

Technical Information

Proline Promass X 300

Coriolis flowmeter



Highest capacity four-tube flowmeter with a compact, easily accessible transmitter

Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- For highest flow rates and outstanding performance in on-/offshore oil and gas applications

Device properties

- Nominal diameter: DN 300 to 400 (12 to 16")
- Four-tube system with low pressure drop
- Complete exterior design made of 1.4435 (316L)
- Compact dual-compartment housing with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Remote display available

Your benefits

- Increased profit – single installation point providing premium accuracy for large quantities
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no in-/outlet run needs
- Full access to process and diagnostic information – numerous, freely combinable I/Os and Ethernet
- Reduced complexity and variety – freely configurable I/O functionality
- Integrated verification – Heartbeat Technology

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About this document

Symbols

Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective earth (PE) Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ■ Interior ground terminal: protective earth is connected to the mains supply. ■ Exterior ground terminal: device is connected to the plant grounding system.

Communication-specific symbols

Symbol	Meaning
	Wireless Local Area Network (WLAN) Communication via a wireless, local area network
	LED LED is off.
	LED LED is on.
	LED LED flashing.

Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Symbols in graphics

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

Function and system design

Measuring principle

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

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

F_c = Coriolis force

Δm = moving mass

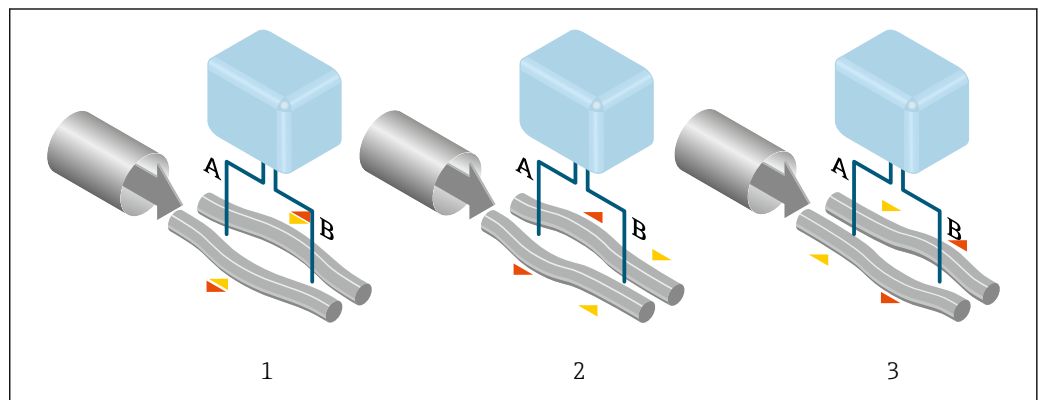
ω = rotational velocity

v = radial velocity in rotating or oscillating system

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

In the sensor, two sets of two parallel measuring tubes containing flowing medium oscillate in antiphase, acting like a vibrating fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):

- At zero flow (when the medium is at a standstill) the two tubes oscillate in phase (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



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

Density measurement

The measuring tube is continuously excited at its resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tube and medium) results in a corresponding, automatic adjustment in the oscillation frequency. The resonance frequency is thus a function of the medium density. The microprocessor utilizes this relationship to obtain a density signal.

Volume measurement

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

Temperature measurement

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

Gas Fraction Handler (GFH)

The Gas Fraction Handler is a Promass software function that improves measurement stability and repeatability. The function continuously checks for the presence of disturbances in single-phase flow, i.e. gas bubbles in liquids. In the presence of the second phase, flow and density become increasingly unstable. The Gas Fraction Handler function improves measurement stability with respect to the severity of the disturbances, without any effect under single-phase flow conditions.

 The Gas Fraction Handler is only available for device versions with HART, Modbus RS485, PROFINET, PROFINET over Ethernet-APL and Modbus TCP over Ethernet-APL.

 For more detailed information on the Gas Fraction Handler, see the "Gas Fraction Handler" Special Documentation →  101

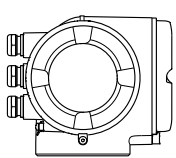
Measuring system

The device consists of a transmitter and a sensor.

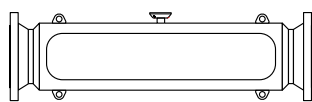
The device is available as a compact version:

The transmitter and sensor form a mechanical unit.

