TI01385D/06/EN/03.24-00
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2024-01-31

Technical Information
Proline Prosonic Flow G 300

Ultrasonic time-of-flight flowmeter

Highly robust gas specialist for fluctuating conditions with compact, easily accessible transmitter

Application

- The measuring principle is unaffected by gas composition
- Accurate measurement of natural and process gas in the chemical as well as oil and gas industries

Device properties

- Direct measurement: flow, pressure & temperature
- Wetted parts: titanium / 316L
- Maximum measuring accuracy: 0.5 %
- Compact dual-compartment housing with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Remote display available

Your benefits

- Flexible device with user-definable gas mixtures for demanding measuring tasks
- Maximum reliability even with humid or wet gas – sensor design insensitive to condensate
- High-performance process control – real-time pressure- and temperaturecompensated values
- Efficient solution – multivariable, no pressure loss
- Full access to process and diagnostic information – numerous, freely combinable I/Os
- Reduced complexity and variety – freely configurable I/O functionality
- 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.
	**Potential equalization connection (PE: protective earth)** 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: potential equalization is connected to the supply network. ▪ 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 network.
	**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is 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

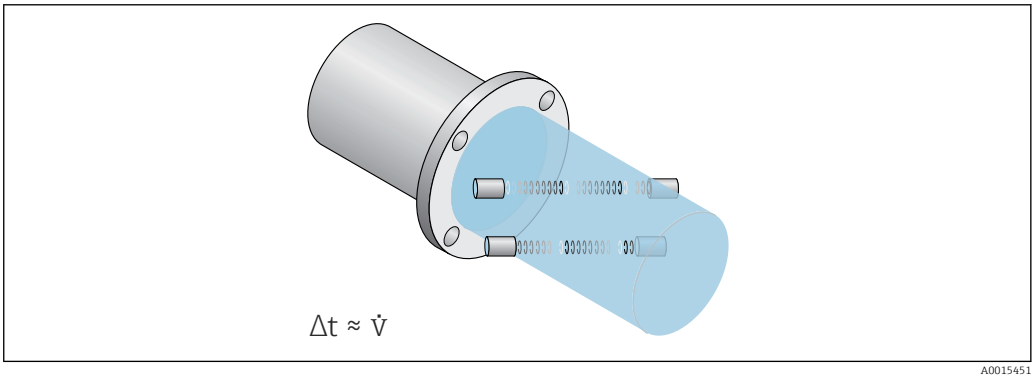
Measuring principle

The measuring device measures the flow velocity in the measuring tube based on an offset arrangement of ultrasonic sensors downstream. The design does not cause any pressure loss and does not have any moving parts.

The flow signal is determined by alternately measuring the transit time of an acoustic signal from one sensor to the other. This is based on the fact that sound is transmitted faster with the direction of flow than against the direction of flow. This difference time (Δt) is used to determine the flow velocity between the sensors.

The volume flow rate is established by combining all the flow velocities determined by the sensor pairs with the cross sectional area of the meter body and extensive knowledge about fluid flow dynamics. The design of the sensors and their position ensures that only a short straight run of pipe upstream of the meter is required after typical flow obstructions such as bends in one or two planes.

Constant evaluation of the flow measurement is facilitated thanks to advanced digital signal processing and innovative sensor design. These two factors reduce sensitivity with regard to two-phase flow conditions (humid and changing gas conditions) and increase measurement reliability.



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Measurement of the gas quality (Advanced gas analysis)

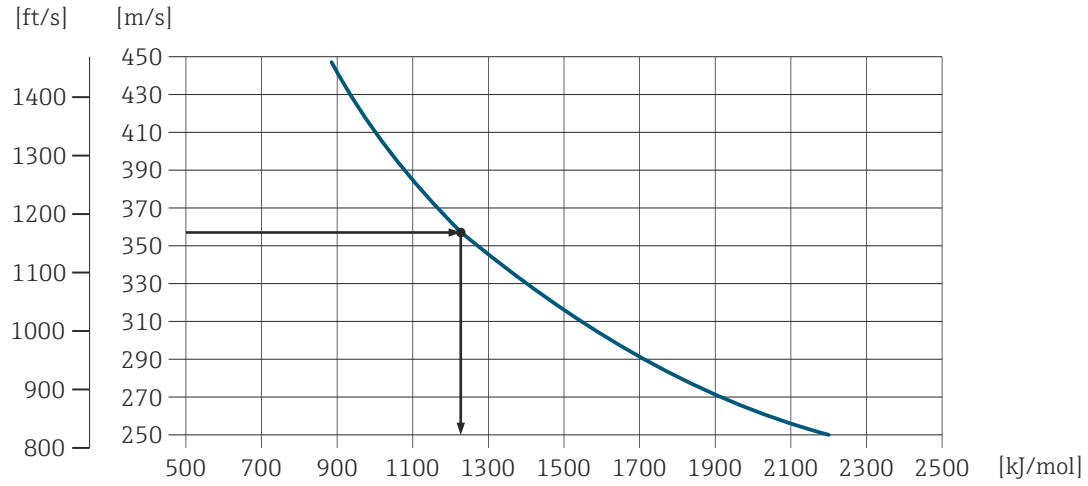
The measuring device accurately records the sound velocity, gas temperature and gas pressure. This means that the properties of the gas mixture can be calculated directly and displayed on site.
Example:

- Density, calorific value, energy flow (calorific power) and Wobbe index of a natural gas whose composition is unknown or variable
- Density, molar mass and viscosity of a known process gas or gas mixture

In the case of gas mixtures primarily consisting of methane, CO_2 and saturated steam (e.g. biogas and some types of coal gas), the measuring device enables direct measurement of the methane fraction and other gas properties.

The direct recording of gas properties makes it possible to monitor gas flow and gas quality 24/7. Plant operators can thus react swiftly and specifically to problems occurring in the process.

The following shows the calculation of the calorific value of a natural gas based on the sound velocity [m/s (ft/s)], at a certain constant temperature T and a certain constant pressure p.



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For detailed information on the "Advanced gas analysis" application package, see:
Special Documentation → 75

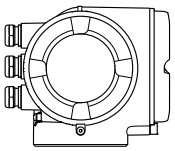
Measuring system

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

Transmitter

Proline 300



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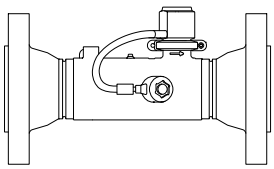
Device versions and materials:
- Transmitter housing
  - Aluminum, coated: aluminum, AlSi10Mg, coated
  - Cast, stainless: cast, stainless steel, 1.4409 (CF3M) similar to 316L
- Material of window in transmitter housing:
  - Aluminum, coated: glass
  - Cast, stainless: glass

Configuration:
- External operation via 4-line, illuminated graphic local display (LCD) with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning.
- Via service interface or WLAN interface:
  - Operating tools (e.g. FieldCare, DeviceCare)
  - Web server (access via Web browser, e.g. Microsoft Internet Explorer, Microsoft Edge)

Sensor

Prosonic Flow G

Single-path version: DN 25 (1")



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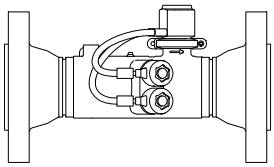
Two-path version: DN 50 to 300 (2 to 12")



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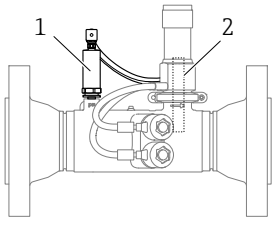
- Measurement of:
  - Process gases and gas mixtures
  - Natural gases
  - Coal gases
  - Shale gases
  - Biogases/sewage gases
- Range of nominal diameter: DN 25 to 300 (1 to 12")
- Materials:
  - Measuring tube:
    Stainless steel: 1.4408/1.4409 (CF3M)
  - Welding neck flanges:
    Stainless steel: 1.4404 (316, 316L)
  - Ultrasonic transducer:
    Grade 2 titanium
    Stainless steel: 1.4404 (316, 316L)
  - Seal for ultrasonic transducer:
    FKM material group

Pressure measuring cell and temperature sensor



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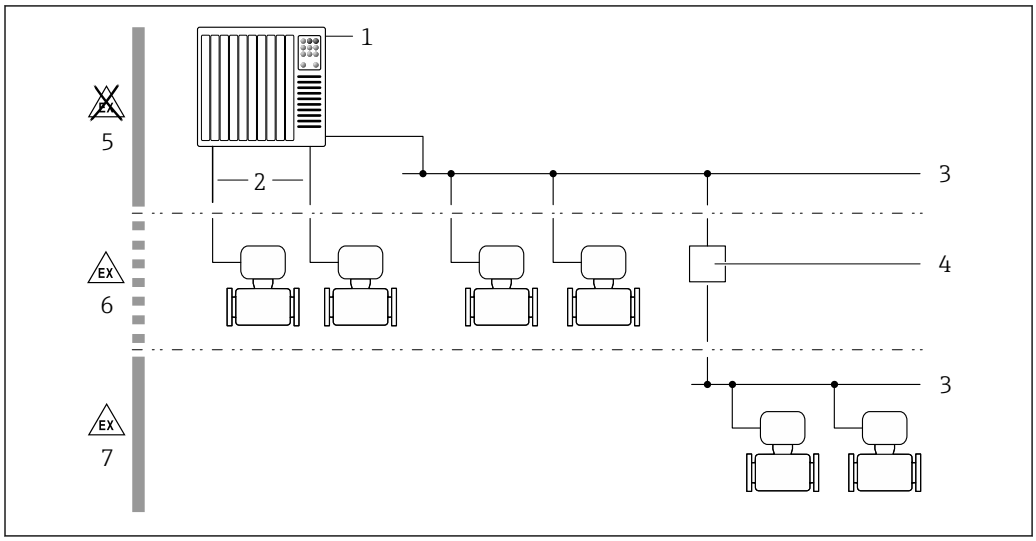
1 Pressure measuring cell
2 Temperature sensor

- Pressure measuring cell versions:
  - 2 bar (29 psi) absolute
  - 4 bar (58 psi) absolute
  - 10 bar (145 psi) absolute
  - 40 bar (580 psi) absolute
  - 100 bar (1450 psi) absolute
- Temperature sensor
  Covers the entire measuring range without variance

Material
- Wetted parts:
  - Membrane: stainless steel, 1.4435 (316L)
  - Process connection: stainless steel, 1.4404 (316, 316L)
  - Temperature sensor: stainless steel, 1.4404 (316, 316L)
- Non-wetted parts:
  Housing: stainless steel, 1.4404 (316, 316L)

Equipment architecture



1 Possibilities for integrating measuring devices into a system

1 *Control system (e.g. PLC)*
2 *Connecting cable (0/4 to 20 mA HART etc.)*
3 *Fieldbus*
4 *Coupler*
5 *Non-hazardous area*
6 *Hazardous area: Zone 2; Class I, Division 2*
7 *Hazardous area: Zone 1; Class I, Division 1*

Dependability

IT security

Our 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:

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 🖹 9	Not enabled	On an individual basis following risk assessment
Access code (also applies to web server login or FieldCare connection) → 🖹 9	Not enabled (0000)	Assign a customized access code during commissioning
WLAN (order option in display module)	Enabled	On an individual basis following risk assessment
WLAN security mode	Enabled (WPA2-PSK)	Do not change
WLAN passphrase (Password) → 🖹 9	Serial number	Assign an individual WLAN passphrase during commissioning
WLAN mode	Access point	On an individual basis following risk assessment
Web server → 🖹 9	Enabled	On an individual basis following risk assessment
CDI-RJ45 service interface→ 🖹 9	–	On an individual basis following risk assessment

Protecting access via hardware write protection

Write access to the parameters of the device via the local display, web browser 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

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- User-specific access code
  Protect write access to the device parameters via the local display, web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- WLAN passphrase
  The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.
- Infrastructure mode
  When the device is operated in infrastructure mode, the WLAN passphrase corresponds to the WLAN passphrase configured on the operator side.

User-specific access code

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

WLAN passphrase: Operation as WLAN access point

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface, which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter.

Infrastructure mode

A connection between the device and WLAN access point is protected by means of an SSID and passphrase on the system side. Please contact the relevant system administrator for access.

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning for safety reasons.
- Follow the general rules for generating a secure password when defining and managing the access code and network key.
- The user is responsible for the management and careful handling of the access code and network key.

Access via web server

With the integrated web server, the device can be operated and configured via a web browser. The connection is established via the service interface (CDI-RJ45) or the WLAN interface.

The web server is enabled when the device is delivered. The web server can be disabled via the **Web server functionality** parameter if necessary (e.g., after commissioning).

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.

For detailed information on device parameters, see:
"Description of device parameters" document .

Access via service interface (CDI-RJ45)

The device can be connected to a network via the service interface (CDI-RJ45). Device-specific functions guarantee the secure operation of the device in a network.

The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures such as network segmentation.

Transmitters with an Ex de approval may not be connected via the service interface (CDI-RJ45)!

Input

Measured variable

Direct measured variables

- Flow velocity
- Sound velocity
- Process temperature (optional): based on Pt1000 Class A platinum resistor
- Pressure (optional): based on pressure measuring cell for measuring absolute pressure

Calculated measured variables

- Volume flow
- Corrected volume flow (corrected/standard volume flow)
- Mass flow
- Energy flow
- Density

Optionally calculated measured variables

Order code for "Application package", option EF "Advanced gas analysis"

- Wobbe index
- Methane fraction
- Molar mass
- Dynamic viscosity
- Calorific value

Optionally calculated measured variables depend on the gas type.

Measuring range

- With the specified measurement accuracy: v = 0.3 to 40 m/s (0.98 to 131.2 ft/s)
- With reduced measurement accuracy: v = 0.3 to 60 m/s (0.98 to 196.8 ft/s)

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
			Full scale value current output	Pulse value	Low flow cut off (v ~ 0.1 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³/pulse]	[m³/h]
25	1	0.50 to 67	50	0.007	0.17
50	2	2.05 to 274	210	0.03	0.68
80	3	4.60 to 614	460	0.06	1.5
100	4	8 to 1 064	800	0.1	2.7
150	6	18.1 to 2 414	1 800	0.3	6.0
200	8	32 to 4 235	3 200	0.4	11
250	10	50 to 6 662	5 000	0.7	17
300	12	71 to 9 426	7 100	1.0	24

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
			Full scale value current output	Pulse value	Low flow cut off (v ~ 0.1 m/s)
[in]	[mm]	[ft³/hr]	[ft³/hr]	[ft³/pulse]	[ft³/hr]
1	25	17.7 to 2 358	1 800	0.2	5.9
2	50	73 to 9 668	7 300	1	24
3	80	163 to 21 694	16 000	2	54
4	100	282 to 37 579	28 000	4	94
6	150	639 to 85 253	64 000	9	213

Nominal diameter		Recommended flow	Factory settings		
			Full scale value current output	Pulse value	Low flow cut off (v ~ 0.1 m/s)
[in]	[mm]	[ft³/hr]	[ft³/hr]	[ft³/pulse]	[ft³/hr]
8	200	1 122 to 149 544	110 000	16	374
10	250	1 764 to 235 259	180 000	25	588
12	300	2 497 to 332 890	250 000	35	832

To calculate the measuring range, use the *Applicator* sizing tool → 73

Recommended measuring range

Flow limit → 43

Operable flow range

133 : 1

Input signal

Output and input variants

→ 14

External measured values

To increase the measurement accuracy of certain measured variables or to calculate the corrected volume flow for gases, the use of the integrated pressure and temperature measurement function is recommended:
- Temperature measurement to increase measurement accuracy (order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; integrated temperature measurement")
- Temperature and pressure measurement to increase measurement accuracy (order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; integrated pressure + temperature measurement")

The measuring device provides optional interface that enable the transmission of externally measured variables (temperature, pressure, gas composition (gas composition can only be transmitted via Modbus)) to the measuring device:
- Analog inputs 4-20 mA
- Digital inputs (via HART input or Modbus)

Pressure values can be transmitted as absolute or gauge pressure. For gauge pressure, the atmospheric pressure must be specified by the customer.

Various pressure and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 73

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

Current input

The measured values are written from the automation system to the measuring device via the current input → 13.

Digital communication

The measured values can be written by the automation system via:
Modbus RS485

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 µA
Voltage drop	Typically: 0.6 to 2 V for 3.6 to 22 mA (passive)
Maximum input voltage	≤ 30 V (passive)
Open-circuit voltage	≤ 28.8 V (active)
Possible input variables	▪ Pressure ▪ Temperature

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Configurable: 5 to 200 ms
Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

Output

Output and input variants

Depending on the option selected for output/input 1, different options are available for the other outputs and inputs. Only one option can be selected for each output/input 1 to 3. The following tables must be read vertically (↓).

Example: If the option BA "4–20 mA HART" was selected for output/input 1, one of the options A, B, D, E, F, H, I or J is available for output 2 and one of the options A, B, D, E, F, H, I or J is available for output 3.

Output/input 1 and options for output/input 2

Options for output/input 3 → 15

Order code for "Output; input 1" (020) →	Possible options			
Current output 4 to 20 mA HART	**BA**			
Current output 4 to 20 mA HART Ex i passive		**CA**		
Current output 4 to 20 mA HART Ex i active			**CC**	
Modbus RS485				**MA**
Order code for "Output; input 2" (021) →	↓	↓	↓	↓
Not used	**A**	**A**	**A**	**A**
Current output 4 to 20 mA	**B**			**B**
Current output 4 to 20 mA Ex i passive		**C**	**C**	
User-configurable input/output [1]	**D**			**D**
Pulse/frequency/switch output	**E**			**E**
Double pulse output [2]	**F**			**F**
Pulse/frequency/switch output Ex i passive		**G**	**G**	
Relay output	**H**			**H**
Current input 0/4 to 20 mA	**I**			**I**
Status input	**J**			**J**

1) A specific input or output can be assigned to a user-configurable input/output → 21.
2) If double pulse output (F) is selected for output/input 2 (021), only the double pulse output (F) option is available for selection for output/input 3 (022).

