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Technical Information
Proline Prowirl F 200

Vortex flowmeter



Versatile flowmeter with detection of wet steam conditions and best-in-class accuracy

Application

- Preferred measuring principle for wet/saturated/ superheated steam, gases & liquids (also cryogenic)
- Suitable for a wide range of applications; optimized for steam applications

Device properties

- Wet steam capabilities for DN 25 to 300 (1 bis 12") Industrial siphon design for pressure measurement
- Flexible positioning of pressure cell
- Display module with data transfer function
- Robust dual-compartment housing
- Plant safety: worldwide approvals (SIL, Haz. area)

Your benefits

- Easy energy management – integrated temperature and pressure measurement for steam and gases
- Reliable, secure measurement technology – compliance with international Vortex standard ISO 12764
- Same accuracy down to Re 10 000 – most linear Vortex meter body
- Long-term stability – robust drift-free capacitive sensor
- Convenient device wiring – separate connection compartment, various output options including Ethernet
- Safe operation – no need to open the device due to display with touch control, background lighting
- Integrated verification – Heartbeat Technology

Endress+Hauser
People for Process Automation

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About this document

Symbols

Electrical symbols

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 earth (PE)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: protective earth is connected to the mains supply. ▪ Exterior ground terminal: device is connected to the plant grounding system.

Communication-specific symbols

Symbol	Meaning
	**Wireless Local Area Network (WLAN)** Communication via a wireless, local area network
	**Bluetooth** Wireless data transmission between devices over a short distance via radio technology
	**LED** LED is off.
	**LED** LED is on.
	**LED** LED flashing.

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

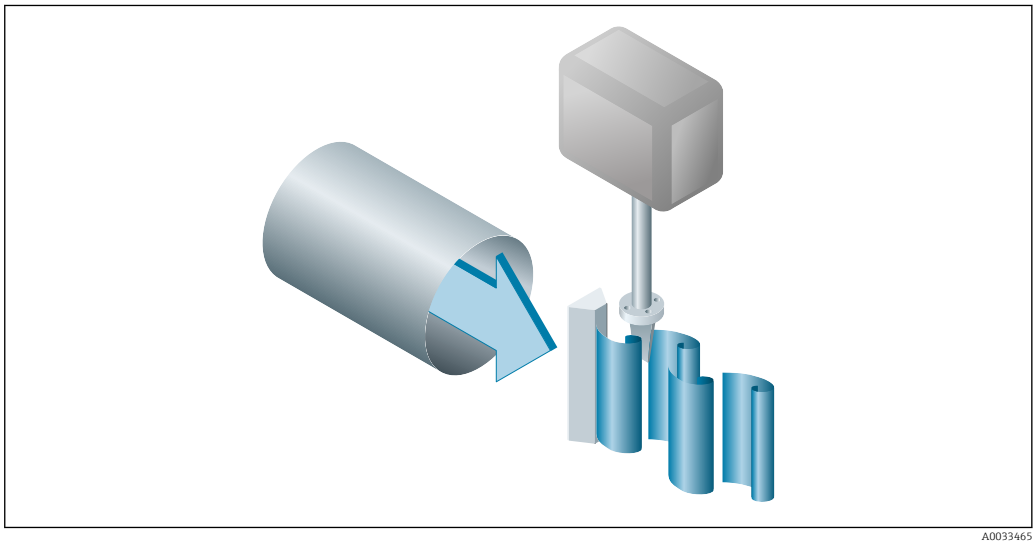
Symbols in graphics

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

Function and system design

Measuring principle

Vortex meters work on the principle of the *Karman vortex street*. When fluid flows past a bluff body, vortices are alternately formed on both sides with opposite directions of rotation. These vortices each generate a local low pressure. The pressure fluctuations are recorded by the sensor and converted to electrical pulses. The vortices develop very regularly within the permitted application limits of the device. Therefore, the frequency of vortex shedding is proportional to the volume flow.



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1 Sample graphic

The calibration factor (K-factor) is used as the proportional constant:

$$\text{K-Factor} = \frac{\text{Pulses}}{\text{Unit Volume } [\text{m}^3]}$$

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Within the application limits of the device, the K-factor only depends on the geometry of the device. For Re > 10 000 it is:
- Independent of the flow velocity and the fluid properties viscosity and density
- Independent of the type of substance under measurement: steam, gas or liquid

The primary measuring signal is linear to the flow. After production, the K-factor is determined in the factory by means of calibration. It is not subject to long-time drift or zero-point drift.

The device does not contain any moving parts and does not require any maintenance.

The capacitance sensor

The sensor of a vortex flowmeter has a major influence on the performance, robustness and reliability of the entire measuring system.

The robust DSC sensor is:
- burst-tested
- tested against vibrations
- tested against thermal shock (thermal shocks of 150 K/s)

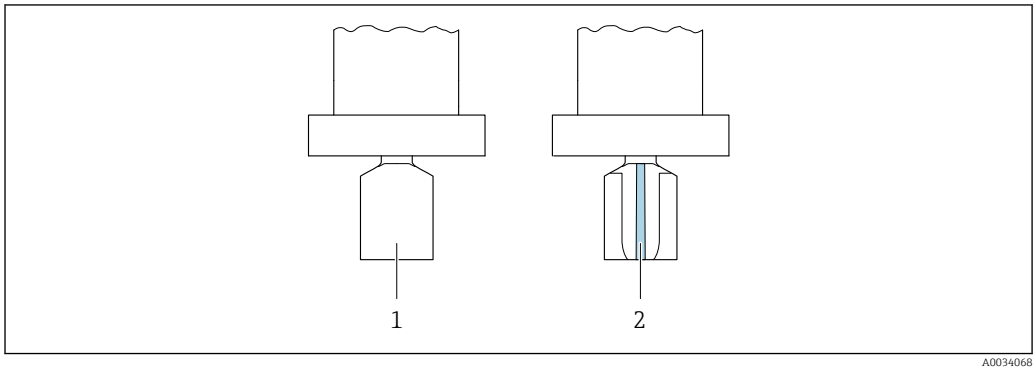
The measuring device uses the tried-and-tested, capacitance measuring technology from Endress+Hauser, which is already in use in over 450 000 measuring points worldwide. Thanks to its design, the capacitance sensor is also particularly mechanically resistant to temperature shocks and pressure shocks in steam pipelines.

Temperature measurement

The "mass" option is available under the order code for "Sensor version". With this option the measuring device can also measure the temperature of the medium.

The temperature is measured via Pt 1000 temperature sensors. These are located in the paddle of the DSC sensor and are therefore in the direct vicinity of the fluid.

Order code for "Sensor version; DSC sensor; measuring tube":
- Option AA "volume; 316L; 316L"
- Option AB "volume; Alloy C22; 316L"
- Option AC "volume; Alloy C22; Alloy C22"
- Option BA "volume high-temperature; 316L; 316L"
- Option BB "volume high-temperature; Alloy C22; 316L"
- Option CA "Mass; 316L; 316L (integrated temperature measurement)"
- Option CB "Mass; Alloy C22; 316L (integrated temperature measurement)"
- Option CC "Mass; Alloy C22; Alloy C22 (integrated temperature measurement)"



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1 Order code for "Sensor version", option "volume" or "volume high-temperature"
2 Order code for "Sensor version", option "mass"

Pressure and temperature measurement

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

The "mass steam" or "mass gas/liquid" options are available under the order code for "Sensor version; DSC sensor; measuring tube". With these options, the measuring instrument can also measure the pressure and temperature of the fluid.

The temperature is measured via Pt 1000 temperature sensors. These are located in the paddle of the DSC sensor and are therefore in the direct vicinity of the fluid. Pressure measurement is located directly on the meter body at the level of the bluff body. The position of the pressure tapping was chosen so that pressure and temperature could be measured at the same point. This enables accurate density and/or energy compensation of the fluid using pressure and temperature. The measured pressure tends to be somewhat lower than the line pressure. For this reason, Endress+Hauser offers a correction to the line pressure (integrated in the device).

Order code for "Sensor version; DSC sensor; measuring tube":
- Option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)"
- Option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temperature measurement)"

Lifelong calibration

Experience has shown that recalibrated measuring devices demonstrate a very high degree of stability compared to their original calibration: The recalibration values were all within the original measuring accuracy specifications of the devices. This applies to the measured volume flow, the device's primary measured variable.

Various tests and simulation have shown that once the radii of the edges on the bluff body are less than 1 mm (0.04 in), the resulting effect does not have a negative impact on accuracy.

If the radii of the edges on the bluff body do not exceed 1 mm (0.04 in), the following general statements apply (in the case of non-abrasive and non-corrosive media, such as in most water and steam applications):
- The measuring device does not display an offset in the calibration and the accuracy is still guaranteed.
- All the edges on the bluff body have a radius that is typically smaller in size. As the measuring devices are naturally also calibrated with these radii, the measuring device remains within the specified accuracy rating provided that the additional radius that is produced as a result of wear and tear does not exceed 1 mm (0.04 in).

Consequently, it can be said that the product line offers lifelong calibration if the measuring device is used in non-abrasive and non-corrosive media.

Inlet run correction

Inlet run correction makes it possible to shorten the necessary inlet run before the measuring device to a minimum length of 10 × DN. If the inlet run available is too short, the measuring device can correct the measured error depending on the preceding disruption in the flow profile. This produces an additional measurement error of ±0.5 % o.r. [1)]

The **Inlet Run Correction** function can be used for the following pressure ratings and nominal diameters:
DN 15 to 150 (½ to 6")
- EN (DIN)
- ASME B16.5, Sch. 40/80

Inlet run correction is possible for the following flow obstructions:
- Single elbow (90° elbow)
- Double elbow (2 × 90° elbows, opposite)
- Double elbow 3D (2 × 90° elbows, opposite, not on one plane)
- Reduction by one nominal diameter size

For detailed information on the inlet run correction, see the Operating Instructions for the device → 102

Air and industrial gases

The measuring device enables users to calculate the density and energy of air and industrial gases. The calculations are based on time-tested standard calculation methods. It is possible to automatically compensate for the effect of pressure and temperature via an external or constant value.

This makes it possible to output the energy flow, standard volume flow and mass flow of the following gases:
- Single gas
- Gas mixture
- Air
- User-specific gas

For detailed information on the parameters, see the Operating Instructions.→ 103

Natural gas

The device enables users to calculate the chemical properties (gross calorific value, net calorific value) of natural gases. The calculations are based on time-tested standard calculation methods. It is

1) o.r. = of reading

possible to automatically compensate for the effect of pressure and temperature via an external or constant value.

This makes it possible to output the energy flow, standard volume flow and mass flow in accordance with the following standard methods:

Energy can be calculated based on the following standards:
- AGA5
- ISO 6976
- GPA 2172

Density can be calculated based on the following standards:
- ISO 12213-2 (AGA8-DC92)
- ISO 12213-3
- AGA NX19
- AGA8 Gross 1
- SGERG 88

For detailed information on the parameters, see the Operating Instructions.→ 103

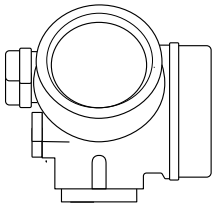
Measuring system

The device consists of a transmitter and a sensor.

Two device versions are available:
- Compact version - transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

Transmitter

Proline 200

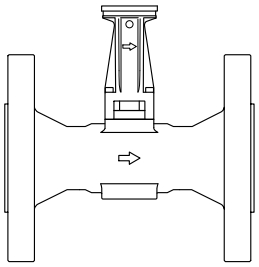


Device versions and materials:
- Compact or remote version, aluminum coated:
  Aluminum, AlSi10Mg, coated
- Compact or remote version, stainless:
  For maximum corrosion resistance: stainless steel CF3M

Configuration:
- Via four-line local display with key operation or 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

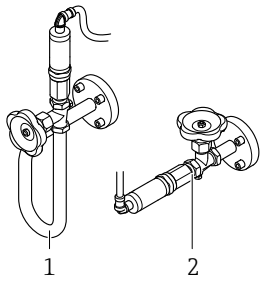
Prowirl F



Flanged version:
- Nominal diameter range: DN 15 to 300 (½ to 12")
- Materials:
  - Measuring tubes
    DN 15 to 300 (½ to 12"): stainless cast steel, CF3M/1.4408
    DN 15 to 150 (½ to 6"): cast alloy, CX2MW similar to Alloy C22/2.4602
  - Flange connections
    DN 15 to 300 (½ to 12"): stainless steel, triple-certified material, 1.4404/F316/F316L
  - DN 15 to 150 (½ to 6"), pressure ratings up to PN40/Class 300: cast alloy, CX2MW similar to Alloy C22/2.4602

Pressure measuring cell

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.



1 Option DA "Mass steam"
2 Option DB "Mass gas/liquid"

Versions:
Pressure components
- Pressure measuring cell 2 bar_a
- Pressure measuring cell 4 bar_a
- Pressure measuring cell 10 bar_a
- Pressure measuring cell 40 bar_a
- Pressure measuring cell 100 bar_a

Material
- Wetted parts:
  - Process connection
    Stainless steel, 1.4404/316L
  - Membrane
    Stainless steel, 1.4435/316L
- Non-wetted parts:
  Housing
  Stainless steel ,1.4404

Security

IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. The following list provides an overview of the most important functions:

Protecting access via hardware write protection

Write access to the parameters of the device via the local display or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the main electronics module). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered.

Protecting access via a password

A password can be used to protect against write access to the device parameters.

This controls write access to the device parameters via the local display or other operating tools (e.g. FieldCare, DeviceCare) and, in terms of functionality, corresponds to hardware write protection. If the CDI service interface is used, read access is only possible by first entering the password.

User-specific access code

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code.

Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to *"Read only"* access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

For detailed information on device parameters, see: Description of Device Parameters.

Advanced safety requirements

If the specified requirements for measures cannot be met, alternative measures may need to be put in place. This may involve, for example, mechanical protection of the product against tampering, the cabling, or organizational measures. The Proline measuring instruments can be used in the open field for example. Measures to combat physical tampering of the Proline measuring instruments must be arranged by the customer.

Additional analysis is required if Proline measuring instruments are integrated into a different system. Please note the following:
- The fieldbus network (OT) and company network (IT) must be strictly separated.
- Endress+Hauser recommends the segmentation of the fieldbus networks according to DIN IEC 62443-3-3.

Network

Pay particular attention to the network components used, the router and switches for example. The operator must guarantee the integrity of the components. Access to the network must be restricted by the operator, if necessary.

FDI Packages

Signed FDI Packages can be obtained via www.endress.com for the configuration of the field device.

User training

Depending on the application scenario, users who are not specialized in this area may come in contact with the instrument. We recommend that these users be trained in the safe use of the relevant terminals, components and/or interfaces and be made aware of security issues.

Input

Measured variable

Direct measured variables

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Measured variable**
AA	Volume; 316L; 316L	Volume flow
AB	Volume; Alloy C22; 316L	
AC	Volume; Alloy C22; Alloy C22	
BA	Volume high-temperature; 316L; 316L	
BB	Volume high-temperature; Alloy C22; 316L	

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Measured variable**
CA	Mass; 316L; 316L (integrated temperature measurement)	▪ Volume flow ▪ Temperature
CB	Mass; Alloy C22; 316L (integrated temperature measurement)	
CC	Mass; Alloy C22; Alloy C22 (integrated temperature measurement)	

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Measured variable**
DA	Mass steam; 316L; 316L (integrated pressure/temperature measurement)	▪ Volume flow ▪ Temperature ▪ Pressure
DB	Mass gas/liquid; 316L; 316L (integrated pressure/temperature measurement)	

Calculated measured variables

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Measured variable**
AA	Volume; 316L; 316L	Under constant process conditions: ▪ Mass flow [1)] ▪ Corrected volume flow The totalized values for: ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow
AB	Volume; Alloy C22; 316L	
AC	Volume; Alloy C22; Alloy C22	
BA	Volume high-temperature; 316L; 316L	
BB	Volume high-temperature; Alloy C22; 316L	

1) A fixed density must be entered for calculating the mass flow (**Setup** menu → **Advanced setup** submenu → **External compensation** submenu → **Fixed density** parameter).

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Measured variable**
CA	Mass; 316L; 316L (integrated temperature measurement)	▪ Corrected volume flow ▪ Mass flow ▪ Calculated saturated steam pressure ▪ Energy flow ▪ Heat flow difference ▪ Specific volume ▪ Degrees of superheat
CB	Mass; Alloy C22; 316L (integrated temperature measurement)	
CC	Mass; Alloy C22; Alloy C22 (integrated temperature measurement)	
DA	Mass steam; 316L; 316L (integrated pressure/temperature measurement)	
DB	Mass gas/liquid; 316L; 316L (integrated pressure/ temperature measurement)	

Order code for "Sensor version", option "mass flow (integrated temperature measurement)" combined with order code for "Application package"		
Option	**Description**	**Measured variable**
EU	Wet steam measurement	▪ Steam quality ▪ Total mass flow ▪ Condensate mass flow

Measuring range

The measuring range is dependent on the nominal diameter, the fluid and environmental influences.

The following specified values are the largest possible flow measuring ranges (Q_{min} … Q_{max}) for each nominal diameter. Depending on the fluid properties and environmental influences, the measuring range may be subject to additional restrictions. Additional restrictions apply to both the lower range value and the upper range value.

Flow measuring ranges in SI units

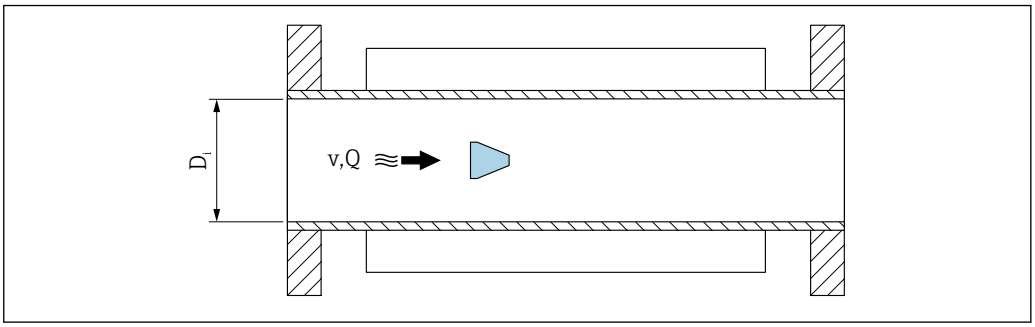
DN [mm]	Liquids [m³/h]	Gas/steam [m³/h]
15	0.076 to 4.9	0.39 to 25
25	0.23 to 15	1.2 to 130
40	0.57 to 37	2.9 to 310
50	0.96 to 62	4.9 to 820
80	2.2 to 140	11 to 1800
100	3.7 to 240	19 to 3200
150	8.5 to 540	43 to 7300
200	15 to 950	75 to 13000
250	23 to 1500	120 to 20000
300	33 to 2100	170 to 28000

Flow measuring ranges in US units

DN	Liquids	Gas/steam
[in]	[ft³/min]	[ft³/min]
½	0.045 to 2.9	0.23 to 15
1	0.14 to 8.8	0.7 to 74
1½	0.34 to 22	1.7 to 180
2	0.56 to 36	2.9 to 480
3	1.3 to 81	6.4 to 1100
4	2.2 to 140	11 to 1900

DN	Liquids	Gas/steam
[in]	[ft³/min]	[ft³/min]
6	5 to 320	25 to 4 300
8	8.7 to 560	44 to 7 500
10	14 to 880	70 to 12 000
12	19 to 1 300	99 to 17 000

Flow velocity



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D_i *Measuring tube internal diameter (corresponds to dimension K→ 61)*
v *Velocity in measuring tube*
Q *Flow*

The internal diameter of measuring tube D_i is denoted in the dimensions as dimension K→ 61.

Calculation of flow velocity:

$$v\ [m/s] = \frac{4 \cdot Q\ [m^3/h]}{\pi \cdot D_i\ [m]^2} \cdot \frac{1}{3600\ [s/h]}$$

$$v\ [ft/s] = \frac{4 \cdot Q\ [ft^3/min]}{\pi \cdot D_i\ [ft]^2} \cdot \frac{1}{60\ [s/min]}$$

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Lower range value

The Applicator is available for calculation purposes.

Reynolds number

A restriction applies to the lower range value due to the turbulent flow profile, which only occurs with Reynolds numbers greater than 5 000. The Reynolds number is dimensionless and indicates the ratio of the inertia force of a fluid to its viscous force when flowing and is used as a characteristic variable for pipe flows. In the case of pipe flows with Reynolds numbers less than 5 000, periodic vortices are no longer generated and flow rate measurement is no longer possible.

The Reynolds number is calculated as follows:

$$Re = \frac{4 \cdot Q\ [m^3/s] \cdot \rho\ [kg/m^3]}{\pi \cdot D_i\ [m] \cdot \mu\ [Pa \cdot s]}$$

$$Re = \frac{4 \cdot Q\ [ft^3/s] \cdot \rho\ [lbm/ft^3]}{\pi \cdot D_i\ [ft] \cdot \mu\ [lbf \cdot s/ft^2]}$$

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Re	*Reynolds number*
Q	*Flow*
D_i	*Internal diameter of measuring tube (corresponds to dimension K→ 61)*
μ	*Dynamic viscosity*
ρ	*Density*

The Reynolds number 5 000, together with the density and viscosity of the fluid and the nominal diameter, is used to calculate the corresponding flow rate.

$$Q_{Re = 5000}\ [m^3/h] = \frac{5000 \cdot \pi \cdot D_i\ [m] \cdot \mu\ [Pa \cdot s]}{4 \cdot \rho\ [kg/m^3]} \cdot 3600\ [s/h]$$

$$Q_{Re = 5000}\ [ft^3/h] = \frac{5000 \cdot \pi \cdot D_i\ [ft] \cdot \mu\ [lbf \cdot s/ft^2]}{4 \cdot \rho\ [lbm/ft^3]} \cdot 60\ [s/min]$$

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$Q_{Re = 5000}$	*Flow rate at Reynolds number 5000*
D_i	*Internal diameter of measuring tube (corresponds to dimension K→ 61)*
μ	*Dynamic viscosity*
ρ	*Density*

Minimum measurable flow velocity based on signal amplitude

The measuring signal must have a certain minimum signal amplitude so that the signals can be evaluated without any errors. Using the nominal diameter, the corresponding flow can also be derived from this amplitude.

The minimum signal amplitude depends on the setting for the sensitivity of the DSC sensor, the steam quality **x** and the force of the vibrations present **a**.

The value **mf** corresponds to the lowest measurable flow velocity without vibration (no wet steam) for a density of 1 kg/m³ (0.0624 lb/ft³).

The value **mf** can be set in the range of 20 to 6 m/s (65.6 to 19.7 ft/s) (factory setting 11 m/s (36.1 ft/s)) with the **Sensitivity** parameter (value range 1 to 9, factory setting 5).

The lowest flow velocity that can be measured on account of the signal amplitude $\mathbf{v_{AmpMin}}$ is derived from the **Sensitivity** parameter and steam quality **x** or from the force of vibrations present **a**.

$$v_{AmpMin}\ [m/s] = \max \begin{cases} \dfrac{mf\ [m/s]}{x^2 \cdot \sqrt{\dfrac{\rho\ [kg/m^3]}{1\ [kg/m^3]}}} \\ \dfrac{\sqrt{50[m] \cdot a\ [m/s^2]}}{x^2} \end{cases}$$

$$v_{AmpMin}\ [ft/s] = \max \begin{cases} \dfrac{mf\ [ft/s]}{x^2 \cdot \sqrt{\dfrac{\rho\ [lbm/ft^3]}{0.0624\ [lbm/ft^3]}}} \\ \dfrac{\sqrt{164[ft] \cdot a\ [ft/s^2]}}{x^2} \end{cases}$$

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v_{AmpMin}	*Minimum measurable flow velocity based on signal amplitude*
mf	*Sensitivity*
x	*Steam quality*
ρ	*Density*

Minimum measurable flow rate based on signal amplitude

$$Q_{AmpMin}\ [m^3/h] = \frac{v_{AmpMin}\ [m/s] \cdot \pi \cdot (D_i\ [m])^2}{4} \cdot 3600\ [s/h]$$

$$Q_{AmpMin}\ [ft^3/min] = \frac{v_{AmpMin}\ [ft/s] \cdot \pi \cdot (D_i\ [ft])^2}{4} \cdot 60\ [s/min]$$

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Q_{AmpMin}	*Minimum measurable flow rate based on signal amplitude*
v_{AmpMin}	*Minimum measurable flow velocity based on signal amplitude*
D_i	*Internal diameter of measuring tube (corresponds to dimension K→ 61)*
ρ	*Density*

Effective lower range value

The effective lower range value Q_{min_eff} is determined using the largest of the three values Q_{min}, $Q_{Re = 5000}$ and Q_{AmpMin}.

$$Q_{min_eff}\ [m^3/h] = \max \begin{cases} Q_{min}\ [m^3/h] \\ Q_{Re = 5000}\ [m^3/h] \\ Q_{AmpMin}\ [m^3/h] \end{cases}$$

$$Q_{min_eff}\ [ft^3/min] = \max \begin{cases} Q_{min}\ [ft^3/min] \\ Q_{Re = 5000}\ [ft^3/min] \\ Q_{AmpMin}\ [ft^3/min] \end{cases}$$

A0034313

Q_{min_eff}	*Effective lower range value*
Q_{min}	*Minimum measurable flow rate*
$Q_{Re = 5000}$	*Flow rate at Reynolds number 5000*
Q_{AmpMin}	*Minimum measurable flow rate based on signal amplitude*

Upper range value

The Applicator is available for calculation purposes.

Maximum measurable flow rate based on signal amplitude

The measuring signal amplitude must be below a certain limit value to ensure that the signals can be evaluated without error. This results in a maximum permitted flow rate Q_{AmpMax}.

$$Q_{AmpMax}\ [m^3/h] = \frac{URV\ [m/s] \cdot \pi \cdot D_i\ [m]^2}{4 \cdot \sqrt{\frac{\rho\ [kg/m^3]}{1\ [kg/m^3]}}} \cdot 3600\ [s/h]$$

$$Q_{AmpMax}\ [ft^3/min] = \frac{URV\ [ft/s] \cdot \pi \cdot D_i\ [ft]^2}{4 \cdot \sqrt{\frac{\rho\ [lbm/ft^3]}{0.0624\ [lbm/ft^3]}}} \cdot 60\ [s/min]$$

A0034316

Q_{AmpMax}	*Maximum measurable flow rate based on signal amplitude*
D_i	*Internal diameter of measuring tube (corresponds to dimension K→ 61)*
ρ	*Density*
URV	Limit value for determining the maximum flow rate: ▪ DN 15 to 40: URV = 350 ▪ DN 50 to 300: URV = 600 ▪ NPS ½ to 1½: URV = 1148 ▪ NPS 2 to 12: URV = 1969

Restricted upper range value is dependent on Mach number

For gas applications, an additional restriction applies to the upper range value with regard to the Mach number in the measuring instrument, which must be less than 0.3. The Mach number Ma describes the ratio of the flow velocity v to the speed of sound c in the fluid.

$$Ma = \frac{v\ [m/s]}{c\ [m/s]}$$

$$Ma = \frac{v\ [ft/s]}{c\ [ft/s]}$$

A0034321

Ma	*Mach number*
v	*Flow velocity*
c	*Speed of sound*

The corresponding flow rate can be derived using the nominal diameter.

$$Q_{MaMax = 0.3}\ [m^3/h] = \frac{0.3 \cdot c\ [m/s] \cdot \pi \cdot D_i\ [m]^2}{4} \cdot 3600\ [s/h]$$

$$Q_{MaMax = 0.3}\ [ft^3/min] = \frac{0.3 \cdot c\ [ft/s] \cdot \pi \cdot D_i\ [ft]^2}{4} \cdot 60\ [s/min]$$

A0034337

$Q_{MaMax = 0.3}$	*Restricted upper range value is dependent on Mach number*
c	*Speed of sound*
D_i	*Internal diameter of measuring tube (corresponds to dimension K→ 61)*
ρ	*Density*

Effective upper range value

The effective upper range value Q_{max_eff} is determined using the smallest of the three values Q_{max}, Q_{AmpMax} and $Q_{MaMax = 0.3}$.

$$Q_{max_eff}\ [m^3/h] = \min \begin{cases} Q_{max}\ [m^3/h] \\ Q_{AmpMax}\ [m^3/h] \\ Q_{MaMax = 0.3}\ [m^3/h] \end{cases}$$

$$Q_{max_eff}\ [ft^3/min] = \min \begin{cases} Q_{max}\ [ft^3/min] \\ Q_{AmpMax}\ [ft^3/min] \\ Q_{MaMax = 0.3}\ [ft^3/min] \end{cases}$$

A0034338

Q_{max_eff}	*Effective upper range value*
Q_{max}	*Maximum measurable flow rate*
Q_{AmpMax}	*Maximum measurable flow rate based on signal amplitude*
$Q_{MaMax = 0.3}$	*Restricted upper range value is dependent on Mach number*

For liquids, the occurrence of cavitation may also restrict the upper range value.

