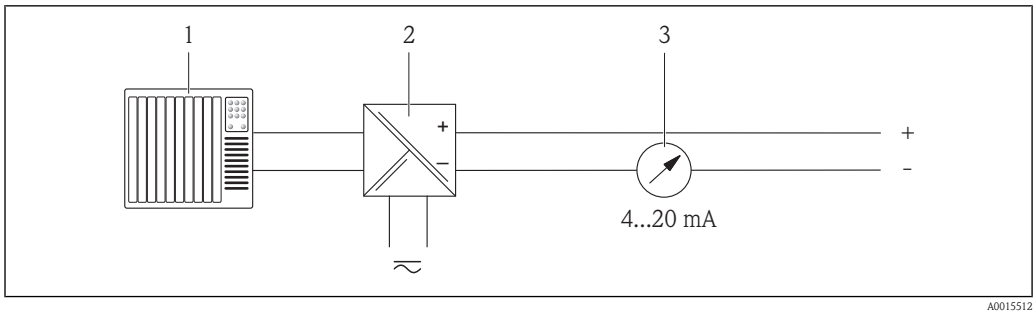
1 Cable entry for output 1
2 Cable entry for output 2

Connection examples



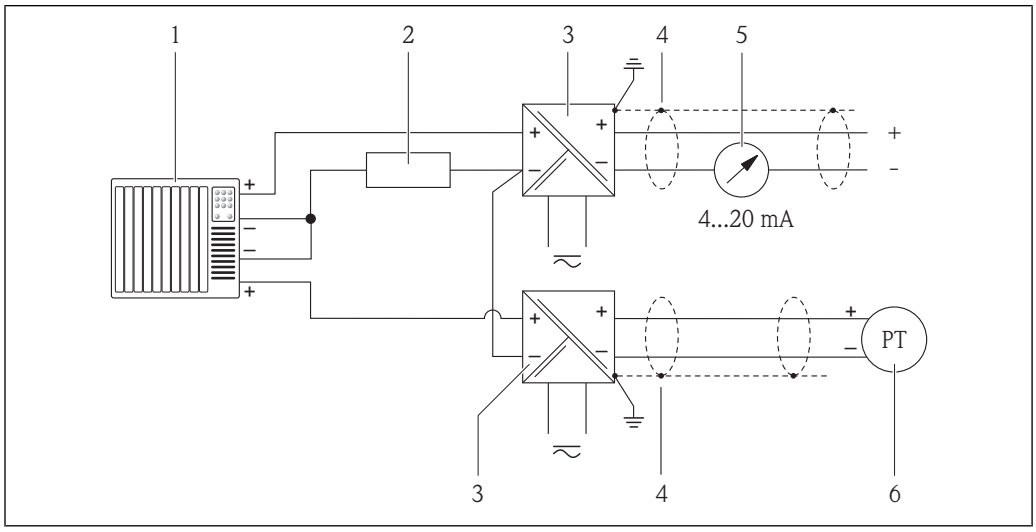
4 Connection example for 4-20 mA HART current output, passive

1 Control system (e.g. PLC)
2 Active barrier for power supply (e.g. RN221N) (→ 8)
3 Observe cable specification (→ 10)
4 Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 7)
5 Connection for Field Communicator 375/475 or Commubox FXA191/195
6 Analog display unit: observe maximum load (→ 7)



5 Connection example for 4-20 mA current output, passive

1 Control system (e.g. PLC)
2 Active barrier for power supply (e.g. RN221N) (→ 8)
3 Analog display unit: observe maximum load (→ 7)



6 Connection example for HART input with a common negative

1 Control system (e.g. PLC)
2 Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 7)
3 Active barrier for power supply (e.g. RN221N) (→ 8)
4 Observe cable specification (→ 10)
5 Analog display unit: observe maximum load (→ 7)
6 Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements (→ 6)

Potential equalization

No special measures for potential equalization are required.

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

Terminals

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

Cable entries

- Cable gland (not for Ex d): M20 × 1.5 with cable ∅ 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - For non-Ex and Ex: 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
- A normal device cable suffices if only the analog signal is used.
- A shielded cable is recommended if using the HART protocol. Observe grounding concept of the plant.

Performance characteristics

Reference operating conditions

- Error limits following ISO/DIS 11631
- Calibration gas: air
- Temperature regulated to 24 ± 0.5 °C (75.2 ± 0.9 °F) under atmospheric pressure
- Humidity regulated to < 40 % RH
- Accuracy based on accredited calibration rigs that are traced to ISO 17025.

To calculate the measuring range, use the *Applicator* sizing tool (→ 31)

Maximum measured error

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

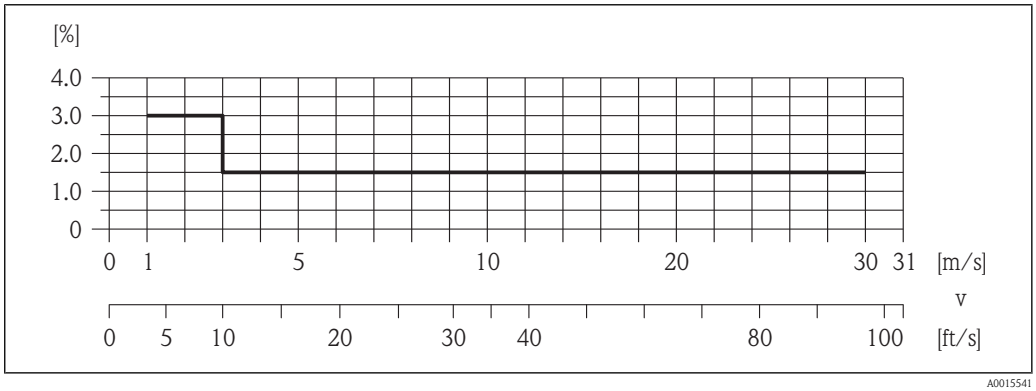
o.r. = of reading; o.f.s. = of full scale value; abs. = absolute; 1 g/cm³ = 1 kg/l; T = medium temperature

Volume flow
- ±1.5 % o.r. for 3 to 30 m/s (9.84 to 98.4 ft/s)
- ±3 % o.r. for 1 to 3 m/s (3.28 to 9.84 ft/s)

Methane
±2 % o.f.s. = ±2 % abs.