Output/input 1 and options for output/input 3

Options for output/input 2 → 14

Order code for "Output; input 1" (020) →	Possible options			
Current output 4 to 20 mA HART	**BA**			
Current output 4 to 20 mA HART Ex i passive		**CA**		
Current output 4 to 20 mA HART Ex i active			**CC**	
Modbus RS485				**MA**
Order code for "Output; input 3" (022) →	↓	↓	↓	↓
Not used	**A**	**A**	**A**	**A**
Current output 4 to 20 mA	**B**			**B**
Current output 4 to 20 mA Ex i passive		**C**	**C**	
User-configurable input/output	**D**			**D**
Pulse/frequency/switch output	**E**			**E**
Double pulse output (slave)	**F**			**F**
Pulse/frequency/switch output Ex i passive		**G**	**G**	
Relay output	**H**			**H**
Current input 0/4 to 20 mA	**I**			**I**
Status input	**J**			**J**

Output signal

Current output 4 to 20 mA HART

Order code	"Output; input 1" (20): Option BA: current output 4 to 20 mA HART
Signal mode	Can be set to: ▪ Active ▪ Passive
Current range	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ 0 to 20 mA (only if the signal mode is active) ▪ Fixed current
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature ▪ Methane fraction [1] ▪ Molar mass [1] ▪ Density ▪ Dynamic viscosity [1] ▪ Calorific value [1] ▪ Wobbe index [1] ▪ Pressure [2] ▪ Temperature [3]

1) Only for the order code for "Application package", option EF "Advanced gas analysis" and corresponding configuration
2) Only for the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; pressure + temperature measurement integrated"
3) Only for the order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; pressure + temperature measurement integrated"

Current output 4 to 20 mA HART Ex i

Order code	"Output; input 1" (20) choose from: ▪ Option CA: current output 4 to 20 mA HART Ex i passive ▪ Option CC: current output 4 to 20 mA HART Ex i active
Signal mode	Depends on the selected order version.
Current range	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ 0 to 20 mA (only if the signal mode is active) ▪ Fixed current
Open-circuit voltage	DC 21.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	▪ 250 to 400 Ω (active) ▪ 250 to 700 Ω (passive)
Resolution	0.38 µA

Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature ▪ Methane fraction [1)] ▪ Molar mass [1)] ▪ Density ▪ Dynamic viscosity [1)] ▪ Calorific value [1)] ▪ Wobbe index [1)] ▪ Pressure [2)] ▪ Temperature [3)]

1) Only for the order code for "Application package", option EF "Advanced gas analysis" and corresponding configuration
2) Only for the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; pressure + temperature measurement integrated"
3) Only for the order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; pressure + temperature measurement integrated"

Modbus RS485

Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Integrated, can be activated via DIP switches

Current output 4 to 20 mA

Order code	"Output; input 2" (21), "Output; input 3" (022): Option B: current output 4 to 20 mA
Signal mode	Can be set to: ▪ Active ▪ Passive
Current range	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ 0 to 20 mA (only if the signal mode is active) ▪ Fixed current
Maximum output values	22.5 mA
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	0 to 700 Ω
Resolution	0.38 µA

Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature ▪ Methane fraction [1] ▪ Molar mass [1] ▪ Density ▪ Dynamic viscosity [1] ▪ Calorific value [1] ▪ Wobbe index [1] ▪ Pressure [2] ▪ Temperature [3]

1) Only for the order code for "Application package", option EF "Advanced gas analysis" and corresponding configuration
2) Only for the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; pressure + temperature measurement integrated"
3) Only for the order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; pressure + temperature measurement integrated"

Current output 4 to 20 mA Ex i passive

Order code	"Output; input 2" (21), "Output; input 3" (022): Option C: current output 4 to 20 mA Ex i passive
Signal mode	Passive
Current range	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ Fixed current
Maximum output values	22.5 mA
Maximum input voltage	DC 30 V
Load	0 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0 to 999 s
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature ▪ Methane fraction [1] ▪ Molar mass [1] ▪ Density ▪ Dynamic viscosity [1] ▪ Calorific value [1] ▪ Wobbe index [1] ▪ Pressure [2] ▪ Temperature [3]

1) Only for the order code for "Application package", option EF "Advanced gas analysis" and corresponding configuration
2) Only for the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; pressure + temperature measurement integrated"
3) Only for the order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; pressure + temperature measurement integrated"

Pulse/frequency/switch output

Function	Can be configured as pulse, frequency or switch output
Version	Open collector Can be set to: ▪ Active ▪ Passive Ex-i, passive
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Pulse output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Pulse width	Configurable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Configurable
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow
Frequency output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Output frequency	Configurable: end value frequency 2 to 10 000 Hz(f_{max} = 12 500 Hz)
Damping	Configurable: 0 to 999.9 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature ▪ Methane fraction [1] ▪ Molar mass [1] ▪ Density ▪ Dynamic viscosity [1] ▪ Calorific value [1] ▪ Wobbe index [1] ▪ Pressure [2] ▪ Temperature [3]
Switch output	
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s

Number of switching cycles	Unlimited

Assignable functions	▪ Disable
	▪ On
	▪ Diagnostic behavior
	▪ Limit
	  ▪ Volume flow
	  ▪ Corrected volume flow
	  ▪ Mass flow
	  ▪ Energy flow
	  ▪ Flow velocity
	  ▪ Electronics temperature
	  ▪ Sound velocity
	  ▪ Methane fraction [1]
	  ▪ Molar mass [1]
	  ▪ Density
	  ▪ Dynamic viscosity [1]
	  ▪ Calorific value [1]
	  ▪ Wobbe index [1]
	  ▪ Pressure [2]
	  ▪ Temperature [3]
	  ▪ Totalizer 1-3
	▪ Flow direction monitoring
	▪ Status
	  Low flow cut off

1) Only for the order code for "Application package", option EF "Advanced gas analysis" and corresponding configuration
2) Only for the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; pressure + temperature measurement integrated"
3) Only for the order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; pressure + temperature measurement integrated"

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ Active ▪ Passive ▪ Passive NAMUR
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Output frequency	Configurable: 0 to 1000 Hz
Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Energy flow

Relay output

Function	Switch output
Version	Relay output, galvanically isolated

Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)
Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A

Assignable functions	▪ Disable
	▪ On
	▪ Diagnostic behavior
	▪ Limit
	  ▪ Volume flow
	  ▪ Corrected volume flow
	  ▪ Mass flow
	  ▪ Energy flow
	  ▪ Flow velocity
	  ▪ Electronics temperature
	  ▪ Sound velocity
	  ▪ Methane fraction [1]
	  ▪ Molar mass [1]
	  ▪ Density
	  ▪ Dynamic viscosity [1]
	  ▪ Calorific value [1]
	  ▪ Wobbe index [1]
	  ▪ Pressure [2]
	  ▪ Temperature [3]
	  ▪ Totalizer 1-3
	▪ Flow direction monitoring
	▪ Status
	  Low flow cut off

1) Only for the order code for "Application package", option EF "Advanced gas analysis" and corresponding configuration
2) Only for the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; titanium gr. 2; pressure + temperature measurement integrated"
3) Only for the order code for "Measuring tube; Transducer; Sensor version", option AB "316L; titanium gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; pressure + temperature measurement integrated"

User-configurable input/output

One specific input or output is assigned to a user-configurable input/output (configurable I/O) during device commissioning.

The following inputs and outputs are available for assignment:
- Choice of current output: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Pulse/frequency/switch output
- Choice of current input: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Status input

The technical values correspond to those of the inputs and outputs described in this section.

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

Modbus RS485

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

Current output 0/4 to 20 mA

4 to 20 mA

Failure mode	Choose from: ▪ 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

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Fault mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Fault mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Definable value between: 2 to 12 500 Hz
Switch output	
Fault mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

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

Local display

Plain text display	With information on cause and remedial measures
Backlight	Red lighting indicates a device error.

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
  - HART protocol
  - Modbus RS485
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation → 61

Web browser

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred

Load

Output signal → 16

Ex connection data

Safety-related values

Order code "Output; input 1"	Output type	Safety-related values "Output; input 1"	
		26 (+)	27 (–)
Option **BA**	Current output 4 to 20 mA HART	U_N = 30 V_{DC} U_M = 250 V_{AC}	
Option **MA**	Modbus RS485	U_N = 30 V_{DC} U_M = 250 V_{AC}	

Order code "Output; input 2"; "Output; input 3"	Output type	Safety-related values			
		Output; input 2		Output; input 3	
		24 (+)	25 (–)	22 (+)	23 (–)
Option **B**	Current output 4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}			
Option **D**	User-configurable input/ output	U_N = 30 V_{DC} U_M = 250 V_{AC}			
Option **E**	Pulse/frequency/switch output	U_N = 30 V_{DC} U_M = 250 V_{AC}			
Option **F**	Double pulse output	U_N = 30 V_{DC} U_M = 250 V_{AC}			
Option **H**	Relay output	U_N = 30 V_{DC} I_N =100 mA_{DC}/500 mA_{AC} U_M = 250 V_{AC}			
Option **I**	Current input 4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}			
Option **J**	Status input	U_N = 30 V_{DC} U_M = 250 V_{AC}			

Intrinsically safe values

Order code "Output; input 1"	Output type	Intrinsically safe values "Output; input 1"	
		26 (+)	27 (–)
Option **CA**	Current output 4 to 20 mA HART Ex i passive	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 µH C_i = 6 nF	
Option **CC**	Current output 4 to 20 mA HART Ex i active	**Ex ia** U_0 = 21.8 V I_0 = 90 mA P_0 = 491 mW L_0 = 4.1 mH(IIC)/ 15 mH(IIB) C_0 = 160 nF(IIC)/ 1 160 nF(IIB) U_i = 30 V I_i = 10 mA P_i = 0.3 W L_i = 5 µH C_i = 6 nF	**Ex ic** [1] U_0 = 21.8 V I_0 = 90 mA P_i = 491 mW L_0 = 9 mH(IIC)/ 39 mH(IIB) C_0 = 600 nF(IIC)/ 4 000 nF(IIB)

1) Only available for transmitter Zone 2; Class I, Division 2.

Order code for "Output; input 2"; "Output; input 3"	Output type	Intrinsically safe values or NIFW values			
		Output; input 2		Output; input 3	
		24 (+)	25 (–)	22 (+)	23 (–)
Option **C**	Current output 4 to 20 mA Ex i passive	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 C_i = 0			
Option **G**	Pulse/frequency/switch output Ex i passive	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 C_i = 0			

Low flow cut off

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

Galvanic isolation

The outputs are galvanically isolated:
- from the power supply
- from one another
- from the potential equalization (PE) terminal

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x5D (93)
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
System integration	Information on system integration: Operating Instructions → 🖹 74. - Measured variables via HART protocol - Burst Mode functionality

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Response times	▪ Direct data access: typically 25 to 50 ms ▪ Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transmission mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information → 🖹 74
System integration	Information regarding system integration: Operating Instructions . ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

Power supply

Terminal assignment

Transmitter: supply voltage, input/outputs

HART

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered .					

Modbus RS485

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (B)	27 (A)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered .					

Terminal assignment of the remote display and operating module → 27.

Available device plugs

Device plugs may not be used in hazardous areas!

Device plug for connecting to the service interface:
Order code for "Accessory mounted"
Option **NB**, RJ45 M12 adapter (service interface) → 33

Order code for "Accessory mounted", option NB "Adapter RJ45 M12 (service interface)"

Order code "Accessory mounted"	Cable entry/coupling → 27	
	Cable entry 2	Cable entry 3
NB	Plug M12 × 1	–

Supply voltage

Order code "Power supply"	Terminal voltage		Frequency range
Option **I**	DC 24 V	±20%	–
	AC 100 to 240 V	–15…+10%	50/60 Hz

Power consumption

Transmitter

Max. 10 W (active power)

switch-on current	Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21

Current consumption

Transmitter

- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)

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 pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

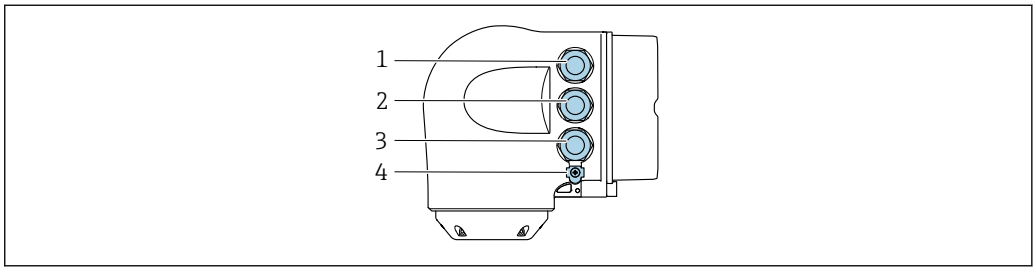
Overcurrent protection element

The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own.
- The circuit breaker must be easy to reach and labeled accordingly.
- Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.

Electrical connection

Transmitter connection

- Terminal assignment→ 26
- Device plugs available→ 26



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1 *Terminal connection for supply voltage*
2 *Terminal connection for signal transmission, input/output*
3 *Terminal connection for signal transmission, input/output or terminal for network connection via service interface (CDI-RJ45); Optional: terminal connection for external WLAN antenna or connection for remote display and operating module DKX001*
4 *Terminal connection for potential equalization (PE)*

An adapter for the RJ45 to the M12 plug is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

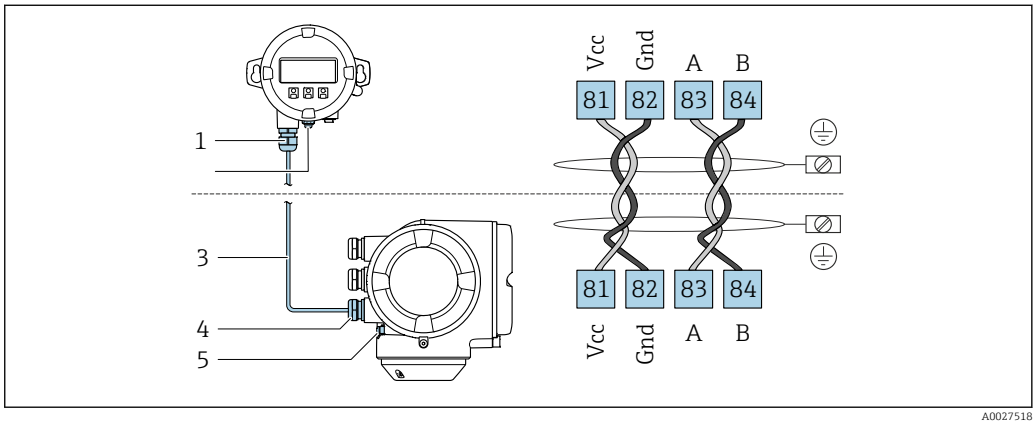
The adapter connects the service interface (CDI-RJ45) to an M12 plug mounted in the cable entry. The connection to the service interface can therefore be established via an M12 plug without opening the device.

Network connection via service interface (CDI-RJ45) → 63

Connecting the remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra → 71.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



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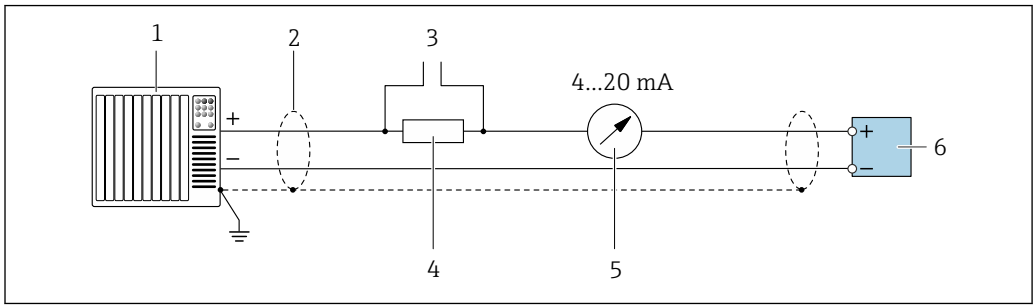
1 *Remote display and operating module DKX001*
2 *Terminal connection for potential equalization (PE)*
3 *Connecting cable*
4 *Measuring device*
5 *Terminal connection for potential equalization (PE)*

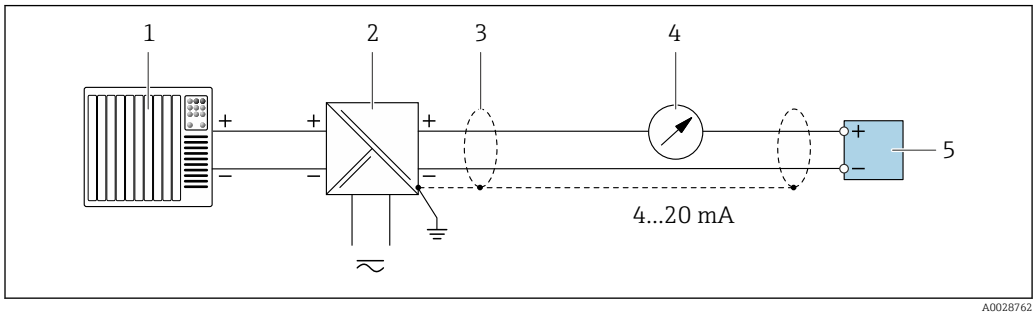
Connection examples

Current output 4 to 20 mA HART



2 *Connection example for 4 to 20 mA HART current output (active)*

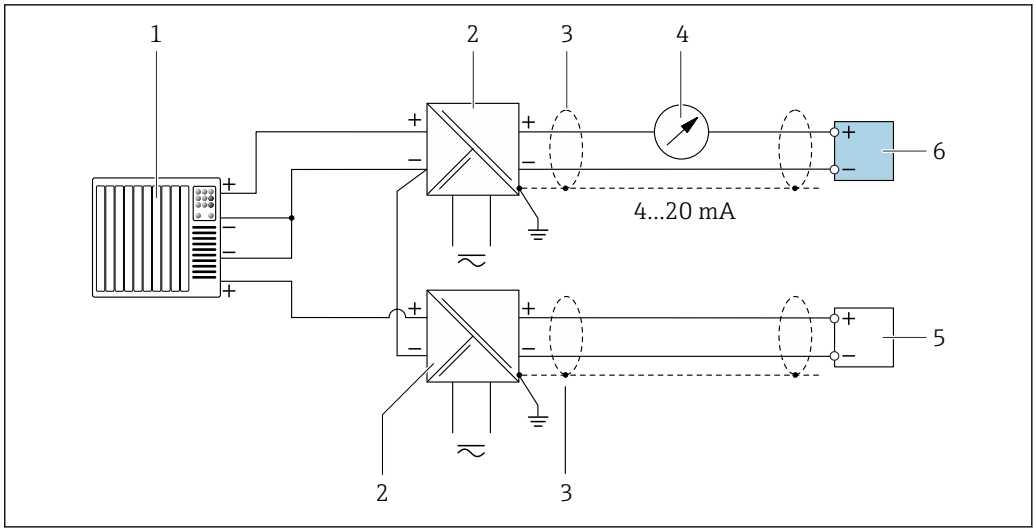
1 *Automation system with current input (e.g. PLC)*
2 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 33*
3 *Connection for HART operating devices → 61*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 16*
5 *Analog display unit: observe maximum load → 16*
6 *Transmitter*



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

1 *Automation system with current input (e.g. PLC)*
2 *Power supply*
3 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 33*
4 *Analog display unit: observe maximum load → 16*
5 *Transmitter*