Operable flow range

Typically up to 49: 1

The value may vary depending on the operating conditions (ratio between the effective lower range value and upper range value).

$$\frac{Q_{max_eff}}{Q_{min_eff}}$$

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Q_{max_eff}	*Effective upper range value*
Q_{min_eff}	*Effective lower range value*

Input signal

Current input

Current input	4-20 mA (passive)
Resolution	1 µA
Voltage drop	Typically: 2.2 to 3 V for 3.6 to 22 mA
Maximum voltage	≤ 35 V
Possible input variables	▪ Pressure ▪ Temperature ▪ Density

External measured values

To increase the measurement accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring instrument:
- Operating pressure to increase measurement accuracy (Endress+Hauser recommends the use of a pressure measuring instrument for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase measurement accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

- Various pressure measuring devices can be ordered as accessories from Endress+Hauser.
- If using pressure measuring devices, pay attention to outlet runs when installing external devices→ 🖹 51.

If the measuring instrument does not have pressure or temperature compensation [2)], it is recommended that external pressure measured values be read in so that the following measured variables can be calculated:
- Energy flow
- Mass flow
- Corrected volume flow

If the device does not have temperature compensation, it is recommended that external pressure measurement values be read in so that the following measured variables can be calculated:
- Energy flow
- Mass flow
- Corrected volume flow

Integrated pressure and temperature measurement

The measuring device can also directly record external variables for density and energy compensation.

This product version offers the following benefits:
- Measurement of pressure, temperature and flow in a true 2-wire version
- Recording of pressure and temperature at the same point, thus ensuring maximum accuracy of density and energy compensation.
- Continuous monitoring of pressure and temperature, thus enabling complete integration in Heartbeat.
- Easy testing of pressure measurement accuracy:
  - Application of pressure by pressure calibration unit, followed by input into measuring device
  - Automatic error correction performed by device in the event of a deviation
- Availability of calculated line pressure.

Current input

The measured values are written from the automation system to the measuring device via the current input → 🖹 17.

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

Digital communication

The measured values can be written from the automation system to the measuring via:
- FOUNDATION Fieldbus
- PROFIBUS PA
- Modbus TCP over Ethernet-APL
- PROFINET over Ethernet-APL

2) Order code for "Sensor version", DSC sensor; measuring tube" option DA, DB

Output

Output signal

Current output

Current output 1	4-20 mA HART (passive)
Current output 2	4-20 mA (passive)
Resolution	< 1 µA
Damping	Configurable: 0.0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Flow velocity ▪ Temperature ▪ Pressure ▪ Calculated saturated steam pressure ▪ Steam quality ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference

Pulse/frequency/switch output

Function	Can be configured as pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	▪ DC 35 V ▪ 50 mA For information on the Ex connection values → 24
Voltage drop	▪ At ≤ 2 mA: 2 V ▪ At 10 mA: 8 V
Residual current	≤ 0.05 mA
Pulse output	
Pulse width	Configurable: 5 to 2 000 ms
Maximum pulse rate	100 Impulse/s
Pulse value	Configurable
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference
Frequency output	
Output frequency	Configurable: 0 to 1 000 Hz
Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Flow velocity ▪ Temperature ▪ Calculated saturated steam pressure ▪ Steam quality ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference ▪ Pressure

Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s
Number of switching cycles	Unlimited

Assignable functions	▪ Off
	▪ On
	▪ Diagnostic behavior
	▪ Limit value
	  ▪ Volume flow
	  ▪ Corrected volume flow
	  ▪ Mass flow
	  ▪ Flow velocity
	  ▪ Temperature
	  ▪ Calculated saturated steam pressure
	  ▪ Steam quality
	  ▪ Total mass flow
	  ▪ Energy flow
	  ▪ Heat flow difference
	  ▪ Pressure
	  ▪ Reynolds number
	  ▪ Totalizer 1-3
	▪ Status
	▪ Status of low flow cut off

FOUNDATION Fieldbus

FOUNDATION Fieldbus	H1, IEC 61158-2, galvanically isolated
Data transfer	31.25 kbit/s
Current consumption	15 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

PROFIBUS PA

PROFIBUS PA	In accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
Data transmission	31.25 kbit/s
Current consumption	16 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

PROFINET over Ethernet-APL

Device use	**Device connection to an APL field switch** The device may only be operated according to the following APL port classifications: ▪ If used in hazardous areas: SLAA or SLAC [1)] ▪ If used in non-hazardous areas: SLAX ▪ Connection values of APL field switch (corresponds to APL port classification SPCC or SPAA): ▪ Maximum input voltage: 15 V_{DC} ▪ Minimum output values: 0.54 W **Device connection to an SPE switch** If used in non-hazardous areas: suitable SPE switch SPE switch prerequisite: ▪ Support of 10BASE-T1L standard ▪ Support of PoDL power class 10, 11 or 12 ▪ Detection of SPE field devices without integrated PoDL module Connection values of SPE switch: ▪ Maximum input voltage: 30 V_{DC} ▪ Minimum output values: 1.85 W
PROFINET	According to IEC 61158 and IEC 61784
Ethernet-APL	According to IEEE 802.3cg, APL port profile specification v1.0, galvanically isolated
Data transfer	10 Mbit/s Full-duplex
Current consumption	**Transmitter** Max. 55.56 mA
Permitted supply voltage	▪ Ex: 9 to 15 V ▪ Non-Ex: 9 to 30 V
Network connection	With integrated reverse polarity protection

1) For more information on using the device in the hazardous area, see the Ex-specific Safety Instructions

Modbus TCP over Ethernet-APL

Device use	**Device connection to an APL field switch** The device may only be operated according to the following APL port classifications: ▪ If used in hazardous areas: SLAA or SLAC [1)] ▪ If used in non-hazardous areas: SLAX ▪ Connection values of APL field switch (corresponds to APL port classification SPCC or SPAA): ▪ Maximum input voltage: 15 V_{DC} ▪ Minimum output values: 0.54 W **Device connection to an SPE switch** If used in non-hazardous areas: suitable SPE switch SPE switch prerequisite: ▪ Support of 10BASE-T1L standard ▪ Support of PoDL power class 10, 11 or 12 ▪ Detection of SPE field devices without integrated PoDL module Connection values of SPE switch: ▪ Maximum input voltage: 30 V_{DC} ▪ Minimum output values: 1.85 W
Modbus TCP over Ethernet-APL	Modbus application protocol V1.1b3
Ethernet-APL	According to IEEE 802.3cg, APL port profile specification v1.0, galvanically isolated
Data transfer	10 Mbit/s Full-duplex

Current consumption	**Transmitter** Max. 55.56 mA
Permitted supply voltage	▪ Ex: 9 to 15 V ▪ Non-Ex: 9 to 30 V
Network connection	With integrated reverse polarity protection

1) For more information on using the device in the hazardous area, see the Ex-specific Safety Instructions

Signal on alarm

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

HART current output

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

Current output

Current output 4-20 mA	
Failure mode	Configurable: ▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ▪ 4 to 20 mA in accordance with US ▪ Min. value: 3.59 mA ▪ Max. value: 22.5 mA ▪ Definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

Pulse/frequency/switch output

Pulse output	
Failure mode	No pulses
Frequency output	
Failure mode	Configurable: ▪ Actual value ▪ 0 Hz ▪ Definable value between: 0 to 1 250 Hz
Switch output	
Failure mode	Configurable: ▪ Current status ▪ Open ▪ Closed

FOUNDATION Fieldbus

Status and alarm messages	Diagnostics in accordance with FF-891
Failure current FDE (Fault Disconnection Electronic)	0 mA

PROFIBUS PA

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

PROFINET over Ethernet-APL

Device diagnostics	Diagnostics according to PROFINET PA Profile 4.02

Modbus TCP over Ethernet-APL/SPE

Failure mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

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.

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication
  - HART protocol
  - FOUNDATION Fieldbus
  - PROFIBUS PA
  - Modbus TCP over Ethernet-APL
  - PROFINET over Ethernet-APL
- Via service interface
  Endress+Hauser Common Data Interface (CDI)
- Plain text display
  With information on cause and remedial actions

Additional information on remote operation → 91

LEDs

LEDs are only available for PROFINET over Ethernet-APLand Modbus TCP over Ethernet-APL .

Status information	Status indicated by various LEDs The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Network available ▪ Connection established ▪ Diagnostic status [1] ▪ PROFINET blinking feature [2]

1) Only available for Modbus over Ethernet-APL
2) Only available for PROFINET over Ethernet-APL

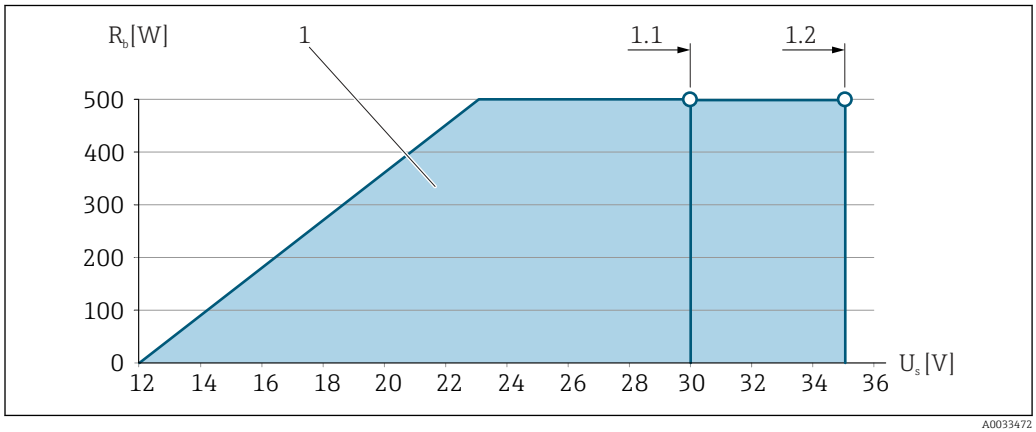
Load

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

- $R_B \leq (U_S - U_{term.\ min})$: 0.022 A
- $R_B \leq 500\ \Omega$



2 *Load for a compact version without local operation*

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" for non-hazardous area and Ex d

Sample calculation
Supply voltage of power supply unit:
- $U_S = 19$ V
- $U_{term.\ min} = 12$ V (measuring device) + 1 V (local operation without lighting) = 13 V

Maximum load: $R_B \leq (19\ V - 13\ V)$: 0.022 A = 273 Ω

The minimum terminal voltage ($U_{KI\ min}$) increases if local operation is used..

Ex connection data

The devices are 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.

Low flow cut off

The switch points for low flow cut off are preset and can be configured.

Galvanic isolation

All inputs and outputs are galvanically isolated from one another.

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x0038
HART protocol revision	7
Device description files (DTM, DD)	Information and files available at: www.endress.com → Downloads area
Load	▪ Min. 250 Ω ▪ Max. 500 Ω
System integration	For information on system integration, see Operating Instructions→ 🖹 103 ▪ Measured variables via HART protocol ▪ Burst Mode functionality

FOUNDATION Fieldbus

Manufacturer ID	0x452B48
Ident number	0x1038
Device revision	2
DD revision **CFF revision**	Information and files at: ▪ www.endress.com → Download Area ▪ www.fieldcommgroup.org
Device Tester Version (ITK version)	6.2.0
ITK Test Campaign Number	Information: ▪ www.endress.com ▪ www.fieldcommgroup.org
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 ▪ Read events ▪ Read trend data
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
System integration	For information on system integration, see Operating Instructions→ 🖹 103 ▪ Cyclic data transmission ▪ Description of the modules ▪ Execution times ▪ Methods

PROFIBUS PA

Manufacturer ID	0x11
Ident number	0x1564
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files at: ▪ www.endress.com → Download Area ▪ https://www.profibus.com

Supported functions	▪ Identification & Maintenance Simple device identification via 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)
System integration	For information on system integration, see Operating Instructions→ 🖹 103 ▪ Cyclic data transmission ▪ Block model ▪ Description of the modules

PROFINET over Ethernet-APL

Protocol	Application layer protocol for decentral device periphery and distributed automation, Version 2.43
Communication type	Ethernet Advanced Physical Layer 10BASE-T1L
Conformance Class	Conformance Class B (PA)
Netload Class	PROFINET Netload Robustness Class 2 10 Mbit/s
Data transfer	10 Mbit/s Full-duplex
Cycle times	64 ms
Polarity	Automatic correction of crossed "APL signal +" and "APL signal -" signal lines
Media Redundancy Protocol (MRP)	Not possible (point-to-point connection to APL field switch)
System redundancy support	System redundancy S2 (2 AR with 1 NAP)
Device profile	PROFINET PA profile 4.02 (Application interface identifier API: 0x9700)
Manufacturer ID	17
Device type ID	0xA438
Device description files (GSD, DTM, FDI)	Information and files available at: ▪ www.endress.com → Downloads area ▪ www.profibus.com
Supported connections	▪ 2x AR (IO Controller AR) ▪ 2x AR (IO Supervisor Device AR connection allowed)
Configuration options for measuring instrument	▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated Web server via Web browser and IP address ▪ Device master file (GSD), can be read out via the integrated Web server of the measuring instrument. ▪ Onsite operation
Configuration of the device name	▪ DCP protocol ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated web server

Supported functions	▪ Identification & Maintenance, simple device identifier via:
	  ▪ Control system
	  ▪ Nameplate
	▪ Measured value status
	The process variables are communicated with a measured value status
	▪ Blinking feature via the local display for simple device identification and assignment
	▪ Device operation via asset management software (e.g. FieldCare, DeviceCare, SIMATIC PDM with FDI package)

System integration	Information regarding system integration: Operating Instructions . ▪ Cyclic data transmission ▪ Overview and description of the modules ▪ Status coding ▪ Factory setting

Modbus TCP over Ethernet-APL

Protocol	▪ Modbus application protocol V1.1b3 applies in this document. ▪ TCP
Response times	On Modbus client request: Typically 3 to 5 ms
Modbus TCP port	502
TCP connections	Maximum 4
Communication type	Ethernet Advanced Physical Layer 10BASE-T1L
Data transfer	▪ 10 Mbit/s ▪ Full-duplex
Polarity	Automatic correction of crossed "APL signal + " and "APL signal -" signal lines
Device type	Address
Device type ID	0xC438
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Broadcast support for function codes	▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Supported transfer speed	10 Mbit/s (APL)
Supported features	Address can be configured using DHCP or software
Device description files (FDI)	Information and files available at: ▪ www.endress.com → Downloads area ▪ www.profibus.com
Configuration options for measuring instrument	▪ Asset management software (FieldCare, DeviceCare, Field Expert) ▪ Integrated Web server via Web browser and IP address ▪ Local operation
Configuration options of the device name	▪ DHCP protocol ▪ Asset management software (FieldCare, DeviceCare, Field Expert) ▪ Integrated web server

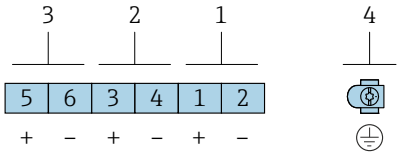
Supported functions	▪ Device identification using: Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Device operation via asset management software (e.g FieldCare, DeviceCare)
System integration	Information regarding system integration: Operating Instructions . ▪ Status coding ▪ Factory setting ▪ FDI ▪ FieldCare

Power supply

Terminal assignment

Transmitter

Connection versions



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Maximum number of terminals *Terminals 1 to 6:* *Without integrated overvoltage protection*	*Maximum number of terminals for order code for "Accessory mounted", option NA "Overvoltage protection"* ▪ *Terminals 1 to 4:* *With integrated overvoltage protection* ▪ *Terminals 5 to 6:* *Without integrated overvoltage protection*

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

Order code for "Output"	Terminal numbers					
	Output 1		Output 2		Input	
	1 (+)	2 (-)	3 (+)	4 (-)	5 (+)	6 (-)
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 **D** [1] [2]	4-20 mA HART (passive)		Pulse/frequency/switch output (passive)		4-20 mA current input (passive)	
Option **E** [3]	FOUNDATION Fieldbus		Pulse/frequency/switch output (passive)		-	
Option **G** [3]	PROFIBUS PA		Pulse/frequency/switch output (passive)		-	

Order code for "Output"	Terminal numbers					
	Output 1		Output 2		Input	
	1 (+)	2 (-)	3 (+)	4 (-)	5 (+)	6 (-)
Option **S** [3]	PROFINET over Ethernet-APL/SPE, 10 Mbit/s		-		-	
Option **T**	Modbus TCP over Ethernet-APL/SPE, 10 Mbit/s		-		-	

1) Output 1 must always be used; output 2 is optional.
2) The integrated overvoltage protection is not used with option D: Terminals 5 and 6 (current input) are not protected against overvoltage.
3) With integrated reverse polarity protection

Connecting cable for remote version

Transmitter and sensor connection housing

In the case of the remote version, the sensor and transmitter are mounted separately from on another and connected by a connecting cable. Connection is performed via the sensor connection housing and the transmitter housing.

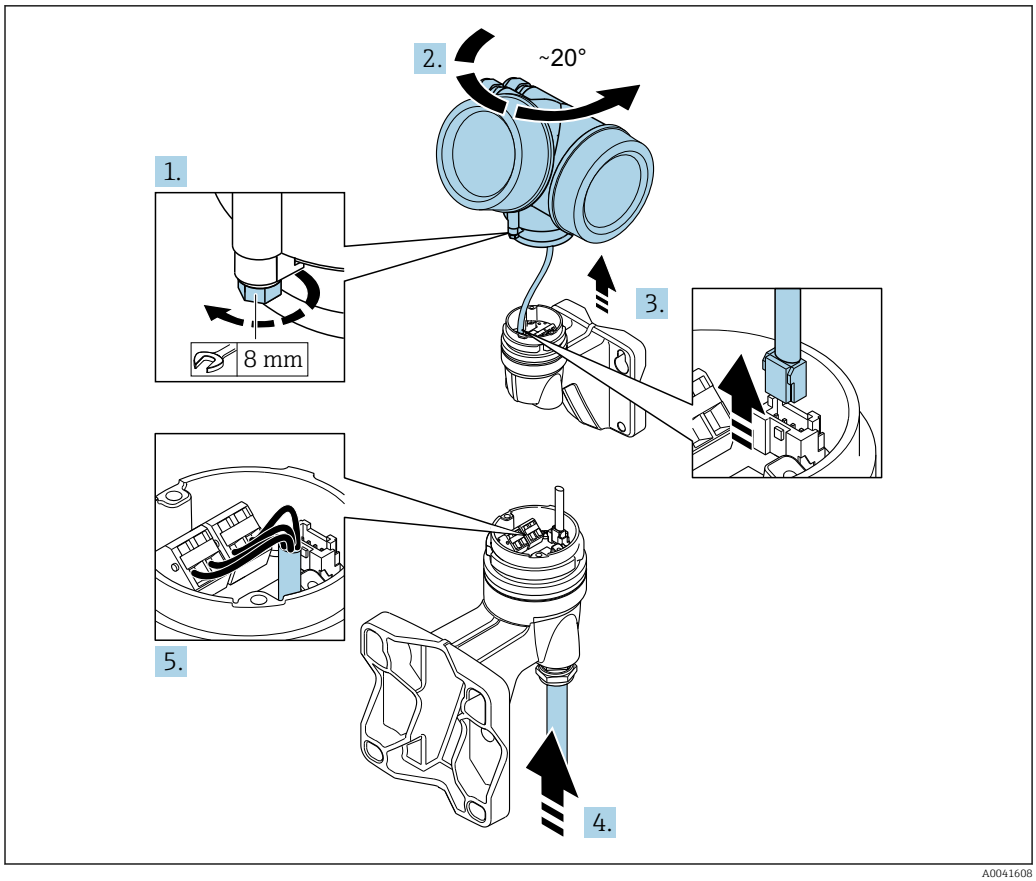
How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable
- Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB

In the following versions, an M12 device connector is used for connection in the transmitter housing:
- All other approvals
- Use of connecting cable (standard)

Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connection via terminals

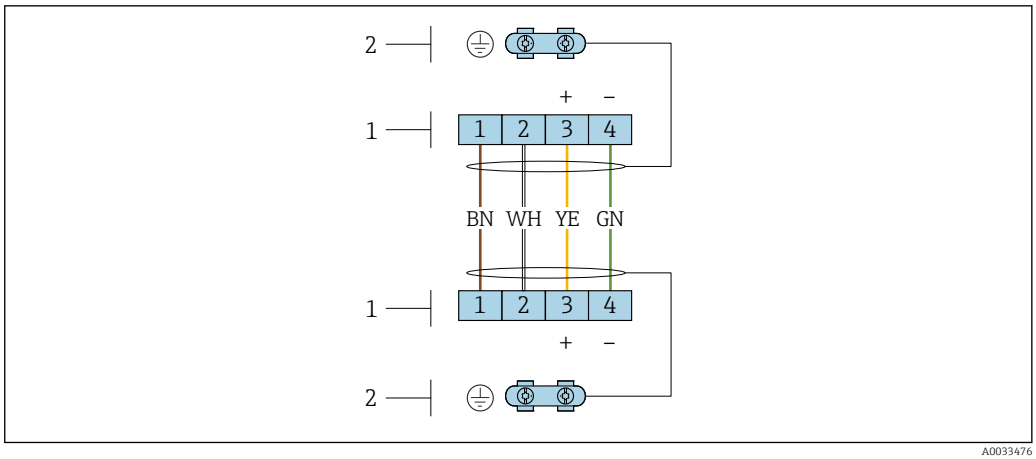


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1. Loosen the securing clamp of the transmitter housing.
2. Turn the transmitter housing clockwise by approx. 20°.
3. NOTICE
   The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!
   ▶ Pay attention to the signal cable when lifting the transmitter housing!

   Lift the transmitter housing, plug the signal cable out of the connection board of the wall holder and remove the transmitter housing.
4. Release the cable gland and insert the connecting cable (use the shorter stripped end of the connecting cable).
5. Wire the connecting cable → 3, 31→ 4, 31.
6. Reverse the removal procedure to reassemble the transmitter housing.
7. Firmly tighten the cable gland.

Connecting cable (standard, reinforced)



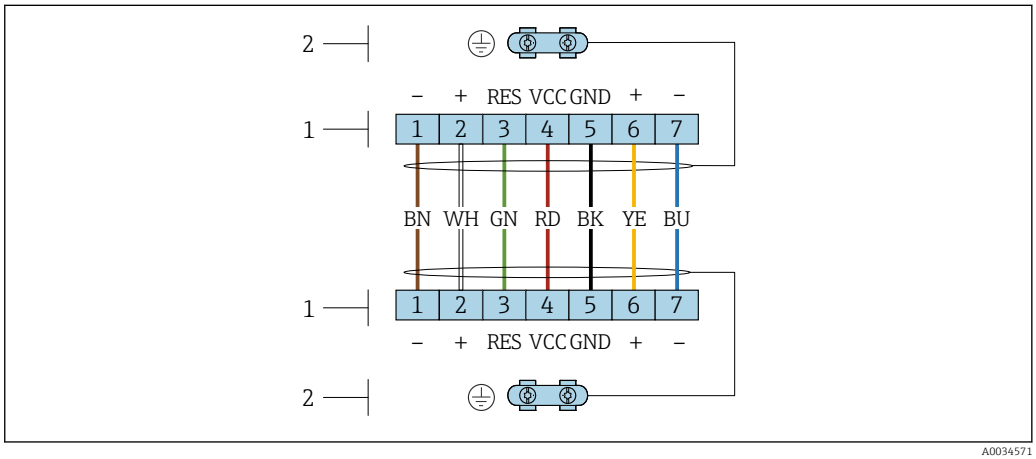
3 *Terminals for connection compartment in the transmitter wall holder and the sensor connection housing*

1 Terminals for connecting cable
2 Grounding via the cable strain relief

Terminal number	Assignment	Cable color Connecting cable
1	Supply voltage	Brown
2	Grounding	White
3	RS485 (+)	Yellow
4	RS485 (–)	Green

Connecting cable (option "mass pressure-/temperature-compensated")

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB



4 *Terminals for connection compartment in the transmitter wall holder and the sensor connection housing*

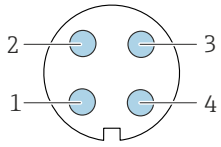
1 Terminals for connecting cable
2 Grounding via the cable strain relief

Terminal number	Assignment	Cable color Connecting cable
1	RS485 (-) DPC	Brown
2	RS485 (+) DPC	White
3	Reset	Green
4	Supply voltage	Red

Terminal number	Assignment	Cable color Connecting cable
5	Grounding	Black
6	RS485 (+)	Yellow
7	RS485 (–)	Blue

Pin assignment, device plug

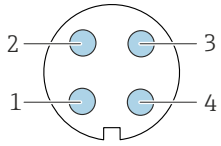
PROFIBUS PA



Pin		Assignment	Coding	Plug/socket
1	+	PROFIBUS PA +	A	Plug
2		Grounding		
3	-	PROFIBUS PA –		
4		Not used		
Metal plug housing		Cable shield		

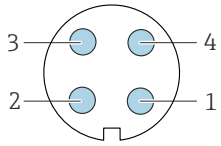
Recommended plug:
- Binder, series 713, part no. 99 1430 814 04
- Phoenix, part no. 1413934 SACC-FS-4QO SH PBPA SCO

FOUNDATION Fieldbus



Pin		Assignment	Coding	Plug/socket
1	+	Signal +	A	Plug
2	-	Signal –		
3		Cable shield[1]		
4		Not used		
Metal plug housing		Cable shield		
[1]If a cable shield is used				

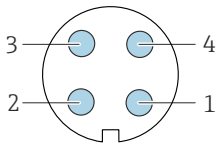
PROFINET over Ethernet-APL



Pin	Assignment	Coding	Plug/socket
1	Ethernet-APL signal -	A	Socket
2	Ethernet-APL signal +		
3	Cable shield[1]		
4	Not used		
Metal plug housing	Cable shield		
[1]If a cable shield is used			

Recommended plug:
- Binder, series 713, part no. 99 1430 814 04
- Phoenix, part no. 1413934 SACC-FS-4QO SH PBPA SCO

Modbus TCP over Ethernet-APL 10 Mbit/s



Pin	Assignment	Coding	Plug/socket
1	Ethernet-APL signal -	A	Socket
2	Ethernet-APL signal +		
3	Cable shield[1]		
4	Not used		
Metal plug housing	Cable shield		
[1]If a cable shield is used			

Recommended plug:
- Binder, series 713, part no. 99 1430 814 04
- Phoenix, part no. 1413934 SACC-FS-4QO SH PBPA SCO

Supply voltage

Transmitter

An external power supply is required for each output.

For installation in systems where the power unit is tested to ensure it meets safety requirements (e.g. SELV/PELV Class 2 limited energy). Only one wire is permitted per terminal.