Temperature
±0.6 °C ± 0.005 · T °C (±0.9 °F ± 0.005 · (T – 32) °F)

Example for max. measured error (volume flow)



7 Example for max. measured error (volume flow) in % o.r.

Repeatability

o.r. = of reading; o.f.s. = of full scale value; abs. = absolute; 1 g/cm³ = 1 kg/l; T = medium temperature

Volume flow
±0.5 % o.r.

Methane
±0.5 % o.f.s. = ±0.5 % abs.

Temperature
±0.3 °C ± 0.0025 · T °C (±0.45 °F ± 0.0025 · (T – 32) °F)

Response time

- The response time depends on the configuration (damping).
- Response time in the event of erratic changes in the flow: after 1 000 ms 95 % of the full scale value.

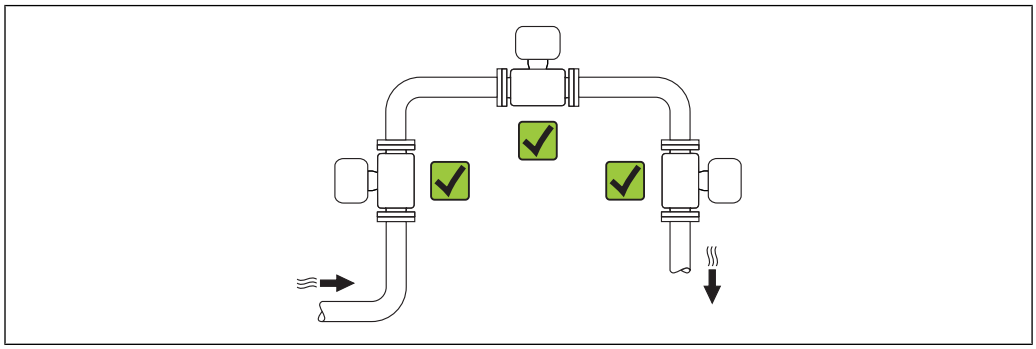
Influence of ambient temperature

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

Installation

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

Mounting location



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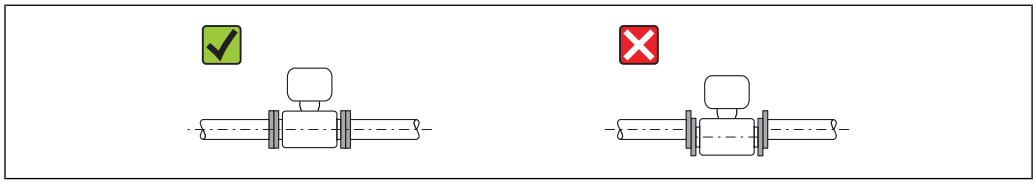
Orientation

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

- Install the measuring device in a parallel plane free of external mechanical stress.
- The internal diameter of the pipe must match the internal diameter of the sensor (→ 17).



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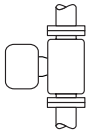
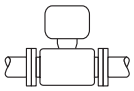
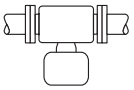
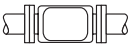
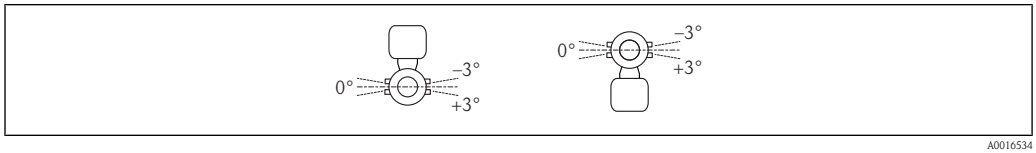
Orientation			Compact version
A	Vertical orientation	 A0015545	✓✓
B	Horizontal orientation, transmitter head up *	 A0015589	✓✓
C	Horizontal orientation, transmitter head down *	 A0015590	✓
D	Horizontal orientation, transmitter head at side	 A0015592	✗

* A maximum deviation of only ±3 ° is permitted for the horizontal alignment of the transducers.



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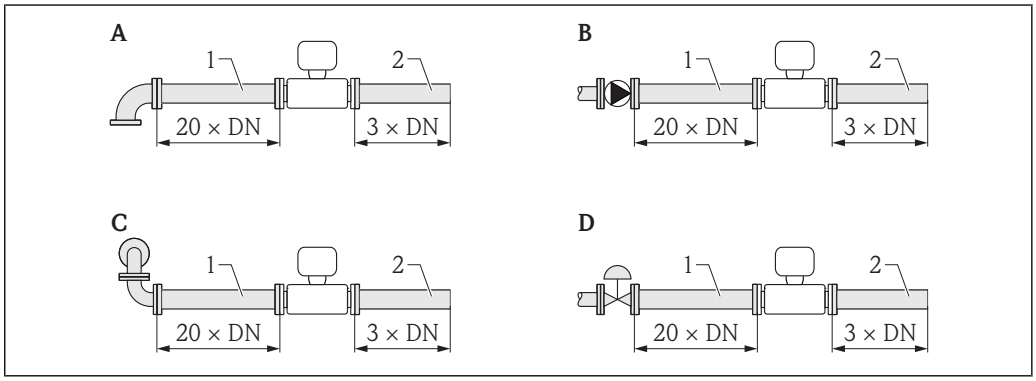
Inlet and outlet runs

The sensor should be mounted upstream of assemblies such as valves, T-sections, elbows etc. where possible. As a minimum, the inlet and outlet runs shown below must be observed to achieve the specific accuracy of the device. The longest inlet run shown must be observed if two or more flow disturbances are present.