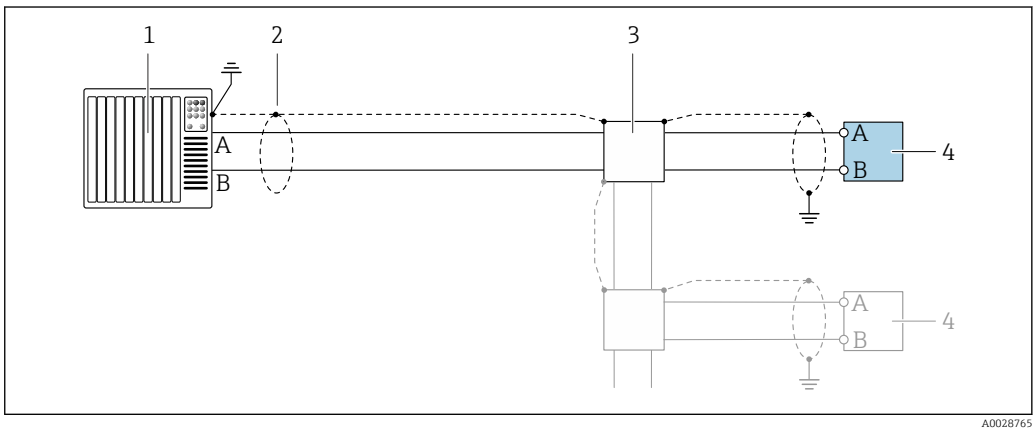
HART input



4 Connection example for HART input with a common negative (passive)

1 *Automation system with HART output (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)*
3 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load → 16*
5 *Pressure measuring device (e.g. Cerabar M, Cerabar S): observe requirements*
6 *Transmitter*

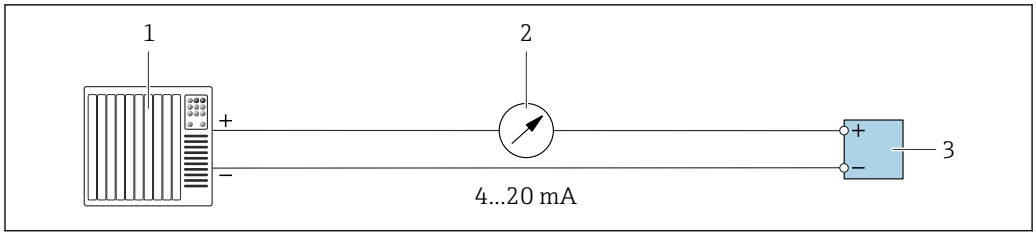
Modbus RS485



5 Connection example for Modbus RS485, non-hazardous area and Zone 2; Class I, Division 2

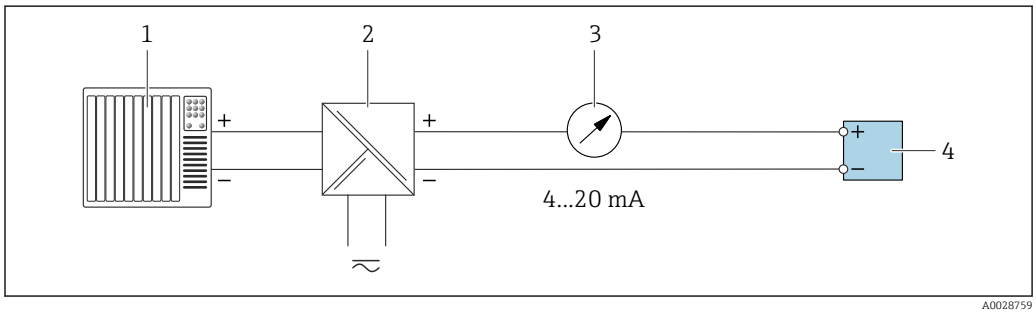
1 *Control system (e.g. PLC)*
2 *Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Distribution box*
4 *Transmitter*

Current output 4-20 mA



6 Connection example for 4-20 mA current output (active)

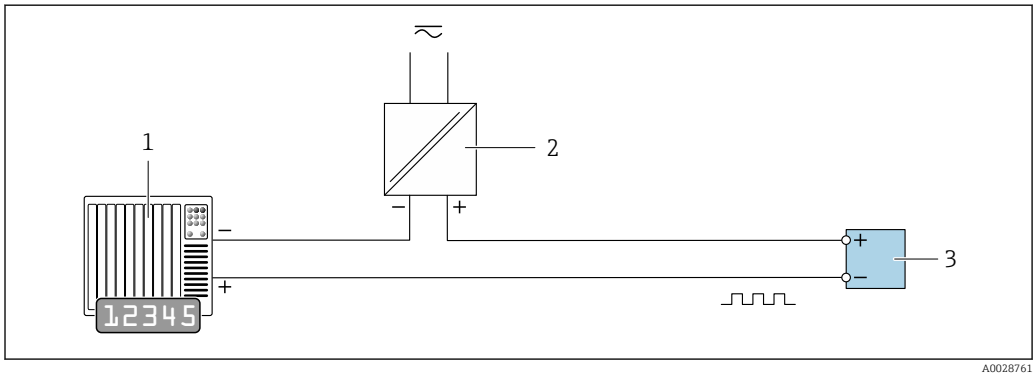
1 Automation system with current input (e.g. PLC)
2 Analog display unit: observe maximum load → 16
3 Transmitter



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

1 Automation system with current input (e.g. PLC)
2 Active barrier for power supply (e.g. RN221N)
3 Analog display unit: observe maximum load → 16
4 Transmitter

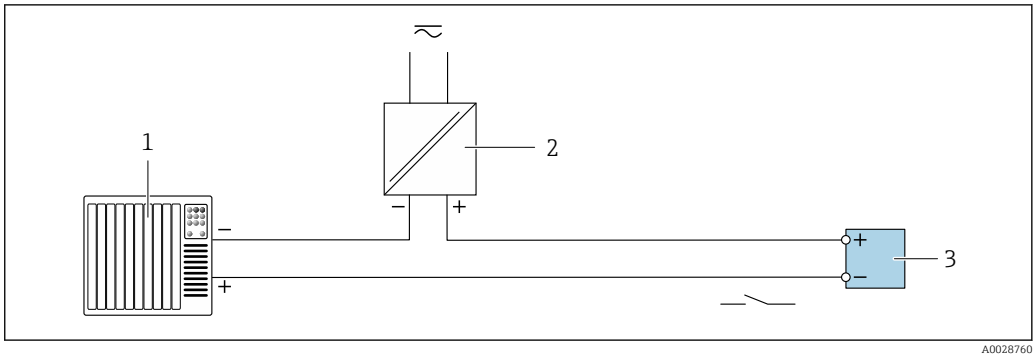
Pulse/frequency output



8 Connection example for pulse/frequency output (passive)

1 Automation system with pulse/frequency input (e.g. PLC with 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 19

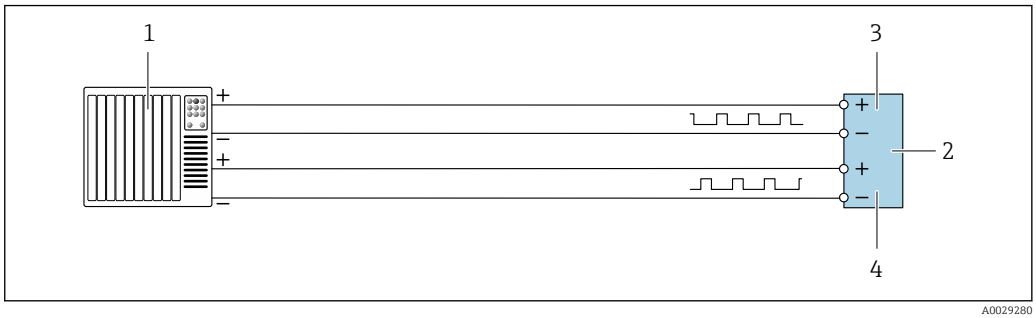
Switch output



9 Connection example for switch output (passive)

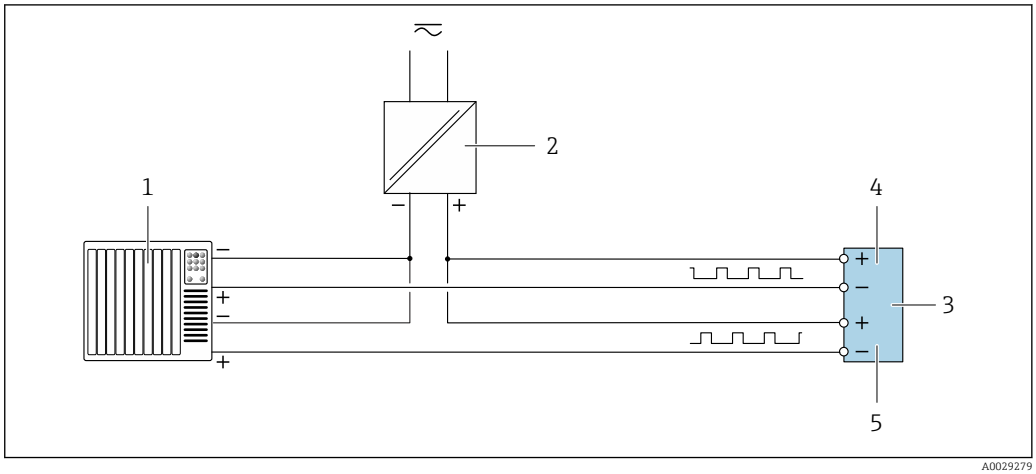
1 Automation system with switch input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 19

Double pulse output



10 Connection example for double pulse output (active)

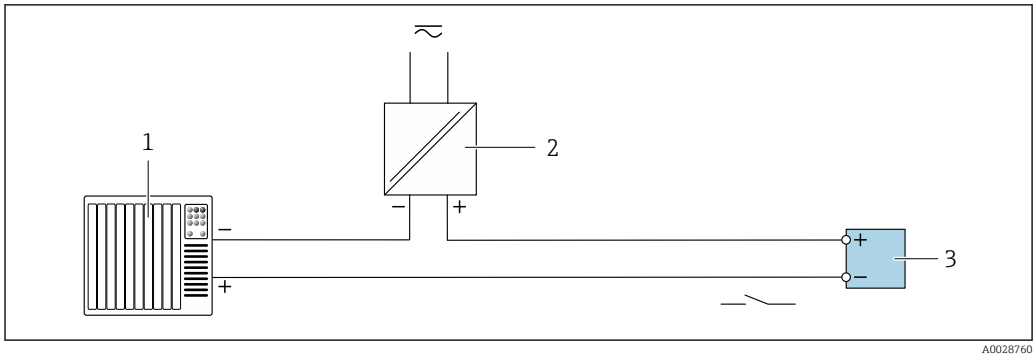
1 Automation system with double pulse input (e.g. PLC)
2 Transmitter: observe input values → 20
3 Double pulse output
4 Double pulse output (slave), phase-shifted



11 Connection example for double pulse output (passive)

1 Automation system with double pulse input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 20
4 Double pulse output
5 Double pulse output (slave), phase-shifted

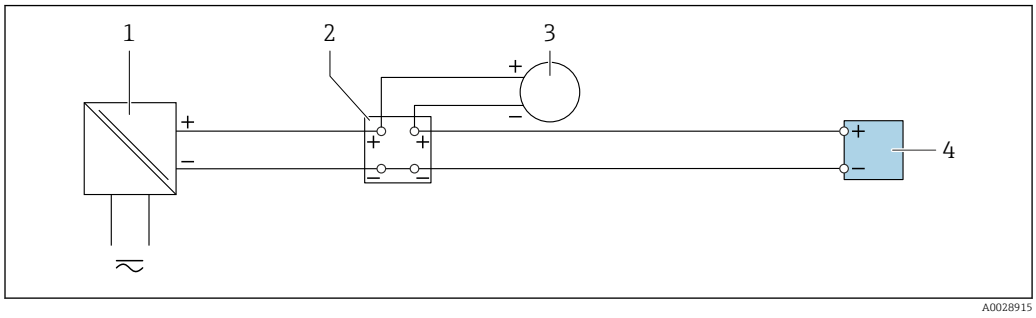
Relay output



12 Connection example for relay output (passive)

1 Automation system with relay input (e.g. PLC)
2 Power supply
3 Transmitter: observe input values → 20

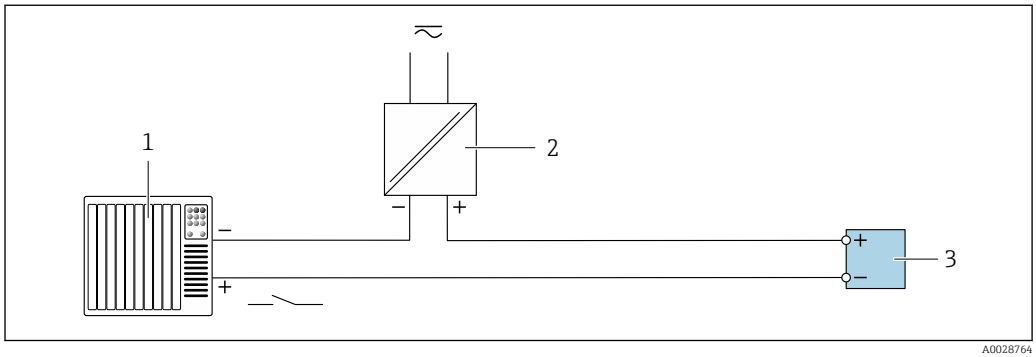
Current input



13 Connection example for 4 to 20 mA current input

1 Power supply
2 Terminal box
3 External measuring device (to read in pressure or temperature, for instance)
4 Transmitter

Status input



14 Connection example for status input

1 Automation system with status output (e.g. PLC)
2 Power supply
3 Transmitter

Potential equalization

Requirements

For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Medium, Connect the sensor and transmitter to the same electric potential [1)]
- Use a ground cable with a minimum cross-section of 6 mm² (10 AWG) and a cable lug for potential equalization connections

Terminals

Spring-loaded terminals: Suitable for strands and strands with ferrules.
Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG).

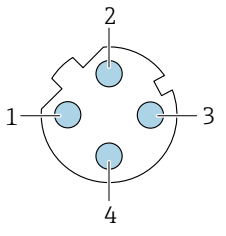
Cable entries

- Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½"
  - M20

Pin assignment, device plug

Service interface for

Order code for "Accessories mounted", option **NB**: Adapter RJ45 M12 (service interface)



Pin		Assignment
1	+	Tx
2	+	Rx
3	-	Tx
4	-	Rx
Coding		**Plug/socket**
D		Socket

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

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.

Power supply cable (incl. conductor for the inner ground terminal)

Standard installation cable is sufficient.

Protective grounding cable for the outer ground terminal

Conductor cross-section < 2.1 mm² (14 AWG)

The use of a cable lug enables the connection of larger cross-sections.

The grounding impedance must be less than 2 Ω.

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe grounding concept of the plant.

Modbus RS485

The EIA/TIA-485 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

1)

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm² (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Current output 0/4 to 20 mA

Standard installation cable is sufficient

Pulse /frequency /switch output

Standard installation cable is sufficient

Double pulse output

Standard installation cable is sufficient

Relay output

Standard installation cable is sufficient.

Current input 0/4 to 20 mA

Standard installation cable is sufficient

Status input

Standard installation cable is sufficient

Connecting cable for transmitter - remote display and operating module DKX001

Standard cable

A standard cable can be used as the connecting cable.

Standard cable	4 cores (2 pairs); pair-stranded with common shield
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	Maximum 1 000 nF for Zone 1; Class I, Division 1
L/R	Maximum 24 µH/Ω for Zone 1; Class I, Division 1
Cable length	Maximum 300 m (1 000 ft), see the following table

Cross-section	**Cable length for use in:** ▪ **Non-hazardous area** ▪ **Hazardous area: Zone 2; Class I, Division 2** ▪ **Hazardous area: Zone 1; Class I, Division 1**
0.34 mm² (22 AWG)	80 m (270 ft)
0.50 mm² (20 AWG)	120 m (400 ft)
0.75 mm² (18 AWG)	180 m (600 ft)
1.00 mm² (17 AWG)	240 m (800 ft)
1.50 mm² (15 AWG)	300 m (1 000 ft)

Optionally available connecting cable

Standard cable	2 × 2 × 0.34 mm² (22 AWG) PVC cable [1] with common shield (2 pairs, pair-stranded)
Flame resistance	According to DIN EN 60332-1-2
Oil-resistance	According to DIN EN 60811-2-1
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	≤200 pF/m
L/R	≤24 µH/Ω
Available cable length	10 m (35 ft)
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 can impair the cable outer sheath. Protect the cable from direct sunshine where possible.

Overvoltage protection

Mains voltage fluctuations	→ 26
Overvoltage category	Overvoltage category II
Short-term, temporary overvoltage	Between cable and ground up to 1200 V, for max. 5 s
Long-term, temporary overvoltage	Between cable and ground up to 500 V

Performance characteristics

Reference operating conditions

- Maximum permissible error according to ISO/DIN 11631
- Calibration gas: dry air
- Accuracy information is based on accredited calibration rigs that are traced to ISO 17025.

Maximum measurement error

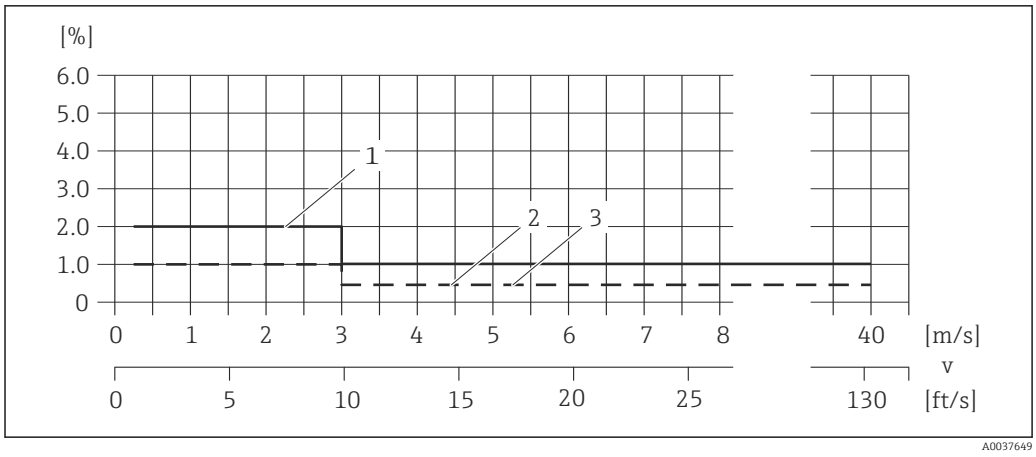
o.r. = of reading; o.f.s. = of full scale value; abs. = absolute; T = medium temperature

Volume flow

Standard Order code for "Flow calibration", option A "1%"	▪ ±1.0 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s) ▪ ±2.0 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)
Optional Order code for "Flow calibration", option C "0.50%"	▪ ±0.5 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s) ▪ ±1.0 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)
Optional Order code for "Flow calibration", option D "0.50%, traceable to ISO/IEC 17025"	▪ ±0.5 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s) ▪ ±1.0 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)

The measuring device may be operated for flow velocities 40 to 60 m/s (131.2 to 196.8 ft/s), but larger measurement errors may then occur.

The specification applies to Reynolds numbers Re ≥ 10 000. Larger measurement errors may occur for Reynolds numbers Re < 10 000.