Supply voltage for a compact version without a local display [1)]

Order code for "Output; input"	Minimum Terminal voltage [2)]	Maximum Terminal voltage
Option **A**: 4-20 mA HART	≥ DC 12 V	DC 35 V
Option **B**: 4-20 mA HART, pulse/ frequency/switch output	≥ DC 12 V	DC 35 V
Option **C**: 4-20 mA HART + 4-20 mA analog	≥ DC 12 V	DC 30 V
Option **D**: 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input [3)]	≥ DC 12 V	DC 35 V
Option **E**: FOUNDATION Fieldbus, pulse/ frequency/switch output	≥ DC 9 V	DC 32 V
Option **G**: PROFIBUS PA, pulse/frequency/ switch output	≥ DC 9 V	DC 32 V
Option **S** : PROFINET over Ethernet-APL/ SPE, 10 Mbit/s	≥ DC 9 V	DC 30 V
Option **T** : Modbus TCP over Ethernet-APL/ SPE, 10 Mbit/s	≥ DC 9 V	DC 30 V

1) In event of external supply voltage of the power supply unit with load, the PROFIBUS DP/PA coupler or FOUNDATION Fieldbus power conditioner
2) Increase of minimum terminal voltage with local operation: See the table below.
3) Voltage drop 2.2 to 3 V for 3.59 to 22 mA

Increase of minimum terminal voltage with local operation

Order code for "Display; operation"	Increase in minimum Terminal voltage
Option **C**: Local operation SD02	+ DC 1 V
Option **E**: Local operation SD03 with lighting (**backlighting** not used)	+ DC 1 V
Option **E**: Local operation SD03 with lighting (**backlighting** used)	+ DC 3 V

Order code for "Sensor version; DSC sensor; measuring tube"	Increase in minimum Terminal voltage
Option **DA**: Mass steam; 316L; 316L (integrated pressure/temperature measurement)	+ DC 1 V
Option **DB**: Mass gas/liquid; 316L; 316L (integrated pressure/temperature measurement),	+ DC 1 V

- For information on the load, see → 📄 23
- Available as accessory: Power supply unit for power supply → 📄 102
- For information on the Ex connection values → 📄 24

Power consumption

Transmitter

Order code for "Output; input"	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 D: 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input	▪ Operation with output 1: 770 mW ▪ Operation with output 1 and 2: 2770 mW ▪ Operation with output 1 and input: 840 mW ▪ Operation with output 1, 2 and input: 2840 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
Option T: Modbus TCP over Ethernet-APL/ SPE, 10 Mbit/s	Operation with output 1: Ex: 833 mW Non-Ex: 1.5 W

For information on the Ex connection values → 📄 24

Current consumption

Current output

For every 4-20 mA current output or 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

Current input

3.59 to 22.5 mA

Internal current limiting: max. 26 mA

FOUNDATION Fieldbus

15 mA

PROFIBUS PA

15 mA

PROFINET over Ethernet-APL

20 to 55.56 mA

Modbus TCP over Ethernet-APL

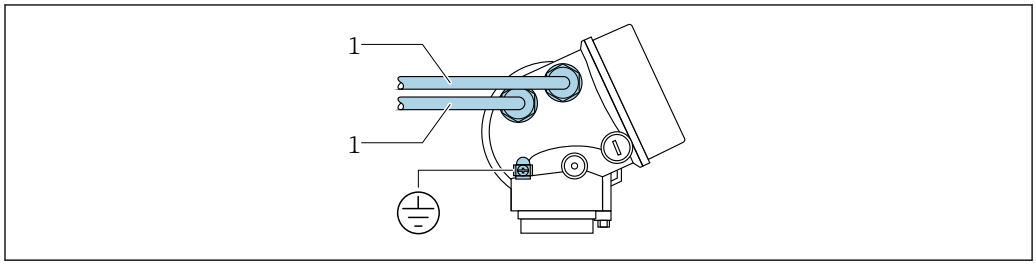
20 to 55.56 mA

Power supply failure

- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memory or in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

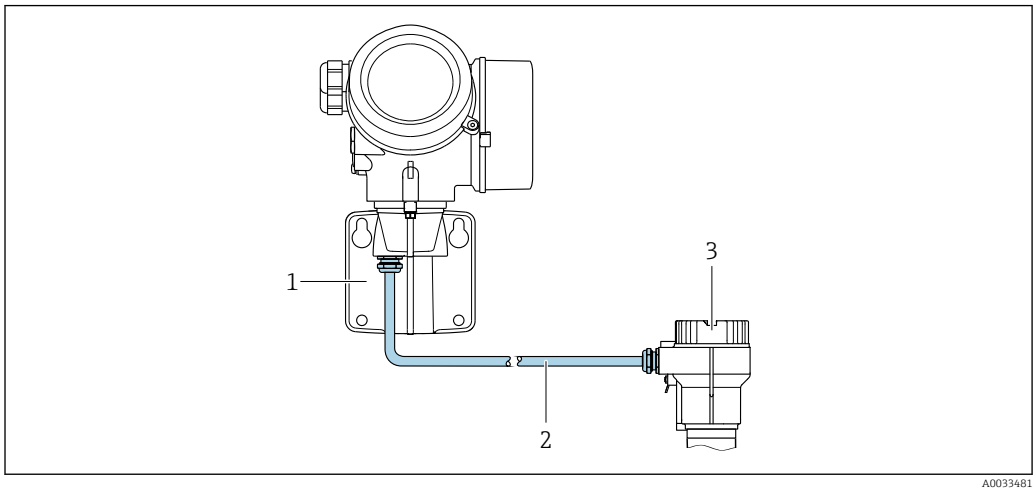
Transmitter connection



1 Cable entries for inputs/outputs

Remote version connection

Connecting cable



5 Connecting cable connection

1 Wall holder with connection compartment (transmitter)
2 Connecting cable
3 Sensor connection housing

How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

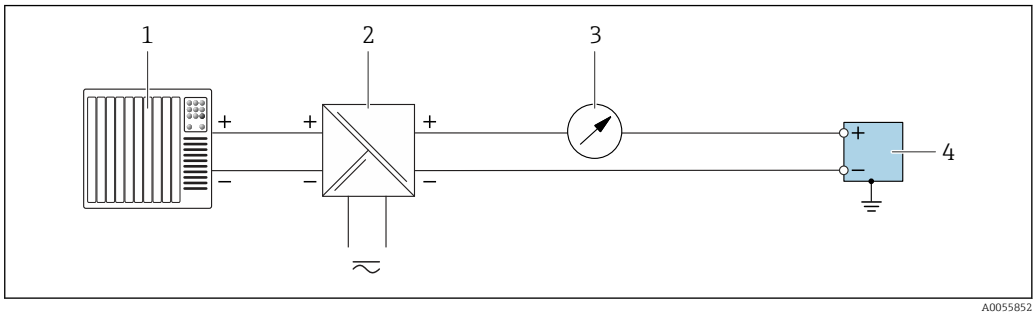
In the following versions, only terminals can be used for connection in the transmitter housing:
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable
- Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB

In the following versions, an M12 device connector is used for connection in the transmitter housing:
- All other approvals
- Use of connecting cable (standard)

Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connection examples

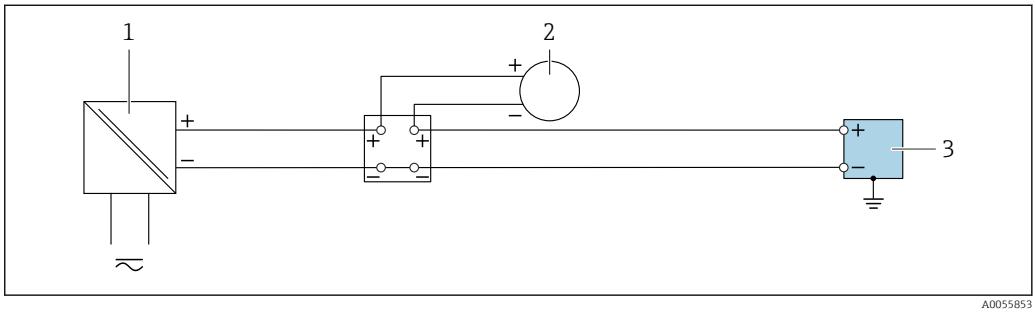
Current output 4 to 20 mA (without HART)



6 *Connection example for 4 to 20 mA current output (passive)*

1 *Automation system with current input (e.g. PLC)*
2 *Power supply*
3 *Optional additional display unit: Observe maximum load*
4 *Transmitter with current output (passive)*

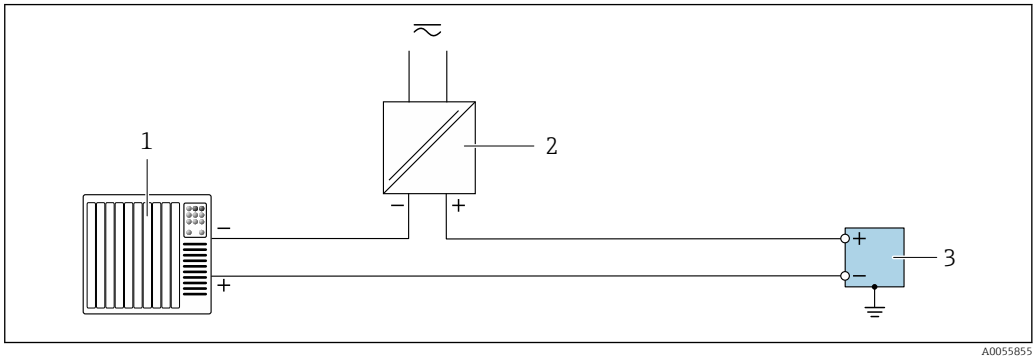
Current input 4 to 20 mA



7 *Connection example for 4 to 20 mA current input*

1 *Power supply*
2 *External measuring instrument with 4 to 20 mA passive current output. e.g. pressure or temperature)*
3 *Transmitter with 4 to 20 mA current input*

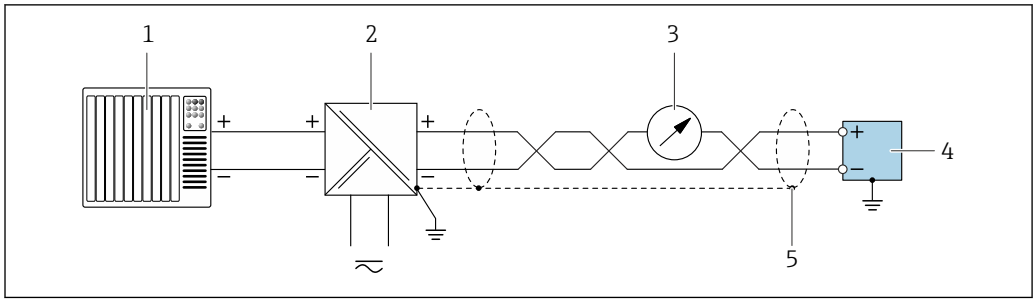
Pulse output/frequency output/switch output



8 *Connection example for pulse output/frequency output/switch output (passive)*

1 *Automation system with pulse input/frequency input/switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter with pulse output/frequency output/switch output (passive)*

Current output 4 to 20 mA HART



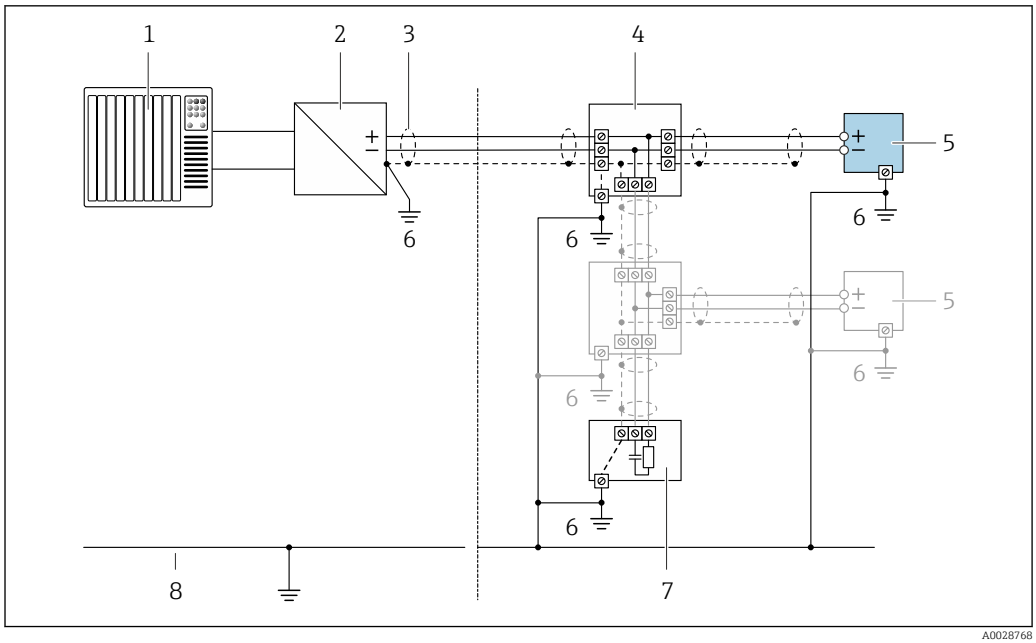
9 Connection example for 4 to 20 mA current output with HART (passive)

1 *Automation system with 4 to 20 mA current input with HART (e.g. PLC)*
2 *Power supply*
3 *Optional display unit: Note maximum load*
4 *Transmitter with 4 to 20 mA current output with HART (passive)*
5 *Ground cable shield at one end. For installations in compliance with NAMUR NE 89, grounding of the cable shield on both sides is required.*

PROFIBUS PA

See https://www.profibus.com "PROFIBUS Installation Guidelines".

FOUNDATION Fieldbus



10 Connection example for FOUNDATION Fieldbus

1 *Automation system (e.g. PLC)*
2 *Power Conditioner (FOUNDATION Fieldbus)*
3 *Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *T-box*
5 *Measuring instrument*
6 *Local grounding*
7 *Bus terminator*
8 *Potential equalization conductor*

Ethernet-APL

See https://www.profibus.com Ethernet-APL White Paper "

Potential equalization

Requirements

For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Connect the medium , sensor and transmitter to the same electric potential.
- Use a ground cable with a minimum cross-section of 6 mm^2 (10 AWG) and a cable lug for potential equalization connections.

Terminals

- For device version without integrated overvoltage protection: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm^2 (20 to 14 AWG)
- For device version with integrated overvoltage protection: screw terminals for wire cross-sections 0.2 to 2.5 mm^2 (24 to 14 AWG)

Cable entries

The type of cable entry available depends on the specific device version.

Cable gland (not for Ex d)
M20 × 1.5

Thread for cable entry
- NPT ½"
- G ½"
- M20 × 1.5

Cable specification

Permitted temperature range

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Signal cable

4 to 20 mA current output (without HART)

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

Shielded twisted-pair cable.

See https://www.fieldcommgroup.org "HART PROTOCOL SPECIFICATIONS".

PROFIBUS PA

Shielded twisted-pair cable. Cable type A is recommended.

See https://www.profibus.com "PROFIBUS Installation Guidelines".

Ethernet-APL

Shielded twisted-pair cable. Cable type A is recommended.

See https://www.profibus.com Ethernet-APL White Paper "

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)

Connecting cable for remote version

Connecting cable (standard)

Standard cable	2 × 2 × 0.5 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85 %
Cable length	5 m (15 ft), 10 m (30 ft), 20 m (60 ft), 30 m (90 ft)
Continuous operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (armored)

Cable, armored	2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) and additional steel-wire braided sheath [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Strain relief and reinforcement	Steel-wire braid, galvanized
Cable length	10 m (30 ft), 20 m (60 ft), 30 m (90 ft)
Continuous operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (option "mass pressure-/temperature-compensated")

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB

Standard cable	[(3 × 2) + 1] × 0.34 mm² (22 AWG) PVC cable with common shield (3 pairs, pair-stranded) [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Cable length	10 m (30 ft), 30 m (90 ft)
Continuous operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (option "mass pressure-/temperature-compensated")

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB

Standard cable	[(3 × 2) + 1] × 0.34 mm² (22 AWG) PVC cable with common shield (3 pairs, pair-stranded) [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Cable length	10 m (30 ft), 30 m (90 ft)
Continuous operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Overvoltage protection

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

Input voltage range	Values correspond to supply voltage specifications → 🖹 33 [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 .

For detailed information on the temperature tables, see the "Safety Instructions" (XA) for the device.

The use of an external overvoltage protection e.g. HAW 569 is recommended.

Performance characteristics

Reference operating conditions

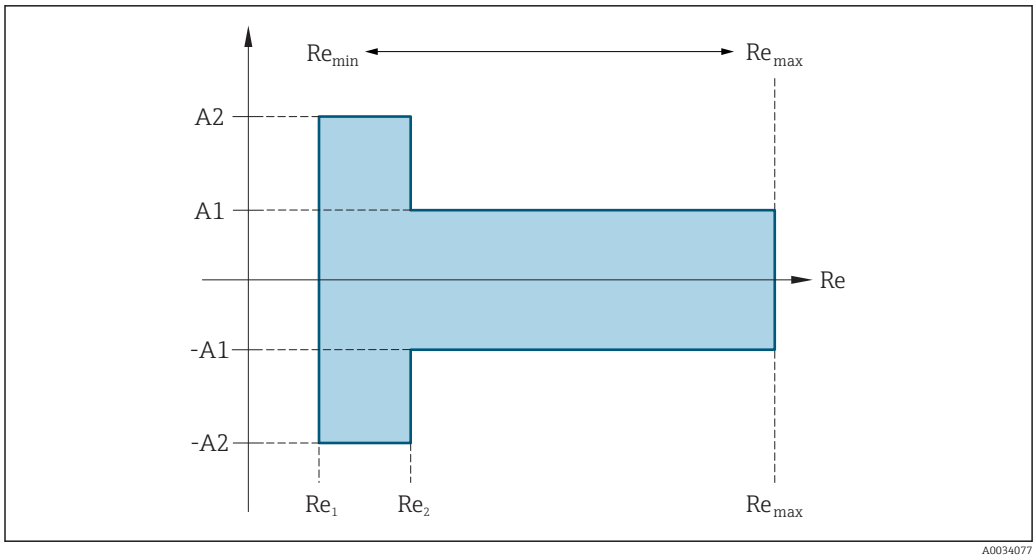
- Error limits following ISO/DIN 11631
- +20 to +30 °C (+68 to +86 °F)
- 2 to 4 bar (29 to 58 psi)
- Calibration system traceable to national standards
- Calibration with the process connection corresponding to the particular standard

To obtain measured errors, use the *Applicator* sizing tool → 🖹 102

Maximum measurement error

Base accuracy

o.r. = of reading



A0034077

Reynolds number	
Re_1	5000
Re_2	10000
Re_{min}	Reynolds number for minimum permitted volume flow in measuring tube ▪ Standard ▪ Option N "0.65% volume PremiumCal 5-point
	$Q_{AmpMin}\ [m^3/h] = \frac{v_{AmpMin}\ [m/s] \cdot \pi \cdot (D_i\ [m])^2}{4} \cdot 3600\ [s/h]$ $Q_{AmpMin}\ [ft^3/min] = \frac{v_{AmpMin}\ [ft/s] \cdot \pi \cdot (D_i\ [ft])^2}{4} \cdot 60\ [s/min]$ A0034304
Re_{max}	Defined by internal diameter of measuring tube, Mach number and maximum permitted velocity in measuring tube $Re_{max} = \frac{\rho \cdot 4 \cdot Q_{max_eff}}{\mu \cdot \pi \cdot K}$ A0034339 Further information on effective upper range value Q_{max_eff} → 17

Volume flow

Medium type		Incompressible		Compressible	
Reynolds number Range	**Measurement error**	**PremiumCal** [1]	**Standard**	**PremiumCal** [1]	**Standard**
Re_2 to Re_{max}	A1	< 0.65 %	< 0.75 %	< 0.9 %	< 1.0 %
Re_1 to Re_2	A2	< 2.5 %	< 5.0 %	< 2.5 %	< 5.0 %

1) Order code for "Calibration flow", option N "0.65% volume PremiumCal 5-point"

Temperature

- Saturated steam and liquids at room temperature, if T > 100 °C (212 °F): < 1 °C (1.8 °F)
- Gas: < 1 % o.r. [K]
- Rise time 50 % (stirred under water, following IEC 60751): 8 s

Pressure

Order code for "Pressure component" [1]	Nominal value [bar abs.]	Pressure ranges and measured errors [2]	
		Pressure range [bar abs.]	Measurement error
Option **B** Pressure measuring cell 2 bar_a	2	0.01 ≤ p ≤ 0.4 0.4 ≤ p ≤ 2	0.5 % of 0.4 bar abs. 0.5 % o.r.
Option **C** Pressure measuring cell 4 bar_a	4	0.01 ≤ p ≤ 0.8 0.8 ≤ p ≤ 4	0.5 % of 0.8 bar abs. 0.5 % o.r.
Option **D** Pressure measuring cell 10 bar_a	10	0.01 ≤ p ≤ 2 2 ≤ p ≤ 10	0.5 % of 2 bar abs. 0.5 % o.r.
Option **E** Pressure measuring cell 40 bar_a	40	0.01 ≤ p ≤ 8 8 ≤ p ≤ 40	0.5 % of 8 bar abs. 0.5 % o.r.
Option **F** Pressure measuring cell 100 bar_a	100	0.01 ≤ p ≤ 20 20 ≤ p ≤ 100	0.5 % of 20 bar abs. 0.5 % o.r.

1) Sensor version "Mass (integrated pressure/temperature measurement)" is only available for measuring instruments in the HART, PROFINET over Ethernet-APL and Modbus TCP over Ethernet-APL communication modes.
2) The specific measured errors refer to the position of the measurement in the measuring tube and do not correspond to the pressure in the pipe connection line upstream or downstream from the measuring instrument. No measured error is specified for the measured error for the "pressure" measured variable that can be assigned to the outputs.

Mass flow saturated steam

Sensor version				Mass (integrated temperature measurement) [1]		Mass (integrated pressure/ temperature measurement) [2] [1]	
Process pressure [bar abs.]	Flow velocity [m/s (ft/s)]	Reynolds number Range	Measurement error	PremiumCal [3]	Standard	PremiumCal [3]	Standard
> 4.76	20 to 50 (66 to 164)	Re_2 to Re_{max}	A1	< 1.6 %	< 1.7 %	< 1.4 %	< 1.5 %
> 3.62	10 to 70 (33 to 230)	Re_2 to Re_{max}	A1	< 1.9 %	< 2.0 %	< 1.7 %	< 1.8 %
In all cases not specified here, the following applies: < 5.7 %							

1) Detailed calculation with Applicator
2) Sensor version only available for measuring instruments in the HART, PROFINET over Ethernet-APL and Modbus TCP over Ethernet-APL communication modes.
3) Order code for "Calibration flow", option N "0.65% volume PremiumCal 5-point"

Mass flow of superheated steam/gases [3) 4)]

Sensor version				Mass (integrated pressure/ temperature measurement) [1) 2)]		Mass (integrated temperature measurement) + external pressure compensation [3) 2)]	
Process pressure [bar abs.]	**Flow velocity [m/s (ft/s)]**	**Reynolds number Range**	**Measurement error**	**PremiumCal** [4)]	**Standard**	**PremiumCal** [4)]	**Standard**
< 40	All velocities	Re_2 to Re_{max}	A1	< 1.4 %	< 1.5 %	< 1.6 %	< 1.7 %
< 120		Re_2 to Re_{max}	A1	< 2.3 %	< 2.4 %	< 2.5 %	< 2.6 %
In all cases not specified here, the following applies: < 6.6 %							

1) Sensor version only available for measuring instruments in the HART, PROFINET over Ethernet-APL and Modbus TCP over Ethernet-APL communication modes
2) Detailed calculation with Applicator
3) The use of a Cerabar S is required for the measurement errors listed in the following section. The measurement error used to calculate the error in the measured pressure is 0.15 %.
4) Order code for "Calibration flow", option N "0.65% volume PremiumCal 5-point"

Water mass flow

Sensor version				Mass (integrated temperature measurement)	
Process pressure [bar abs.]	**Flow velocity [m/s (ft/s)]**	**Reynolds number range**	**Measured value deviation**	**PremiumCal** [1)]	**Standard**
All pressures	All velocities	Re_2 to Re_{max}	A1	< 0.75 %	< 0.85 %
		Re_1 to Re_2	A2	< 2.6 %	< 2.7 %

1) Order code for "Calibration flow", option N "0.65% volume PremiumCal 5-point"

Mass flow (user-specific liquids)

To specify the system accuracy, Endress+Hauser requires information about the type of liquid and its operating temperature or information in table form about the dependency between the liquid density and the temperature.

Example

- Acetone is to be measured at fluid temperatures from +70 to +90 °C (+158 to +194 °F).
- For this purpose, the **Reference temperature** parameter (7703) (here 80 °C (176 °F)), **Reference density** parameter (7700) (here 720.00 kg/m³) and **Linear expansion coefficient** parameter (7621) (here 18.0298 × 10^{-4} 1/°C) must be entered in the transmitter.
- The overall system uncertainty, which is less than 0.9 % for the example above, is comprised of the following measurement uncertainties: uncertainty of volume flow measurement, uncertainty of temperature measurement, uncertainty of the density-temperature correlation used (including the resulting uncertainty of density).

Mass flow (other media)

Depends on the selected fluid and the pressure value, which is specified in the parameters. Individual error analysis must be performed.

Diameter mismatch correction

The measuring device is calibrated according to the ordered process connection. This calibration takes account of the edge at the transition from the mating pipe to the process connection. If the mating pipe used deviates from the ordered process connection, a diameter mismatch correction can compensate for the effects. The difference between the internal diameter of the ordered process connection and the internal diameter of the mating pipe used must be taken into consideration.

3) Single gas, gas mixture, air: NEL40; natural gas: ISO 12213-2 contains AGA8-DC92, AGA NX-19, ISO 12213-3 contains SGERG-88 and AGA8 Gross Method 1
4) The measuring instrument is calibrated with water and has been verified under pressure on gas calibration rigs.

The measuring device can correct shifts in the calibration factor which are caused, for example, by a diameter mismatch between the device flange (e.g. ASME B16.5/Sch. 80, DN 50 (2")) and the mating pipe (e.g. ASME B16.5/Sch. 40, DN 50 (2")). Only apply diameter mismatch correction within the following limit values (listed below) for which test measurements have also been performed.

Flange connection:
- DN 15 (½"): ±20 % of the internal diameter
- DN 25 (1"): ±15 % of the internal diameter
- DN 40 (1½"): ±12 % of the internal diameter
- DN ≥ 50 (2"): ±10 % of the internal diameter

If the standard internal diameter of the ordered process connection differs from the internal diameter of the mating pipe, an additional measuring uncertainty of approx. 2 % o.r. must be expected.

Example
Influence of the diameter mismatch without using the correction function:
- Mating pipe DN 100 (4"), Schedule 80
- Device flange DN 100 (4"), Schedule 40
- This installation position results in a diameter mismatch of 5 mm (0.2 in). If the correction function is not used, an additional measuring uncertainty of approx. 2 % o.r. must be expected.
- If the basic conditions are met and the feature is enabled, the additional measuring uncertainty is 1 % o.r.