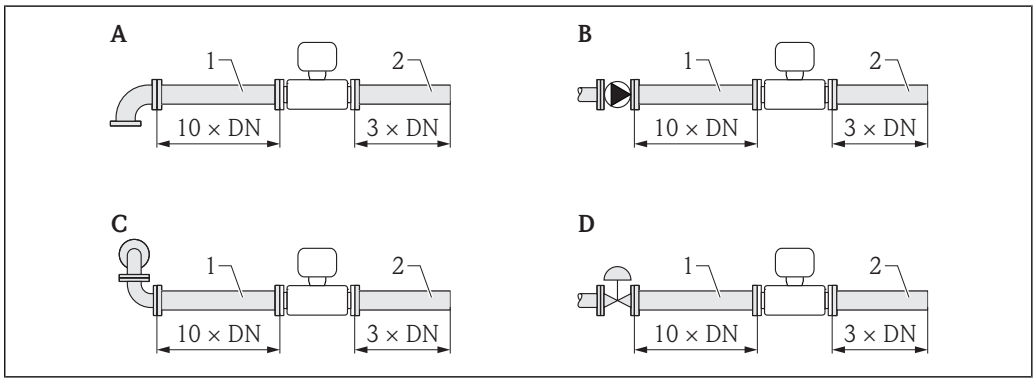
Single-path version: DN 50 (2"), DN 80 (3")



8 Single-path version: minimum inlet and outlet runs with various flow obstructions

A 90 ° elbow or T-section
B Pump
C 2× 90 ° elbow 3-dimensional
D Control valve
1 Inlet run
2 Outlet run

Two-path version: DN 100 to 200 (4 to 8")



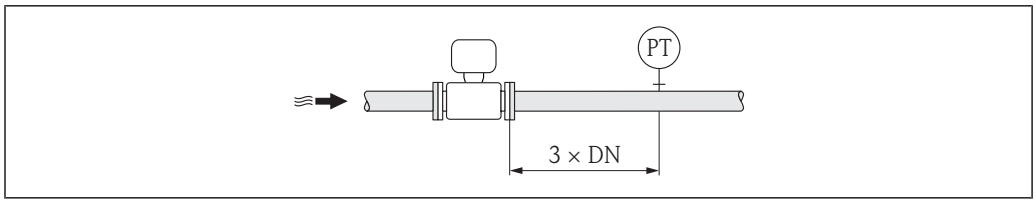
9 Two-path version: minimum inlet and outlet runs with various flow obstructions

A 90 ° elbow or T-section
B Pump
C 2× 90 ° elbow 3-dimensional
D Control valve
1 Inlet run
2 Outlet run

Special mounting instructions

Outlet run for pressure transmitter

If a pressure transmitter is installed downstream of the measuring device, make sure there is sufficient distance between the two devices.



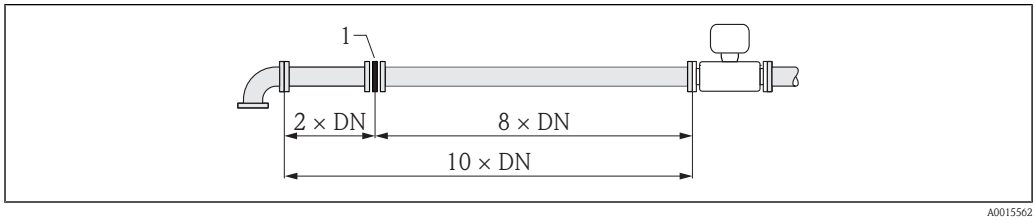
PT Pressure transmitter

Flow conditioner

It is advisable to use a flow conditioner if the inlet runs cannot be observed. Using a flow conditioner reduces the inlet required as follows:

Single-path version	Two-path version
10 × DN	5 × DN

The flow conditioner should be installed so that it divides the available inlet run by a ratio of roughly 20 : 80. Example for an inlet run of 10 × DN:



1 Flow conditioner

Pressure loss

The pressure loss for flow conditioners is calculated as follows:
Δp [mbar] = 0.0085 · ρ [kg/m³] · v² [m/s]

Example for biogas
p = 1 040 mbar abs.
ρ = 1.0432 kg/m³ at t = 54 °C (129 °F)
v = 7 m/s
Δp = 0.0085 · 1.0432 kg/m³ · 49 m/s = 0.434 mbar

---
abs.: absolute
ρ: density of the process medium
v: average flow velocity

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.

Weather protection covers can be ordered from Endress+Hauser: see "Accessories" section (→ 30)

Temperature tables

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

Ex ia, Ex d

SI units

Nominal diameter [mm]	T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
50 to 200	40	60	80	80	80	80	80
50 to 200	50	–	80	80	80	80	80
50 to 200	60	–	55	80	80	80	80

US units

Nominal diameter [in]	T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
2 to 8	104	140	176	176	176	176	176
2 to 8	122	–	176	176	176	176	176
2 to 8	140	–	131	176	176	176	176

Storage temperature

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

Degree of protection

- For transmitters and sensors: IP66 and IP67, Type 4X enclosure
- For transmitters with an open housing: IP20, Type 1 enclosure, is also the degree of protection of the display module

Shock resistance

In accordance with EN 60721-3-4

Vibration resistance

Class 4M4, in accordance with EN 60721-3-4

Electromagnetic compatibility (EMC)

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

Details are provided in the Declaration of Conformity.

Process

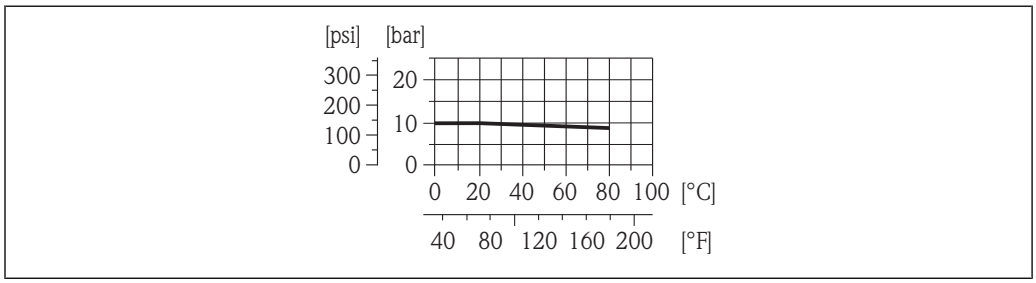
Medium temperature range

Sensor
0 to +80 °C (+32 to +176 °F)

Pressure-temperature ratings

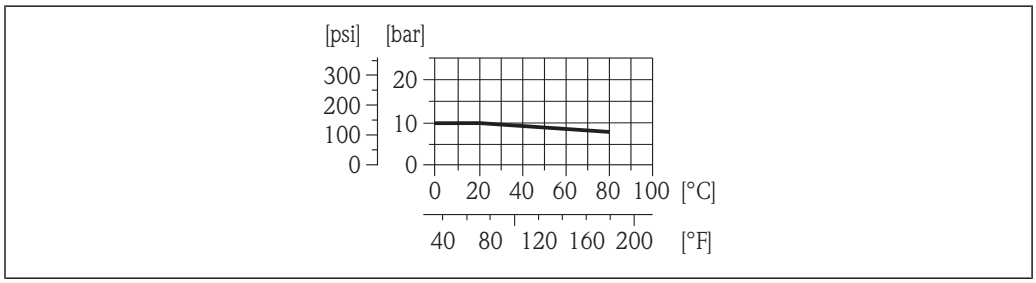
The following material load diagrams refer to the entire device and not just the process connection.