15 Maximum measurement error (volume flow) in % of reading

1 Standard (order code for "Flow calibration", option A "1%")
2 Optional (order code for "Flow calibration", option C "0.50%")
3 Optional (order code for "Flow calibration", option D "0.50%, traceable to ISO/IEC 17025"

Corrected volume flow

Standard Order code for "Flow calibration", option A "1%"	▪ ±1.2 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s) ▪ ±2.1 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)
Optional Order code for "Flow calibration", option C "0.50%"	▪ ±0.8 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s) ▪ ±1.2 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)
Optional Order code for "Flow calibration", option D "0.50%, traceable to ISO/IEC 17025"	▪ ±0.8 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s) ▪ ±1.2 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)

The specification for corrected volume flow applies to the integrated temperature and pressure measurement (order code for "Measuring tube; Transducer; Sensor version", option AC "316L; Titanium Gr. 2; integrated pressure + temperature measurement"), when the pressure measuring cell is operated in the optimum pressure measurement range.

The measuring device may be operated for flow velocities 40 to 60 m/s (131.2 to 196.8 ft/s), but larger measurement errors may then occur.

The specification applies to Reynolds numbers Re ≥ 10 000. Larger measurement errors may occur for Reynolds numbers Re < 10 000.

Temperature

Optional (order code for "Measuring tube; Transducer; Sensor version", option AB "316L; Titanium Gr. 2; temperature measurement integrated" or AC "316L; titanium gr. 2; integrated pressure + temperature measurement")
±0.35 °C ± 0.002 · T °C (±0.63 °F ± 0.0011 · (T − 32) °F)

The additional measurement error caused by heat conduction is not taken into consideration here. The error caused by heat conduction can be reduced by using thermal insulation
→ 44.

Pressure

Optional (order code for "Measuring tube; Transducer; Sensor version", option AC "316L; Titanium Gr. 2; integrated pressure + temperature measurement")

The specific measurement errors refer to the position of the measurement in the measuring pipe and do not correspond to the pressure in the pipe connection line upstream or downstream from the measuring device.

Order code for "Pressure component"	Nominal value absolute [bar (psi)]	Pressure ranges and measurement errors	
		Pressure range, absolute [bar (psi)]	Measurement error, absolute
Option B "Pressure measuring cell 2bar/29psi abs"	2 bar (30 psi)	0.01 (0.1) ≤ p ≤ 0.4 (5.8) 0.4 (5.8) ≤ p ≤ 2 (29)	±0.5 % of 0.4 bar (5.8 psi) ±0.5 % o.r.
Option C "Pressure measuring cell 4bar/58psi abs"	4 bar (60 psi)	0.01 (0.1) ≤ p ≤ 0.8 (11.6) 0.8 (11.6) ≤ p ≤ 4 (58)	±0.5 % of 0.8 bar (11.6 psi) ±0.5 % o.r.
Option D "Pressure measuring cell 10bar/145psi abs"	10 bar (150 psi)	0.01 (0.1) ≤ p ≤ 2 (29) 2 (29) ≤ p ≤ 10 (145)	±0.5 % of 2 bar (29 psi) ±0.5 % o.r.
Option E "Pressure measuring cell 40bar/580psi abs"	40 bar (600 psi)	0.01 (0.1) ≤ p ≤ 8 (116) 8 (116) ≤ p ≤ 40 (580)	±0.5 % of 8 bar (116 psi) ±0.5 % o.r.
Option F "Pressure measuring cell 100bar/1450psi abs"	100 bar (1 500 psi)	0.01 (0.1) ≤ p ≤ 20 (290) 20 (290) ≤ p ≤ 100 (1 450)	±0.5 % of 20 bar (290 psi) ±0.5 % o.r.

Sound velocity

±0.2 % o.r.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ±50 ppm o.r. (over the entire ambient temperature range)

Repeatability

o.r. = of reading

Volume flow

- ±0.2 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s)
- ±0.4 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)

Corrected volume flow

- ±0.25 % o.r. for 3 to 40 m/s (9.84 to 131.2 ft/s)
- ±0.45 % o.r. for 0.3 to 3 m/s (0.98 to 9.84 ft/s)

Temperature

±0.175 °C ± 0.001 · T °C (±0.315 °F ± 0.00055 · (T − 32) °F)

Pressure

Optional (order code for "Measuring tube; Transducer; Sensor version", option AC "316L; Titanium Gr. 2; integrated pressure + temperature measurement")

Order code for "Pressure component"	Nominal value absolute [bar (psi)]	Pressure ranges and measurement errors	
		Pressure range, absolute [bar (psi)]	Measurement error, absolute
Option B "Pressure measuring cell 2bar/29psi abs"	2 bar (30 psi)	0.01 (0.1) ≤ p ≤ 0.4 (5.8) 0.4 (5.8) ≤ p ≤ 2 (29)	±0.1 % of 0.4 bar (5.8 psi) ±0.1 % o.r.
Option C "Pressure measuring cell 4bar/58psi abs"	4 bar (60 psi)	0.01 (0.1) ≤ p ≤ 0.8 (11.6) 0.8 (11.6) ≤ p ≤ 4 (58)	±0.1 % of 0.8 bar (11.6 psi) ±0.1 % o.r.

Order code for "Pressure component"	Nominal value absolute [bar (psi)]	Pressure ranges and measurement errors	
		Pressure range, absolute [bar (psi)]	Measurement error, absolute
Option D "Pressure measuring cell 10bar/145psi abs"	10 bar (150 psi)	0.01 (0.1) ≤ p ≤ 2 (29) 2 (29) ≤ p ≤ 10 (145)	±0.1 % of 2 bar (29 psi) ±0.1 % o.r.
Option E "Pressure measuring cell 40bar/580psi abs"	40 bar (600 psi)	0.01 (0.1) ≤ p ≤ 8 (116) 8 (116) ≤ p ≤ 40 (580)	±0.1 % of 8 bar (116 psi) ±0.1 % o.r.
Option F "Pressure measuring cell 100bar/1450psi abs"	100 bar (1 500 psi)	0.01 (0.1) ≤ p ≤ 20 (290) 20 (290) ≤ p ≤ 100 (1 450)	±0.1 % of 20 bar (290 psi) ±0.1 % o.r.

Sound velocity

±0.04 % o.r.

Influence of ambient temperature

Current output

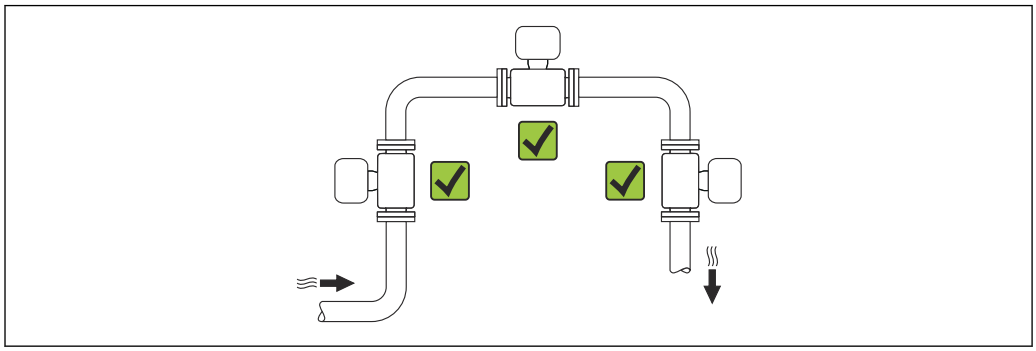
Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

Mounting procedure

Mounting location

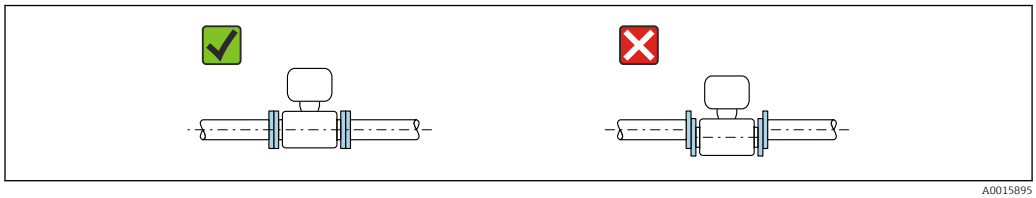


A0015543

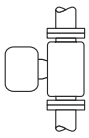
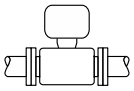
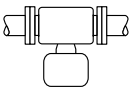
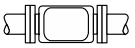
Orientation

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

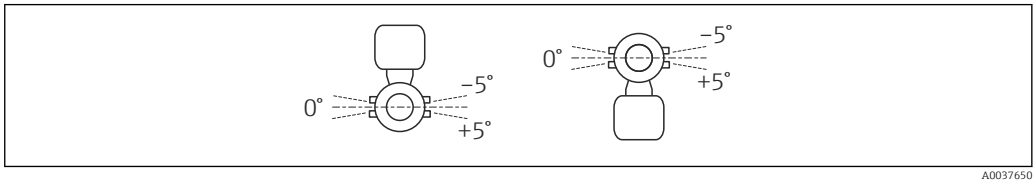
- Install the measuring device in a parallel plane free of external mechanical stress.
- The internal diameter of the pipe must match the internal diameter of the sensor .



A0015895

Orientation			Compact version
A	Vertical orientation	 A0015545	✓✓
B	Horizontal orientation, transmitter head up [1]	 A0015589	✓✓
C	Horizontal orientation, transmitter head down [1]	 A0015590	✓
D	Horizontal orientation, transmitter head at side	 A0015592	✗

1) The horizontal alignment of the transducers may only deviate by a maximum of ±5° , particularly if a liquid is present in the medium (wet gas).

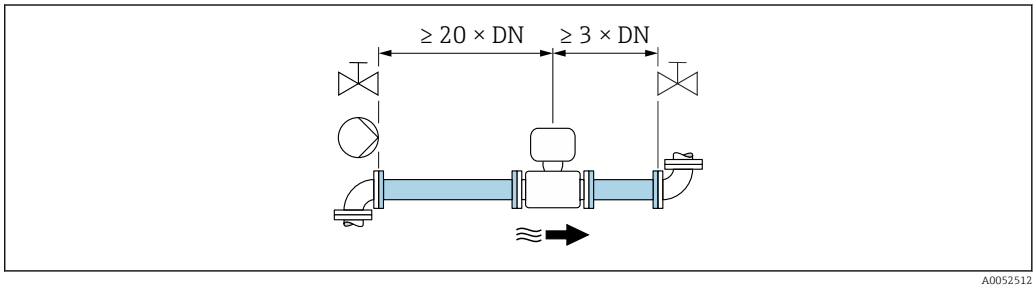


A0037650

Inlet and outlet runs

If possible, install the sensors upstream of assemblies such as valves, T-pieces, elbows, and pumps. If this is not possible, the specified measurement accuracy of the measuring device is achieved by observing the specified minimum inlet and outlet runs with optimum sensor configuration.

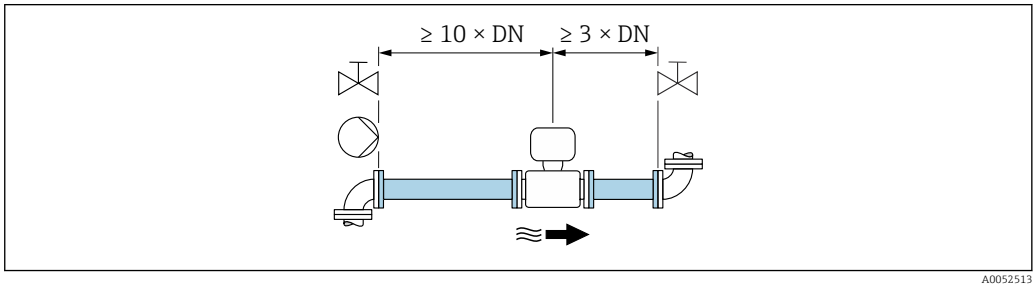
Single-path version: DN 25 (1")



A0052512

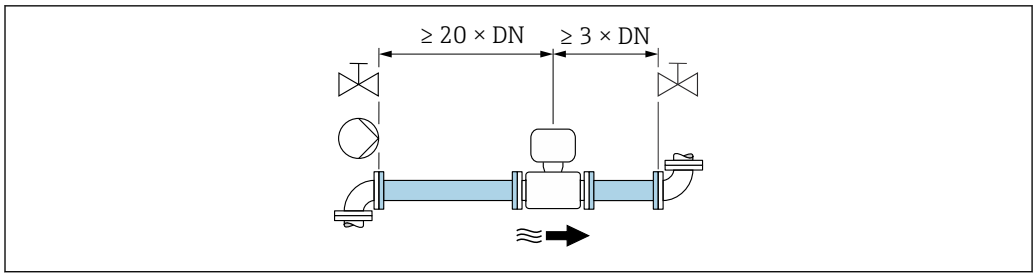
16 *Single-path version: Minimum inlet and outlet runs with various flow obstructions. For order code for "Flow calibration", option A "1 %".*

Two-path version: DN 50 to 300 (2 to 12")



A0052513

17 *Two-path version: minimum inlet and outlet runs with various flow obstructions For order code for "Flow calibration", option A "1 %".*



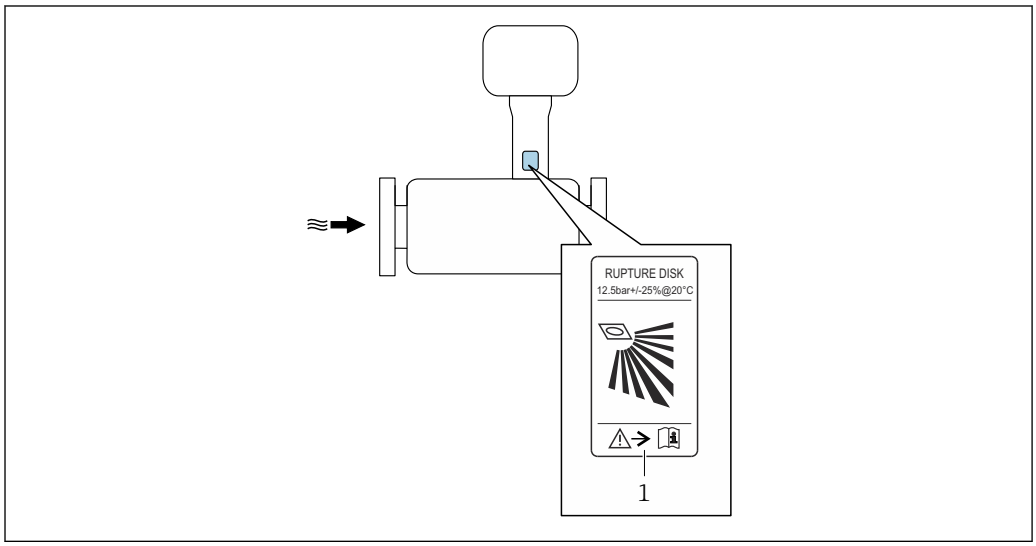
18 *Two-path version: minimum inlet and outlet runs with various flow obstructions For order code for "Flow calibration", option C "0.50%" and option D "0.50%, traceable to ISO/IEC17025".*

Special mounting instructions

Rupture disk

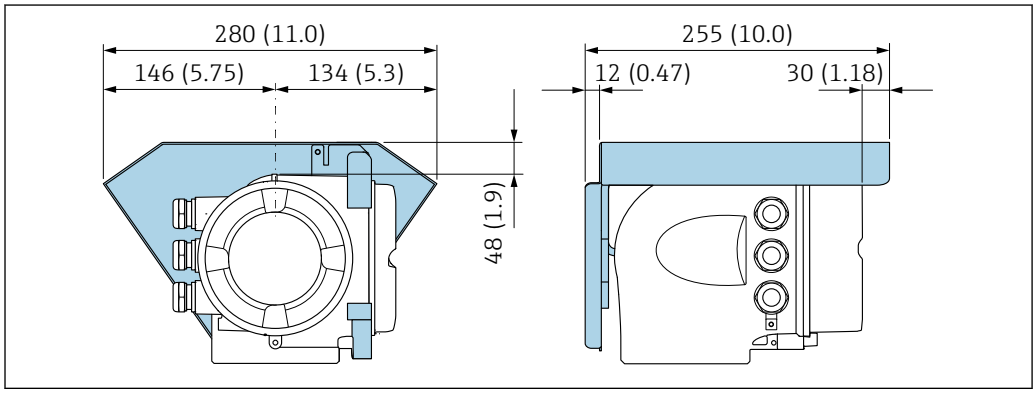
Process-related information: → 43.

The position of the rupture disk is indicated on a sticker applied over it. If the rupture disk is triggered, the sticker is destroyed. The disk can therefore be visually monitored.



1 *Rupture disk label*

Weather protection cover



19 *Engineering unit mm (in)*

Environment

Ambient temperature range

Measuring device	▪ Standard:−40 to +60 °C (−40 to +140 °F) ▪ Optional order code for "Test, certificate", option JP: −50 to +60 °C (−58 to +140 °F)
Readability of the local display	−20 to +60 °C (−4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.

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

You can order a weather protection cover from Endress+Hauser. → 71.

Storage temperature

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

Display modules

−40 to +80 °C (−40 to +176 °F)

Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 4 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)

Degree of protection

Transmitter

▪ 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

Optional

External WLAN antenna

IP67

Shock and vibration resistance

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

▪ 2 to 8.4 Hz, 3.5 mm peak
▪ 8.4 to 2 000 Hz, 1 g peak

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

▪ 10 to 200 Hz, 0.003 g^2/Hz
▪ 200 to 2 000 Hz, 0.001 g^2/Hz
▪ Total: 1.54 g rms

Shock half-sine, according to IEC 60068-2-27

6 ms 30 g

Rough handling shocks according to IEC 60068-2-31

Electromagnetic compatibility (EMC)

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

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

Sensor
- Without integrated pressure measuring cell: −50 to +150 °C (−58 to +302 °F)
- With integrated pressure measuring cell: −50 to +100 °C (−58 to +212 °F)

Sound velocity range

200 to 600 m/s (656 to 1 969 ft/s)

Medium pressure range

Min. medium pressure: 0.7 bar (10.2 psi) absolute

The maximum permitted medium pressure is defined by the pressure/temperature curves (→ 🖹 42) and the pressure specifications of the integrated pressure measuring cell (optional; order code for "Measuring tube; transducer; sensor version", option AC "316L; Titanium Gr. 2; pressure + temperature measurement integrated").