For detailed information on the parameters for diameter mismatch correction, see the Operating Instructions → 🖹 103

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±10 µA

Pulse/frequency output

o.r. = of reading

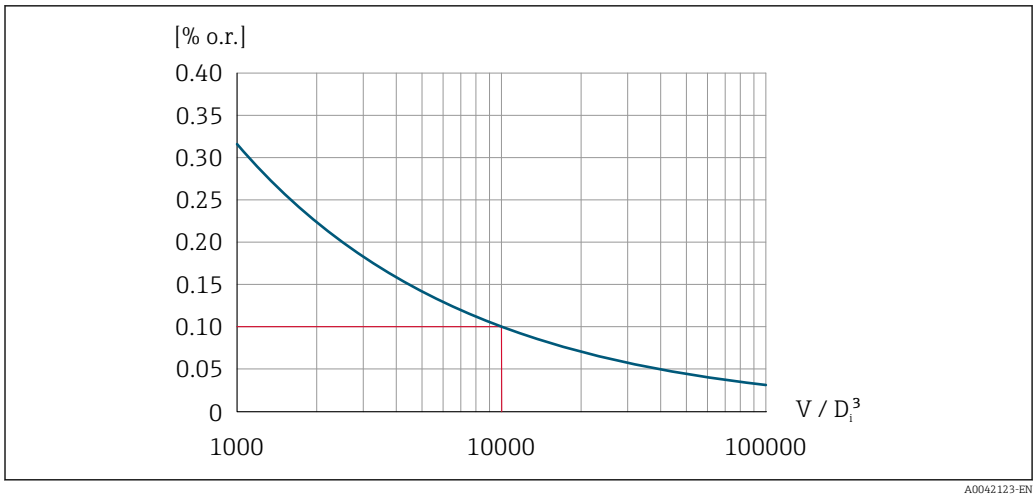
Accuracy	Max. ±100 ppm o.r.

Repeatability

o.r. = of reading

$$r = \left\{ \frac{100 \cdot D_i^3}{V} \right\}^{1/2} \% \text{ o.r.}$$

A0042121-EN



11 Repeatability = 0.1 % o.r. with a measured volume [m³] of V = 10 000 · D_i^3

The repeatability can be improved if the measured volume is increased. Repeatability is not a device characteristic but a statistical variable that is dependent on the boundary conditions indicated.

Response time

If all the configurable functions for filter times (flow damping, display damping, current output time constant, frequency output time constant, status output time constant) are set to 0, in the event of vortex frequencies of 10 Hz and higher a response time of max(T_v,100 ms) can be expected.

In the event of measuring frequencies < 10 Hz, the response time is > 100 ms and can be up to 10 s. T_v is the average vortex period duration of the flowing fluid.

Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 5 to 95%.

Operating height

According to EN 61010-1
- ≤ 2 000 m (6 562 ft)
- > 2 000 m (6 562 ft) with additional overvoltage protection (e.g. Endress+Hauser HAW Series)

Influence of ambient temperature

Current output

o.r. = of reading

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

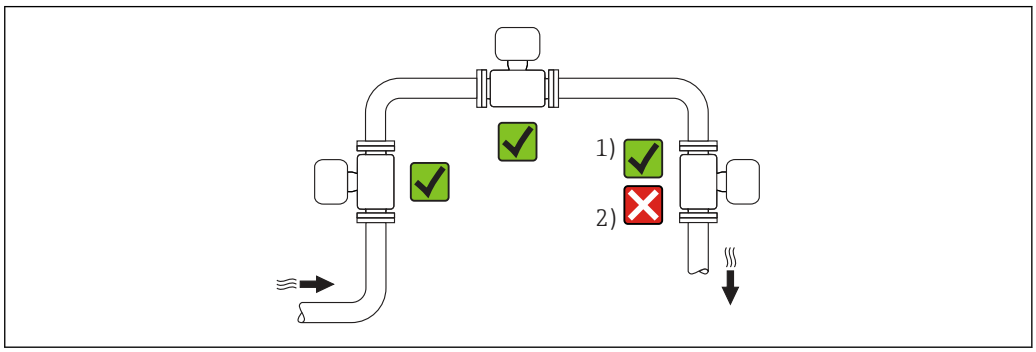
Pulse/frequency output

o.r. = of reading

Temperature coefficient	Max. ±100 ppm o.r.

Installation

Mounting location



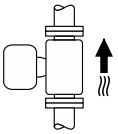
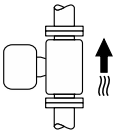
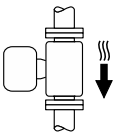
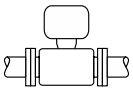
A0042128

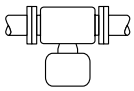
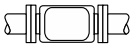
1 *Installation suitable for gases and steam; the measuring device must be installed upside-down in a horizontal pipe if the order code for "Application package", option ES "Wet steam detection" or EU "Wet steam measurement" is used*
2 *Installation not suitable for liquids*

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).

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. Therefore, please note the following:

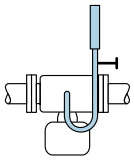
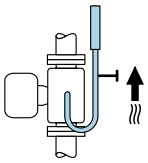
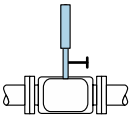
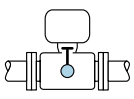
Orientation			Recommendation	
			Compact version	Remote version
A	Vertical orientation (liquids)	 A0015591	✓✓ 1)	✓✓
A	Vertical orientation (dry gases)	 A0015591  A0041785	✓✓	✓✓
B	Horizontal orientation, transmitter head up	 A0015589	✓✓ 2)	✓✓

Orientation			Recommendation	
			Compact version	Remote version
C	Horizontal orientation, transmitter head down	 A0015590	✓✓ 3) 4)	✓✓
D	Horizontal orientation, transmitter head at side	 A0015592	✓✓ 3)	✓✓

1) In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (Fig. A). Disruption in flow measurement!
2) In the case of hot media (e.g. steam or medium temperature (TM) ≥ 200 °C (392 °F): orientation C or D
3) In the case of very cold media (e.g. liquid nitrogen): orientation B or D
4) For "Wet steam detection/measurement" option: orientation C

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

Pressure measuring cell

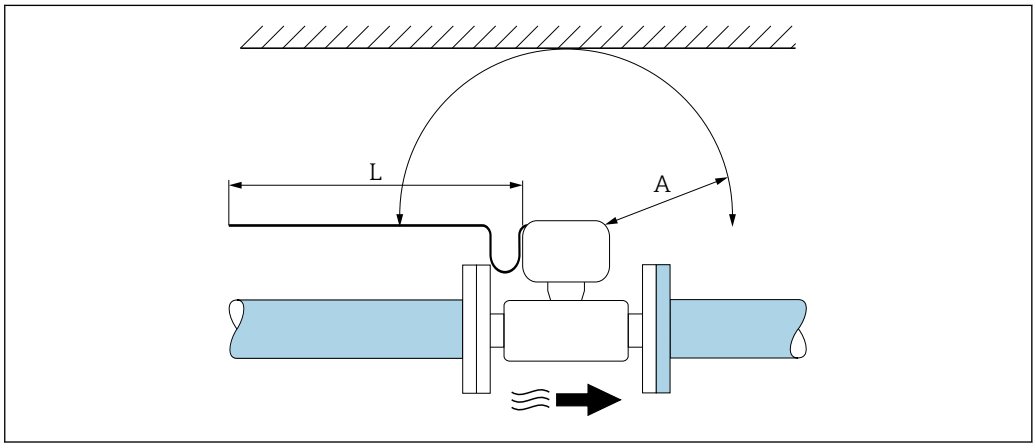
Steam pressure measurement			Option DA
E	▪ With the transmitter installed at the bottom or at the side ▪ Protection against rising heat ▪ Reduction in temperature to almost ambient temperature due to siphon 1)	 A0034057	✓✓
F		 A0034058	✓✓
Gas pressure measurement			**Option DB**
G	▪ Pressure measuring cell with shutoff device above tapping point ▪ Discharge of any condensate into the process	 A0034092	✓✓
Liquid pressure measurement			**Option DB**
H	Device with shutoff device at the same level as tapping point	 A0034091	✓✓

1) Note max. permitted ambient temperature of transmitter→ 🖹 53.

Minimum spacing and cable length

Order code for "Sensor version", option "Mass" DA, DB

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

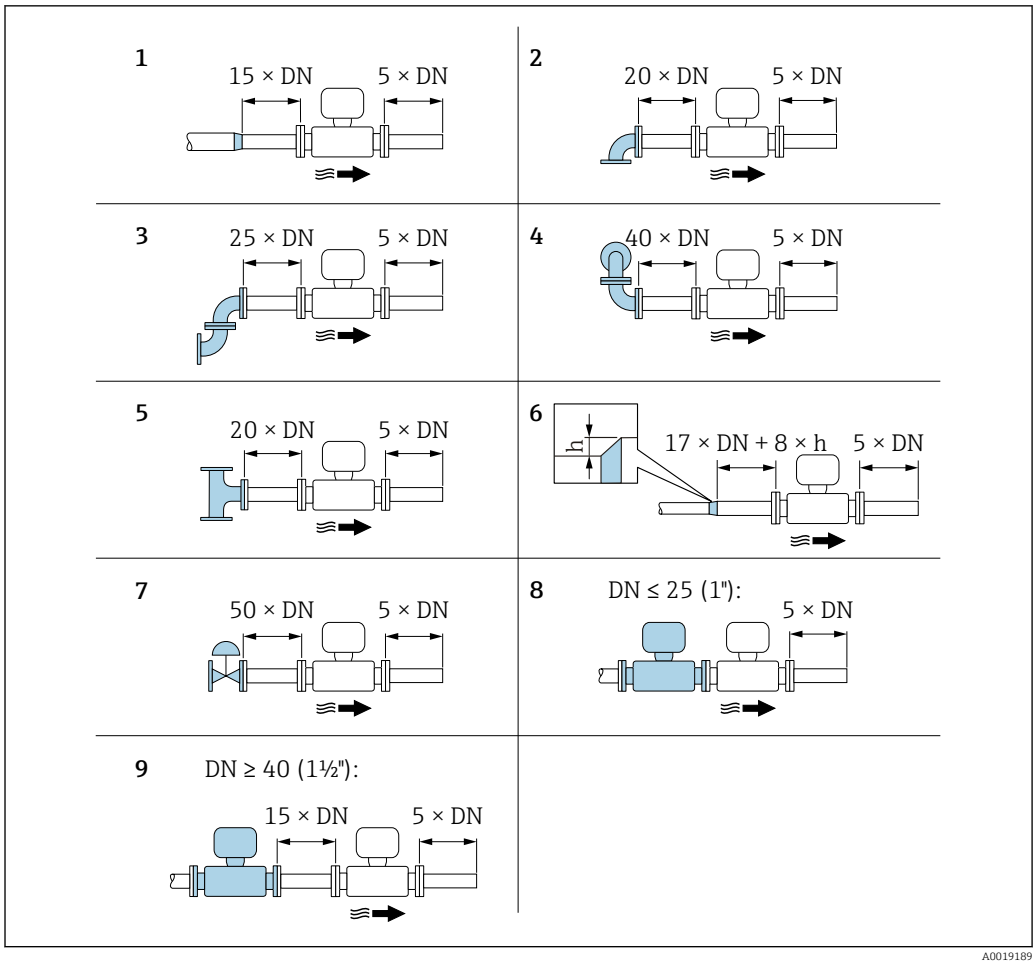


A Minimum spacing in all directions
L Required cable length

The following dimensions must be observed to guarantee problem-free access to the device for service purposes:
- A = 100 mm (3.94 in)
- L = L + 150 mm (5.91 in)

Inlet and outlet runs

To achieve the specified measurement accuracy of the measuring instrument, observe at least the inlet and outlet runs listed below.



12 *Minimum inlet and outlet runs with various flow obstructions*

h Difference in expansion
1 Reduction by one nominal diameter size
2 Single elbow (90° elbow)
3 Double elbow (2 × 90° elbows, opposite)
4 Double elbow 3D (2 × 90° elbows, opposite, not on one plane)
5 T-piece
6 Expansion
7 Control valve
8 Two measuring instruments in a row where DN ≤ 25 (1"): directly flange on flange
9 Two measuring instruments in a row where DN ≥ 40 (1½"): for spacing; see graphic

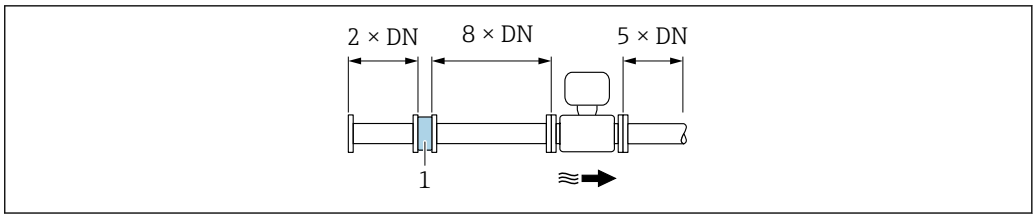
- If there are several flow disturbances present, the longest specified inlet run must be maintained.
- If the required inlet runs cannot be observed, it is possible to install a specially designed flow conditioner → 50.

The **inlet run correction** function:
- Makes it possible to shorten the inlet run to a minimum length of 10 × DN in the event of flow obstructions 1 to 4. An additional measurement uncertainty of ±0.5% o.r. occurs here.
- Cannot be combined with the **wet steam detection/measurement** → 98 application package. If wet steam detection/measurement is used, the corresponding inlet runs must be taken into consideration. It is not possible to use a flow conditioner for wet steam.

Flow conditioner

If the inlet runs cannot be observed, the use of a flow conditioner is recommended.

The flow conditioner is fitted between two pipe flanges and centered by the mounting bolts. Generally this reduces the inlet run needed to 10 × DN with full measurement accuracy.



A0019208

1 Flow conditioner

The pressure loss for flow conditioners is calculated as follows:

$\Delta p\ [mbar] = 0.0085 \cdot \rho\ [kg/m^3] \cdot v^2\ [m/s]$

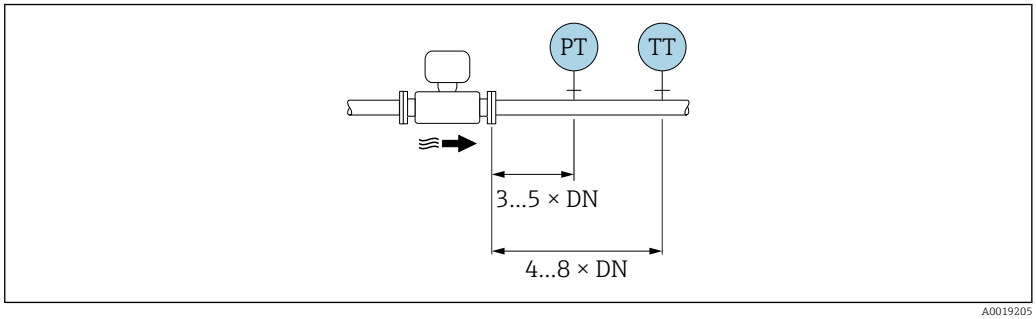
Example for steam	Example for H_2O condensate (80 °C)
p = 10 bar abs. t = 240 °C → ρ = 4.39 kg/m³ v = 40 m/s	ρ = 965 kg/m³ v = 2.5 m/s
$\Delta p = 0.0085 \cdot 4.39 \cdot 40^2 = 59.7$ mbar	$\Delta p = 0.0085 \cdot 965 \cdot 2.5^2 = 51.3$ mbar

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

- A specially designed flow conditioner is available as an accessory → 101.
- Dimensions of the flow conditioner → 69.

Outlet runs when installing external devices

If installing an external device, observe the specified distance.



A0019205

PT Pressure
TT Temperature device

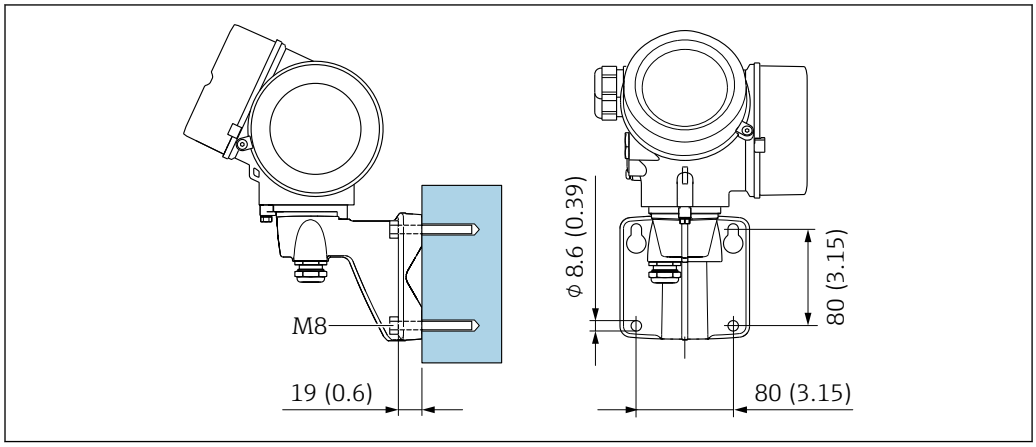
Length of connecting cable

To ensure correct measuring results when using the remote version:
- Observe the maximum permitted cable length: L_{max} = 30 m (90 ft).
- The value for the cable length must be calculated if the cable cross-section differs from the specification.

For detailed information about calculating the length of the connecting cable, refer to the Operating Instructions for the device.

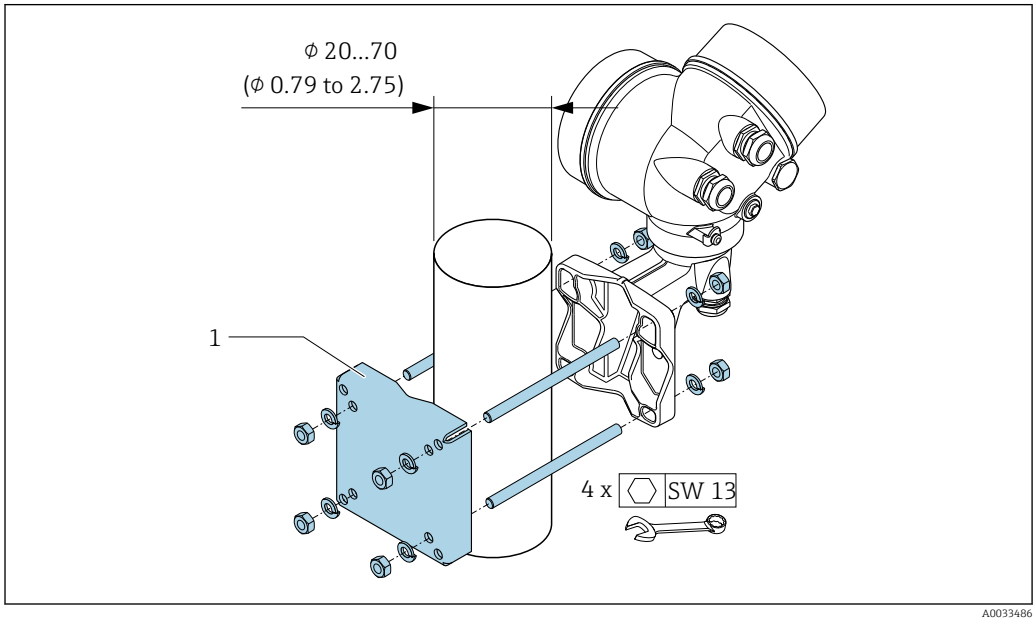
Installing the transmitter housing

Wall mounting



13 mm (in)

Pipe mounting



14 mm (in)

Protective cover

A protective cover is available as an accessory for the device. It is used to protect against direct sunlight, precipitation and ice.

When installing the protective cover, a minimum upward clearance must be maintained: 222 mm (8.74 in)

The protective cover can be ordered via the product structure together with the device: Order code for "Accessories enclosed" option PB "Protective cover"

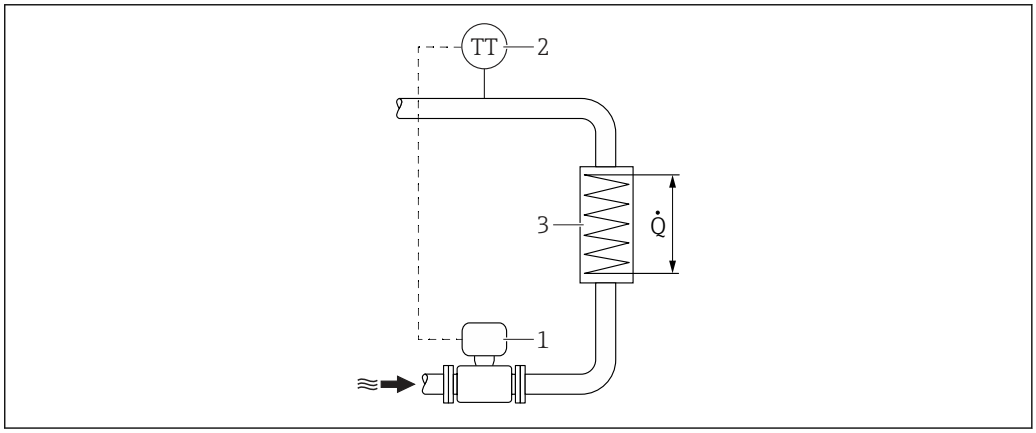
Ordered separately as an accessory → 100

Installation for delta heat measurements

- Order code for "Sensor version", option CA "Mass; 316L; 316L (integrated temperature measurement), −200 to +400 °C (−328 to +750 °F)"
- Order code for "Sensor version", option CB "Mass; Alloy C22; 316L (integrated temperature measurement), −200 to +400 °C (−328 to +750 °F)"
- Order code for "Sensor version", option CC "Mass; Alloy C22; Alloy C22 (integrated temperature measurement), −40 to +260 °C (−40 to +500 °F)"
- Order code for "Sensor version", option DA "Mass steam; 316L; 316L (integrated pressure/ temperature measurement), −200 to +400 °C (−328 to +750 °F)"
- Order code for "Sensor version", option DB "Mass gas/liquid; 316L; 316L (integrated pressure/ temperature measurement), −40 to +100 °C (−40 to +212 °F)"

The second temperature measurement is taken using a separate temperature sensor. The measuring instrument reads in this value via a communication interface.

- In the case of saturated steam delta heat measurements, the measuring instrument must be installed on the steam side.
- In the case of water delta heat measurements, the device can be installed on the cold or warm side.



15 Layout for delta heat measurement of saturated steam and water

1 Measuring instrument
2 Temperature sensor
3 Heat exchanger
Q Heat flow

Environment

Ambient temperature range

Compact version

Measuring instrument	Non-hazardous area:	−40 to +80 °C (−40 to +176 °F) [1] −40 to +80 °C (−40 to +176 °F)
	Ex i, Ex nA, Ex ec:	−40 to +70 °C (−40 to +158 °F) [1]
	Ex d, XP:	−40 to +60 °C (−40 to +140 °F) [1]
	Ex d, Ex ia:	−40 to +60 °C (−40 to +140 °F) [1]
Local display		−40 to +70 °C (−40 to +158 °F) [2] [1]

1) Additionally available as order code for "Test, certificate", option JN "Transmitter ambient temperature −50 °C (−58 °F)". This option is only available in combination with a "High-temperature sensor -200 to +400 °C(-328 to +750 °F)", see order code 060 for "Sensor version; DSC sensor; measuring tube" with options BA, BB, CA, CB.
2) At temperatures below −20 °C (−4 °F), depending on the physical characteristics involved, it may no longer be possible to read the liquid crystal display.

Remote version

Transmitter	Non-hazardous area:	−40 to +80 °C (−40 to +176 °F) [1] −40 to +80 °C (−40 to +176 °F)
	Ex i, Ex nA, Ex ec:	−40 to +80 °C (−40 to +176 °F) [1]
	Ex d:	−40 to +60 °C (−40 to +140 °F) [1]
	Ex d, Ex ia:	−40 to +60 °C (−40 to +140 °F) [1]
Sensor	Non-hazardous area:	−40 to +85 °C (−40 to +185 °F) [1]
	Ex i, Ex nA, Ex ec:	−40 to +85 °C (−40 to +185 °F) [1]
	Ex d:	−40 to +85 °C (−40 to +185 °F) [1]
	Ex d, Ex ia:	−40 to +85 °C (−40 to +185 °F) [1]
Local display		−40 to +70 °C (−40 to +158 °F) [2] [1]

1) Additionally available as order code for "Test, certificate", option JN "Transmitter ambient temperature −50 °C (−58 °F)". This option is only available in combination with a "High-temperature sensor -200 to +400 °C(-328 to +750 °F)", see order code 060 for "Sensor version; DSC sensor; measuring tube" with options BA, BB, CA, CB.
2) At temperatures < −20 °C (−4 °F), depending on the physical characteristics involved, it may no longer be possible to read the liquid crystal display.

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

You can order a weather protection cover from Endress+Hauser. → 100.

Storage temperature

All components apart from the display modules:
−50 to +90 °C (−58 to +194 °F)

Display modules

−40 to +80 °C (−40 to +176 °F)

Remote display FHX50:
−40 to +80 °C (−40 to +176 °F)

Climate class

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

Degree of protection

Transmitter
- Standard: IP66/67, type 4X enclosure, suitable for pollution degree 4
- When the housing is open: IP20, type 1 enclosure, suitable for pollution degree 2
- Display module: IP20, type 1 enclosure, suitable for pollution degree 2

Sensor
IP66/67, Type 4X [5] enclosure, suitable for pollution degree 4

Device plug
IP67, only in screwed situation

Vibration-resistance and shock resistance

Vibration sinusoidal, in accordance with IEC 60068-2-6

Order code for "Housing", option B "GT18 dual compartment, 316L, compact" and order code for "Sensor version; DSC sensor; Meas. tube", option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)" or option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temp. measurement)"
- 2 to 8.4 Hz, 3.5 mm peak
- 8.4 to 500 Hz, 1 g peak

5) Type 4X is not used when a pressure measuring cell is installed.

Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote"
- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 500 Hz, 2 g peak

Vibration broad-band random, according to IEC 60068-2-64

Order code for "Housing", option B "GT18 dual compartment, 316L, compact" and order code for "Sensor version; DSC sensor; Meas. tube", option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)" or option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temp. measurement)"
- 10 to 200 Hz, 0.003 g^2/Hz
- 200 to 500 Hz, 0.001 g^2/Hz
- Total: 0.93 g rms

Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote")
- 10 to 200 Hz, 0.01 g^2/Hz
- 200 to 500 Hz, 0.003 g^2/Hz
- Total: 1.67 g rms

Half-sine shocks according to IEC 60068-2-27

- Order code for "Housing", option B "GT18 dual compartment, 316L, compact" and order code for "Sensor version; DSC sensor; Meas. tube", option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)" or option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temp. measurement)"
  6 ms 30 g
- Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote")
  6 ms 50 g

Rough handling shocks according to IEC 60068-2-31

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21), NAMUR Recommendation 21 (NE 21) is fulfilled when the device is installed in accordance with NAMUR Recommendation 98 (NE 98).
- As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4

Details are provided in the Declaration of Conformity.

This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

Process

Medium temperature range

DSC sensor [1)]

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Medium temperature range**
AA	Volume; 316L; 316L	−40 to +260 °C (−40 to +500 °F), stainless steel
AB	Volume; Alloy C22; 316L	
AC	Volume; Alloy C22; Alloy C22	−40 to +260 °C (−40 to +500 °F), Alloy C22
BA	Volume high-temperature; 316L; 316L	−200 to +400 °C (−328 to +752 °F), stainless steel
BB	Volume high-temperature; Alloy C22; 316L	
CA	Mass; 316L; 316L	−200 to +400 °C (−328 to +752 °F), stainless steel
CB	Mass; Alloy C22; 316L	
CC	Mass; Alloy C22; Alloy C22	−40 to +260 °C (−40 to +500 °F), Alloy C22

1) Capacitance sensor

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	**Description**	**Medium temperature range**
For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies: ▪ Only available for measuring instruments with the following communication protocols: ▪ HART ▪ PROFINET over Ethernet-APL ▪ Modbus TCP over Ethernet-APL ▪ Oil-free or grease-free cleaning is not possible.		
DA	Mass steam; 316L; 316L	−200 to +400 °C (−328 to +752 °F), stainless steel [1) 2)]
DB	Mass gas/liquid; 316L; 316L	−40 to +100 °C (−40 to +212 °F), stainless steel [2)]

1) Siphon enables use for extended temperature range (up to +400 °C (+752 °F)).
2) In steam applications, in conjunction with the siphon, the steam temperature may be higher (up to +400 °C (+752 °F)) than the permitted temperature of the pressure measuring cell. Without a siphon, the gas temperature is limited by the maximum permitted temperature of the pressure measuring cell. This applies regardless of whether or not a stop cock is present.