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



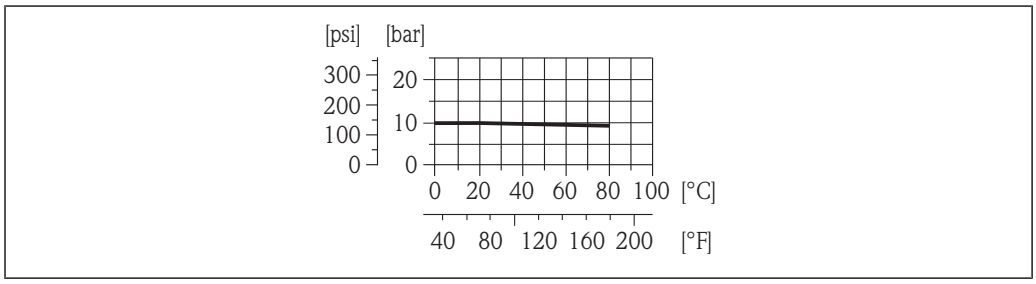
10 With lap joint flange, stamped plate PN 10, material 1.4301/304 (DN 50 to 200 / 2 to 8")

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



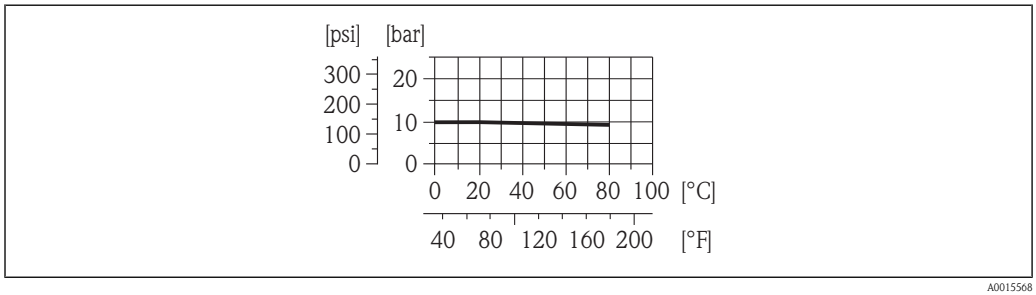
11 With lap joint flange PN 10, material 1.4306/304L (DN 200 / 8")

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



12 With lap joint flange PN 10/16, materials S235JR (DN 50 to 200 / 2 to 8") and 1.4306/304L (DN 50 to 150 / 2 to 6"); With lap joint flange, stamped plate PN 10, material S235JR (DN 50 to 200 / 2 to 8")

Flange connection according to ASME B16.5



13 With lap joint flange Class 150, materials 1.4404/316L and A105 (DN 50 to 200 / 2 to 8")

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, 10 to 50 % of the maximum full scale value can be considered ideal.

Pressure loss

There is no pressure loss.

System pressure

Sensor
Max. 10 bar (145 psi)

Thermal insulation

For optimum temperature and methane fraction measurement (order characteristic for "Sensor version", option 2), make sure that heat is neither lost nor applied to the sensor. Thermal insulation can ensure that such heat transfer does not take place.

Thermal insulation is particularly recommended in situations where there is a large difference between the process temperature and the ambient temperature. This can result in heat convection errors during temperature measurement. A further factor which can lead to measurement errors due to heat convection is a low flow velocity.

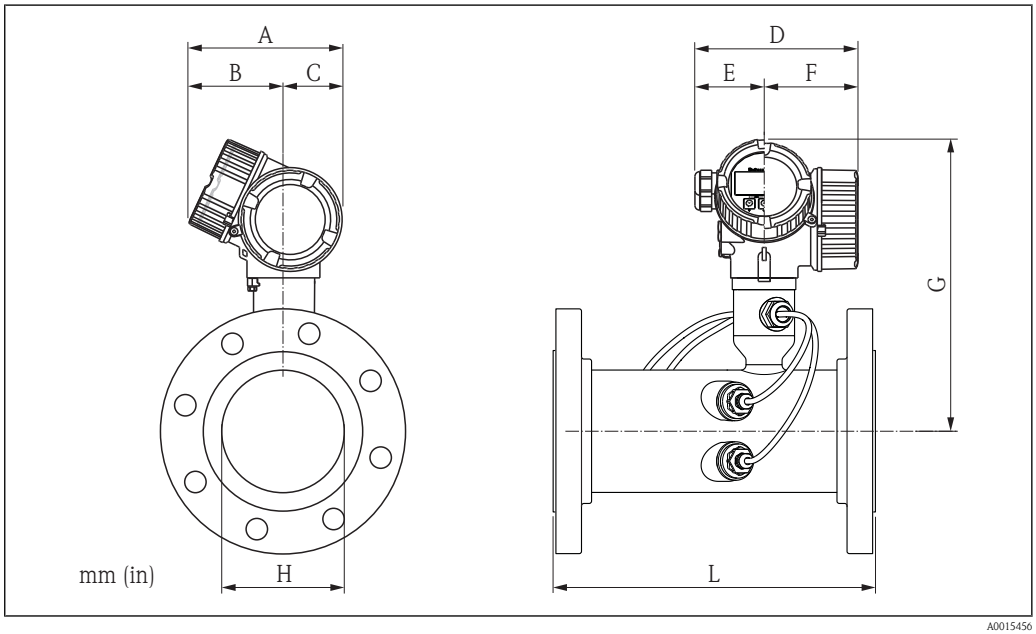
Mechanical construction

Design, dimensions

Compact version

Order characteristic for "Housing", option C, S

Lap joint flange; lap joint flange, stamped plate



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Dimensions in SI units for version without overvoltage protection

DN [mm]	A [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [2] [mm]	⌀ H [mm]	L [mm]
50	162	102	60	165	75	90	254	56.3	250
80	162	102	60	165	75	90	268	84.9	300
100	162	102	60	165	75	90	281	110.3	300