⚠ WARNING

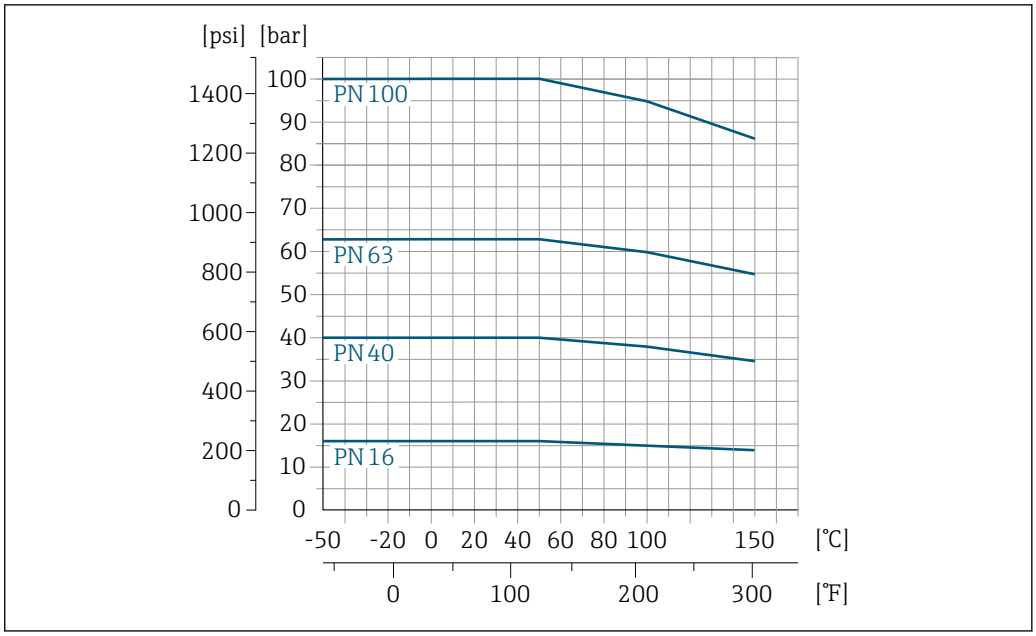
The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.
- ▶ Note specifications regarding the pressure range of the pressure measuring cell.
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the pressure measuring cell.
- ▶ The MWP for the pressure measuring cell depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the pressure measuring cell. Also take the pressure/temperature dependency into consideration.
- ▶ The MWP may be applied at the device for an unlimited period. 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 pressure measuring cell for an unlimited time.
- ▶ The OPL (over pressure limit = sensor overload limit) for the measuring device 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 pressure measuring cell. Also take the pressure/temperature dependency into consideration.
- ▶ The test pressure corresponds to the over pressure limit of the pressure measuring cell and may be applied only temporarily to ensure that the measurement is within the specifications and no permanent damage occurs.

Pressure measuring cell	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/temperature ratings

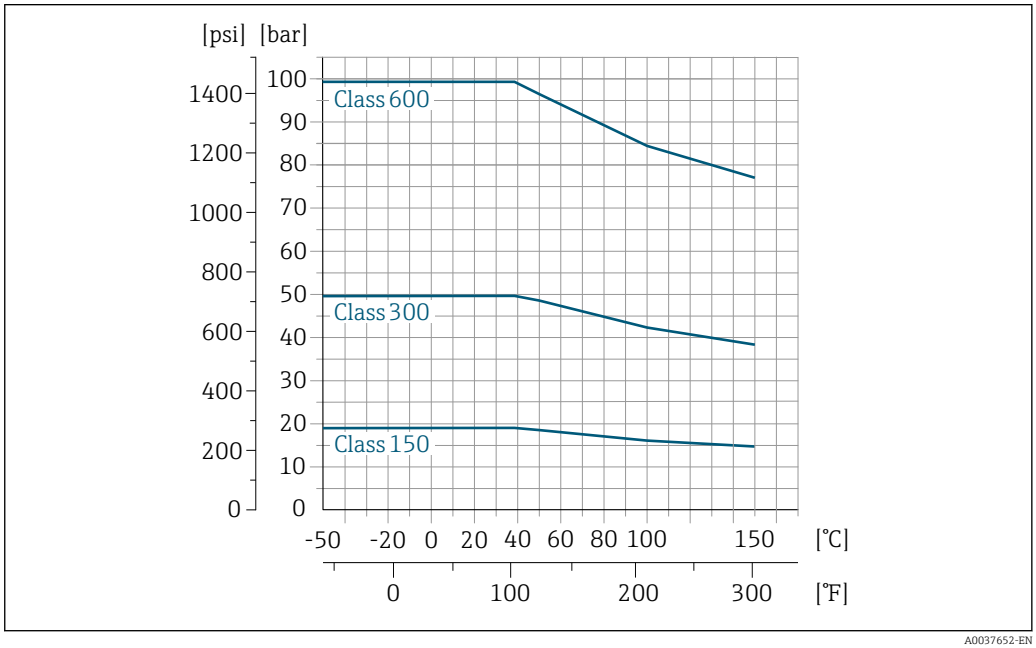
The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.

Welding neck flange according to DIN EN 1092-1, PN 16/40/63/100



20 With flange material 1.4404 (316, 316L)

Welding neck flange according to ASME B16.5 [2], Class 150/300/600



21 With flange material 1.4404 (316, 316L)

Rupture disk

The neck of the measuring device is always fitted with a rupture disk with a triggering pressure of 10 to 15 bar (145 to 217.5 psi). The rupture disk is used for leak detection and for the controlled release of pressure in the neck of the measuring device. The measuring device with an installed rupture disk meets the dual seal requirements of ANSI/ISA-12.27.01.

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.

For an overview of the full scale values for the measuring range, see the "Measuring range" section → 11

2) Material group 2.2

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value.
- In most applications, 10 to 50 % of the maximum full scale value can be considered ideal.

Pressure loss

No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.

Thermal insulation

For optimum measurement performance, make sure that no heat transfer (heat loss or heat supply) can take place at the sensor. This can be ensured by installing thermal insulation. The formation of condensation in the measuring device can also be limited in this way.

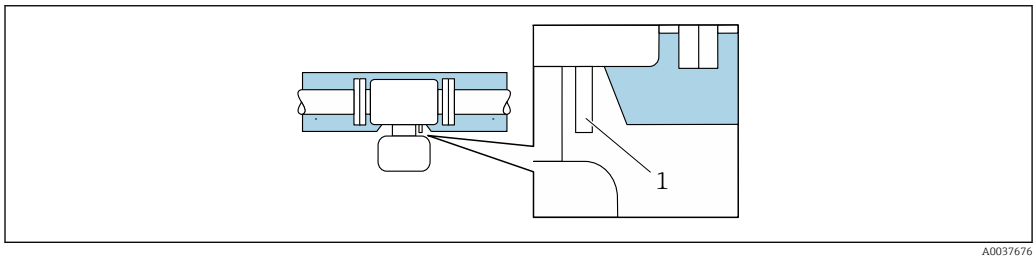
Thermal insulation is particularly recommended in situations in which the difference between the process temperature and ambient temperature is large. This difference leads to an error during temperature measurement that is caused by heat conduction (known as the "heat conduction error").

⚠ WARNING

Electronics overheating on account of thermal insulation!

- ▶ Recommended orientation: horizontal orientation, transmitter housing pointing downwards.
- ▶ Do not insulate the transmitter housing .
- ▶ Maximum permissible temperature at the lower end of the transmitter housing: 80 °C (176 °F)
- ▶ Thermal insulation with extended neck free: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.

The thermal insulation should never cover the transmitter housing and the pressure measuring cell.



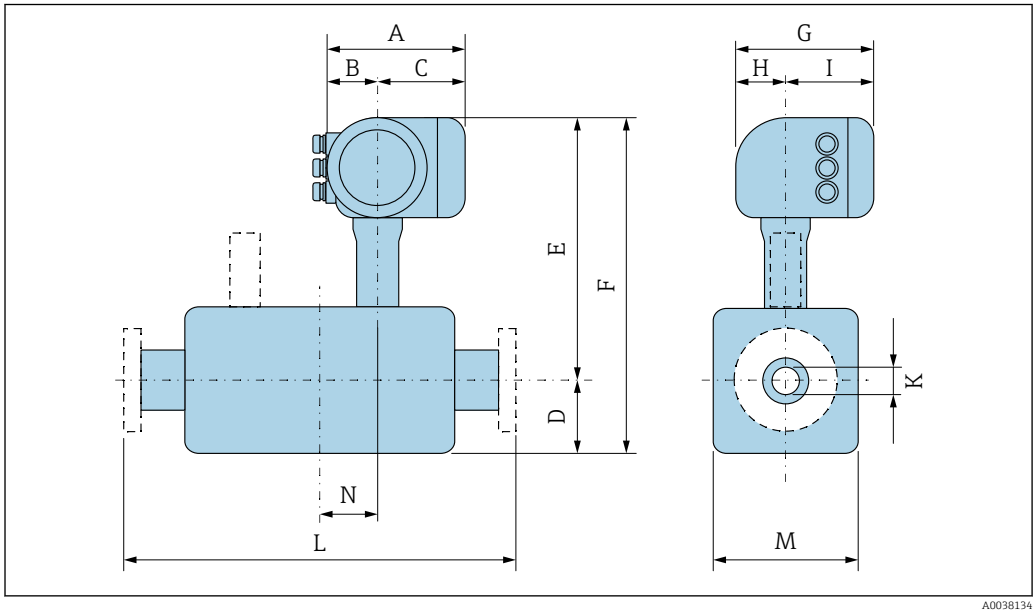
22 Thermal insulation with free extended neck and pressure measuring cell

1 Pressure measuring cell

Mechanical Construction

Dimensions in SI units

Compact version



Order code for "Housing", option A "Aluminum, coated"

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [2] [mm]	H [mm]	I [2] [mm]	K [mm]	L [mm]	M [mm]	N [mm]
25	169	68	101	20	387	407	200	59	141	24.3	[3]	143	47
50	169	68	101	32	400	432	200	59	141	49.2	[3]	225	63
80	169	68	101	44	412	456	200	59	141	73.7	[3]	245	55
100	169	68	101	57	421	478	200	59	141	97.2	[3]	265	72
150	169	68	101	84	447	531	200	59	141	146.3	[3]	308	62
200	169	68	101	110	473	583	200	59	141	193.7	[3]	349	78
250	169	68	101	138	500	638	200	59	141	242.9	[3]	390	84
300	169	68	101	163	526	689	200	59	141	288.9	[3]	430	96

1) Depending on the cable gland used: values up to + 30 mm
2) For version without local display: values - 30 mm
3) Depending on the process connection → 🖹 46

Order code for "Housing", option A "Aluminum, coated"; Ex d

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [2] [mm]	H [mm]	I [2] [mm]	K [mm]	L [mm]	M [mm]	N [mm]
25	188	85	103	20	387	407	206	58	159	24.3	[3]	143	47
50	188	85	103	32	400	432	206	58	159	49.2	[3]	225	63
80	188	85	103	44	412	456	206	58	159	73.7	[3]	245	55
100	188	85	103	57	421	478	206	58	159	97.2	[3]	265	72
150	188	85	103	84	447	531	206	58	159	146.3	[3]	308	62
200	188	85	103	110	473	583	206	58	159	193.7	[3]	349	78
250	188	85	103	138	500	638	206	58	159	242.9	[3]	390	84
300	188	85	103	163	526	689	206	58	159	288.9	[3]	430	96

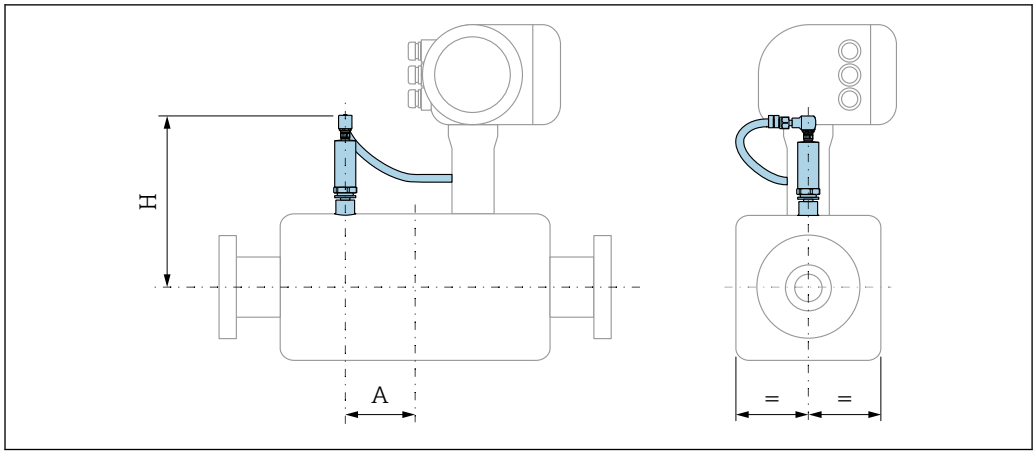
1) Depending on the cable gland used: values up to + 30 mm
2) For version without local display: values - 40 mm
3) Depending on the process connection → 🖹 46

Order code for "Housing", option L "Cast, stainless"

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	L [mm]	M [mm]	N [mm]
25	186	85	101	20	387	407	221	63	158	24.3	[2]	143	47
50	186	85	101	32	400	432	221	63	158	49.2	[2]	225	63
80	186	85	101	44	412	456	221	63	158	73.7	[2]	245	55
100	186	85	101	57	421	478	221	63	158	97.2	[2]	265	72
150	186	85	101	84	447	531	221	63	158	146.3	[2]	308	62
200	186	85	101	110	473	583	221	63	158	193.7	[2]	349	78
250	186	85	101	138	500	638	221	63	158	242.9	[2]	390	84
300	186	85	101	163	526	689	221	63	158	288.9	[2]	430	96

1) Depending on the cable gland used: values up to + 30 mm
2) Depending on the process connection → 🖹 46

Pressure measuring cell



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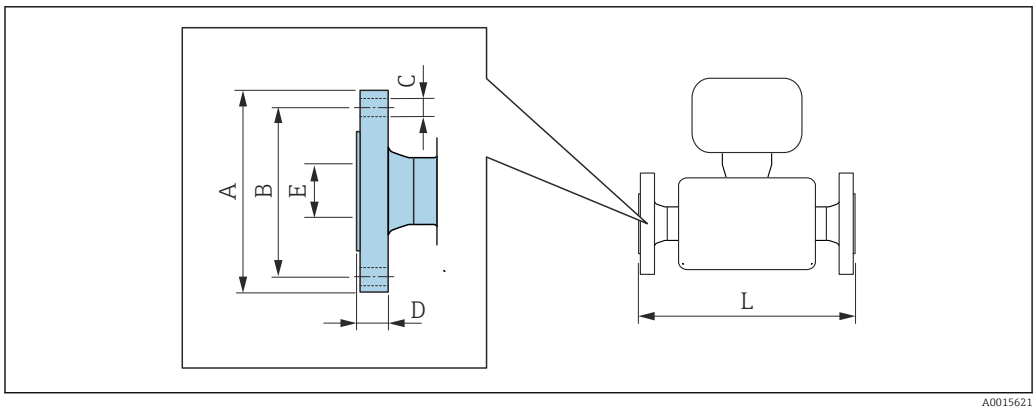
Order code for "Pressure component": options B/C/D/E/F "Pressure measuring cell 2/4/10/40/100 bar absolute"		
DN [mm]	**A [mm]**	**H [mm]**
25	61	172
50	76	187
80	96	201
100	85	213
150	74	240
200	87	269
250	102	299
300	110	326

Flange connections

Welding neck flange EN 1092-1-B1, ASME B16.5



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Length tolerance for dimension L in mm:
- DN 25 to 150: +0 / −3
- DN 200 to 300: +1 / −2

Flange according to EN 1092-1-B1: PN 16
1.4404 (316, 316L): *Order code for "Process connection", option* **D1S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	–	–	–	–	–	–
50	–	–	–	–	–	–
80	–	–	–	–	–	–
100	220	180	8 × Ø18	20	107.1	400
150	285	240	8 × Ø22	22	159.3	400
200	340	295	12 × Ø22	24	206.5	400
250	405	355	12 × Ø26	26	260.5	450
300	460	410	12 × Ø26	28	309.7	500
Surface roughness (flange): EN 1092-1-B1, Ra 3.2 to 12.5 µm						

Flange according to EN 1092-1-B1: PN 40
1.4404 (316, 316L): *Order code for "Process connection", option* **D2S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	115	85	4 × Ø14	18	28.5	300
50	165	125	4 × Ø18	20	54.5	350
80	200	160	8 × Ø18	24	82.5	400
100	235	190	8 × Ø22	24	107.1	400
150	300	250	8 × Ø26	28	159.3	400
200	375	320	12 × Ø30	34	206.5	452
250	450	385	12 × Ø33	38	258.9	520
300	515	450	16 × Ø33	42	307.9	574
Surface roughness (flange): EN 1092-1-B1, Ra 3.2 to 12.5 µm						

Flange according to EN 1092-1-B1: PN 63
1.4404 (316, 316L): *Order code for "Process connection", option* **D3W**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	–	–	–	–	–	–
50	180	135	4 × Ø22	26	54.5	372
80	215	170	8 × Ø22	28	81.7	430
100	250	200	8 × Ø26	30	106.3	420
150	345	280	8 × Ø33	36	157.1	434
200	415	345	12 × Ø36	42	204.9	496
250	470	400	12 × Ø36	46	255.5	560
300	530	460	16 × Ø36	52	301.9	624
Surface roughness (flange): EN 1092-1-B1, Ra 3.2 to 12.5 µm						

Flange according to EN 1092-1-B1: PN 100
1.4404 (316, 316L): *Order code for "Process connection", option* **D4W**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	140	100	4 × Ø18	24	28.5	330
50	195	145	4 × Ø26	28	53.9	384
80	230	180	8 × Ø26	32	80.9	442
100	265	210	8 × Ø30	36	104.3	444
150	355	290	12 × Ø33	44	154.2	474
200	430	360	12 × Ø36	52	199.1	536
250	505	430	12 × Ø39	60	248.1	624
300	585	500	16 × Ø42	68	295.5	684

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

Flange according to ASME B16.5: Class 150 RF Schedule 40
1.4404 (316, 316L): *Order code for "Process connection", option* **AAS**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	108	79.2	4 × Ø15.7	14.2	26.7	300
50	152.4	120.7	4 × Ø19.1	19.1	52.6	350
80	190.5	152.4	4 × Ø19.1	23.9	78	400
100	228.6	190.5	8 × Ø19.1	24.5	102.4	400
150	279.4	241.3	8 × Ø22.4	25.4	154.2	400
200	345	298.5	8 × Ø22.3	29	202.7	478
250	405	362	12 × Ø25.4	30.6	254.6	512
300	485	431.8	12 × Ø25.4	32.2	303.1	570

Surface roughness (flange): Ra 3.2 to 6.3 µm

Flange according to ASME B16.5: Class 300 RF Schedule 40
1.4404 (316, 316L): *Order code for "Process connection", option* **ABS**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	124	88.9	4 × Ø19.1	17.5	26.7	300
50	165.1	127	8 × Ø19.1	22.4	52.6	350
80	209.6	168.1	8 × Ø22.4	28.4	78	400
100	254	200.2	8 × Ø22.4	31.8	102.4	400
150	317.5	269.7	12 × Ø22.4	36.6	154.2	400
200	380	330.2	12 × Ø25.4	41.7	202.7	498
250	445	387.4	16 × Ø28.6	48.1	254.6	544
300	520	450.8	16 × Ø31.8	51.3	303.1	602