Pressure measuring cell

Order code for "Pressure component"		
Option	**Description**	**Medium temperature range**
B C D E F	Pressure measuring cell 2bar/29psi abs Pressure measuring cell 4bar/58psi abs Pressure measuring cell 10bar/145psi abs Pressure measuring cell 40bar/580psi abs Pressure measuring cell 100bar/1450psi abs	−40 to +100 °C (−40 to +212 °F)

Seals

Order code for "DSC sensor seal"		
Option	**Description**	**Medium temperature range**
A	Graphite	−200 to +400 °C (−328 to +752 °F)
B	Viton	−15 to +175 °C (+5 to +347 °F)
C	Gylon	−200 to +260 °C (−328 to +500 °F)
D	Kalrez	−20 to +275 °C (−4 to +527 °F)

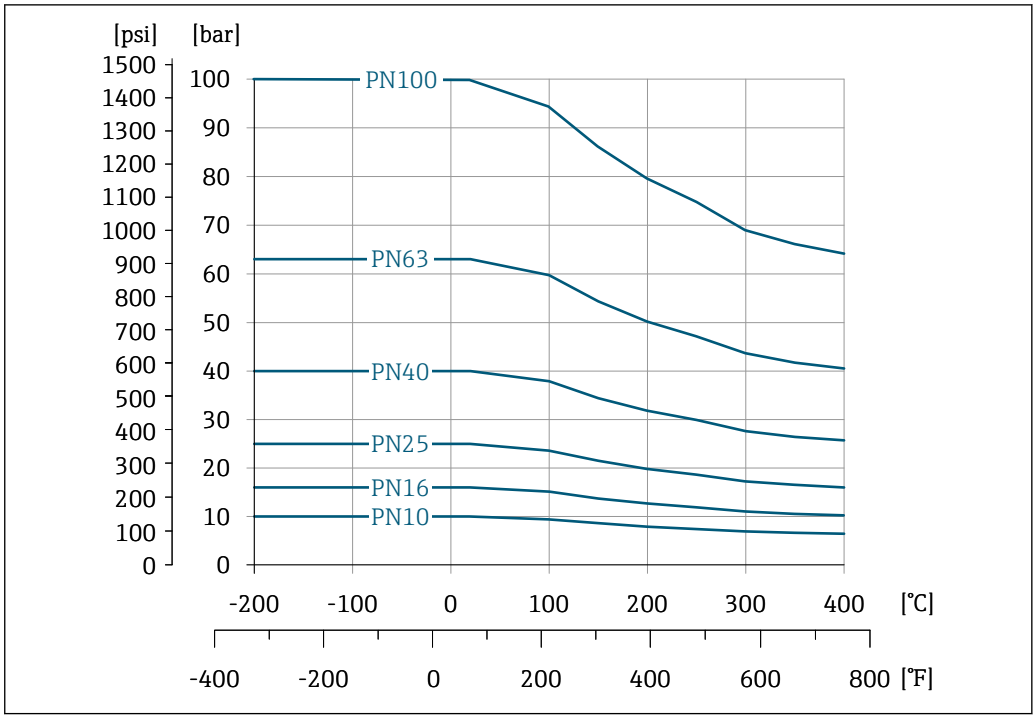
Pressure/temperature ratings

The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.

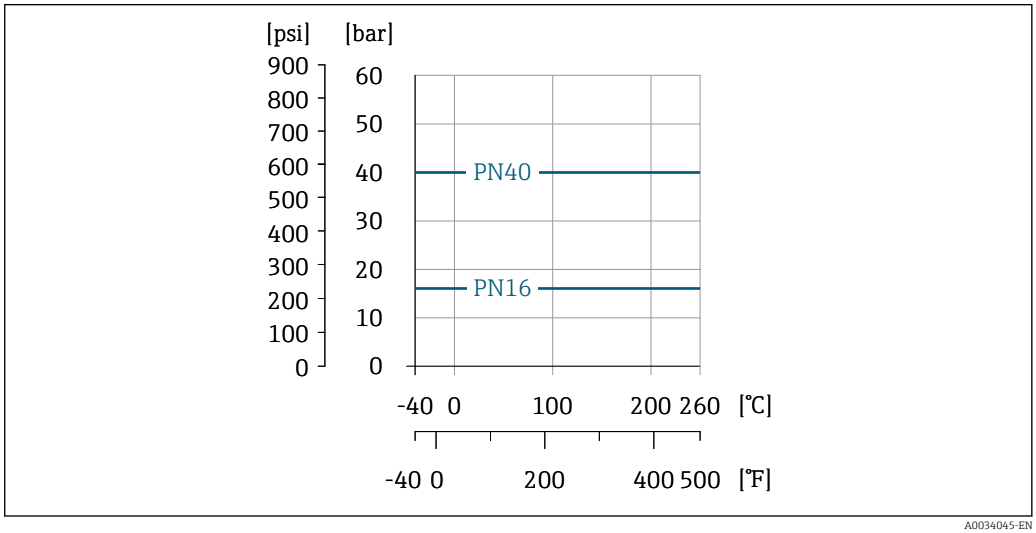
The pressure-temperature rating for the specific measuring device is programmed into the software. If values exceed the curve range a warning is displayed. Depending on the system configuration and sensor version, the pressure and temperature are determined by entering, reading in or calculating values.

Integral mass vortex: The permitted pressure for the measuring device can be less than indicated in this section, depending on the selected pressure measuring cell.→ 59

Flange connection: flange similar to EN 1092-1 (DIN 2501)



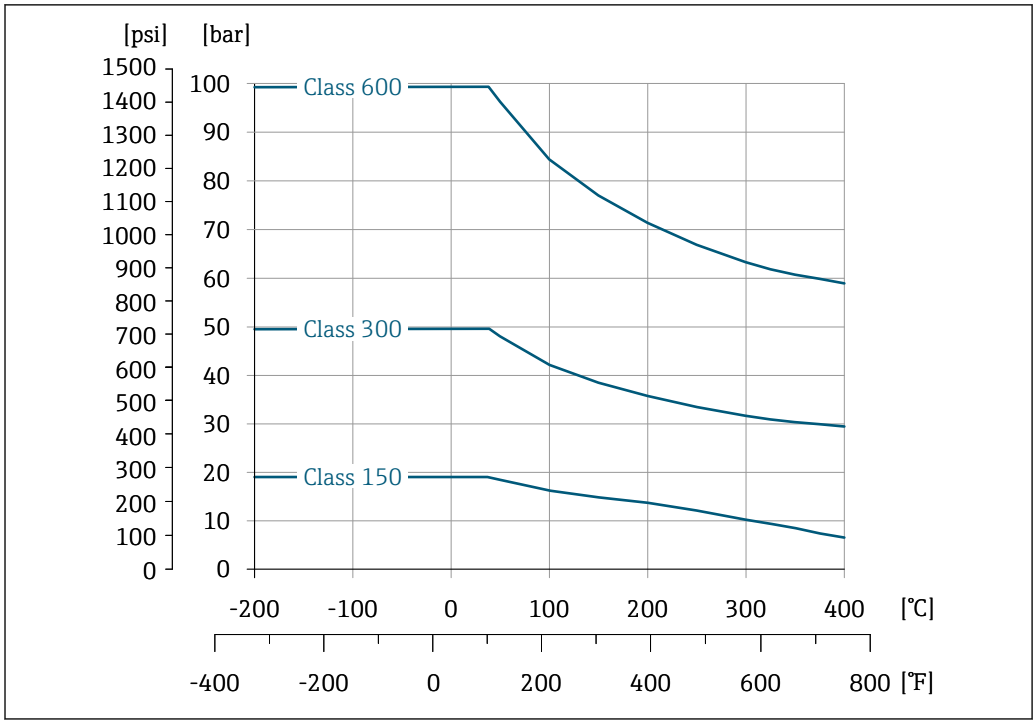
16 *Flange connection material: stainless steel, multiple certifications, 1.4404/F316/F316L*



17 *Flange connection material: cast alloy, 2.4602/UNS N06022 similar to Alloy C22/2.4602*

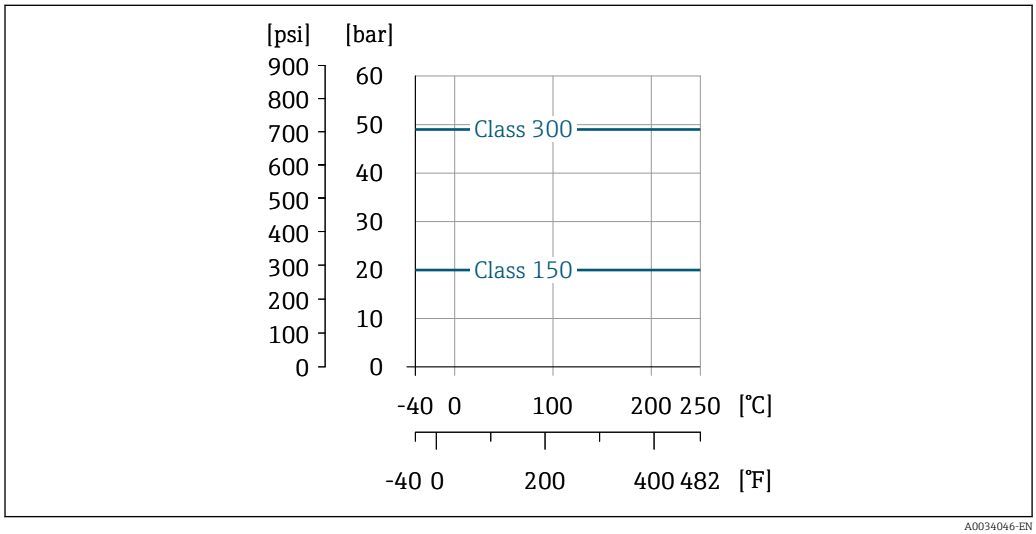
For DIN EN flanges: pressure/temperature rating similar to DIN EN 1092-1 (2018), material group 13E0

Flange connection: flange similar to ASME B16.5



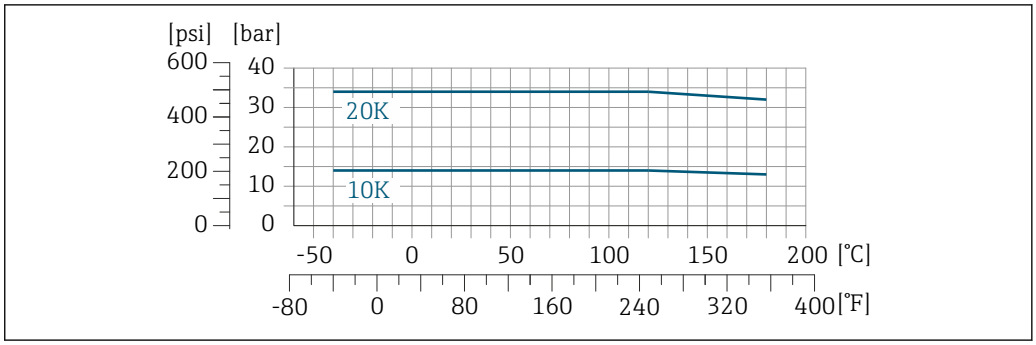
18 *Flange connection material: stainless steel, multiple certifications, 1.4404/F316/F316L*

For ASME flanges: pressure/temperature curve similar to ASME B16.5 (2017), material group 2.2

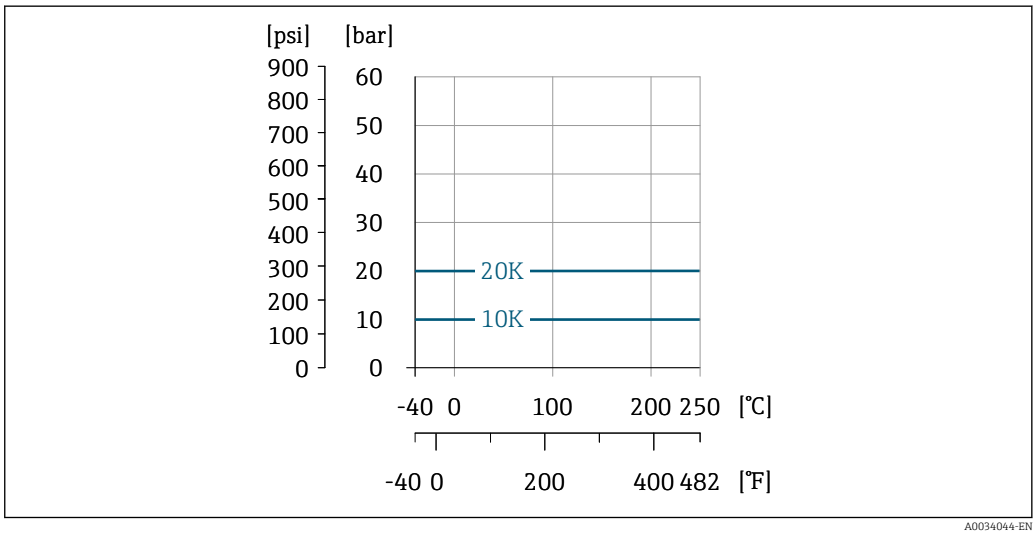


19 *Flange connection material: cast alloy, CX2MW similar to Alloy C22/2.4602*

Flange connection: flange similar to JIS B2220



20 *Flange connection material: stainless steel, multiple certifications, 1.4404/F316/F316L*



21 *Flange connection material: cast alloy, CX2MW similar to Alloy C22/2.4602*

For JIS flanges: pressure/temperature rating similar to JIS B2220 (2012), material group 2.2, division 1

Nominal pressure of sensor

The following overpressure resistance values apply to the sensor shaft in the event of a membrane rupture:

Sensor version; DSC sensor; measuring tube	Overpressure, sensor shaft in [bar a]
Volume	200
Volume high-temperature	200
Mass (integrated temperature measurement)	200
Mass steam (integrated pressure/temperature measurement) Mass gas/liquid (integrated pressure/temperature measurement)	200

Pressure specifications

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

The OPL (over pressure limit = sensor overload limit) for the measuring instrument depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process

connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the appropriate standards and further information → 🖹 43. The OPL may only be applied for a limited period of time.

The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the appropriate standards and further information → 🖹 43. The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.

⚠ WARNING

The maximum pressure for the measuring instrument depends on the lowest-rated element with regard to pressure.

- ▶ Note specifications regarding pressure range → 🖹 43.
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP of the device.
- ▶ MWP: The MWP is indicated on the nameplate. This value refers to a reference temperature of +20 °C (+68°F) and may be applied to the device for an unlimited time. Note temperature dependence of MWP.
- ▶ OPL: The test pressure corresponds to the over pressure limit of the sensor and may be applied only temporarily to ensure that the measurement is within the specifications and no permanent damage occurs. In the case of sensor range and process connection combinations where the OPL of the process connection is less than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If using the entire sensor range, select a process connection with a higher OPL value.

Sensor	Maximum sensor measuring range		MWP	OPL
	Lower (LRL)	Upper (URL)		
	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
2 bar (30 psi)	0 (0)	+2 (+30)	6.7 (100.5)	10 (150)
4 bar (60 psi)	0 (0)	+4 (+60)	10.7 (160.5)	16 (240)
10 bar (150 psi)	0 (0)	+10 (+150)	25 (375)	40 (600)
40 bar (600 psi)	0 (0)	+40 (+600)	100 (1 500)	160 (2 400)
100 bar (1 500 psi)	0 (0)	+100 (+1 500)	100 (1 500)	160 (2 400)

Pressure loss

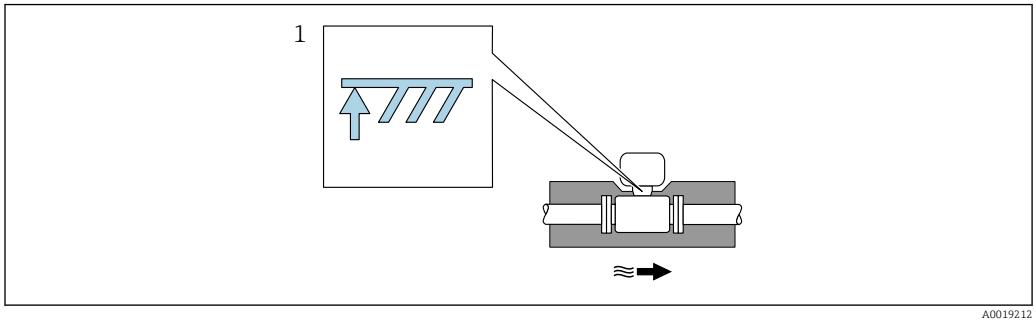
For a precise calculation, use the Applicator → 🖹 102.

Thermal insulation

For optimum temperature measurement and mass calculation, heat transfer at the sensor must be avoided for some fluids. This can be ensured by installing thermal insulation. A wide range of materials can be used for the required insulation.

This applies for:
- Compact version
- Remote sensor version

The maximum insulation height permitted is illustrated in the diagram:



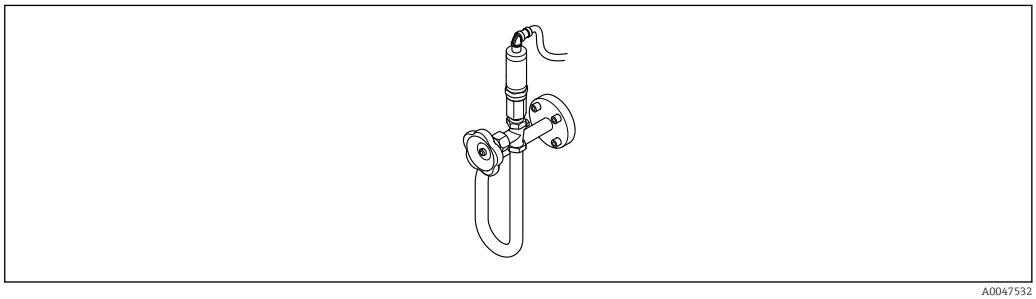
A0019212

1 Maximum insulation height

- ▶ When insulating, 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.

The function of the siphon is to protect the pressure measuring cell from excessively high steam process temperatures through the formation of condensate in the U-tube/circular pipe. To ensure the steam condenses, the siphon may only be insulated as far as the connection flange on the measuring tube side.



A0047532

22 *Siphon*

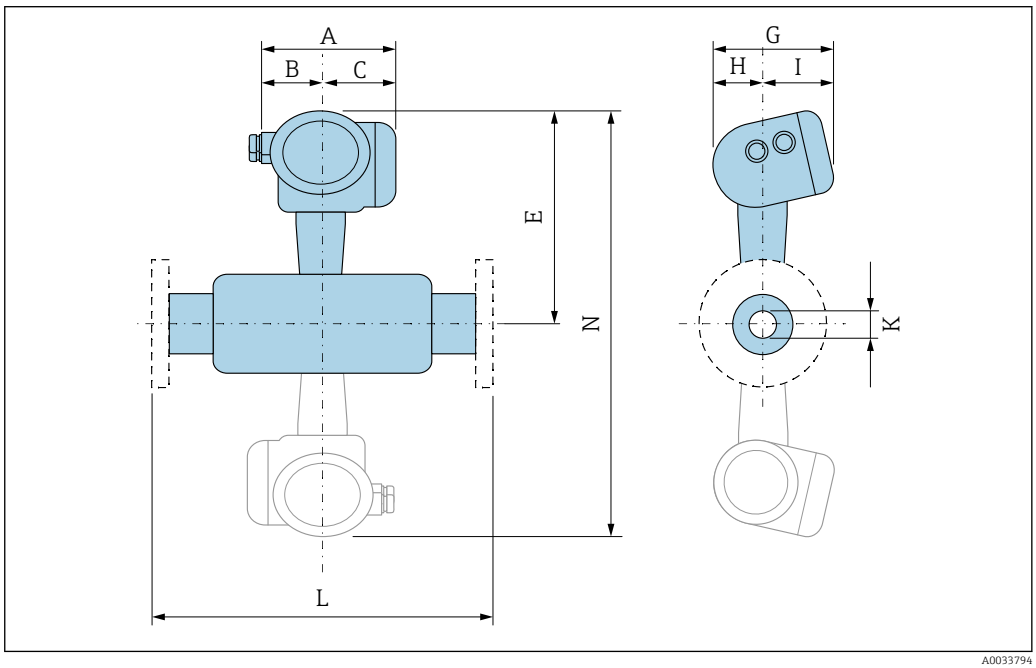
Mechanical construction

Dimensions in SI units

Pay attention to the information on diameter mismatch correction→ 44.

Compact version

Order code for "Housing", option B "GT18 dual compartment, 316L, compact"; option C "GT20 dual compartment, aluminum, coated, compact"



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23 *Grayed out: Dualsens version*

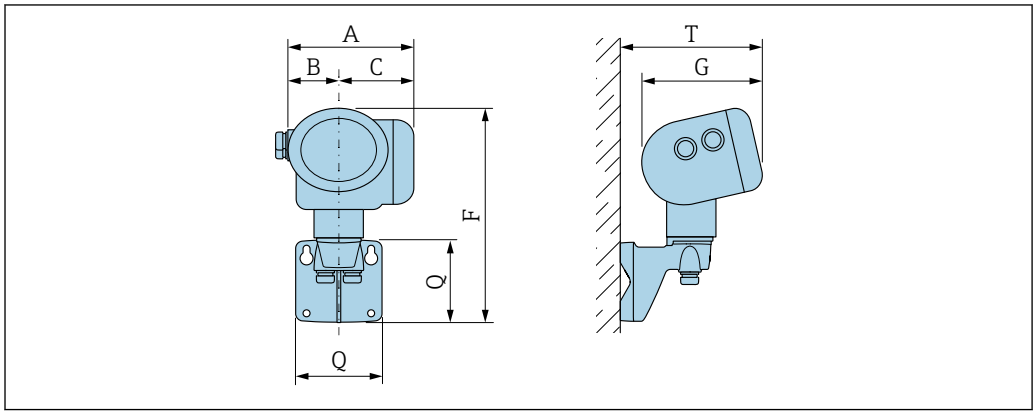
DN [mm]	A [1] [mm]	B [mm]	C [1] [mm]	E [2] [3] [4] [mm]	G [mm]	H [mm]	I [5] [mm]	K (D_i) [mm]	L [mm]	N [6] [7] [mm]
15	140.2	51.7	88.5	252	159.9	58.2	101.7	13.9	[8]	[9]
25	140.2	51.7	88.5	258	159.9	58.2	101.7	24.3	[8]	[9]

DN [mm]	A [1] [mm]	B [mm]	C [1] [mm]	E [2] [3] [4] [mm]	G [mm]	H [mm]	I [5] [mm]	K (D_i) [mm]	L [mm]	N [6] [7] [mm]
40	140.2	51.7	88.5	266	159.9	58.2	101.7	38.1	[8]	531
50	140.2	51.7	88.5	272	159.9	58.2	101.7	49.2	[8]	543
80	140.2	51.7	88.5	286	159.9	58.2	101.7	73.7	[8]	571
100	140.2	51.7	88.5	300	159.9	58.2	101.7	97.0	[8]	599
150	140.2	51.7	88.5	325	159.9	58.2	101.7	146.3	[8]	650
200	140.2	51.7	88.5	348	159.9	58.2	101.7	193.7	[8]	695
250	140.2	51.7	88.5	375	159.9	58.2	101.7	242.8	[8]	750
300	140.2	51.7	88.5	397	159.9	58.2	101.7	288.9	[8]	795

1) For version with overvoltage protection: values + 8 mm
2) For version without local display: values - 10 mm
3) For high-temperature/low-temperature version: values + 29 mm
4) For p-T-compensated version
5) For version without local display: values - 7 mm
6) For version without local display: values - 20 mm
7) For high-temperature/low-temperature version: values + 58 mm
8) Dependent on respective flange connection
9) Not available as a Dualsens version

Transmitter remote version

Order code for "Housing", option J "GT20 dual compartment, aluminum, coated, remote"; option K "GT18 dual compartment, 316L, remote"



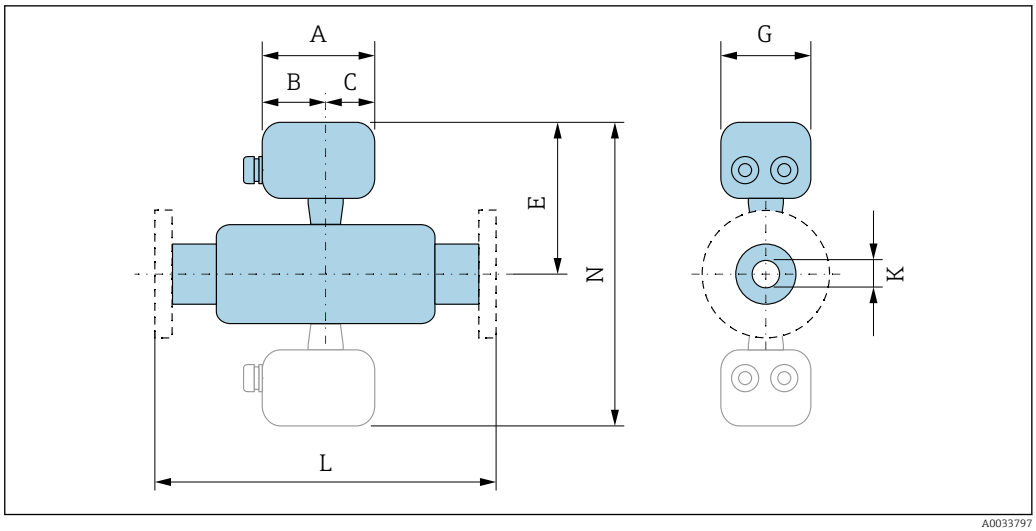
A0033796

A [1] [mm]	B [mm]	C [1] [mm]	F [2] [mm]	G [3] [mm]	Q [mm]	T [3] [mm]
140.2	51.7	88.5	254	159.9	107	191

1) For version with overvoltage protection: value + 8 mm
2) For version without local display: value - 10 mm
3) For version without local display: value - 7 mm

Sensor remote version

Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote"; option K "GT18 two-chamber, 316L, remote"



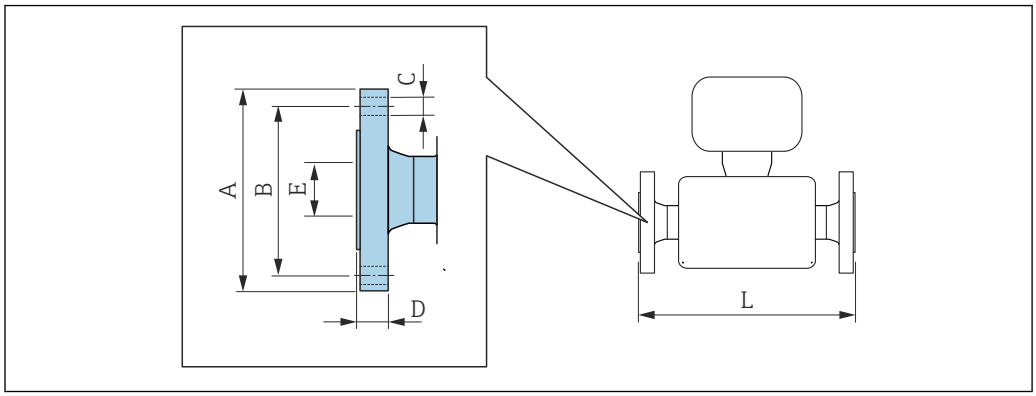
24 *Grayed out: Dualsens version*

DN [mm]	A [mm]	B [mm]	C [mm]	E [1] [mm]	G [mm]	K (D_i) [mm]	L [mm]	N [2] [mm]
15	107.3	60.0	47.3	225	94.5	13.9	3)	4)
25	107.3	60.0	47.3	231	94.5	24.3	3)	4)
40	107.3	60.0	47.3	239	94.5	38.1	3)	477
50	107.3	60.0	47.3	245	94.5	49.2	3)	489
80	107.3	60.0	47.3	259	94.5	73.7	3)	517
100	107.3	60.0	47.3	273	94.5	97.0	3)	545
150	107.3	60.0	47.3	298	94.5	146.3	3)	596
200	107.3	60.0	47.3	321	94.5	193.7	3)	641
250	107.3	60.0	47.3	348	94.5	242.8	3)	696
300	107.3	60.0	47.3	370	94.5	288.9	3)	741