DN [mm]	A [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [2] [mm]	Ø H [mm]	L [mm]
150	162	102	60	165	75	90	308	164.3	350
200	162	102	60	165	75	90	334	213.9	400

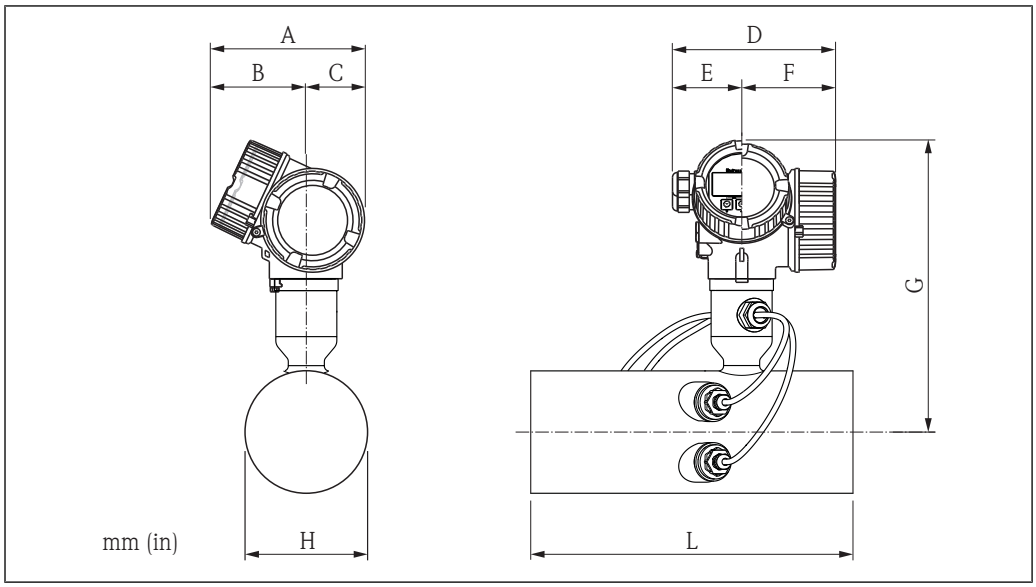
1) for version without local display: values - 7 mm
2) for version without local display: values - 10 mm

Dimensions in US units for version without overvoltage protection

DN [in]	A [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [2] [in]	Ø H [in]	L [in]
2	6.38	4.02	2.36	6.50	2.95	3.54	10.0	2.22	9.84
3	6.38	4.02	2.36	6.50	2.95	3.54	10.6	3.34	11.81
4	6.38	4.02	2.36	6.50	2.95	3.54	11.1	4.34	11.81
6	6.38	4.02	2.36	6.50	2.95	3.54	12.1	6.47	13.78
8	6.38	4.02	2.36	6.50	2.95	3.54	13.2	8.42	15.75

1) for version without local display: values - 0.28 in
2) for version without local display: values - 0.39 in

Without flange



Dimensions in SI units for version without overvoltage protection

DN [mm]	A [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [2] [mm]	Ø H [mm]	L [mm]
50	162	102	60	165	75	90	254	56.3	282.5 +0,0/–1,0
80	162	102	60	165	75	90	268	84.9	336.5 +0,0/–1,0
100	162	102	60	165	75	90	281	110.3	338.0 +0,0/–1,0
150	162	102	60	165	75	90	308	164.3	394.0 +0,0/–1,5
200	162	102	60	165	75	90	334	213.9	447.0 +0,0/–2,0

1) for version without local display: values - 7 mm
2) for version without local display: values - 10 mm

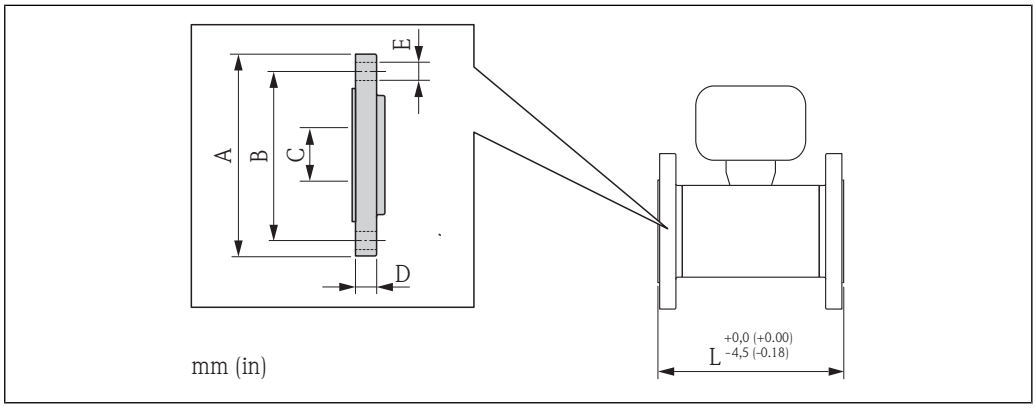
Dimensions in US units for version without overvoltage protection

DN [in]	A [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [2] [in]	∅ H [in]	L [in]
2	6.38	4.02	2.36	6.50	2.95	3.54	10.0	2.22	11.1 +0,0/–0,04
3	6.38	4.02	2.36	6.50	2.95	3.54	10.6	3.34	13.2 +0,0/–0,04
4	6.38	4.02	2.36	6.50	2.95	3.54	11.1	4.34	13.3 +0,0/–0,04
6	6.38	4.02	2.36	6.50	2.95	3.54	12.1	6.47	15.5 +0,0/–0,06
8	6.38	4.02	2.36	6.50	2.95	3.54	13.2	8.42	17.6 +0,0/–0,08

1) for version without local display: values - 0.28 in
2) for version without local display: values - 0.39 in

Process connections in SI units

Flange connections EN (DIN), ASME B16.5



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Flange connections EN (DIN)

Flange according to EN 1092-1 (DIN 2501); PN 10/16: 1.4306/304L, S235JR (lap joint flange)						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	∅ E [mm]	L [mm]
50	165	125	60.3	22	4 × 18	250
80	200	160	88.9	22	8 × 18	300
100	220	180	114.3	24	8 × 18	300
150	285	240	168.3	26	8 × 22	350

Flange according to EN 1092-1 (DIN 2501); PN 10: 1.4306/304L, S235JR (lap joint flange)						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	∅ E [mm]	L [mm]
200	340	295	219.1	27	8 × 22	400