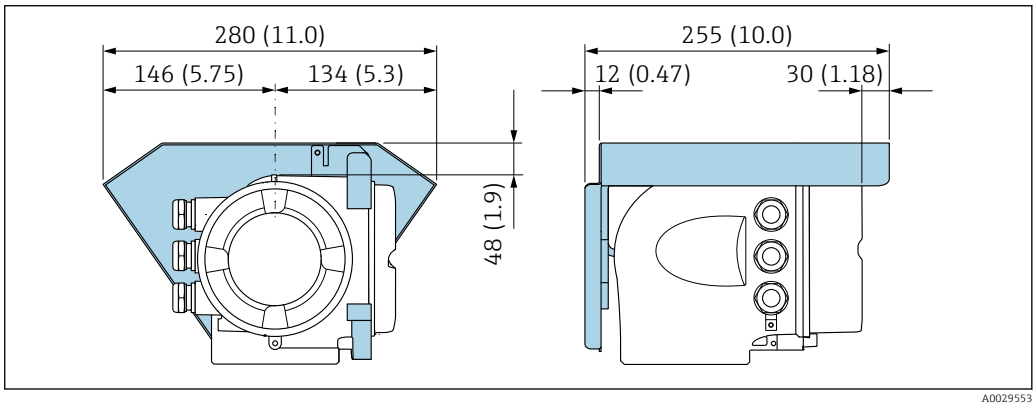
Surface roughness (flange): Ra 3.2 to 6.3 µm

Flange according to ASME B16.5: Class 300 RF Schedule 80 **1.4404 (316, 316L):** *Order code for "Process connection", option* **AGS**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
25	124	88.9	4 × Ø19.1	17.5	24.3	300
50	165.1	127	8 × Ø19.1	22.4	49.2	350
80	209.6	168.1	8 × Ø22.4	28.4	73.7	400
100	254	200.2	8 × Ø22.4	31.8	97	400
150	317.5	269.7	12 × Ø22.4	36.6	146.3	400
200	380	330.2	12 × Ø25.4	41.7	193.7	498
250	445	387.4	16 × Ø28.6	48.1	242.8	544
300	520	450.8	16 × Ø31.8	51.3	288.9	602
Surface roughness (flange): Ra 3.2 to 6.3 µm						

Flange according to ASME B16.5: Class 600 RF Schedule 80 **1.4404 (316, 316L):** *Order code for "Process connection", option* **ACS**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
25	124	88.9	4 × Ø19.1	24.5	24.3	352
50	165	127	8 × Ø19.1	32.4	49.2	408
80	210	168.3	8 × Ø22.2	38.8	73.7	466
100	275	215.9	8 × Ø25.4	45.1	97	482
150	355	292.1	12 × Ø28.6	54.7	146.3	492
200	420	349.2	12 × Ø31.8	62.6	193.7	554
250	510	431.8	16 × Ø35.0	70.5	242.8	626
300	560	489	20 × Ø35.0	73.7	288.9	666
Surface roughness (flange): Ra 3.2 to 6.3 µm						

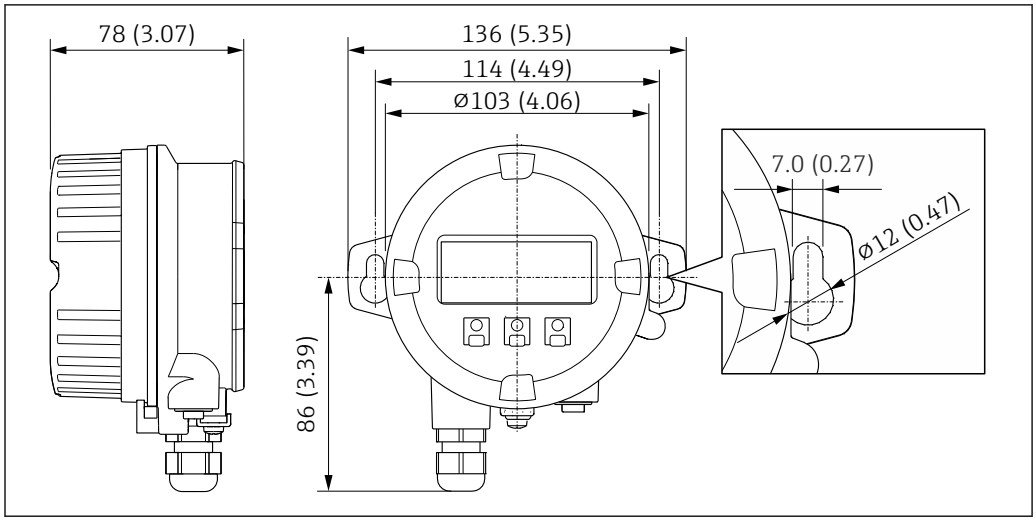
Accessories

Weather protection cover



23 Engineering unit mm (in)

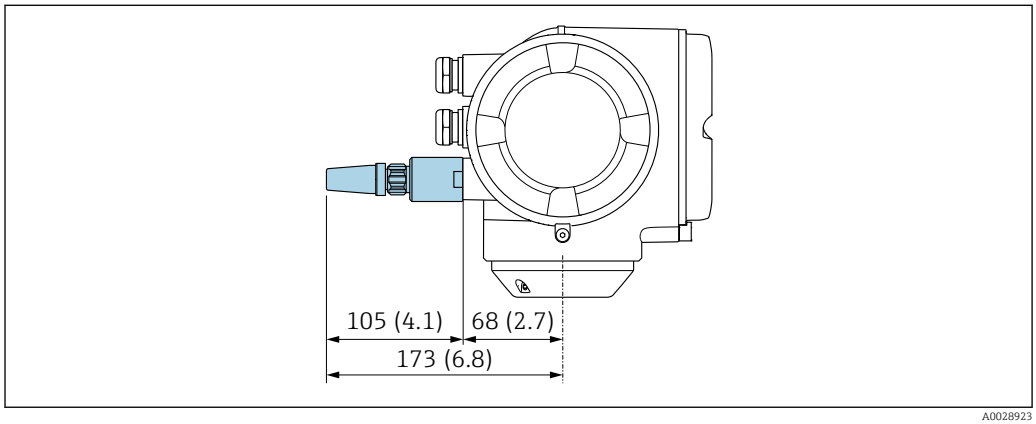
Remote display and operating module DKX001



24 Engineering unit mm (in)

External WLAN antenna

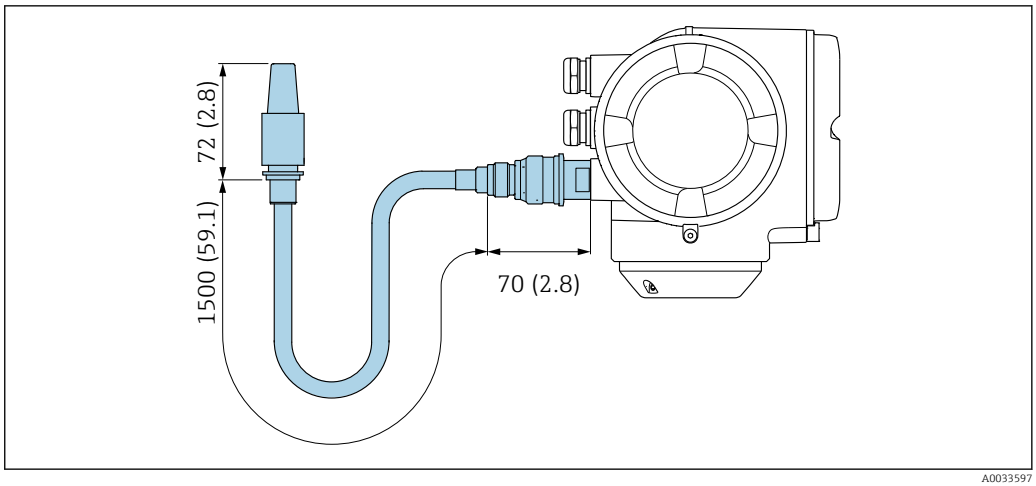
External WLAN antenna mounted on device



25 Engineering unit mm (in)

External WLAN antenna mounted with cable

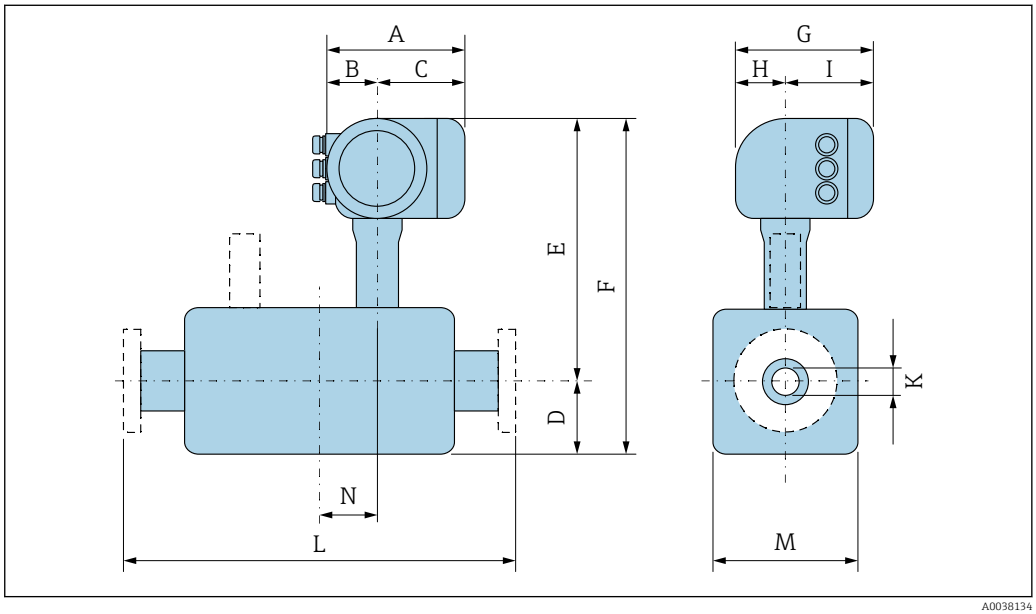
The external WLAN antenna can be mounted separately from the transmitter if the transmission/ reception conditions at the transmitter mounting location are poor.



26 *Engineering unit mm (in)*

Dimensions in US units

Compact version



Order code for "Housing", option A "Aluminum, coated"

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [2] [in]	H [in]	I [2] [in]	K [in]	L [in]	M [in]	N [in]
1	6.65	2.68	3.98	0.79	15.2	16.0	7.87	2.32	5.55	0.96	[3]	5.63	1.85
2	6.65	2.68	3.98	1.26	15.8	17.0	7.87	2.32	5.55	1.94	[3]	8.86	2.48
3	6.65	2.68	3.98	1.73	16.2	18.0	7.87	2.32	5.55	2.90	[3]	9.65	2.17
4	6.65	2.68	3.98	2.24	16.6	18.8	7.87	2.32	5.55	3.83	[3]	10.4	2.83
6	6.65	2.68	3.98	3.31	17.6	20.9	7.87	2.32	5.55	5.76	[3]	12.1	2.44
8	6.65	2.68	3.98	4.33	18.6	23.0	7.87	2.32	5.55	7.63	[3]	13.7	3.07
10	6.65	2.68	3.98	5.43	19.7	25.1	7.87	2.32	5.55	9.56	[3]	15.4	3.31
12	6.65	2.68	3.98	6.42	20.7	27.1	7.87	2.32	5.55	11.4	[3]	16.9	3.78

1) Depending on the cable gland used: values up to + 1.18 in
2) For version without local display: values - 1.18 in
3) Depending on the process connection → 53

Order code for "Housing", option A "Aluminum, coated"; Ex d

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [2] [in]	H [in]	I [2] [in]	K [in]	L [in]	M [in]	N [in]
1	7.40	3.35	4.06	0.79	15.2	16.0	8.11	2.28	6.26	0.96	[3]	5.63	1.85
2	7.40	3.35	4.06	1.26	15.8	17.0	8.11	2.28	6.26	1.94	[3]	8.86	2.48
3	7.40	3.35	4.06	1.73	16.2	18.0	8.11	2.28	6.26	2.90	[3]	9.65	2.17
4	7.40	3.35	4.06	2.24	16.6	18.8	8.11	2.28	6.26	3.83	[3]	10.4	2.83
6	7.40	3.35	4.06	3.31	17.6	20.9	8.11	2.28	6.26	5.76	[3]	12.1	2.44
8	7.40	3.35	4.06	4.33	18.6	23.0	8.11	2.28	6.26	7.63	[3]	13.7	3.07
10	7.40	3.35	4.06	5.43	19.7	25.1	8.11	2.28	6.26	9.56	[3]	15.4	3.31
12	7.40	3.35	4.06	6.42	20.7	27.1	8.11	2.28	6.26	11.4	[3]	16.9	3.78

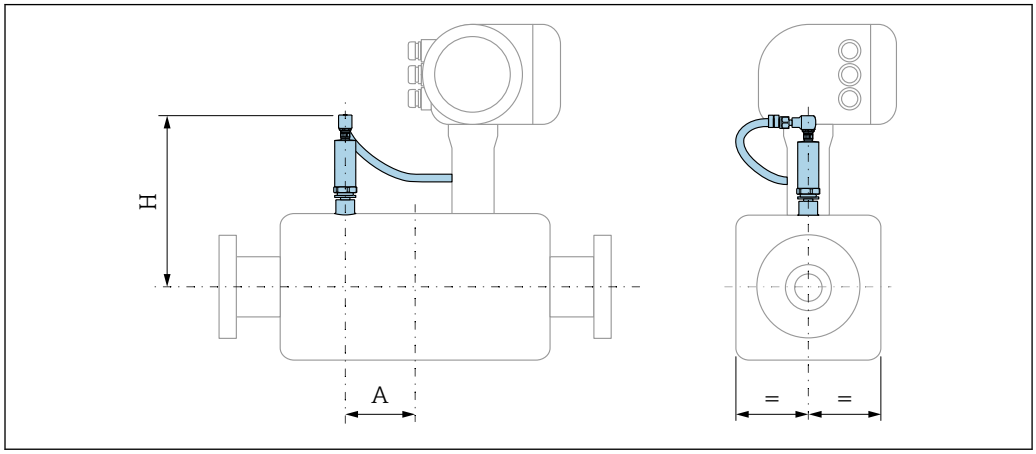
1) Depending on the cable gland used: values up to + 1.18 in
2) For version without local display: values - 1.57 in
3) Depending on the process connection → 53

Order code for "Housing", option L "Cast, stainless"

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	I [in]	K [in]	L [in]	M [in]	N [in]
1	7.32	3.35	3.98	0.79	15.2	16.0	8.7	2.48	6.22	0.96	[2]	5.63	1.85
2	7.32	3.35	3.98	1.26	15.8	17.0	8.7	2.48	6.22	1.94	[2]	8.86	2.48
3	7.32	3.35	3.98	1.73	16.2	18.0	8.7	2.48	6.22	2.90	[2]	9.65	2.17
4	7.32	3.35	3.98	2.24	16.6	18.8	8.7	2.48	6.22	3.83	[2]	10.4	2.83
6	7.32	3.35	3.98	3.31	17.6	20.9	8.7	2.48	6.22	5.76	[2]	12.1	2.44
8	7.32	3.35	3.98	4.33	18.6	23.0	8.7	2.48	6.22	7.63	[2]	13.7	3.07
10	7.32	3.35	3.98	5.43	19.7	25.1	8.7	2.48	6.22	9.56	[2]	15.4	3.31
12	7.32	3.35	3.98	6.42	20.7	27.1	8.7	2.48	6.22	11.4	[2]	16.9	3.78

1) Depending on the cable gland used: values up to + 1.18 in
2) Depending on the process connection → 53

Pressure measuring cell



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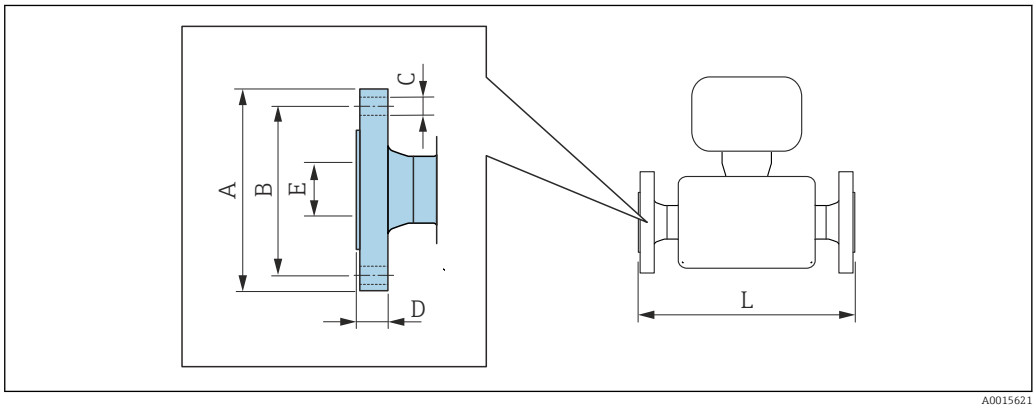
Order code for "Pressure component": options B/C/D/E/F "Pressure measuring cell 29/58/145/580/1450 psia"		
DN [in]	**A [in]**	**B [in]**
1	2.40	6.77
2	2.99	7.36
3	3.78	7.91
4	3.35	8.39
6	2.91	9.45
8	3.43	10.6
10	4.02	11.8
12	4.33	12.8

Flange connections

Welding neck flange ASME B16.5



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Length tolerance for dimension L in inch:
- DN 1 to 6": +0 / −0.11
- DN 8 to 12": +0.04 / −0.08

Flange according to ASME B16.5: Class 150 RF Schedule 40 1.4404 (316, 316L): *Order code for "Process connection", option* **AAS**						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [in]**
1	4.25	3.12	4 × Ø0.62	0.56	1.05	11.8
2	6.00	4.75	4 × Ø0.75	0.75	2.07	13.8
3	7.50	6.00	4 × Ø0.75	0.94	3.07	15.8
4	9.00	7.50	8 × Ø0.75	0.96	4.03	15.8
6	11.0	9.50	8 × Ø0.88	1.00	6.07	15.8
8	13.6	11.8	8 × Ø0.88	1.14	7.98	18.8
10	15.9	14.3	12 × Ø1.00	1.20	10.0	20.2
12	19.1	17.0	12 × Ø1.00	1.27	11.9	22.4
Surface roughness (flange): Ra 125 to 250 µin						

Flange according to ASME B16.5: Class 300 RF Schedule 40
1.4404 (316, 316L): *Order code for "Process connection", option* **ABS**

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
1	4.88	3.5	4 × Ø0.75	0.69	1.05	11.8
2	6.50	5.00	8 × Ø0.75	0.88	2.07	13.8
3	8.25	6.62	8 × Ø0.88	1.12	3.07	15.8
4	10.0	7.88	8 × Ø0.88	1.25	4.03	15.8
6	12.5	10.6	12 × Ø0.88	1.44	6.07	15.8
8	15.0	13.0	12 × Ø1.00	1.64	7.98	19.6
10	17.5	15.3	16 × Ø1.13	1.89	10.0	21.4
12	20.5	17.8	16 × Ø1.25	2.02	11.9	23.7
Surface roughness (flange): Ra 125 to 250 µin						