1) For high-temperature/low-temperature version: values + 29 mm
2) For high-temperature/low-temperature version: values + 58 mm
3) Dependent on respective flange connection
4) Not available as a Dualsens version

Flange connections

Flange



A0015621

Length tolerance for dimension L in mm:
DN ≤ 100: +1.5 to −2.0 mm
DN ≥ 150: ±3.5 mm

Flange connection dimensions similar to DIN EN 1092-1: PN 10 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option DDS						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [1)] [mm]**	**L [2)] [mm]**
200	340	295	8 × Ø22	24	193.7	251
250	395	350	12 × Ø22	26	242.8	282
300	445	400	12 × Ø22	26	288.9	328
Raised face similar to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.
2) Version compliant with ISO 13359 available on request: for DN 200: 350 mm; for DN 250: 450 mm; for DN 300: 500 mm

Flange connection dimensions similar to DIN EN 1092-1: PN 16 ▪ Triple-certified material, 1.4404/F316/F316L ▪ Alloy C22/2.4602 (DN 15 to 150) Order code for "Process connection", option D1S						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [1)] [mm]**	**L [2) 3)] [mm]**
100	220	180	8 × Ø18	20	97.0	250
150	285	240	8 × Ø22	22	146.3	300
200	340	295	12 × Ø22	24	193.7	251
250	405	355	12 × Ø26	26	242.8	286
300	460	410	12 × Ø26	28	288.9	348
Raised face according to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.
2) Complies with ISO 13359 for DN 100-150
3) Version compliant with ISO 13359 available on request: for DN 200: 350 mm; for DN 250: 450 mm; for DN 300: 500 mm

Flange connection dimensions similar to DIN EN 1092-1: PN 25

- **Triple-certified material, 1.4404/F316/F316L**
- **Alloy C22/2.4602 (DN 15 to 150)**

Order code for "Process connection", option DES

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [2] [mm]
200	360	310	12 × Ø26	30	193.7	287
250	425	370	12 × Ø30	32	242.8	322
300	485	430	16 × Ø30	34	288.9	376
Raised face according to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.
2) Version compliant with ISO 13359 available on request: for DN 200: 350 mm; for DN 250: 450 mm; for DN 300: 500 mm

Flange connection dimensions similar to DIN EN 1092-1: PN 40

- **Triple-certified material, 1.4404/F316/F316L**
- **Alloy C22/2.4602 (DN 15 to 150)**

Order code for "Process connection", option D2S

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [2] [3] [mm]
15	95	65	4 × Ø14	16	13.9	200
25	115	85	4 × Ø14	18	24.3	200
40	150	110	4 × Ø18	18	38.1	200
50	165	125	4 × Ø18	20	49.2	200
80	200	160	8 × Ø18	24	73.7	200
100	235	190	8 × Ø22	24	97	250
150	300	250	8 × Ø26	28	146.3	300
200	375	320	12 × Ø30	34	193.7	303
250	450	385	12 × Ø33	38	242.8	356
300	515	450	16 × Ø33	42	288.9	422
Raised face according to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.
2) Complies with ISO 13359 for DN 15-150
3) Version compliant with ISO 13359 available on request: for DN 200: 350 mm; for DN 250: 450 mm; for DN 300: 500 mm

Flange connection dimensions similar to DIN EN 1092-1: PN 40 with groove

- **Triple-certified material, 1.4404/F316/F316L**
- **Alloy C22/2.4602 (DN 15 to 150)**

Order code for "Process connection", option D6S

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [2] [3] [mm]
15	95	65	4 × Ø14	16	13.9	200
25	115	85	4 × Ø14	18	24.3	200
40	150	110	4 × Ø18	18	38.1	200
50	165	125	4 × Ø18	20	49.2	200

Flange connection dimensions similar to DIN EN 1092-1: PN 40 with groove

- **Triple-certified material, 1.4404/F316/F316L**
- **Alloy C22/2.4602 (DN 15 to 150)**

Order code for "Process connection", option D6S

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [2) 3)] [mm]
80	200	160	8 × Ø18	24	73.7	200
100	235	190	8 × Ø22	24	97	250
150	300	250	8 × Ø26	28	146.3	300
Raised face according to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.
2) Complies with ISO 13359 for DN 15-150
3) Version compliant with ISO 13359 available on request: for DN 200: 350 mm; for DN 250: 450 mm; for DN 300: 500 mm

Flange connection dimensions similar to DIN EN 1092-1: PN 63
Triple-certified material, 1.4404/F316/F316L
Order code for "Process connection", option D3W

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [mm]
50	180	135	4 × Ø22	26	49.2	222
80	215	170	8 × Ø22	28	73.7	228
100	250	200	8 × Ø26	30	97	268
150	345	280	8 × Ø33	36	146.3	316
200	415	345	12 × Ø36	42	193.7	347
250	470	400	12 × Ø36	46	242.8	396
300	530	460	16 × Ø36	52	288.9	472
Raised face according to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Flange connection dimensions similar to DIN EN 1092-1: PN 100
Triple-certified material, 1.4404/F316/F316L
Order code for "Process connection", option D4W

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [mm]
15	105	75	4 × Ø14	20	13.9	179
25	140	100	4 × Ø18	24	24.3	230
40	170	125	4 × Ø22	26	38.1	204
50	195	145	4 × Ø26	28	49.2	234
80	230	180	8 × Ø26	32	73.7	240
100	265	210	8 × Ø30	36	97	292
150	355	290	12 × Ø33	44	146.3	356
200	430	360	12 × Ø36	52	193.7	387
250	505	430	12 × Ø39	60	242.8	460

Flange connection dimensions similar to DIN EN 1092-1: PN 100 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option D4W						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	L [mm]
300	585	500	16 × Ø42	68	288.9	532
Raised face according to DIN EN 1092-1 Form B1: Ra 3.2 to 12.5 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Flange connection dimensions similar to ASME B16.5: Class 150, Schedule 40/80 ▪ Triple-certified material, 1.4404/F316/F316L ▪ Alloy C22/2.4602 (DN 15 to 150) Order code for "Process connection", option AAS/AFS						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
15	88.9	60.5	4 × Ø15.7	11.2	13.9	200
25	107.9	79.2	4 × Ø15.7	15.7	24.3	200
40	127.0	98.6	4 × Ø15.7	17.5	38.1	200
50	152.4	120.7	4 × Ø19.1	19.1	49.2	200
80	190.5	152.4	4 × Ø19.1	23.9	73.7	200
100	228.6	190.5	8 × Ø19.1	24.5	97	250
150	279.4	241.3	8 × Ø22.4	25.4	146.3	300
200	345	298.5	8 × Ø22.3	29	193.7	329
250	405	362	12 × Ø25.4	30.6	242.8	348
300	485	431.8	12 × Ø25.4	32.2	288.9	418
Raised face similar to ASME B16.5 "raised face": Ra 3.2 to 6.3 µm						

Flange connection dimensions similar to ASME B16.5: Class 300, Schedule 40/80 ▪ Triple-certified material, 1.4404/F316/F316L ▪ Alloy C22/2.4602 (DN 15 to 150) Order code for "Process connection", option ABS/AGS						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
15	95.0	66.5	4 × Ø15.7	14.2	13.9	200
25	123.8	88.9	4 × Ø19.1	19.1	24.3	200
40	155.6	114.3	4 × Ø22.4	20.6	38.1	200
50	165.0	127.0	8 × Ø19.1	22.4	49.2	200
80	210.0	168.1	8 × Ø22.4	28.4	73.7	200
100	254.0	200.2	8 × Ø22.4	31.8	97	250
150	317.5	269.7	12 × Ø22.4	36.6	146.3	300
200	380	330.2	12 × Ø25.4	41.7	193.7	350
250	445	387.4	16 × Ø28.6	48.1	242.8	380
300	520	450.8	16 × Ø31.8	51.3	288.9	450
Raised face similar to ASME B16.5 "raised face": Ra 3.2 to 6.3 µm						

Flange connection dimensions similar to ASME B16.5: Class 600, Schedule 80 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option ACS						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1)] [mm]	L [mm]
15	95	66.5	4 × Ø15.7	23	13.9	207
25	125	88.9	4 × Ø19.1	27	24.3	252
40	155	114.3	4 × Ø22.4	31	38.1	234
50	165	127.0	8 × Ø19.1	33	49.2	257
80	210	168.1	8 × Ø22.4	39	73.7	265
100	275	215.9	8 × Ø25.4	49	97	331
150	355	292.1	12 × Ø28.4	64	146.3	375
200	420	349.2	12 × Ø31.8	62.6	193.7	405
250	510	431.8	16 × Ø35	70.5	242.8	462
300	560	489	20 × Ø35	73.7	288.9	514
Raised face similar to ASME B16.5 "raised face": Ra 3.2 to 6.3 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Flange connection dimensions similar to JIS B2220: 10K, schedule 40/80 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option NDS/NFS						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1)] [mm]	L [mm]
50	155	120	4 × Ø19	16	49.2	200
80	185	150	8 × Ø19	18	73.7	200
100	210	175	8 × Ø19	18	97	250
150	280	240	8 × Ø23	22	146.3	300
200	330	290	12 × Ø23	22	193.7	247
250	400	355	12 × Ø25	24	242.8	280
300	445	400	16 × Ø25	24	288.9	334
Raised face similar to JIS 2220 "raised face": Ra 3.2 to 6.3 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

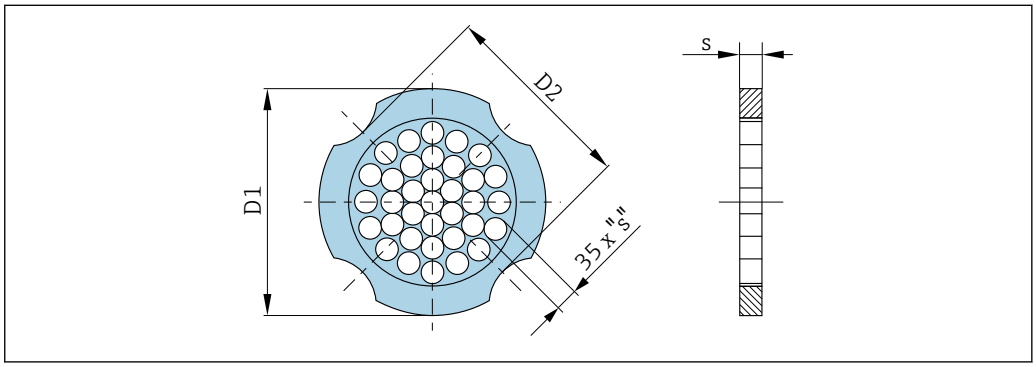
Flange connection dimensions similar to JIS B2220: 20K, schedule 40/80 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option NES/NGS						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1)] [mm]	L [mm]
15	95	70	4 × Ø15	14	13.9	200
25	125	90	4 × Ø19	16	24.3	200
40	140	105	4 × Ø19	18	38.1	200
50	155	120	8 × Ø19	18	49.2	200
80	200	160	8 × Ø23	22	73.7	200
100	225	185	8 × Ø23	24	97	250
150	305	260	12 × Ø25	28	146.3	300

Flange connection dimensions similar to JIS B2220: 20K, schedule 40/80 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option NES/NGS						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [1] [mm]**	**L [mm]**
200	350	305	12 × Ø25	30	193.7	285
250	430	380	12 × Ø27	34	242.8	324
300	480	430	16 × Ø27	36	288.9	386
Raised face similar to JIS 2220 "raised face": Ra 3.2 to 6.3 µm						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (DN 15 to 300). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Accessories

Flow conditioner



A0033504

Used in combination with flanges similar to DIN EN 1092-1: PN 10 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D1	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

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.

Used in combination with flanges similar to DIN EN 1092-1: PN 16 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

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.

Used in combination with flanges similar to DIN EN 1092-1: PN 25 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	171.3	D1	13.3
150	227.0	D2	20.0
200	280.0	D1	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

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.

Used in combination with flanges similar to DIN EN 1092-1: PN 40 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	171.3	D1	13.3

Used in combination with flanges similar to DIN EN 1092-1: PN 40 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
150	227.0	D2	20.0
200	294.0	D2	26.3
250	355.0	D2	33.0
300	420.0	D1	39.6

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.

Used in combination with flanges similar to DIN EN 1092-1: PN 63 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	64.3	D1	2.0
25	85.3	D1	3.5
40	106.3	D1	5.3
50	116.3	D1	6.8
80	151.3	D1	10.1
100	176.5	D2	13.3
150	252.0	D1	20.0
200	309.0	D1	26.3
250	363.0	D1	33.0
300	420.0	D1	39.6

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.

Used in combination with flanges similar to ASME B16.5: Class 150 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	50.1	D1	2.0
25	69.2	D2	3.5
40	88.2	D2	5.3
50	106.6	D2	6.8
80	138.4	D1	10.1
100	176.5	D2	13.3
150	223.5	D1	20.0
200	274.0	D1	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

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.

Used in combination with flanges similar to ASME B16.5: Class 300 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	56.5	D1	2.0
25	74.3	D1	3.5
40	97.7	D2	5.3
50	113.0	D1	6.8
80	151.3	D1	10.1
100	182.6	D1	13.3
150	252.0	D1	20.0
200	309.0	D1	26.3
250	363.0	D1	33.0
300	402.0	D1	39.6

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.

Used in combination with flanges similar to JIS B2220: 10K 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	60.3	D2	2.0
25	76.3	D2	3.5
40	91.3	D2	5.3
50	106.6	D2	6.8
80	136.3	D2	10.1
100	161.3	D2	13.3
150	221.0	D2	20.0
200	271.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

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.

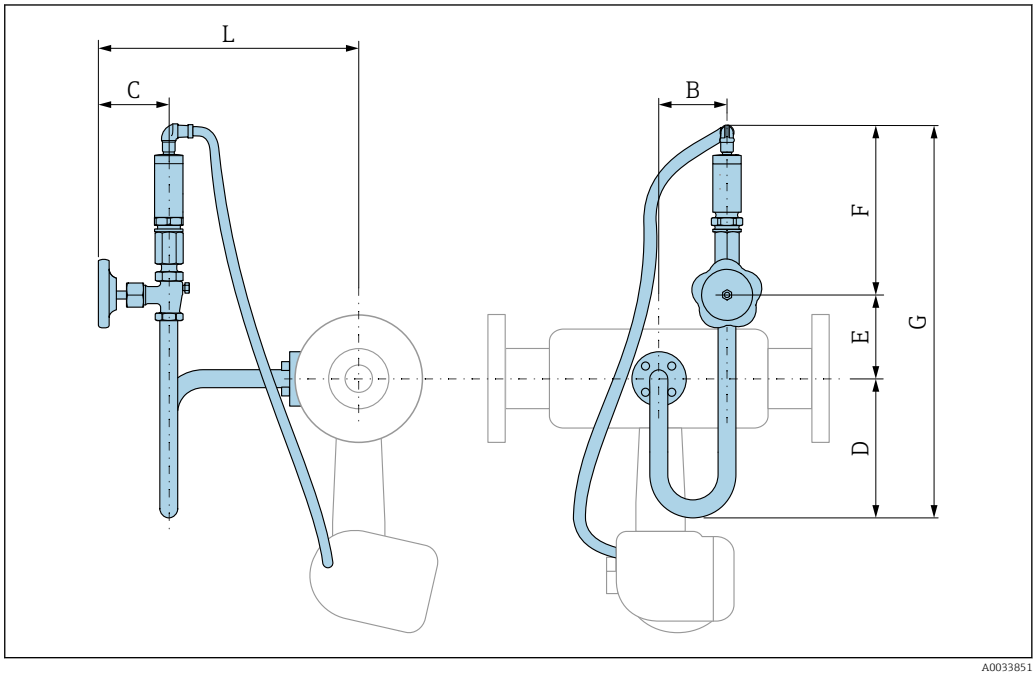
Used in combination with flanges similar to JIS B2220: 20K 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
15	60.3	D2	2.0
25	76.3	D2	3.5
40	91.3	D2	5.3
50	106.6	D2	6.8
80	142.3	D1	10.1
100	167.3	D1	13.3

Used in combination with flanges similar to JIS B2220: 20K 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1]/D2 [2]**	**s [mm]**
150	240.0	D1	20.0
200	284.0	D1	26.3
250	355.0	D2	33.0
300	404.0	D1	39.6

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.

Pressure measuring cell

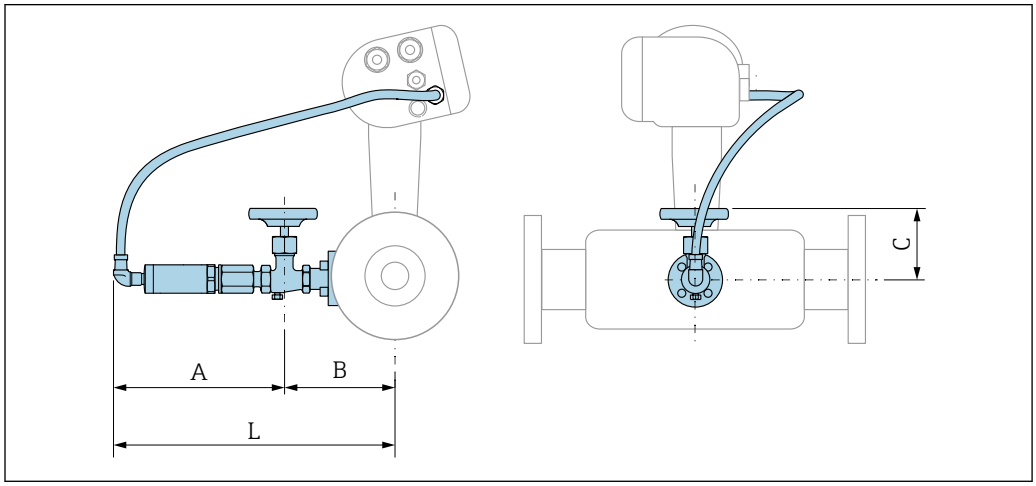
For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.



A0033851

Order code for "Sensor version; DSC sensor; measuring tube": Option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)"							
DN [mm]	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**F [mm]**	**G [mm]**	**L [mm]**
25	76	78.8	155	60.8	190.5	407	307
40	76	78.8	155	60.8	190.5	407	314
50	76	78.8	155	60.8	190.5	407	320
80	76	78.8	155	60.8	190.5	407	331
100	76	78.8	155	60.8	190.5	407	346
150	76	78.8	155	60.8	190.5	407	372

Order code for "Sensor version; DSC sensor; measuring tube": Option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)"							
DN [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	L [mm]
200	76	78.8	155	60.8	190.5	407	395
250	76	78.8	155	60.8	190.5	407	423
300	76	78.8	155	60.8	190.5	407	449



A0034024

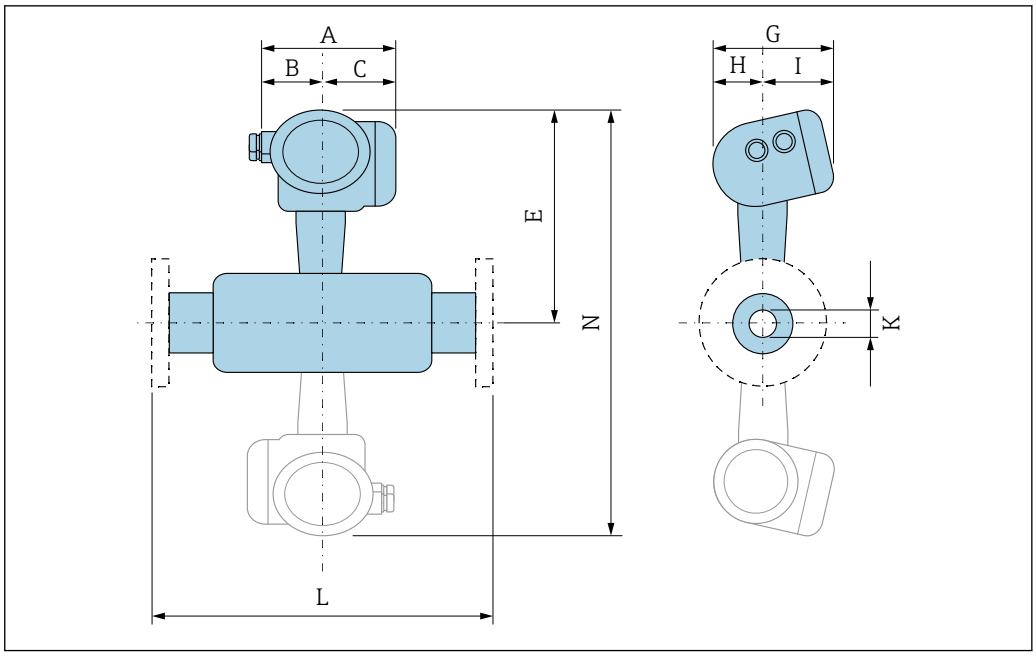
Order code for "Sensor version; DSC sensor; measuring tube": Option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temperature measurement)"				
DN [mm]	A [mm]	B [mm]	C [mm]	L [mm]
25	191	134	78.8	324
40	191	140	78.8	331
50	191	146	78.8	337
80	191	158	78.8	348
100	191	172	78.8	363
150	191	198	78.8	389
200	191	222	78.8	412
250	191	249	78.8	440
300	191	275	78.8	466

Dimensions in US units

Pay attention to the information on diameter mismatch correction→ 44.

Compact version

Order code for "Housing", option B "GT18 dual compartment, 316L, compact"; option C "GT20 dual compartment, aluminum, coated, compact"



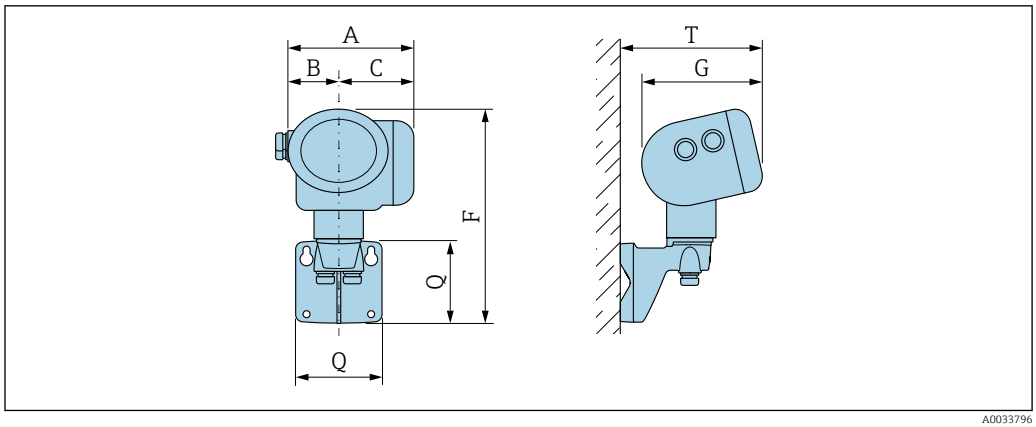
25 *Grayed out: Dualsens version*

DN [in]	A [1] 0.31 in [in]	B [in]	C [1] [in]	E [2) 3) 4)] [in]	G [in]	H [in]	I [5)] [in]	K (D_i) [in]	L [in]	N [6) 7)] [in]
½	5.52	2.04	3.48	9.92	6.3	2.29	4	0.55	8)	9)
1	5.52	2.04	3.48	10.2	6.3	2.29	4	0.96	8)	9)
1½	5.52	2.04	3.48	10.5	6.3	2.29	4	1.5	8)	20.9
2	5.52	2.04	3.48	10.7	6.3	2.29	4	1.94	8)	21.4
3	5.52	2.04	3.48	11.3	6.3	2.29	4	2.9	8)	22.5
4	5.52	2.04	3.48	11.8	6.3	2.29	4	3.82	8)	23.6
6	5.52	2.04	3.48	12.8	6.3	2.29	4	5.76	8)	25.6
8	5.52	2.04	3.48	13.7	6.3	2.29	4	7.63	8)	27.4
10	5.52	2.04	3.48	14.8	6.3	2.29	4	9.56	8)	29.5
12	5.52	2.04	3.48	15.6	6.3	2.29	4	11.4	8)	31.3

1) For version with overvoltage protection: values +
2) For version without local display: values - 0.39 in
3) For high-temperature/low-temperature version: values + 1.14 in
4) For p-T-compensated version
5) For version without local display: values - 0.28 in
6) For version without local display: values - 0.78 in
7) For high-temperature/low-temperature version: values + 2.28 in
8) Dependent on respective flange connection
9) Not available as a Dualsens version

Transmitter remote version

Order code for "Housing", option J "GT20 dual compartment, aluminum, coated, remote"; option K "GT18 dual compartment, 316L, remote"

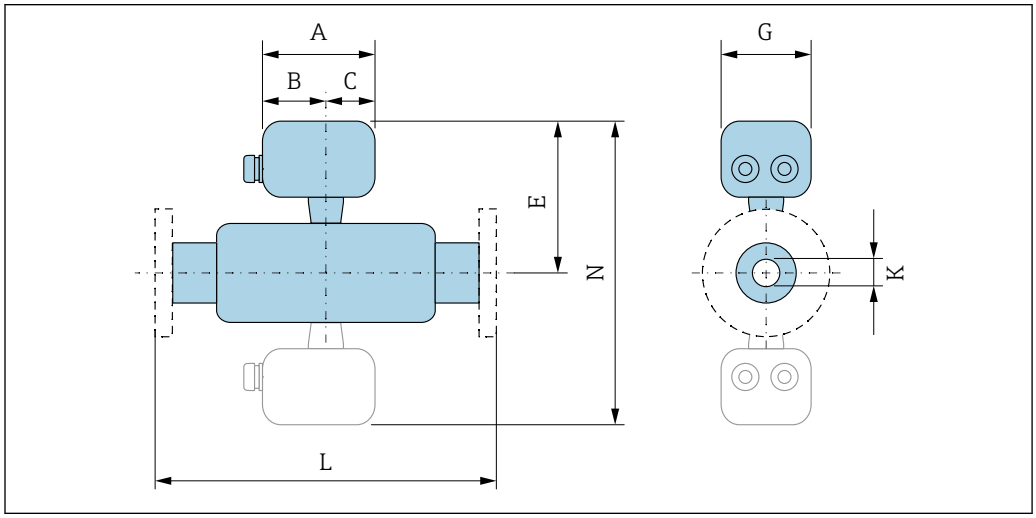


A [1] [in]	B [in]	C [1] [in]	F [2] [in]	G [3] [in]	Q [in]	T [3] [in]
5.52	2.04	3.48	10	6.3	4.21	7.52

1) For version with overvoltage protection: value + 0.31 in
2) For version without local display: value - 0.39 in
3) For version without local display: value - 0.28 in

Sensor remote version

Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote"; option K "GT18 two-chamber, 316L, remote"