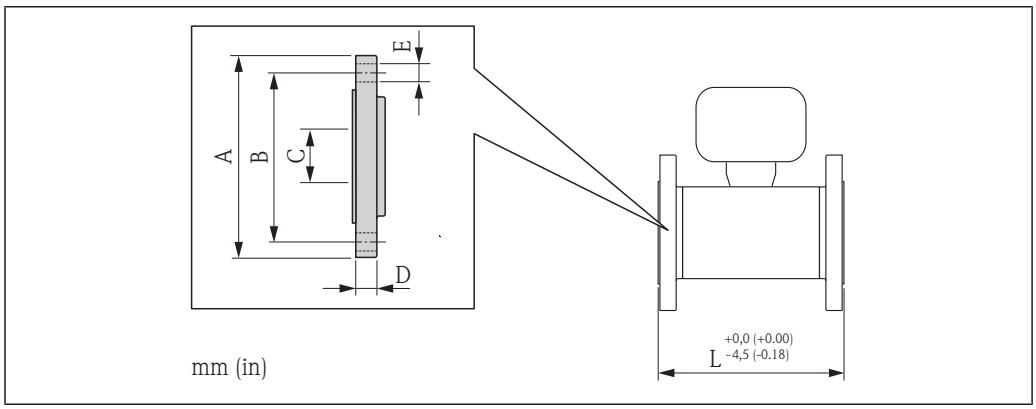
Flange according to EN 1092-1 (DIN 2501); PN 10: 1.4301/304, S235JR (lap joint flange, stamped plate)						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	Ø E [mm]	L [mm]
50	165	125	60.3	22	4 × 17.5	250
80	200	160	88.9	25	8 × 17.5	300
100	220	180	114.3	26	8 × 17.5	300
150	285	240	168.3	29	8 × 21.5	350
200	340	295	219.1	34	8 × 21.5	400

Flange connections ASME B16.5

Flange according to ASME B16.5; Class 150: 1.4404/316L, A105 (lap joint flange)						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	Ø E [mm]	L [mm]
50	152.4	120.7	77.7	21.1	4 × 19.1	250
80	190.5	152.4	108.0	25.9	4 × 19.1	300
100	228.6	190.5	134.9	25.9	8 × 19.1	300
150	279.4	241.3	192.0	27.4	8 × 22.4	350
200	342.9	298.5	246.1	31.0	8 × 22.4	400

Process connections in US units

Flange connections ASME B16.5



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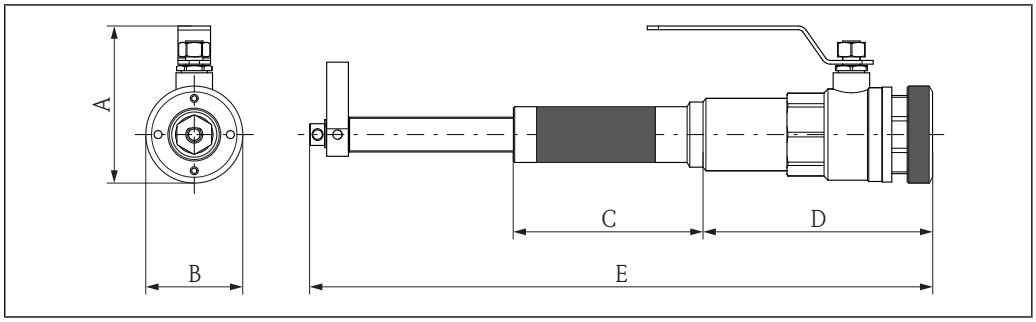
Flange according to ASME B16.5; Class 150: 1.4404/316L, A105 (lap joint flange)						
DN [in]	A [in]	B [in]	C [in]	D [in]	Ø E [in]	L [in]
2	6.00	4.75	3.06	0.83	4 × 0.75	9.84
3	7.50	6.00	4.25	1.02	4 × 0.75	11.81
4	9.00	7.50	5.31	1.02	8 × 0.75	11.81
6	11.00	9.50	7.56	1.08	8 × 0.88	13.78
8	13.50	11.75	9.69	1.22	8 × 0.88	15.75

Accessories

Replacement tool



A0016020

Dimensions in SI units

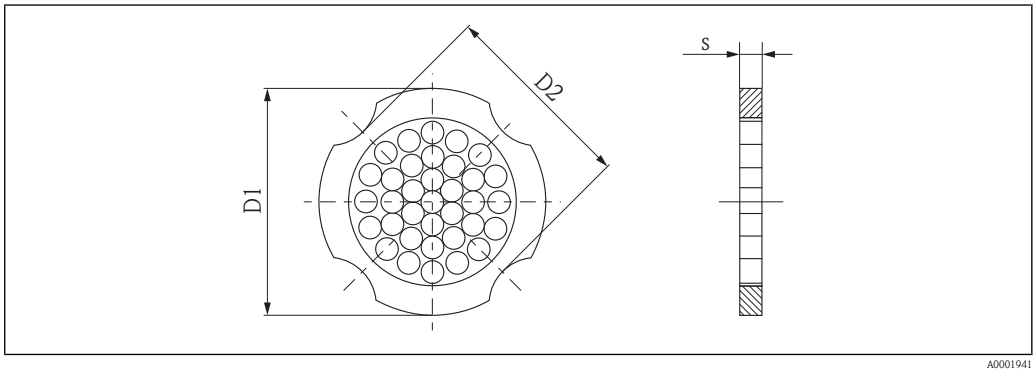
A [mm]	Ø B [mm]	C [mm]	D [mm]	E [mm]
108	67	131	159	330 to 430

Dimensions in US units

A [in]	Ø B [in]	C [in]	D [in]	E [in]
4.25	2.64	5.16	6.26	13 to 17

Flow conditioner

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



A0001941

Dimensions in SI units

DN [mm]	Pressure rating	Centering diameter [mm]	D1 [1] / D2 [2]	s [mm]
50	PN 10/16	110.0	D2	6.80
80	PN 10/16	145.3	D2	10.1
100	PN 10/16	165.3	D2	13.3

DN [mm]	Pressure rating	Centering diameter [mm]	D1 [1] / D2 [2]	s [mm]
150	PN 10/16	221.0	D2	20.0
200	PN 10	274.0	D1	26.3

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

DN [mm]	Pressure rating	Centering diameter [mm]	D1 [1] / D2 [2]	s [mm]
50	Class 150	104.0	D2	6.80
80	Class 150	138.4	D1	10.1
100	Class 150	176.5	D2	13.3
150	Class 150	223.5	D1	20.0
200	Class 150	274.0	D2	26.3

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

Dimensions in US units

DN [in]	Pressure rating	Centering diameter [in]	D1 [1] / D2 [2]	s [in]
2	Class 150	4.09	D2	0.27
3	Class 150	5.45	D1	0.40
4	Class 150	6.95	D2	0.52
6	Class 150	8.81	D1	0.79
8	Class 150	10.8	D2	1.04

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

Weight

Weight in SI units

Compact version

All values (weight) refer to devices with EN (DIN) PN 10/16 flanges. Weight information in [kg].