Flange according to ASME B16.5: Class 300 RF Schedule 80
1.4404 (316, 316L): *Order code for "Process connection", option* **AGS**

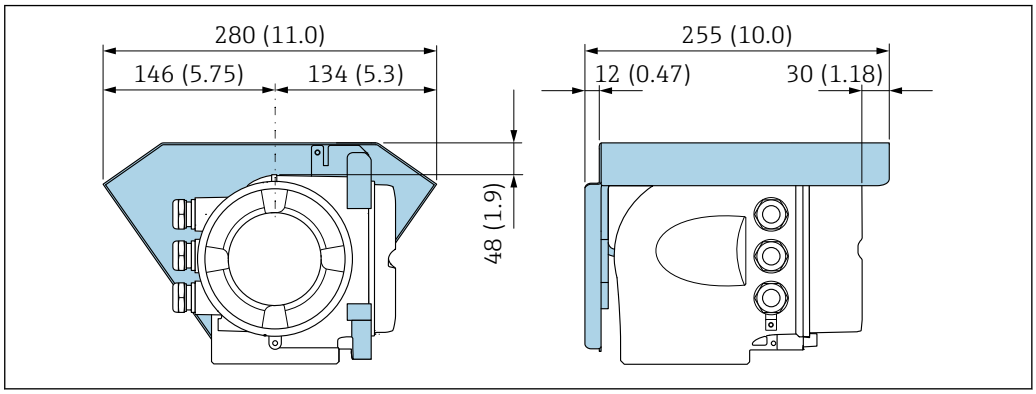
DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
1	4.88	3.5	4 × Ø0.75	0.69	0.96	11.8
2	6.50	5.00	8 × Ø0.75	0.88	1.94	13.8
3	8.25	6.62	8 × Ø0.88	1.12	2.9	15.8
4	10.0	7.88	8 × Ø0.88	1.25	3.82	15.8
6	12.5	10.6	12 × Ø0.88	1.44	5.76	15.8
8	15.0	13.0	12 × Ø1.00	1.64	7.63	19.6
10	17.5	15.3	16 × Ø1.13	1.89	9.56	21.4
12	20.5	17.8	16 × Ø1.25	2.02	11.4	23.7
Surface roughness (flange): Ra 125 to 250 µin						

Flange according to ASME B16.5: Class 600 RF Schedule 80
1.4404 (316, 316L): *Order code for "Process connection", option* **ACS**

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
1	4.88	3.5	4 × Ø0.75	0.96	0.96	13.9
2	6.50	5.00	8 × Ø0.75	1.28	1.94	16.1
3	8.27	6.63	8 × Ø0.87	1.53	2.90	18.4
4	10.8	8.50	8 × Ø1.00	1.78	3.82	18.9
6	14.0	11.5	12 × Ø1.13	2.15	5.76	19.4
8	16.5	13.8	12 × Ø1.25	2.46	7.63	21.8
10	20.1	17.0	16 × Ø1.38	2.78	9.56	24.7
12	22.1	19.3	20 × Ø1.38	2.90	11.4	26.2
Surface roughness (flange): Ra 125 to 250 µin						

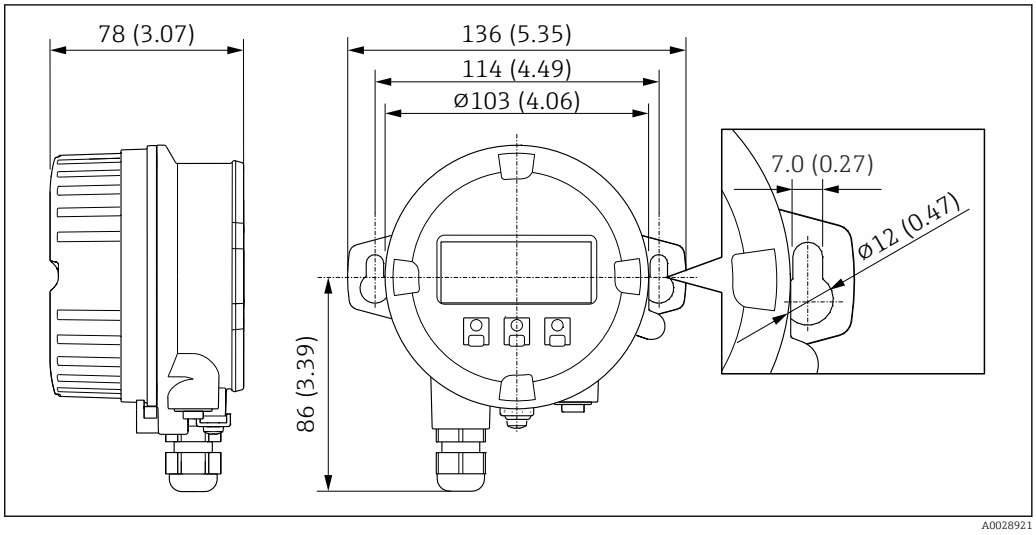
Accessories

Weather protection cover



27 *Engineering unit mm (in)*

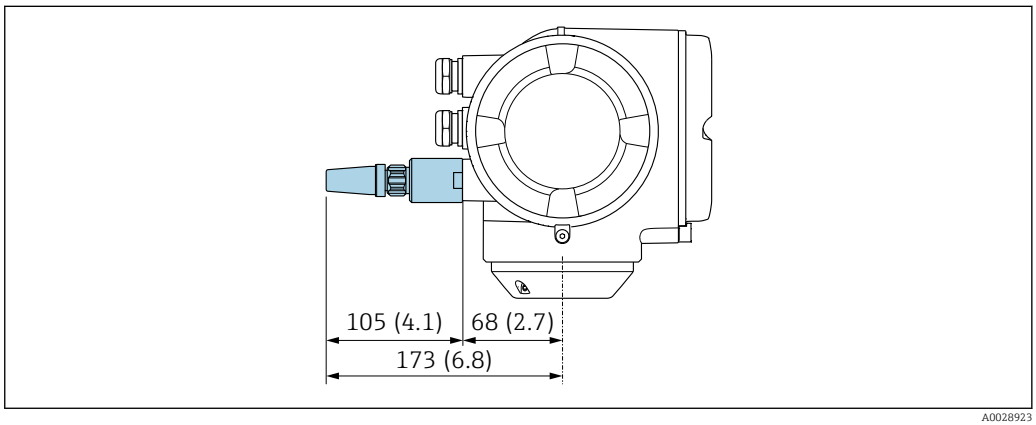
Remote display and operating module DKX001



28 *Engineering unit mm (in)*

External WLAN antenna

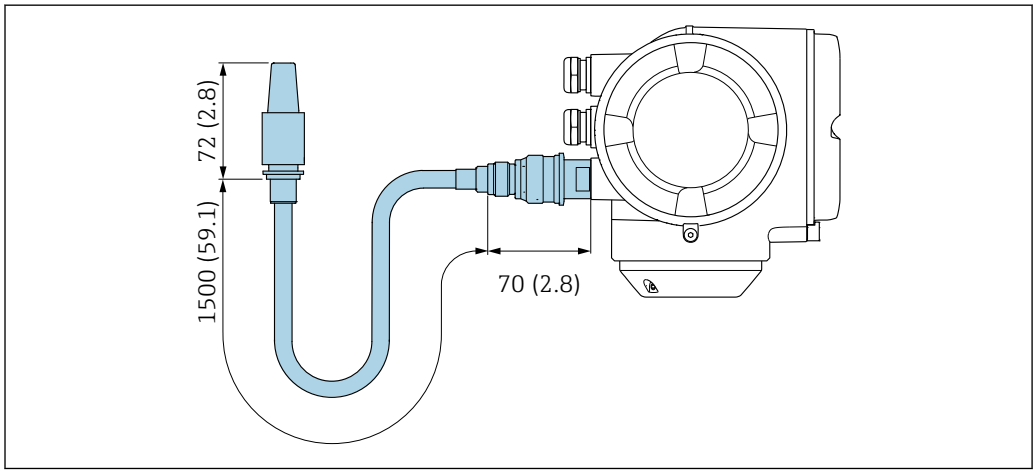
External WLAN antenna mounted on device



29 *Engineering unit mm (in)*

External WLAN antenna mounted with cable

The external WLAN antenna can be mounted separately from the transmitter if the transmission/ reception conditions at the transmitter mounting location are poor.



30 Engineering unit mm (in)

Weight

Weight specifications (exclusive of packaging material) including transmitter as per order code for "Housing", option A "Aluminum, coated".

Different values due to different transmitter versions:
- Transmitter version for the hazardous area
  (Order code for "Housing", option A "Aluminum, coated"; Ex d): +2 kg (+4.4 lbs)
- Cast transmitter version, stainless
  (Order code for "Housing", option L "Cast, stainless"): +6 kg (+13 lbs)

Weight in SI units

Nominal diameter		EN (DIN) [kg] Pressure rating			
[mm]	[in]	PN 16	PN 40	PN 63	PN 100
25	1	12	12	15	15
50	2	18	18	21	24
80	3	24	24	28	32
100	4	26	29	35	42
150	6	38	45	65	79
200	8	54	74	101	131
250	10	79	117	145	208
300	12	110	164	204	300

Nominal diameter		ASME [kg] Pressure rating			
[mm]	[in]	Class 150 RF Sch.40	Class 300 RF Sch.40	Class 300 RF Sch.80	Class 600 RF Sch.80
25	1	12	13	13	14
50	2	17	19	19	21
80	3	24	27	27	31
100	4	29	37	38	52
150	6	42	58	58	91
200	8	69	94	96	139

Nominal diameter		ASME [kg] Pressure rating			
[mm]	[in]	Class 150 RF Sch.40	Class 300 RF Sch.40	Class 300 RF Sch.80	Class 600 RF Sch.80
250	10	96	136	139	225
300	12	145	196	201	281

Weight in US units

Nominal diameter		ASME [lbs] Pressure rating			
[mm]	[in]	Class 150 RF Sch.40	Class 300 RF Sch.40	Class 300 RF Sch.80	Class 600 RF Sch.80
25	1	26	29	29	31
50	2	37	42	42	46
80	3	53	60	60	68
100	4	64	82	84	115
150	6	93	128	128	201
200	8	152	207	212	306
250	10	212	300	306	496
300	12	320	432	443	620

Materials

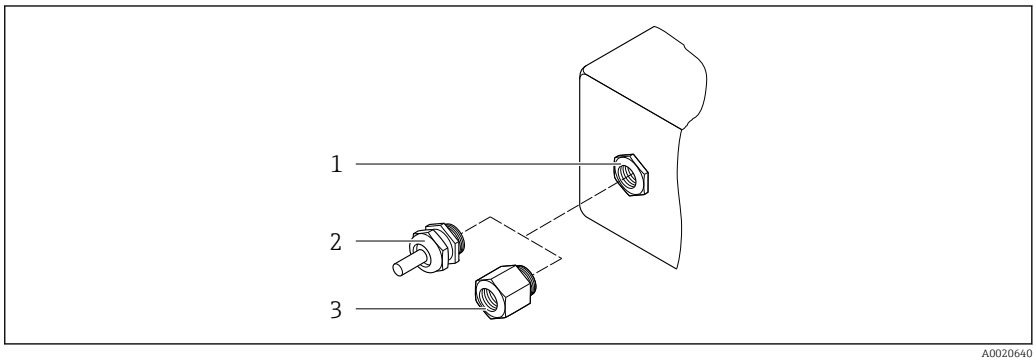
Transmitter housing

Order code for "Housing":
- Option **A** "Aluminum, coated": aluminum, AlSi10Mg, coated
- Option **L** "Cast, stainless": cast, stainless steel, 1.4409 (CF3M)

Window material

Order code for "Housing":
- Option **A** "Aluminum, coated": glass
- Option **L** "Cast, stainless": glass

Cable entries/cable glands



31 Possible cable entries/cable glands

1 Female thread M20 × 1.5
2 Cable gland M20 × 1.5
3 Adapter for cable entry with female thread G ½" or NPT ½"

Order code for "Housing", option A "Aluminum, coated"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Compression fitting M20 × 1.5	Non-Ex: plastic
	Z2, D2, Ex d/de: brass with plastic
Adapter for cable entry with female thread G ½"	Nickel-plated brass
Adapter for cable entry with female thread NPT ½"	

Order code for "Housing", option L "Cast, stainless"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Stainless steel, 1.4404 (316L)
Adapter for cable entry with female thread G ½"	
Adapter for cable entry with female thread NPT ½"	

Measuring pipe

Stainless steel: 1.4408/1.4409 (CF3M)

- If the order code for "Additional approval", option LR "NACE MR0175 / ISO 15156 (wetted parts), declaration" or LS "NACE MR0103 / ISO 17945 (wetted parts), declaration" was ordered, all the metal materials used meet the NACE MR0175 and NACE MR0103 standards.
- The seal material is tested in accordance with NACE TM0187 and NORSOK M710-B.

Process connections

Stainless steel: 1.4404 (316, 316L)

Available process connections→ 59

Cable for transmitter neck/ultrasonic transducer

Including connections for transmitter neck and ultrasonic transducer
Stainless steel: 1.4404 (316, 316L)

Ultrasonic transducer

Grade 2 titanium
Sensor holder: stainless steel: 1.4404 (316, 316L)

Seal for ultrasonic transducer

FKM material group

DANGER

The ultrasonic transducer may not be leak-tight!
Toxic and/or explosive gases may escape!

- The material of the seal is not suitable for applications in pure steam.
- The material of the seal must not be exposed to a pressure increase at low process temperatures below −40 °C (−40 °F).

Temperature sensor

Stainless steel: 1.4404 (316, 316L)

Seal for temperature sensor

Seal-free (self-sealing NPT thread with sealant)

Pressure measuring cell

Stainless steel: 1.4404 (316, 316L)

Seal for pressure measuring cell

Seal-free (self-sealing NPT thread with sealant)

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

- Antenna: ASA plastic (acrylonitrile styrene acrylate) and nickel-plated brass
- Adapter: Stainless steel and nickel-plated brass
- Cable: Polyethylene
- Plug: Nickel-plated brass
- Angle bracket: Stainless steel

Process connections

Flanges:
- EN 1092-1-B1
- ASME B16.5

For information on the different materials used in the process connections → 58

Display and user interface

Operation concept

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

Quick and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief descriptions of the individual parameter functions
- Access to the device via web server
- WLAN access to the device via mobile handheld terminal, tablet or smart phone

Reliable operation
- Operation in local language
- Uniform operating philosophy applied to device and operating tools
- If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.

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

Languages

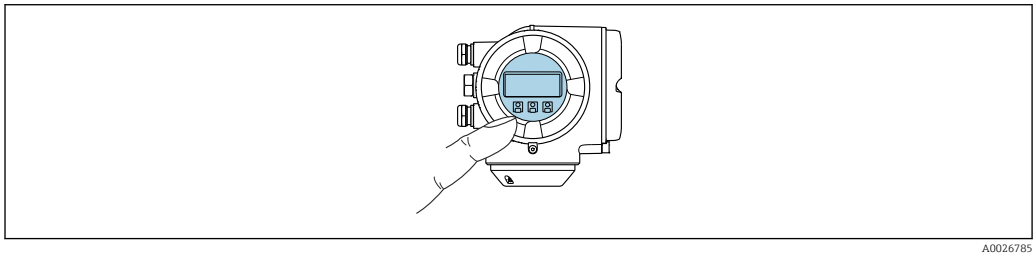
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Vietnamese, Czech, Swedish
- Via web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation

Via display module

Equipment:
- Order code for "Display; operation", option F "4-line, illuminated, graphic display; touch control"
- Order code for "Display; operation", option G "4-line, illuminated, graphic display; touch control + WLAN"

Information about WLAN interface → 63



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32 *Operation with touch control*

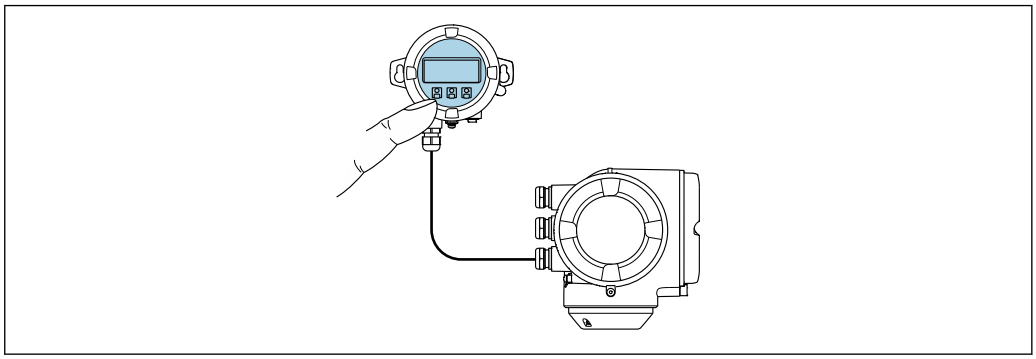
Display elements
- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

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

Via remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra → 71.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



33 *Operation via remote display and operating module DKX001*

Display and operating elements

The display and operating elements correspond to those of the display module → 60.

Housing material

The housing material of the display and operating module DKX001 depends on the choice of transmitter housing material.

Transmitter housing		Remote display and operating module	
Order code for "Housing"	**Material**	**Order code for "Housing"**	**Material**
Option A "Aluminum, coated"	AlSi10Mg, coated	Option C "Single compartment, aluminum, coated"	AlSi10Mg, coated
Option L "Cast, stainless"	Cast stainless steel, 1.4409 (CF3M) similar to 316L	Option A "Single compartment; cast, stainless"	1.4409 (CF3M)

Cable entry

Corresponds to the choice of transmitter housing, order code for "Electrical connection".