26 Grayed out: Dualsens version

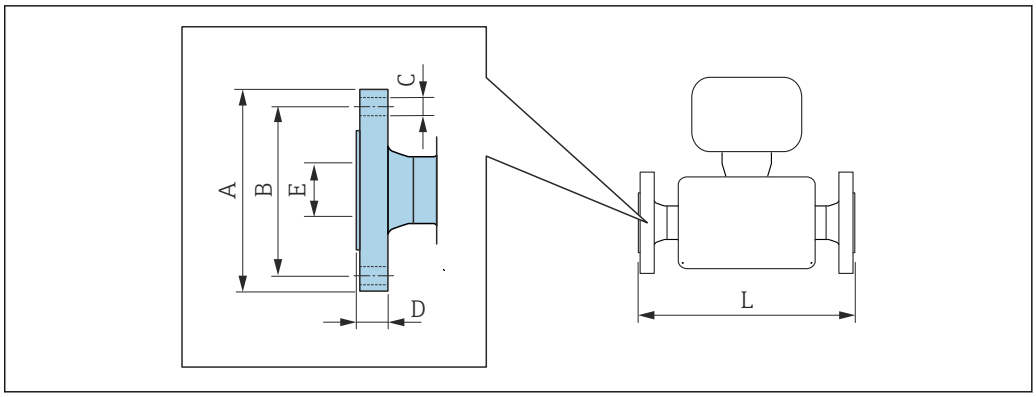
DN [in]	A [in]	B [in]	C [in]	E [1] [in]	G [in]	K (D_i) [in]	L [in]	N [2] [in]
½	4.22	2.36	1.86	8.86	3.72	0.55	[3]	[4]
1	4.22	2.36	1.86	9.09	3.72	0.96	[3]	[4]
1½	4.22	2.36	1.86	9.41	3.72	1.5	[3]	18.8
2	4.22	2.36	1.86	9.65	3.72	1.94	[3]	19.3
3	4.22	2.36	1.86	10.2	3.72	2.9	[3]	20.4
4	4.22	2.36	1.86	10.7	3.72	3.82	[3]	21.5
6	4.22	2.36	1.86	11.7	3.72	5.76	[3]	23.5

DN [in]	A [in]	B [in]	C [in]	E [1] [in]	G [in]	K (D_i) [in]	L [in]	N [2] [in]
8	4.22	2.36	1.86	12.6	3.72	7.63	3)	25.2
10	4.22	2.36	1.86	13.7	3.72	9.56	3)	27.4
12	4.22	2.36	1.86	14.6	3.72	11.4	3)	29.2

1) For high-temperature/low-temperature version: values + 1.14 in
2) For high-temperature/low-temperature version: values + 2.28 in
3) Dependent on respective flange connection
4) Not available as a Dualsens version

Flange connections

Flange



A0015621

Length tolerance for dimension L in inches:
DN ≤ 4": +0.06 to −0.08 in
DN ≥ 6": ±0.14 in

Flange connection dimensions similar to ASME B16.5: Class 150, Schedule 40/80
- **Triple-certified material, 1.4404/F316/F316L**
- **Alloy C22/2.4602 (DN ½ to 6")**

Order code for "Process connection", option AAS/AFS

NPS [in]	A [in]	B [in]	C [in]	D [in]	E [1] [in]	L [in]
½	3.5	2.38	4 × Ø0.62	0.44	0.55	7.87
1	4.25	3.12	4 × Ø0.62	0.62	0.96	7.87
1½	5	3.88	4 × Ø0.62	0.69	1.5	7.87
2	6	4.75	4 × Ø0.75	0.75	1.94	7.87
3	7.5	6	4 × Ø0.75	0.94	2.9	7.87
4	9	7.5	8 × Ø0.75	0.96	3.82	9.84
6	11	9.5	8 × Ø0.88	1	5.76	11.81
8	13.6	11.8	8 × Ø0.88	1.14	7.63	12.95
10	15.9	14.3	12 × Ø1	1.2	9.56	13.7
12	19.1	17	12 × Ø1	1.27	11.4	16.46
Raised face according to ASME B16.5: Ra 125 to 250µin						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (NPS ½ to 12). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Flange connection dimensions similar to ASME B16.5: Class 300, Schedule 40/80 ▪ Triple-certified material, 1.4404/F316/F316L ▪ Alloy C22/2.4602 (DN ½ to 6") Order code for "Process connection", option ABS/AGS						
NPS [in]	A [in]	B [in]	C [in]	D [in]	E [1)] [in]	L [in]
½	3.74	2.62	4 × Ø0.62	0.56	0.55	7.87
1	4.87	3.5	4 × Ø0.75	0.75	0.96	7.87
1½	6.13	4.5	4 × Ø0.88	0.81	1.5	7.87
2	6.5	5	8 × Ø0.75	0.88	1.94	7.87
3	8.27	6.62	8 × Ø0.88	1.12	2.9	7.87
4	10	7.88	8 × Ø0.88	1.25	3.82	9.84
6	12.5	10.6	12 × Ø0.88	1.44	5.76	11.81
8	15	13	12 × Ø1	1.64	7.63	13.78
10	17.5	15.3	16 × Ø1.13	1.89	9.56	14.96
12	20.5	17.7	16 × Ø1.25	2.02	11.4	17.72
Raised face according to ASME B16.5: Ra 125 to 250µin						

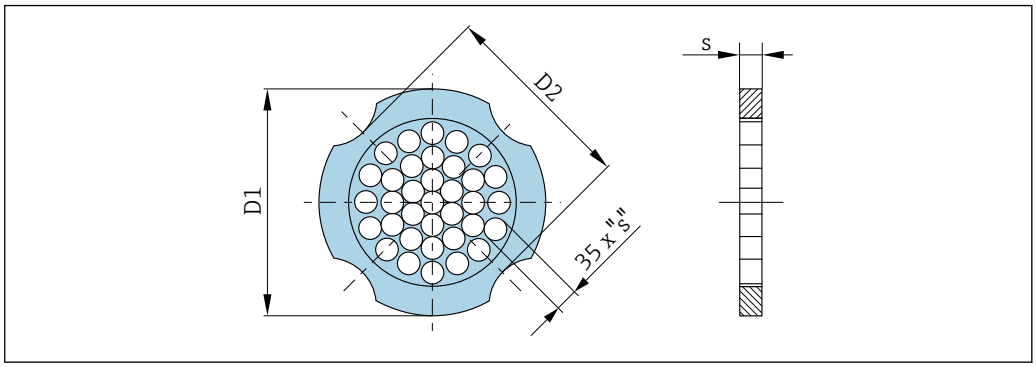
1) The internal diameter of the sensor and process connection correspond to Schedule 80 (NPS ½ to 12). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Flange connection dimensions similar to ASME B16.5: Class 600, Schedule 80 Triple-certified material, 1.4404/F316/F316L Order code for "Process connection", option ACS						
NPS [in]	A [in]	B [in]	C [in]	D [in]	E [1)] [in]	L [in]
½	3.74	2.62	4 × Ø0.62	0.91	0.55	8.15
1	4.92	3.5	4 × Ø0.75	1.06	0.96	9.92
1½	6.1	4.5	4 × Ø0.88	1.22	1.5	9.21
2	6.5	5	8 × Ø0.75	1.3	1.94	10.1
3	8.27	6.62	8 × Ø0.88	1.54	2.9	10.4
4	10.8	8.5	8 × Ø1	1.93	3.82	13.0
6	14	11.5	12 × Ø1.12	2.52	5.76	14.8
8	16.5	13.7	12 × Ø1.25	2.46	7.63	15.9
10	20.1	17	16 × Ø1.38	2.78	9.56	18.2
12	22	19.3	20 × Ø1.38	2.90	11.4	20.2
Raised face according to ASME B16.5: Ra 125 to 250µin						

1) The internal diameter of the sensor and process connection correspond to Schedule 80 (NPS ½ to 12). The devices are calibrated for use in a pipe in accordance with the selected process connection standard.

Accessories

Flow conditioner



Used in combination with flanges similar to ASME B16.5: Class 150 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [in]	**Centering diameter [in]**	**D1 [1]/D2 [2]**	**s [in]**
½	1.97	D1	0.08
1	2.72	D2	0.14
1½	3.47	D2	0.21
2	4.09	D2	0.27
3	5.45	D1	0.40
4	6.95	D2	0.52
6	8.81	D1	0.79
8	10.80	D1	1.04
10	13.40	D1	1.30
12	15.90	D1	1.56

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.

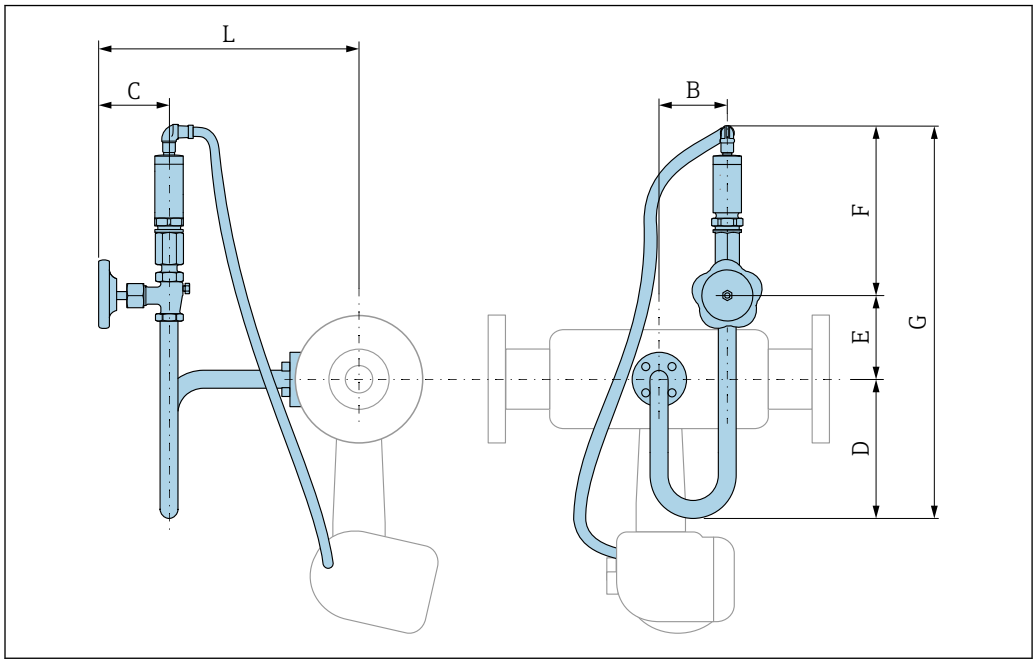
Used in combination with flanges similar to ASME B16.5: Class 300 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [in]	**Centering diameter [in]**	**D1 [1]/D2 [2]**	**s [in]**
½	2.22	D1	0.08
1	2.93	D1	0.14
1½	3.85	D2	0.21
2	4.45	D1	0.27
3	5.96	D1	0.40
4	7.19	D1	0.52
6	9.92	D1	0.79
8	12.20	D1	1.04

Used in combination with flanges similar to ASME B16.5: Class 300 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [in]	**Centering diameter [in]**	**D1 [1]/D2 [2]**	**s [in]**
10	14.30	D1	1.30
12	15.80	D1	1.56

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.

Pressure measuring cell

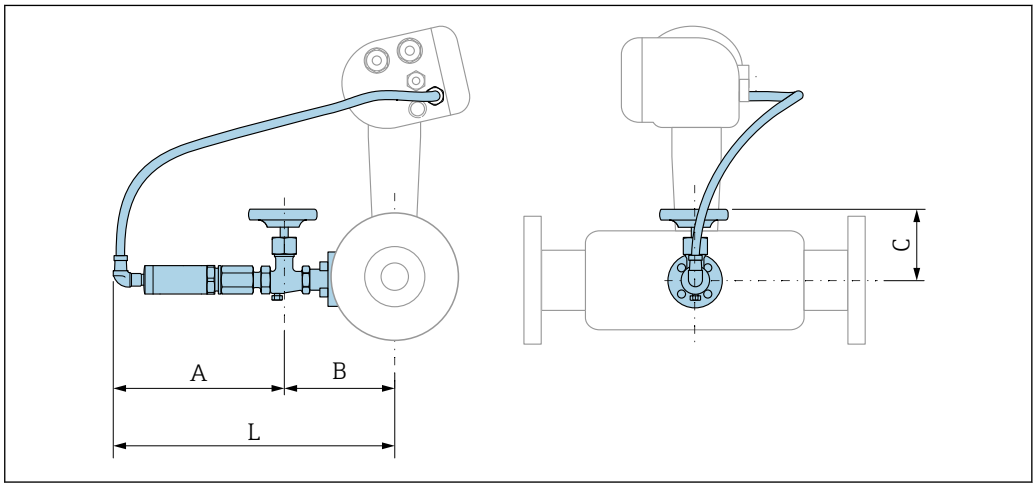
For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.



A0033851

Order code for "Sensor version; DSC sensor; measuring tube": Option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)"							
DN [in]	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**F [in]**	**G [in]**	**L [in]**
1	2.99	3.1	6.1	2.39	7.5	16.02	12.09
1½	2.99	3.1	6.1	2.39	7.5	16.02	12.36
2	2.99	3.1	6.1	2.39	7.5	16.02	12.6
3	2.99	3.1	6.1	2.39	7.5	16.02	13.03
4	2.99	3.1	6.1	2.39	7.5	16.02	13.62
6	2.99	3.1	6.1	2.39	7.5	16.02	14.65
8	2.99	3.1	6.1	2.39	7.5	16.02	15.55

Order code for "Sensor version; DSC sensor; measuring tube": Option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement)"							
DN [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	L [in]
10	2.99	3.1	6.1	2.39	7.5	16.02	16.65
12	2.99	3.1	6.1	2.39	7.5	16.02	17.68



A0034024

Order code for "Sensor version; DSC sensor; measuring tube": Option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temperature measurement)"				
DN [in]	A [in]	B [in]	C [in]	L [in]
1	7.52	5.28	3.1	12.76
1½	7.52	5.51	3.1	13.03
2	7.52	5.75	3.1	13.27
3	7.52	6.22	3.1	13.7
4	7.52	6.77	3.1	14.29
6	7.52	7.8	3.1	15.31
8	7.52	8.74	3.1	16.22
10	7.52	9.8	3.1	17.32
12	7.52	10.83	3.1	18.35

Weight

Compact version

Weight data:
- Including the transmitter:
  - Order code for "Housing", option C "GT20, two-chamber, aluminum, coated, compact" 1.8 kg (4.0 lb):
  - Order code for "Housing", option B "GT18 two-chamber, 316L, compact"4.5 kg (9.9 lb):
- Excluding packaging material

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 "GT20 two-chamber, aluminum, coated, compact" 1)	Order code for "Housing", option B "GT18 two-chamber, 316L, compact" 1)
15	5.1	7.8
25	7.1	9.8
40	9.1	11.8
50	11.1	13.8
80	16.1	18.8
100	21.1	23.8
150	37.1	39.8
200	72.1	74.8
250	111.1	113.8
300	158.1	160.8

1) For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

All values (weight) refer to devices with ASME B16.5, Class 300/Sch. 40 flanges. Weight information in [lbs].

DN [in]	Weight [lbs]	
	Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" 1)	Order code for "Housing", option B "GT18 two-chamber, 316L, compact" 1)
½	11.3	17.3
1	15.7	21.7
1½	22.4	28.3
2	26.8	32.7
3	42.2	48.1
4	66.5	72.4
6	110.5	116.5
8	167.9	173.8
10	240.6	246.6
12	357.5	363.4

1) For high-temperature/low-temperature version: values + 0.4 lbs

Transmitter remote version

Wall-mount housing

Dependent on the material of wall-mount housing:
- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote"2.4 kg (5.2 lb):
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote"6.0 kg (13.2 lb):

Sensor remote version

Weight data:
- Including sensor connection housing:
  - Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote"0.8 kg (1.8 lb):
  - Order code for "Housing", option K "GT18 two-chamber, 316L, remote"2.0 kg (4.4 lb):
- Excluding the connecting cable
- Excluding packaging material

Weight in SI units

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

DN [mm]	Weight [kg]	
	sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" 1)	sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" 1)
15	4.1	5.3
25	6.1	7.3
40	8.1	9.3
50	10.1	11.3
80	15.1	16.3
100	20.1	21.3
150	36.1	37.3
200	71.1	72.3
250	110.1	111.3
300	157.1	158.3

1) For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

All values (weight) refer to devices with ASME B16.5, Class 300/Sch. 40 flanges. Weight information in [lbs].

DN [in]	Weight [lbs]	
	sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" 1)	sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" 1)
½	8.9	11.7
1	13.4	16.1
1½	20.0	22.7
2	24.4	27.2
3	39.8	42.6
4	64.1	66.8
6	108.2	110.9
8	165.5	168.3
10	238.2	241.0
12	355.1	357.8

1) For high-temperature/low-temperature version: values + 0.4 lbs

Accessories

Flow conditioner

Weight in SI units

DN 1) [mm]	Pressure rating	Weight [kg]
15	PN 10 to 40	0.04
25	PN 10 to 40	0.1

DN [1] [mm]	Pressure rating	Weight [kg]
40	PN 10 to 40	0.3
50	PN 10 to 40	0.5
80	PN 10 to 40	1.4
100	PN10 to 40	2.4
150	PN 10/16 PN 25/40	6.3 7.8
200	PN 10 PN 16/25 PN 40	11.5 12.3 15.9
250	PN 10 to 25 PN 40	25.7 27.5
300	PN10 to 25 PN 40	36.4 44.7

1) EN (DIN)

DN [1] [mm]	Pressure rating	Weight [kg]
15	Class 150 Class 300	0.03 0.04
25	Class 150 Class 300	0.1
40	Class 150 Class 300	0.3
50	Class 150 Class 300	0.5
80	Class 150 Class 300	1.2 1.4
100	Class 150 Class 300	2.7
150	Class 150 Class 300	6.3 7.8
200	Class 150 Class 300	12.3 15.8
250	Class 150 Class 300	25.7 27.5
300	Class 150 Class 300	36.4 44.6

1) ASME

DN [1] [mm]	Pressure rating	Weight [kg]
15	20K	0.06
25	20K	0.1
40	20K	0.3
50	10K 20K	0.5
80	10K 20K	1.1

DN [1] [mm]	Pressure rating	Weight [kg]
100	10K 20K	1.80
150	10K 20K	4.5 5.5
200	10K 20K	9.2
250	10K 20K	15.8 19.1
300	10K 20K	26.5

1) JIS

Weight in US units

DN [1] [in]	Pressure rating	Weight [lbs]
½	Class 150 Class 300	0.07 0.09
1	Class 150 Class 300	0.3
1½	Class 150 Class 300	0.7
2	Class 150 Class 300	1.1
3	Class 150 Class 300	2.6 3.1
4	Class 150 Class 300	6.0
6	Class 150 Class 300	14.0 16.0
8	Class 150 Class 300	27.0 35.0
10	Class 150 Class 300	57.0 61.0
12	Class 150 Class 300	80.0 98.0

1) ASME

Materials

Transmitter housing

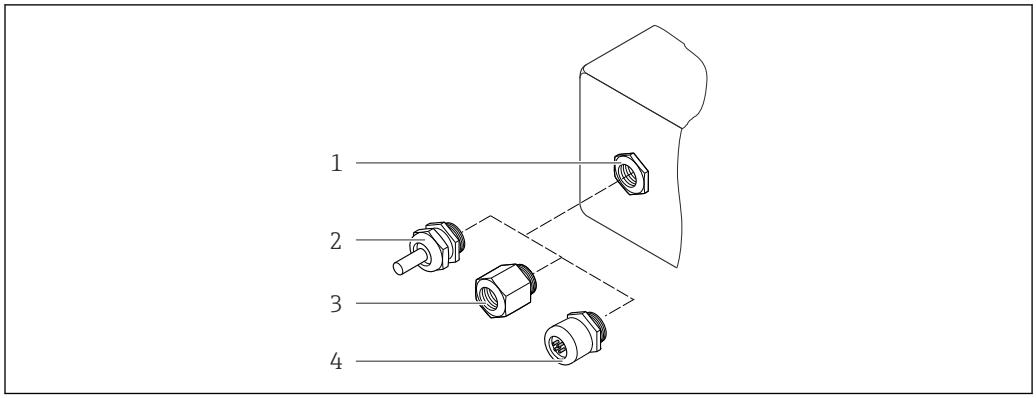
Compact version

- Order code for "Housing", option B "GT18 two-chamber, 316L, compact":
  Stainless steel, CF3M
- Order code for "Housing", option C "GT20, two-chamber, aluminum, coated, compact":
  Aluminum, AlSi10Mg, coated
- Window material: glass

Remote version

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote":
  Aluminum, AlSi10Mg, coated
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote":
  For maximum corrosion resistance: Stainless steel, CF3M
- Window material: glass

Cable entries/cable glands



27 *Possible cable entries/cable glands*

1 *Internal thread M20 × 1.5*
2 *Cable gland M20 × 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*
4 *Device plug*

Order code for "Housing", option B "GT18 dual compartment, 316L, compact" option K "GT18 dual compartment, 316L, remote"

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

Order code for "Housing": option C "GT20 dual compartment, aluminum, coated, compact", option J "GT20 dual compartment, aluminum, coated remote"

Applies also to the following device versions in combination with HART communication mode: Order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam; 316L; 316L", option DB "Mass gas/liquid; 316L; 316L"

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	▪ Non-hazardous area ▪ 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"	Non-hazardous area and hazardous area (except for XP)	Nickel-plated brass
Thread NPT ½" via adapter	Non-hazardous area and hazardous area	

Connecting cable for remote version

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Connecting cable, pressure measuring cell

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

Standard cable: PVC cable with copper shield

Sensor connection housing

The material of the sensor connection housing is dependent on the material selected for the transmitter housing.

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote":
  Coated aluminum AlSi10Mg
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote":
  Stainless cast steel, 1.4408 (CF3M)
  Compliant with:
  - NACE MR0175
  - NACE MR0103

Measuring tubes

DN 15 to 300 (½ to 12"), pressure ratings PN 10/16/25/40 /63/100, Class 150/300 /600 , as well as JIS 10K/20K
- Stainless cast steel, CF3M/1.4408
- Compliant with:
  - NACE MR0175-2003
  - NACE MR0103-2003
- DN15 to 150 (½ to 6"): AD2000, permitted temperature range −10 to +400 °C (+14 to +752 °F) restricted

DN 15 to 150 (½ to 6"), pressure ratings PN 10/16/25/40, Class 150/300:
- CX2MW similar to Alloy C22/2.4602
- Compliant with:
  - NACE MR0175-2003
  - NACE MR0103-2003

DSC sensor

Order code for "Sensor version; DSC sensor; measuring tube", option **AA, BA, CA, DA, DB**

Pressure ratings PN 10/16/25/40/63/100, Class 150/300/600, as well as JIS 10K/20K:
Parts in contact with medium (marked as "wet" on the DSC sensor flange):
- Stainless steel 1.4404 and 316 and 316L
- Compliant with:
  - NACE MR0175/ISO 15156-2015
  - NACE MR0103/ISO 17945-2015

Parts not in contact with medium:
Stainless steel 1.4301 (304)

Order code for "Sensor version; DSC sensor; measuring tube", option **AB, AC, BB, CB, CC**

Pressure ratings PN 10/16/25/40/63/100, Class 150/300/600, as well as JIS 10K/20K:
Parts in contact with medium (marked as "wet" on the DSC sensor flange):
- Alloy C22, UNS N06022 similar to Alloy C22/2.4602
- Compliant with:
  - NACE MR0175/ISO 15156-2015
  - NACE MR0103/ISO 17945-2015

Parts not in contact with medium:
Alloy C22, UNS N06022 similar to Alloy C22/2.4602

Pressure measuring cell

For order code for "Sensor version; DSC sensor; measuring tube", option DA "Mass steam" and DB "Mass gas/liquid", the following applies:
- Only available for measuring instruments with the following communication protocols:
  - HART
  - PROFINET over Ethernet-APL
  - Modbus TCP over Ethernet-APL
- Oil-free or grease-free cleaning is not possible.

- Wetted parts:
  - Process connection
    Stainless steel, 1.4404/316L
  - Membrane
    Stainless steel, 1.4435/316L
- Non-wetted parts:
  Housing
  Stainless steel ,1.4404

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB
- Connection on meter body: Stainless steel, 1.4404/316/316l
- Connection on siphon [6]: Stainless steel, 316/316L
  Siphon: Stainless steel, 1.4571
- Clamping sleeve: Stainless steel: 1.4571 (316Ti)
- Seals on meter body siphon: Sigraflex foil Z TM (BAM-certified (Federal Institute for Materials Research and Testing) for oxygen applications)
- Manometer valve:
  PTFE (polytetrafluoro-ethylene)
  Stainless steel, 1.4571 [7]
- Pressure measuring cell manometer valve: Copper

Process connections

DN 15 to 300 (½ to 12"), pressure ratings PN 10/16/25/40/63/100, Class 150/300/600, as well as JIS 10K/20K:

Welding neck flanges DN 15 to 300 (½ to 12")
Compliant with:
NACE MR0175-2003
NACE MR0103-2003

The following materials are available depending on the pressure rating:
- Stainless steel, multiple certifications, 1.4404/F316/F316L)
- Alloy C22/2.4602

Available process connections → 89

Seals

- Graphite
  Sigraflex foil Z™ (BAM-certified for oxygen applications)
- FPM (Viton™)
- Kalrez 6375™
- Gylon 3504™ (BAM-certified for oxygen applications)

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB
Copper

The technical tightness of tightness class L0.01 according to the TA-Luft regulation (Technical Instructions on Air Quality Control of December 1, 2021; Section 5.2.6.3 Flange connections), with a corresponding specific leakage rate of less than 0.01 mg/(s-m) was verified by means of type-based component tests at a test pressure of 40 bar_a.

Housing support

Stainless steel, 1.4408 (CF3M)

6) Only available with order code for "Sensor version; DSC sensor; measuring tube", option DA.
7) Only for the order code for "Additional approval", option LV IBR: 316ti

Screws for DSC sensor

- Order code for "Sensor version", option AA "Stainless steel, A4-80 according to ISO 3506-1 (316)"
- Order code for "Sensor version", option BA, CA, DA, DB
  Stainless steel, A2 as per ISO 3506-1 (304)
- Order code for "Additional approval", option LL "AD 2000 (including option JA+JB+JK) > DN25 including option LK"
  Stainless steel, A4 as per ISO 3506-1 (316)
- Order code for "Sensor version", option AB, AC, BB, CB, CC
  Stainless steel, 1.4980 according to EN 10269 (Gr. 660 B)

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

Flow conditioner

- Stainless steel: 1.4404 (316/316L)
- Compliant with:
  - NACE MR0175-2003
  - NACE MR0103-2003

Flange connections

Flange connection dimensions and raised face in accordance with:
- DIN EN 1092-1
- ASME B16.5
- JIS B2220

For information on the different materials used in the process connections

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 descriptions of the individual parameter functions

Reliable operation
- Operation in the following languages:
  - Via local display:
    English, German, French, Spanish, Italian, Portuguese, Polish, Russian, Turkish, Chinese, Bahasa (Indonesian)
  - Via "FieldCare" operating tool:
    English, German, French, Spanish, Italian, Chinese
- 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. No need to reconfigure.