Order characteristic for "Housing", option C

Nominal diameter [mm]	Lap joint flange		Lap joint flange, stamped plate	
	1.4306	S235JR	1.4301	S235JR
50	9.5		5.9	
80	11.8		7.5	
100	14.0		9.1	
150	20.9		12.3	
200	27.9		19.1	

Order characteristic for "Housing", option S

Nominal diameter [mm]	Lap joint flange		Lap joint flange, stamped plate	
	1.4306	S235JR	1.4301	S235JR
50	12.4		8.7	
80	14.7		10.3	
100	16.9		12.0	
150	23.7		15.2	
200	30.7		22.0	

Weight in US units

Compact version

All values (weight) refer to devices with ASME B16.5, Class 150 flanges. Weight information in [lbs].

Order characteristic for "Housing", option C

Nominal diameter [in]	Lap joint flange	
	316L	A105
2	18.8	
3	28.6	
4	38.0	
6	49.8	
8	77.4	

Order characteristic for "Housing", option S

Nominal diameter [in]	Lap joint flange	
	316L	A105
2	25.1	
3	34.9	
4	44.3	
6	56.1	
8	83.7	

Accessories

Replacement tool

Weight [kg]	Weight [lbs]
3.66	8.07

Flow conditioner

Weight in SI units

DN [mm]	Pressure rating	Weight [kg]
50	PN 10/16	0.5
	Class 150	0.5
80	PN 10/16	1.4

DN [mm]	Pressure rating	Weight [kg]
	Class 150	1.2
100	PN 10/16	2.4
	Class 150	2.7
150	PN 10/16	6.3
	Class 150	6.3
200	PN 10	11.5
	Class 150	12.3

Weight in US units

DN [in]	Pressure rating	Weight [lbs]
2	Class 150	1.1
3	Class 150	2.6
4	Class 150	6.0
6	Class 150	14.0
8	Class 150	27.0

Materials

Transmitter housing

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

Cable entries

Order characteristic for "Housing", option C

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

For the transmitter neck		
Electrical connection	**Measuring path**	**Material**
Cable gland M20 × 1.5	Two-path	Nickel-plated brass
Cable gland M12 × 1.5	Single-path	

For the sensor	
Electrical connection	**Material**
Cable gland M12 × 1.5	Nickel-plated brass

Order characteristic for "Housing", option S

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

For the transmitter neck		
Electrical connection	**Sensor version**	**Material**
Cable gland M20 × 1.5	Two-path	Stainless steel 1.4305
Cable gland M12 × 1.5	Single-path	

For the sensor		
Electrical connection	**Sensor version**	**Material**
Cable gland M20 × 1.5	Two-path	Stainless steel 1.4305
Cable gland M12 × 1.5	Single-path	

Sensor housing

Stainless steel (cold worked):
– 1.4404/316L
– 1.4435/316L

Process connections

- Stainless steel:
  – 1.4301/304
  – 1.4306/304L
  – 1.4404/316L
- Steel S235JR
- Carbon steel A105

List of all available process connections (→ 26)

Seals

- Transducer: HNBR
- Temperature sensor: AFM 34

Accessories

Replacement tool

- Knurled handle: aluminum
- Stop cock: nickel-plated brass
- Shaft: brass
- Tensioning element: tempered steel

Flow conditioner

Stainless steel 1.4404/316L (in compliance with NACE MR0175-2003 and MR0103-2003)

Weather protection cover

Stainless steel 1.4301

Process connections

Flanges:
– EN 1092-1 (DIN 2501)
– ASME B16.5

For information on the materials of the process connections (→ 25)

Operability

Operating concept

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

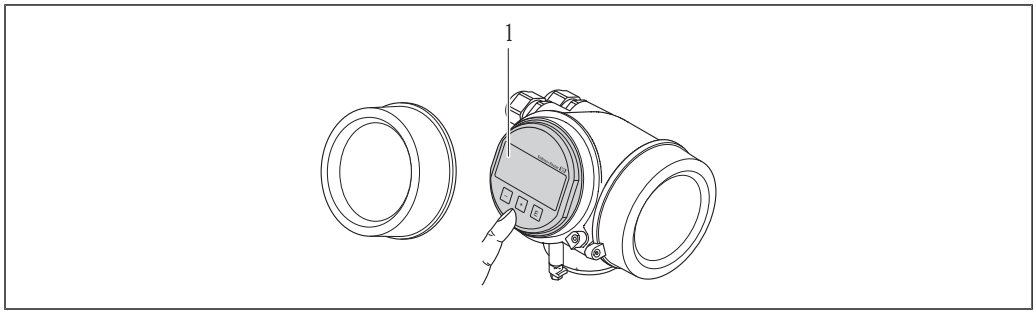
Quick and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

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

Efficient diagnostics increase measurement reliability
- Remedy information is integrated in plain text
- Diverse simulation options and optional line recorder functions

Local operation

Order characteristic for "Display; Operation", option C



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1 Operation with pushbuttons

Display elements
- 4-line display
- 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.