Connecting cable

→ 34

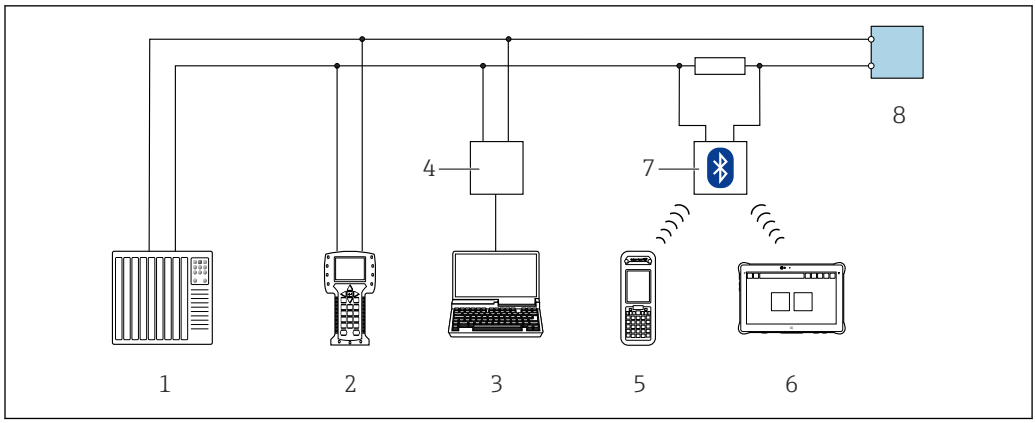
Dimensions

→ 50

Remote operation

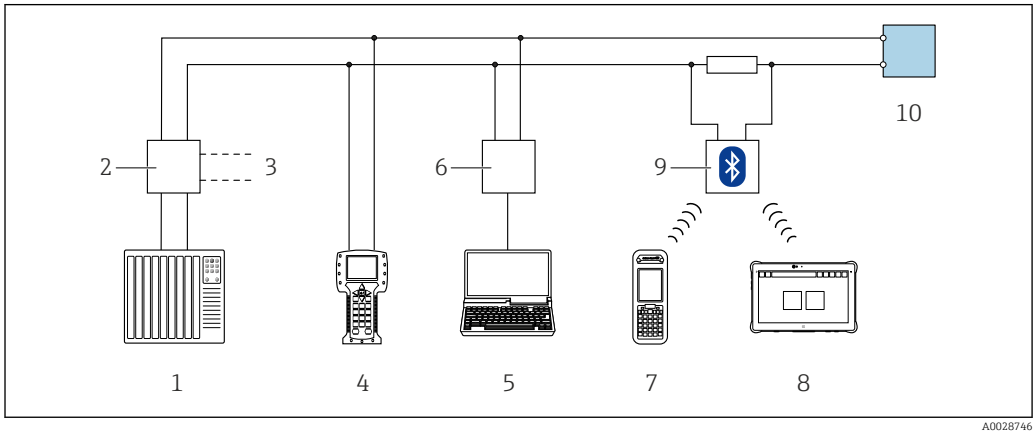
Via HART protocol

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



34 *Options for remote operation via HART protocol (active)*

1 *Control system (e.g. PLC)*
2 *Field Communicator 475*
3 *Computer with web browser (e.g. Microsoft Edge) to access the integrated device web server or computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
4 *Commubox FXA195 (USB)*
5 *Field Xpert SFX350 or SFX370*
6 *Field Xpert SMT70*
7 *VIATOR Bluetooth modem with connecting cable*
8 *Transmitter*

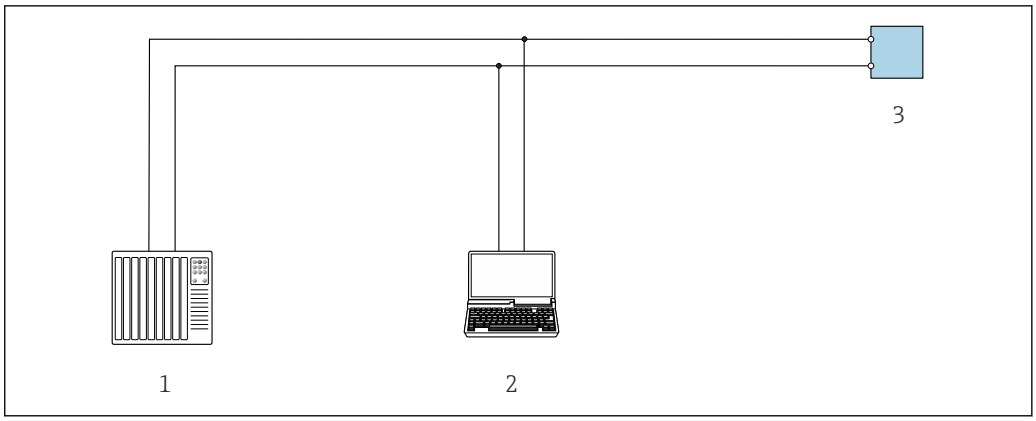


35 *Options for remote operation via HART protocol (passive)*

1 *Control system (e.g. PLC)*
2 *Transmitter power supply unit, e.g. RN221N (with communication resistor)*
3 *Connection for Commubox FXA195 and Field Communicator 475*
4 *Field Communicator 475*
5 *Computer with web browser (e.g. Microsoft Edge) to access the integrated device web server or computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SFX350 or SFX370*
8 *Field Xpert SMT70*
9 *VIATOR Bluetooth modem with connecting cable*
10 *Transmitter*

Via Modbus RS485 protocol

This communication interface is available in device versions with a Modbus RS485 output.



36 *Options for remote operation via Modbus RS485 protocol (active)*

1 Control system (e.g. PLC)
2 Computer with web browser (e.g. Microsoft Edge) to access the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM
3 Transmitter

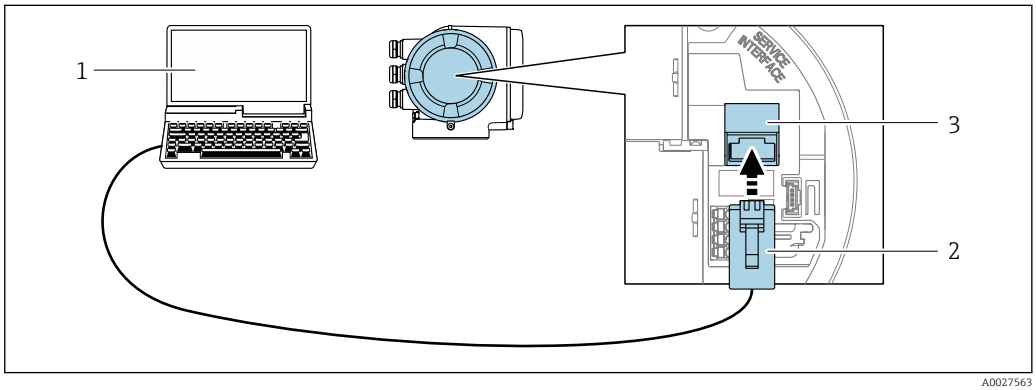
Service interface

Via service interface (CDI-RJ45)

A point-to-point connection can be established to configure the device on site. With the housing open, the connection is established directly via the service interface (CDI-RJ45) of the device.

An adapter for the RJ45 to the M12 plug is optionally available for the non-hazardous area: Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 plug mounted in the cable entry. The connection to the service interface can be established via an M12 plug without opening the device.

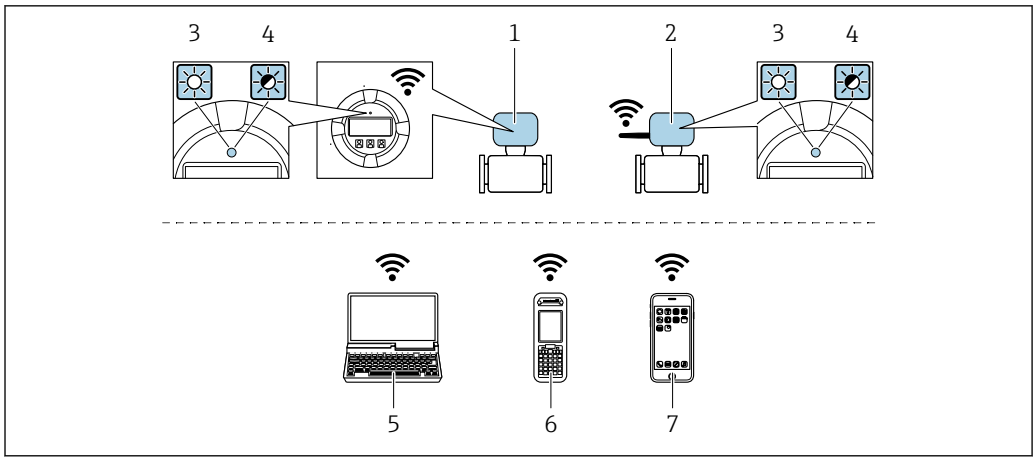


37 *Connection via service interface (CDI-RJ45)*

1 Computer with web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) to access the integrated web server or with an operating tool "FieldCare", "DeviceCare" with COM DTM "CDI Communication TCP/IP" or Modbus DTM
2 Standard Ethernet connecting cable with RJ45 plug
3 Service interface (CDI-RJ45) of the measuring device with access to the integrated web server

Via WLAN interface

The optional WLAN interface is available on the following device version:
Order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN"



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1 *Transmitter with integrated WLAN antenna*
2 *Transmitter with external WLAN antenna*
3 *LED lit constantly: WLAN reception is enabled on measuring device*
4 *LED flashing: WLAN connection established between operating unit and measuring device*
5 *Computer with WLAN interface and web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare)*
6 *Mobile handheld terminal with WLAN interface and web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device web server or operating tool (e.g. FieldCare, DeviceCare)*
7 *Smart phone or tablet (e.g. Field Xpert SMT70)*

Function	WLAN: IEEE 802.11 b/g (2.4 GHz) ▪ Access Point with DHCP server (factory setting) ▪ Network
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antennas	▪ Internal antenna ▪ External antenna (optional) In the event of poor transmission/reception conditions at the place of installation. Available as an accessory . Only 1 antenna is active at any one time!
Range	▪ Internal antenna: typically 10 m (32 ft) ▪ External antenna: typically 50 m (164 ft)
Materials (external antenna)	▪ Antenna: ASA plastic (acrylonitrile styrene acrylate) and nickel-plated brass ▪ Adapter: Stainless steel and nickel-plated brass ▪ Cable: Polyethylene ▪ Plug: Nickel-plated brass ▪ Angle bracket: Stainless steel

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
Web browser	Notebook, PC or tablet with web browser	▪ CDI-RJ45 service interface ▪ WLAN interface	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 📄 73

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 73
Field Xpert	SMT70/77/50	▪ All Fieldbus protocols ▪ WLAN interface ▪ Bluetooth ▪ CDI-RJ45 service interface	Operating Instructions BA01202S Device description files: Use update function of handheld terminal
SmartBlue App	Smart phone or tablet with iOs or Android	WLAN	→ 🖹 73

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
- 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

With the integrated web server, the device can be operated and configured via a web browser service interface (CDI-RJ45) or WLAN interface. The structure of the operating menu is the same as for the local display. 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.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook, for example,) and measuring device:
- Upload the configuration from the measuring device (XML format, configuration backup).
- Save the configuration to the measuring device (XML format, restore configuration).
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification report (PDF file, only available with the **Heartbeat Verification** → 🖹 70 application package)
- Flash firmware version for device firmware upgrade, for example
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package→ 🖹 70)

HistoROM data management

The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.

When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, for example after commissioning.

Additional information on the data storage concept

There are different types of data storage units in which device data are stored and used by the device:

	HistoROM backup	T-DAT	S-DAT
Available data	▪ Event logbook, e.g. diagnostic events ▪ Parameter data record backup ▪ Device firmware package	▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Indicator (minimum/maximum values) ▪ Totalizer value	▪ Sensor data: e.g. nominal diameter ▪ Serial number ▪ Calibration data ▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface PC board in the connection compartment	Can be plugged into the user interface PC board in the connection compartment	In the sensor plug in the transmitter neck part

Data backup

Automatic
- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

Manual
Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:
- Data backup function
  Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
- Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

Data transmission

Manual
Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)

Event list

Automatic
- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server

Data logging

Manual
If the **Extended HistoROM** application package (order option) is enabled:
- Recording of 1 to 4 channels of up to 1 000 measured values (up to 250 measured values per channel)
- User configurable recording interval
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

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.

ATEX/IECEx

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

Ex db eb

Category	Type of protection
II2G	Ex db eb ia IIC T6...T1 Gb

Ex db

Category	Type of protection
II2G	Ex db ia IIC T6...T1 Gb

Ex ec

Category	Type of protection
II3G	Ex ec nC ic IIC T5...T1 Gc

Ex tb

Category	Type of protection
II2D	Ex tb IIIC T** °C Db

$_{C}CSA_{US}$

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

IS (Ex i) and XP (Ex d)
Class I, II, III Division 1 Groups A-G

NI (Ex nA)
Class I Division 2 Groups A - D

Ex d e
Class I, Zone 1 AEx/Ex d e ia IIC T6...T1 Gb

Ex d
Class I, Zone 1 AEx/ Ex d ia IIC T6...T1 Gb

Ex nA
Class I, Zone 2 AEx/Ex nA IIC T5...T1

Ex tb
Zone 21 AEx/ Ex tb IIIC T** °C Db

Functional safety

The measuring device 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:
Volume flow

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 7
- The device can also be operated with certified devices of other manufacturers (interoperability)

Pressure Equipment Directive

The measuring devices can be ordered with or without PED or PESR. If a device with PED or PESR is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary. 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 Para. 3 of the Pressure Equipment Directive 2014/68/EU or
  b) Part 1, Para. 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) Schedule 3, Para. 2 of Statutory Instruments 2016 No. 1105.

Radio approval

The measuring device has radio approval.

For detailed information on the radio approval, see the Special Documentation → 74

Additional certification

CRN approval

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device.

Tests and certificates

- EN10204-3.1 material certificate, wetted parts and sensor housing (order code for "Test, certificate", option JA)
- Pressure test, internal process, Heartbeat Technology verification report (order code for "Test, certificate", option JB)
- Ambient temperature −50 °C (−58 °F) (order code for "Test, certificate", option JP)
- Helium leak testing, internal procedure, Heartbeat Technology verification report (order code for "Test, certificate", option KC)
- EN10204-2.1 confirmation of compliance with the order and EN10204-2.2 test report

Testing of welds

Order code for "Test, certificate", option	Radiographic testing standard		Process connection
	ISO 10675-1 ZG1	ASME B31.3 NFS	
KE	x		RT
KI		x	RT
K5	x		DR
K6		x	DR
RT = Radiographic testing, DR = Digital radiography All options with test report			

External standards and guidelines

- EN 60529
  Degrees of protection provided by enclosure (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326-2-3
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications
- ETSI EN 300 328
  Guidelines for 2.4 GHz radio components.
- EN 301489
  Electromagnetic compatibility and radio spectrum matters (ERM).
- AGA Report No. 9
  Measurement of gas by multipath ultrasonic meters.
- ISO 17089
  Measurement of fluid flow in closed conduits — Ultrasonic meters for gas.

Ordering information

Detailed ordering information is available as follows:
- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center:www.addresses.endress.com

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

Application packages

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

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Detailed information on the application packages:
Special Documentation → 75

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 + Monitoring"

Heartbeat Verification
Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 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.

Heartbeat Monitoring
Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:
- Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time.
- Schedule servicing in time.
- Monitor the process or product quality.

For detailed information, see the Special Documentation for the device.

Advanced gas analysis

Order code for "Application package", option EF "Advanced gas analysis". The application package can only be ordered in combination with the order code for "Measuring tube; Transducer; Sensor version", option AC "316L; Titanium Gr. 2; pressure + temperature measurement integrated".

The application package can be used to calculate the most important gas properties (molar mass, gross calorific value, Wobbe index etc.).

The following gas types are available:
- Single gas (known gas)
- Gas mixture (known composition)
- Coal gas/biogas (measurement of methane fraction)
- Natural gas – standardized calculation (with internationally recognized gas models: AGA NX-19, ISO 12213-2, ISO 12213-3, AGA 5, ISO 6976)
- Natural gas - use of sound velocity (sound velocity-based model for measuring a natural gas whose composition is unknown or variable)
- User-specific gas (generic gas or gas mixture without knowledge of the composition of the gas)

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
Proline 300 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software Order code: 9X3BXX Installation Instructions EA01263D

Remote display and operating module DKX001	▪ If ordered directly with the measuring device: Order code for "Display; operation", option O "Remote display 4-line, illuminated; 10 m (30 ft) cable; touch control" ▪ If ordered separately: ▪ Measuring device: order code for "Display; operation", option M "W/o, prepared for remote display" ▪ DKX001: Via the separate product structure DKX001 ▪ If ordered subsequently: DKX001: Via the separate product structure DKX001 **Mounting bracket for DKX001** ▪ If ordered directly: order code for "Accessory enclosed", option RA "Mounting bracket, pipe 1/2"" ▪ If ordered subsequently: order number: 71340960 **Connecting cable (replacement cable)** Via the separate product structure: DKX002 Further information on display and operating module DKX001→ 🖹 61. Special Documentation SD01763D
External WLAN antenna	External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Accessory enclosed", option P8 "Wireless antenna wide area". ▪ The external WLAN antenna is not suitable for use in hygienic applications. ▪ Additional information regarding the WLAN interface → 🖹 63. Order number: 71351317 Installation Instructions EA01238D
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Order number: 71343505 Installation Instructions EA01160D

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB port Technical Information TI00404F
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
Fieldgate FXA42	Transmission of the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42
Field Xpert SMT50	The Field Xpert SMT50 table PC for device configuration enables mobile plant asset management. 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 devices: ▪ Choice of measuring devices for industrial requirements ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. ▪ Graphic illustration 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 ▪ As a downloadable DVD for local PC installation.
Netilion	IIoT Ecosystem: Unlock knowledge With the Netilion IIoT Ecosystem, Endress+Hauser enables you to optimize your plant performance by digitizing workflows, creating knowledge and establishing new levels of collaboration. Building decades of expertise in process automation, Endress+Hauser provides the process industry with an IIoT Ecosystem that allows data-driven insights. These insights can be applied to optimize processes resulting in increased plant up-time, efficiency, reliability – and ultimately, a more profitable plant. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. 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

Supplemental 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
Proline Prosonic Flow G	KA01374D

Brief Operating Instructions for the transmitter

	Documentation code	
Measuring device	HART	Modbus RS485
Proline 300	KA01375D	KA01376D

Operating Instructions

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow G 300	BA01834D	BA01835D

Description of Device Parameters

	Documentation code	
Measuring device	HART	Modbus RS485
Prosonic Flow 300	GP01130D	GP01131D

Supplementary device-dependent documentation

Safety Instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEx Ex d / Ex de	XA01844D
ATEX/IECEx Ex ec	XA01845D
cCSAus Ex d / Ex de	XA01846D
cCSAus Ex nA	XA01847D
cCSAus XP	XA01848D
EAC Ex d / Ex de	XA02469D
EAC Ex nA	XA02470D
JPN Ex d	XA02076D
KCs Ex d	XA03192D
INMETRO Ex Ex d / Ex de	XA01995D
INMETRO Ex ec	XA01996D

Contents	Documentation code
NEPSI Ex Ex d / Ex de	XA02043D
NEPSI Ex nA	XA02044D
UKEX Ex Ex d / Ex de	XA02574D
UKEX Ex ec	XA02575D

Remote display and operating module DKX001

Contents	Documentation code
ATEX/IECEx Ex i	XA01494D
ATEX/IECEx Ex ec	XA01498D
cCSAus IS	XA01499D
cCSAus Ex nA	XA01513D
INMETRO Ex i	XA01500D
INMETRO Ex ec	XA01501D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D

Functional Safety Manual

Contents	Documentation code
Proline Prosonic Flow G 300	SD02307D

Special documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Remote display and operating module DKX001	SD01763D
Radio approvals for WLAN interface for A309/A310 display module	SD01793D

Contents	Documentation code	
	HART	Modbus RS485
Advanced gas analysis	SD02349D	SD02350D
Functional safety manual	SD02307D	–
Heartbeat Technology	SD02302D	SD02303D
Web server	SD02309D	SD02310D

Installation Instructions

Contents	Comment
Installation instructions for spare part sets and accessories	Documentation code: specified for each individual accessory → 71.

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