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

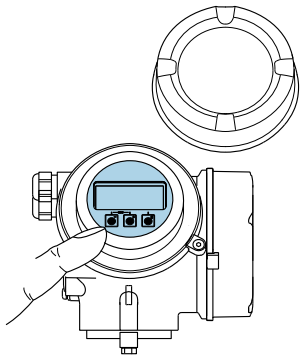
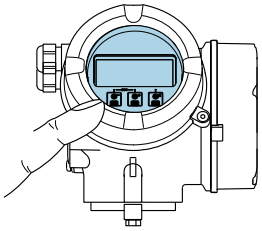
Languages

Can be operated in the following languages:
- Via local display:
  English, German, French, Spanish, Italian, Portuguese, Polish, Russian, Turkish, Chinese, Bahasa (Indonesian)
- Via "FieldCare" operating tool:
  English, German, French, Spanish, Italian, Chinese

Onsite operation

Via display module

Two display modules are available:

Order code for "Display; Operation", option C "SD02"	Order code for "Display; Operation", option E "SD03"
 A0032219	 A0032221
1 Operation with pushbuttons	*1 Operation with touch control*

Display elements

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

Operating elements

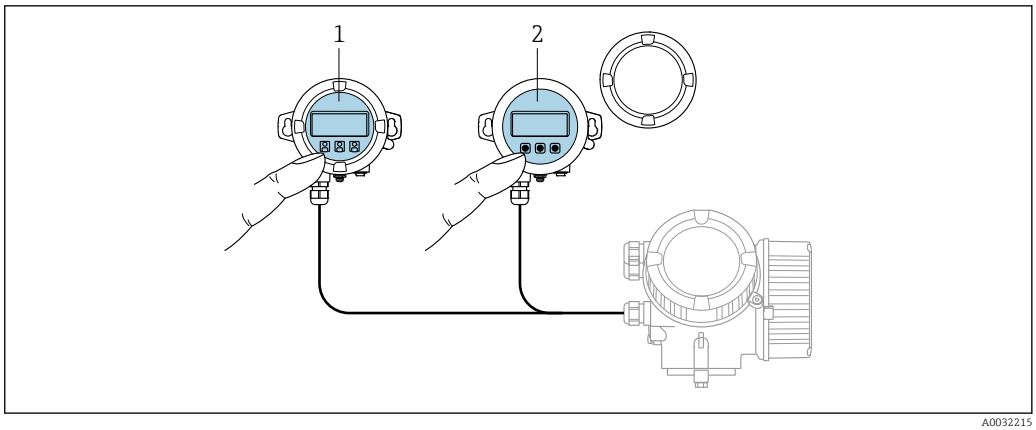
- Operation with 3 push buttons with open housing: ⊞, ⊟, Ⓔ
  or
- External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, Ⓔ
- Operating elements also accessible in the various zones of the hazardous area

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 FHX50

- The remote display FHX50 can be ordered as an optional extra→ 🖹 100.
- The remote display FHX50 cannot be combined with the order code for "Sensor version; DSC sensor; measuring tube", option DA "mass steam" or option DB "mass gas/liquid".



A0032215

28 *FHX50 operating options*

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

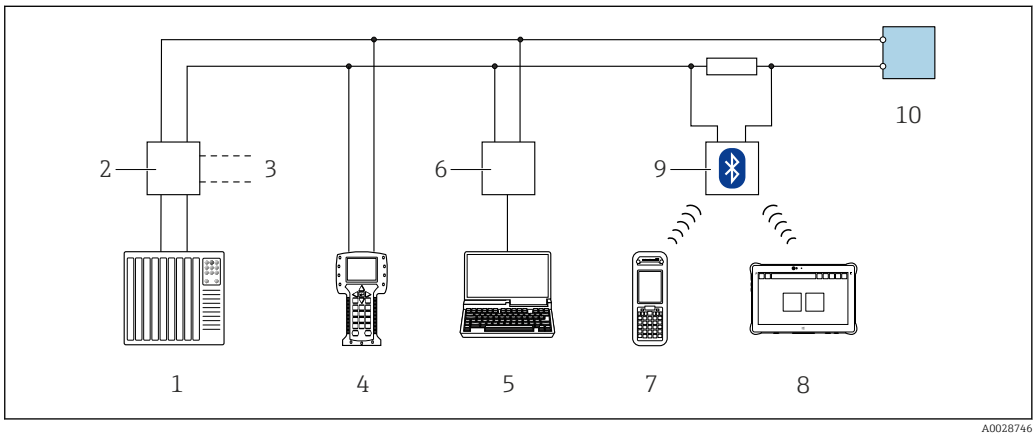
Display and operating elements

The display and operating elements correspond to those of the display module .

Remote operation

Via HART protocol

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



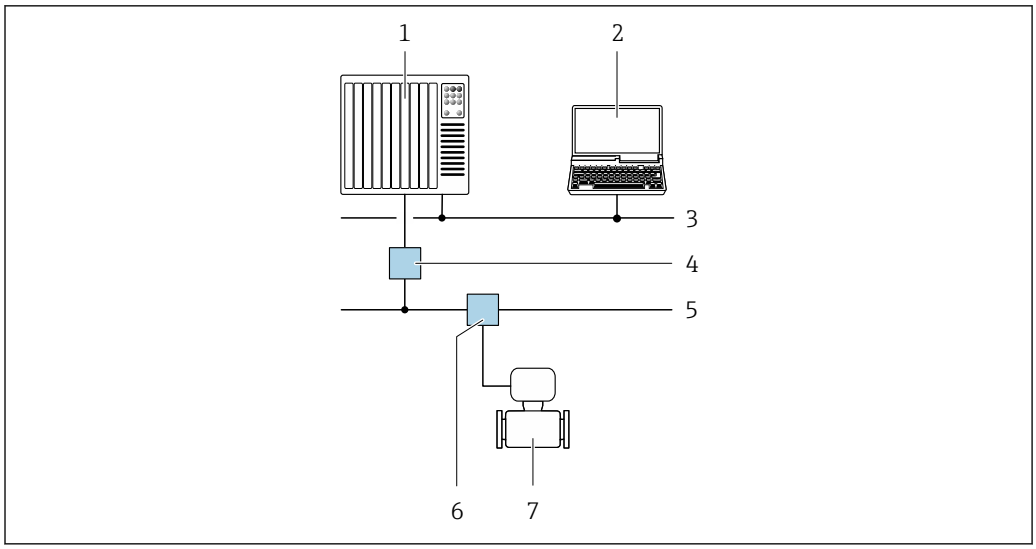
A0028746

29 *Options for remote operation via HART protocol (passive)*

1 Automation 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 Web browser (e.g. Internet Explorer) for accessing computers with an operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, AMS TREX Device Communicator, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
6 Commubox FXA195 (USB)
7 Field Xpert SFX350 or SFX370
8 Field Xpert SMT50 (or 70 or 77)
9 VIATOR Bluetooth modem with connecting cable
10 Transmitter

Via PROFIBUS PA network

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

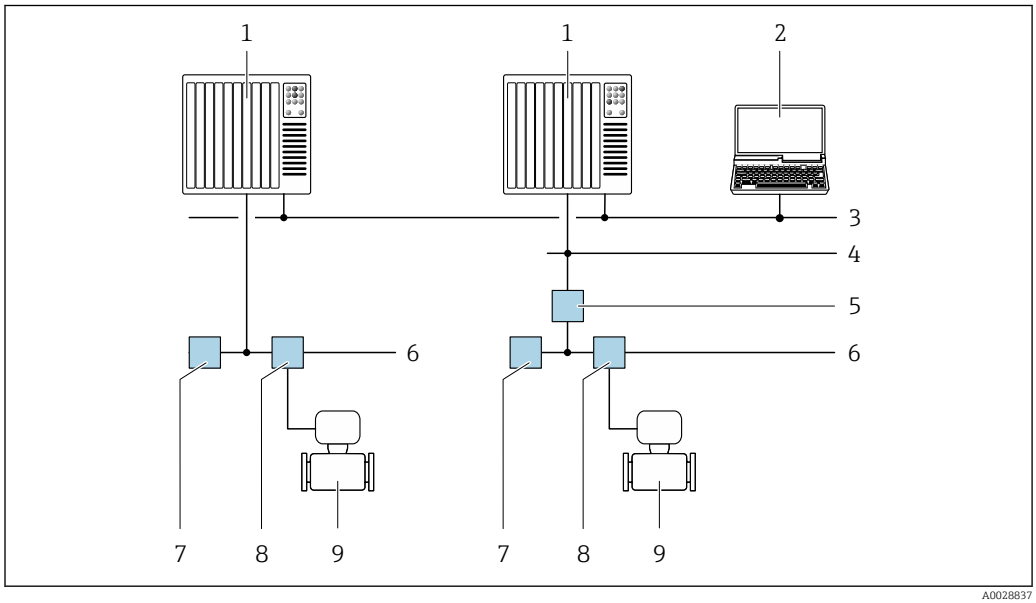


30 *Options for remote operation via PROFIBUS PA network*

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

Via FOUNDATION Fieldbus network

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

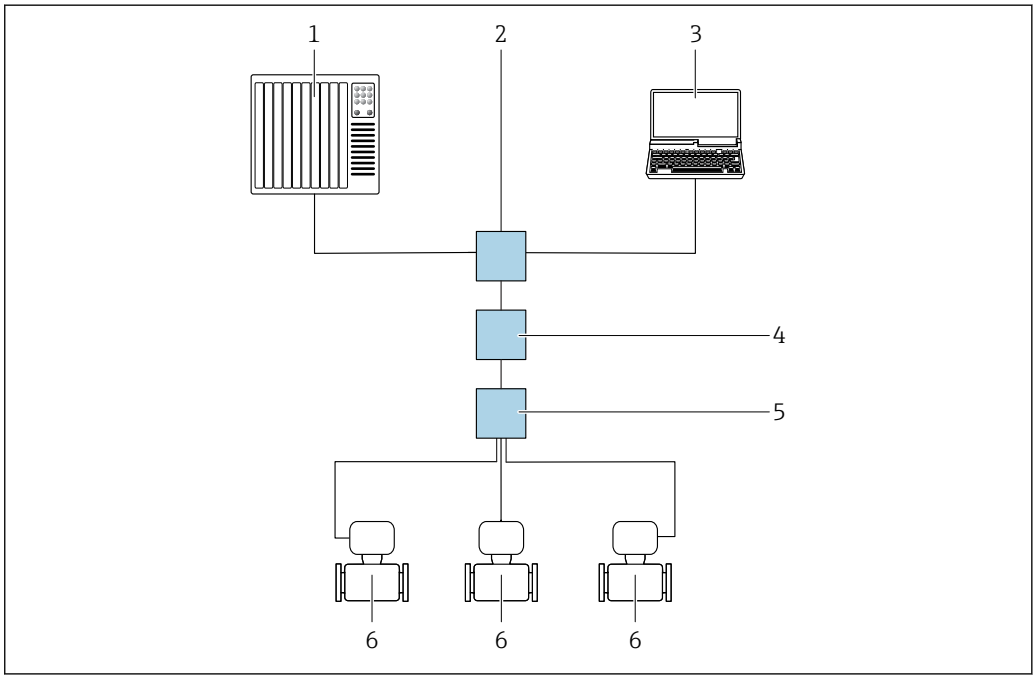


31 *Options for remote operation via FOUNDATION Fieldbus network*

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 instrument*

Via Modbus TCP over Ethernet-APL 10 Mbit/s, SPE 10 Mbit/s

This communication interface is available on port 1 in device versions with a Modbus TCP over Ethernet-APL output.

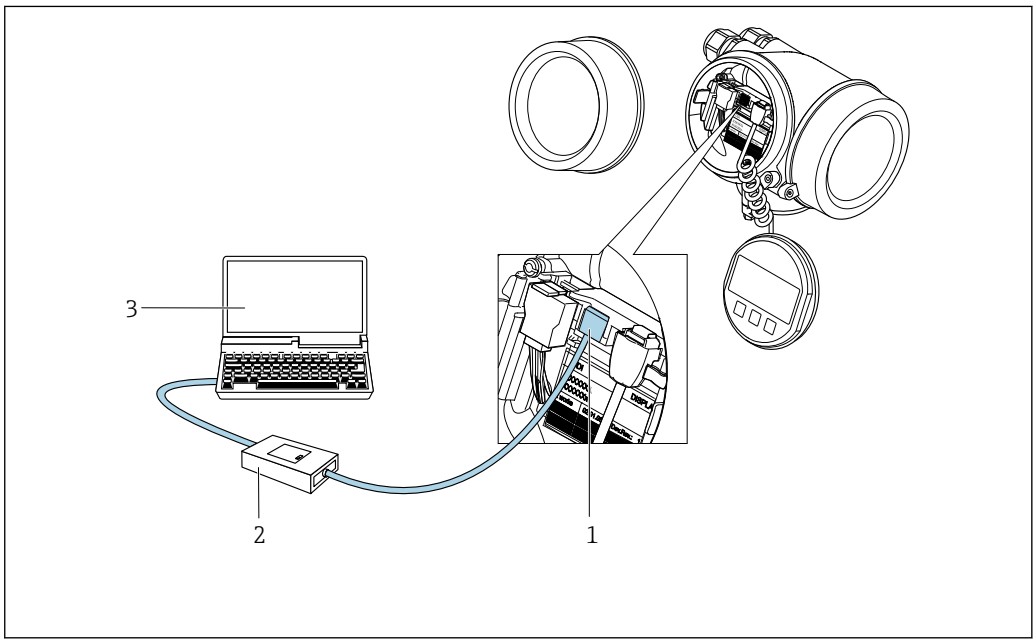


32 *Options for remote operation via Modbus TCP over Ethernet-APL protocol (active)*

1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Ethernet switch, e.g. Scalance X204 (Siemens)*
3 *Computer with web browser or operating tool*
4 *APL power switch/SPE power switch (optional)*
5 *APL field switch/SPE field switch*
6 *Measuring instrument/communication via port 1 (terminal 1 + 2)*

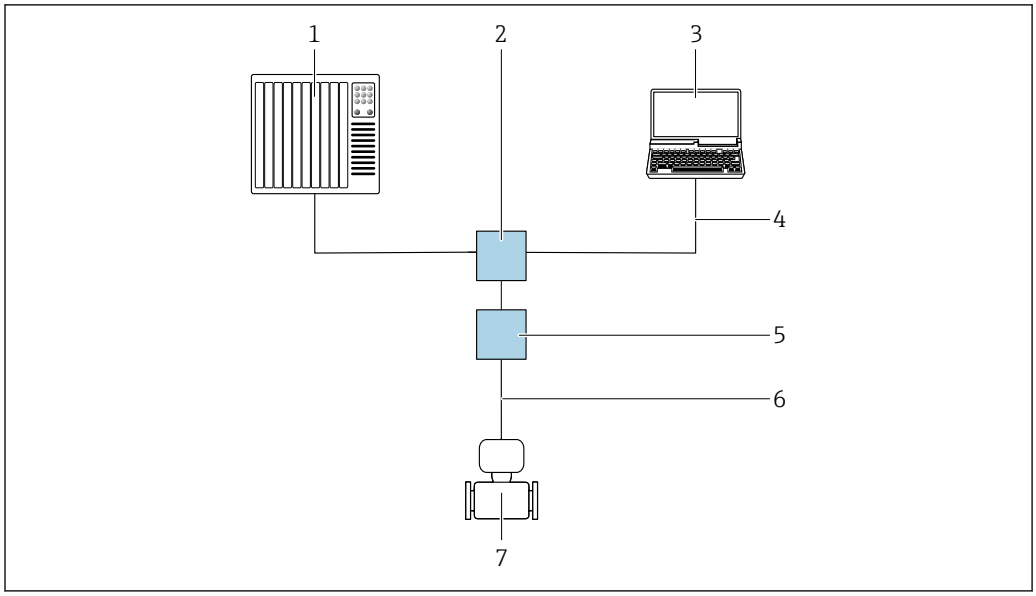
Service interface

Via service interface (CDI)



1 *Service interface (CDI = Endress+Hauser Common Data Interface) of the measuring instrument*
2 *Commubox FXA291*
3 *Computer with operating tool (e.g. FieldCare or DeviceCare) and (CDI) DeviceDTM*

Via PROFINET over Ethernet-APL 10 Mbit/s, SPE 10 Mbit/s



1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Ethernet Switch, e.g. Scalance X204 (Siemens)*
3 *Computer with operating tool (e.g. FieldCare or DeviceCare) and (CDI) DeviceDTM*
4 *Ethernet cable with RJ45 plug*
5 *APL field switch*
6 *2-wire fieldbus cable type A*
7 *Measuring instrument*

Supported operating tools

Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces.

Supported operating tools	Operating unit	Interface	Additional information
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	CDI service interface	→ 🖹 102
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	CDI service interface	→ 🖹 102
Field Xpert	SMT70/77/50	CDI service interface	Operating Instructions BA01202S Device description files: Use update function of handheld terminal

Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) from Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) from Siemens → www.siemens.com
- Asset Management Solutions (AMS) from Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 from Emerson → www.emersonprocess.com
- Emersons TREX → www.emerson.com
- Field Device Manager (FDM) from Honeywell → www.process.honeywell.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The related device description files are available: www.endress.com → Download Area

Web server

Thanks to the integrated web server, the device can be operated and configured using a web browser via PROFINET over Ethernet-APL or Ethernet-APL. In addition to the measured values, status information on the device is displayed and can be used to monitor device health. Furthermore the device data can be managed and the network parameters can be configured.

Access to the network is required for the APL connection.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring instrument:
- Upload the configuration from the measuring instrument (XML format, configuration backup).
- Save the configuration to the measuring instrument (XML format, restore configuration).
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Download driver (GSD) for system integration

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

CE mark

The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

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

UKCA marking

The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark.

Contact address Endress+Hauser UK:
Endress+Hauser Ltd.
Floats Road
Manchester M23 9NF
United Kingdom
www.uk.endress.com

RCM marking

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.

Functional safety

The measuring instrument can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture; order code for "Additional approval", option LA) and SIL 3 (multi-channel architecture with homogeneous redundancy) and is independently evaluated and certified in accordance with IEC 61508.

The following types of monitoring in safety equipment are possible:

Functional safety manual with information for the SIL device

HART certification

HART interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified according to HART
- The device can also be operated with certified devices of other manufacturers (interoperability)

FOUNDATION Fieldbus certification

FOUNDATION Fieldbus interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified in accordance with FOUNDATION Fieldbus H1
- Interoperability Test Kit (ITK), revision version 6.2.0 (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 PNO (PROFIBUS Nutzerorganisation e.V./ PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:
- Certified according to PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

PROFINET over Ethernet-APL certification

PROFINET interface

The measuring instrument is certified and registered by the PROFIBUS Nutzerorganisation e.V. (PNO). The measuring system meets all the requirements of the following specifications:
- Certified according to:
  - Test specification for PROFINET devices
  - PROFINET PA Profile 4.02
  - PROFINET Netload Robustness Class 2 10 Mbit/s
  - APL conformance test
- The device can also be operated with certified devices of other manufacturers (interoperability)
- The device supports PROFINET S2 system redundancy.

Pressure Equipment Directive

The measuring instruments can be ordered with or without PED or PESR. If a device with PED or PESR is required, this must be ordered explicitly. A UK order option must be selected for PESR under the order code for "Approvals".

- With the marking
  a) PED/G1/x (x = category) or
  b) PESR/G1/x (x = category)
  on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements"
  a) specified in Annex I of the Pressure Equipment Directive 2014/68/EU or
  b) Schedule 2 of Statutory Instruments 2016 No. 1105.
- Devices bearing this marking (PED or PESR) 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 (without PED or PESR) are designed and manufactured according to sound engineering practice. They meet the requirements of
  a) Art. 4, Section 3 of the Pressure Equipment Directive 2014/68/EU or
  b) Part 1, Section 8 of Statutory Instruments 2016 No. 1105.
  The scope of application is indicated
  a) in diagrams 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU or
  b) in Schedule 3, Section 2 of Statutory Instruments 2016 No. 1105.

Experience

The Prowirl 200 measuring system is the successor model of the Prowirl 72 and Prowirl 73.

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosure (IP code)
- DIN ISO 13359
  Measurement of conductive liquid flow in closed conduits - Flanged-type electromagnetic flowmeters - Overall length
- ISO 12764
  Measurement of fluid flow in closed conduits — Flow rate measurement by means of vortex shedding flowmeters inserted in circular cross-section conduits running full
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- GB30439.5
  Safety requirements for industrial automation products - Part 5: Flowmeter safety requirements
- EN 61326-1/-2-3
  EMC requirements for electrical equipment for measurement, control and laboratory use
- 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 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnostics of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications
- ETSI EN 300 328
  Guidelines for 2.4 GHz radio components.
- EN 301489
  Electromagnetic compatibility and radio spectrum matters (ERM).

Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the 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

Product generation index

Release date	Product root	Change
01.09.2013	7F2B	TI01084D
01.11.2017	7F2C	TI01333D
01.09.2025	7F2C	TI01333D

More information is available from your Sales Center or at:
www.service.endress.com → Downloads

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 → 104

Diagnostic functionality

Order code for "Application package", option EA "Extended HistoROM"

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 (standard 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.
- Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

For detailed information, see the Operating Instructions for the device.

Heartbeat Technology

Order code for "Application package", option EB "Heartbeat Verification"

Heartbeat Verification
Meets the requirement for traceable verification in accordance with DIN ISO 9001:2015 Clause 7.6 a) "Control of monitoring and measuring equipment"
- Functional testing in the installed state without interrupting the process.
- Traceable verification results on request, including a report.
- Simple testing process via local operation or other operating interfaces.
- Clear measuring point assessment (pass/fail) with high total test coverage within the framework of manufacturer specifications.
- Extension of calibration intervals according to operator's risk evaluation.

Detailed information on Heartbeat Technology:
Special Documentation → 104

Wet steam detection

Order code for "Application package", option ES "Wet steam detection"

Wet steam detection provides a qualitative parameter for monitoring the steam application. It is an additional indicator for checking steam quality. A warning is displayed as soon as the steam quality drops below x = 0.80 (80%).

- Additional quality parameter for ensuring a safe and efficient steam process
- Additional indicator to monitor the operation of steam traps

For detailed information, see the Operating Instructions for the device.

Wet steam measurement

Order code for "Application package", option EU "Wet steam measurement"

Innovative measurement of the steam quality and degree of overheating.

The wet steam detection application package extends wet steam measurement to include the continuous display of the steam quality. The steam quality is used to calculate the correct volume flow and mass flow and can be assigned to outputs.

The condensate amount can be displayed. By evaluating the data, deviations in the process can be quickly detected.

- As the warning values can be freely defined, users have optimum control of the steam process.
- Additional quality parameter for ensuring a safe and efficient steam process.
- Additional indicator to monitor the operation of steam traps.
- Combined with active pressure compensation, the device guarantees correct steam measurement.
- Automatic calculation of the steam state and correct measurement of the steam amount.
- Automatic navigation through the steam areas (wet steam, saturated steam and superheated steam).

For detailed information, see the Operating Instructions for the device.

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
Prowirl 200 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output, input ▪ Display/operation ▪ Housing ▪ Software Installation Instructions EA01056D (Order number: 7X2CXX)

Remote display FHX50	FHX50 housing for accommodating a display module .
	▪ FHX50 housing suitable for:
	  ▪ SD02 display module (push buttons)
	  ▪ SD03 display module (touch control)
	▪ 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 instrument 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 instrument, feature 030: Option L or M "Prepared for FHX50 display"
	▪ Order code for FHX50 housing, feature 050 (measuring instrument 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 instrument 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 instrument version): option B "Not prepared for FHX50 display"
	▪ Feature 020 (display, operation): option A "None, existing displayed used"
	The FHX50 remote display cannot be combined with the order code for "Sensor version; DSC sensor; measuring tube":
	  ▪ option DA "Mass steam; 316L; 316L (integrated pressure/temperature measurement), −200 to +400 °C (−328 to +750 °F)"
	  ▪ option DB "Mass gas/liquid; 316L; 316L (integrated pressure/temperature measurement), −40 to +100 °C (−40 to +212 °F)"
	Special Documentation SD01007F
	(Order number: FHX50)

Overvoltage protection for 2-wire devices	The use of an external overvoltage protection is recommended, e.g. HAW 569.
Overvoltage protection for 2-wire devices	The use of an external overvoltage protection is recommended, e.g. HAW 569.
Protective cover	The protective cover is used to protect against direct sunlight, precipitation and ice. It can be ordered together with the device via the product structure: Order code for "Accessories enclosed" option PB "Protective cover" Special Documentation SD00333F (Order number: 71162242)
Transmitter holder (pipe mounting)	To secure the remote version to the pipe DN 20 to 80 (3/4 to 3") Order code for "Accessory enclosed", option PM

For the sensor

Accessories	Description
Flow conditioner	Is used to shorten the necessary inlet run. (Order number: DK7ST) Dimensions of flow conditioner

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. 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. Technical Information TI00405C
HART loop converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. ▪ Technical Information TI00429F ▪ 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. Operating Instructions BA00061S
Fieldgate FXA42	Transmission of the measured values of connected 4 to 20 mA analog measuring instruments, as well as digital measuring instruments ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42
Field Xpert SMT50	The Field Xpert SMT50 tablet PC for device configuration enables mobile plant asset management in non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. ▪ Technical Information TI01555S ▪ Operating Instructions BA02053S ▪ Product page: www.endress.com/smt50
Field Xpert SMT70	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. ▪ Technical Information TI01342S ▪ Operating Instructions BA01709S ▪ Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. ▪ Technical Information TI01418S ▪ Operating Instructions BA01923S ▪ Product page: www.endress.com/smt77

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring instruments: ▪ Choice of measuring instruments for industrial requirements ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and measurement accuracy. ▪ Graphic display of the calculation results ▪ Determination of the partial order code, 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://portal.endress.com/webapp/applicator
Netilion	IIoT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem,Endress+Hauser allows you to optimize your plant performance, digitize workflows, share knowledge, and enhance collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights can be used to optimize processes, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all intelligent 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. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S

System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager 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. ▪ Technical Information TI00133R ▪ Operating Instructions BA00247R
RN221N	Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission. ▪ Technical Information TI00073R ▪ Operating Instructions BA00202R
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-hazardous area. Bidirectional communication is possible via the HART communication jacks. ▪ Technical Information TI00081R ▪ Brief Operating Instructions KA00110R

Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

Standard Documentation

Supplementary information on the semi-standard options is available in the relevant Special Documentation in the TSP database.

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Prowirl F 200	KA01323D

Brief Operating Instructions for the transmitter

Measuring instrument	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFINET over Ethernet-APL	Modbus TCP over Ethernet-APL
Proline 200	KA01326D	KA01327D	KA01328D	KA01323D	KA01738D

Operating Instructions

Measuring instrument	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFINET over Ethernet-APL	Modbus TCP over Ethernet-APL
Prowirl F 200	BA01686D	BA01694D	BA01690D	BA02132D	BA02398D

Description of Device Parameters

Measuring instrument	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFINET over Ethernet-APL	Modbus TCP
Prowirl 200	GP01109D	GP01111D	GP01110D	GP01170D	GP01240D

Supplementary device-dependent documentation

Safety instructions

Contents	Documentation code
ATEX/IECEx Ex d	XA01635D
ATEX/IECEx Ex ia	XA01636D
ATEX/IECEx Ex ec, Ex ic	XA01637D
$_{C}CSA_{US}$ XP	XA01638D
$_{C}CSA_{US}$ IS	XA01639D
EAC Ex d	XA01684D
EAC Ex ia	XA01782D
EAC Ex ec, Ex ic	XA01685D
INMETRO Ex d	XA01642D
INMETRO Ex ia	XA01640D
INMETRO Ex ec, Ex ic	XA01641D
JPN Ex d	XA01766D
NEPSI Ex d	XA01643D
NEPSI Ex ia	XA01644D
NEPSI Ex ec, Ex ic	XA01645D
UKEX Ex d	XA02630D
UKEX Ex ia	XA02631D
UKEX Ex ec, Ex ic	XA02632D

Functional Safety Manual

Contents	Documentation code
Proline Prowirl 200	SD02025D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Protective cover	SD00333F
Modbus TCP system integration	SD03409D

Contents	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFINET over Ethernet-APL	Modbus TCP over Ethernet-APL
Heartbeat Technology	SD02029D	SD02030D	SD02031D	SD02759D	SD02977D
Wet steam detection	SD02032D	SD02033D	SD02034D	SD02743D	SD02978D
Wet steam measurement	SD02035D	SD02036D	SD02037D	SD02744D	SD02744D

Installation Instructions

Contents	Note
Installation instructions for spare part sets and accessories	The corresponding documentation code is listed with the relevant accessory.→ 🖹 100.

Registered trademarks

HART®
Registered trademark of the FieldComm Group, Austin, Texas USA

PROFIBUS®
Registered trademark of the PROFIBUS Nutzerorganisation e.V. (PROFIBUS User Organization), Karlsruhe, Germany

FOUNDATION™ fieldbus
Registration-pending trademark of the FieldComm Group, Austin, Texas, USA

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

Ethernet-APL™
Registered trademark of the PROFIBUS Nutzerorganisation e.V. (PROFIBUS User Organization), Karlsruhe, Germany

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GYLON®
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People for Process Automation