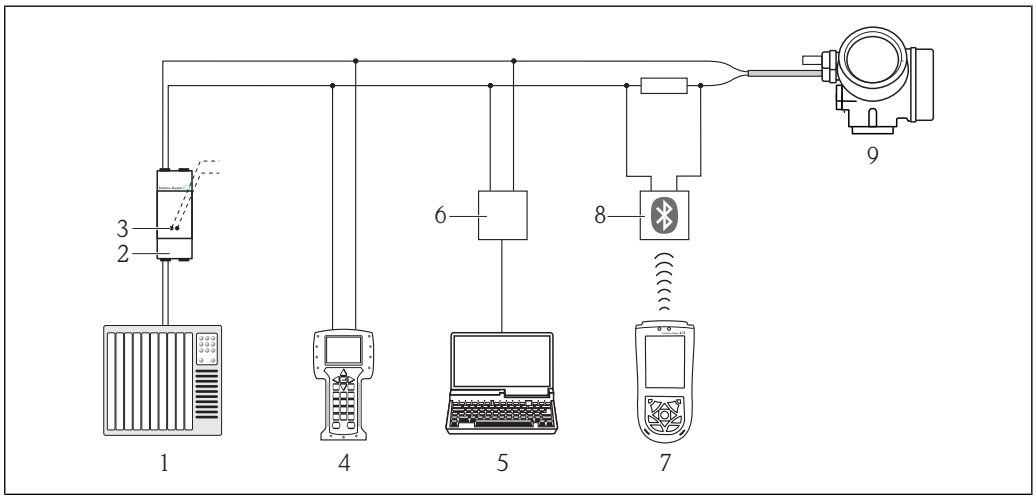
Operating elements
- Local operation with 3 push buttons (⊕, ⊖, Ⓔ)
- Operating elements also accessible in various hazardous areas

Additional functionality

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

Remote operation

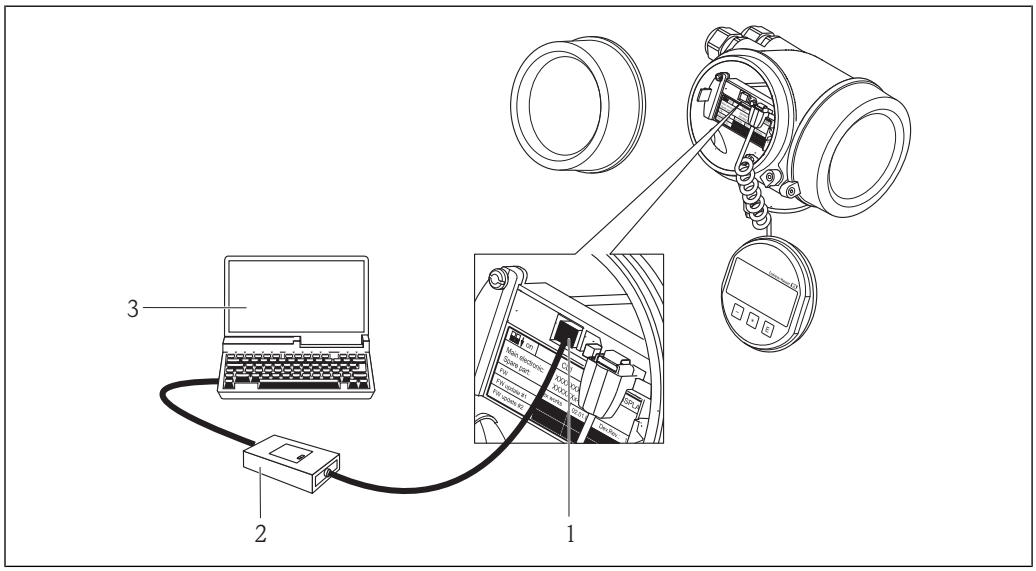
Via HART protocol



14 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 FXA191, FXA195 and Field Communicator 375, 475
4 Field Communicator 375, 475
5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
6 Commubox FXA191 (RS232) or FXA195 (USB)
7 Field Xpert SFX100
8 VIATOR Bluetooth modem with connecting cable
9 Transmitter

Via service interface (CDI)



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

Certificates and approvals

CE mark

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

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

C-Tick symbol

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

Ex approval

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

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

ATEX/IECEx

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

Ex d

Category (ATEX)	Type of protection
II2G	Ex d[ia] IIC T6-T1 Gb

Ex ia

Category (ATEX)	Type of protection
II2G	Ex ia IIC T6-T1 Gb

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

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

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

NI (Ex nA, Ex nL)
Class I Division 2 Groups ABCD; NIFW*

*= Entity and NIFW parameters according to control drawings

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.

- With the PED/G1/I or II 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 to 0.5 bar (7.3 psi)
- 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 97/23/EC.

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  Emissions in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 80
  The application of the pressure equipment directive to process control devices
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Status classification as per NE107
- NAMUR NE 131
  Requirements for field devices for standard applications

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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 from Endress+Hauser either directly with the device or subsequently. 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.

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.

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
Prosonic Flow B 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
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight or extreme cold in winter. For details, see Installation Instructions SD00333F

For the sensor

Accessories	Description
Replacement tool	Is used to remove the transducers on the fly for cleaning or replacement purposes. For details, see Installation Instructions EA00108D
Flow conditioner	Is used to shorten the necessary inlet run.

Communication-specific accessories

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

Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
WirelessHART adapter	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ■ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ■ Via the Internet: https://wapps.endress.com/applicator ■ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: ■ Via the Internet: www.endress.com/lifecyclemanagement ■ On CD-ROM for local PC installation.

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

System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant 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	Power supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R
Cerabar M	The pressure transmitter for measuring the absolute and gauge pressure of gases, steams and liquids. It can be used to read in the operating pressure value via the HART protocol. For details, see "Technical Information" TI00426, TI00436 and Operating Instructions BA00200P, BA00382P
Cerabar S	The pressure transmitter for measuring the absolute and gauge pressure of gases, steams and liquids. It can be used to read in the operating pressure value via the HART protocol. For details, see "Technical Information" TI00383 and Operating Instructions BA00271P

Documentation

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

Standard documentation

Device type	Communication	Document type	Documentation code
9B2B**-	- - - -	Brief Operating Instructions	KA01096D
	HART	Operating Instructions	BA01031D
	HART	Description of Device Parameters	GP01012D

Supplementary device-dependent documentation

Device type	Document type	Approval	Documentation code
9B2B**-	Safety Instructions	ATEX/IECEx Ex d	XA01008D
		ATEX/IECEx Ex i	XA01009D
		$_{C}CSA_{US}$ XP	XA01010D
		$_{C}CSA_{US}$ IS	XA01011D

Device type	Document type	Approval	Documentation code
	Information on the Pressure Equipment Directive		SD00152D
	Installation Instructions		Specified for each individual accessory (→ 30)

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