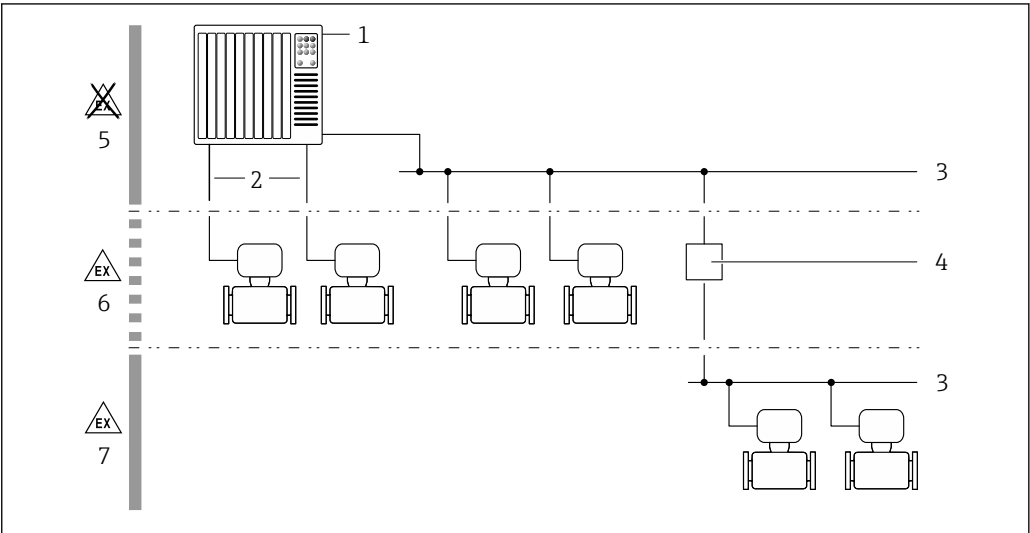
Transmitter

Proline 300  A0026708	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)
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Sensor

Promass X  A0029913	- Compact, bent four-tube system for measuring maximum flow rates, suitable for offshore applications and highly accurate - Simultaneous measurement of flow, volume flow, density and temperature (multivariable) - Nominal diameter range: DN 300 to 400 (12 to 16") - Materials: - Sensor: stainless steel, 1.4404 (316L) - Measuring tubes: stainless steel, 1.4404 (316/316L) - Process connections: stainless steel, 1.4404 (F316/F316L)
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Equipment architecture



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1 Possibilities for integrating measuring instruments into a system

- 1 Automation system (e.g. PLC)
- 2 Connection 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

Reliability

IT security

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

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

Device-specific IT security

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

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 8	Not enabled	On an individual basis following risk assessment
Access code (also applies to web server login or FieldCare connection) → 8	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) → 8	Serial number	Assign an individual WLAN passphrase during commissioning
WLAN mode	Access point	On an individual basis following risk assessment
Web server → 8	Enabled	On an individual basis following risk assessment
Service interface CDI-RJ45 → 9	Enabled	-

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

Local display, web browser and operating tool (e.g. FieldCare, DeviceCare)

- 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.
- When delivered, the device does not have an access code; the default value is 0000 (open).

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 security reasons.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.

Access via web server

The integrated web server can be used to operate and configure the device via a web browser. The connection is established via the service interface (CDI-RJ45) or WLAN interface. For device versions with the Ethernet/IP and PROFINET communication protocols, the connection can also be established via the terminal connection for signal transmission with Ethernet/IP, PROFINET (RJ45 plug), PROFINET over Ethernet-APL (two-wire) or Modbus TCP over Ethernet-APL.

The web server is enabled when the device is delivered. The web server can be disabled if necessary via the **Web server functionality** parameter (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.

Access via OPC UA



The "OPC UA Server" application package is available in the device version with the HART communication protocol → 96.

The device can communicate with OPC UA clients using the "OPC UA Server" application package.

The OPC UA server integrated in the device can be accessed via the WLAN access point using the WLAN interface - which can be ordered as an optional extra - or the service interface (CDI-RJ45) via Ethernet network. Access rights and authorization as per separate configuration.

The following Security Modes are supported as per the OPC UA Specification (IEC 62541):

- Without
- Basic128Rsa15 – signed
- Basic128Rsa15 – signed and encrypted

Access via service interface (port 2): CDI-RJ45

The device can be connected to a network via the service interface. 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.



PROFINET, Ethernet/IP:

The device can be integrated into a ring topology. The device is integrated via the terminal connection for signal transmission, output 1 (port 1) and the terminal connection to the service interface (port 2) → 86.



For detailed information on connecting transmitters with an Ex de approval, see separate document "Safety instructions" (XA) for the device.

Advanced safety requirements

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

Additional analysis is required if Proline measuring instruments are integrated into a different system. Please note the following:

- The fieldbus network (OT) and company network (IT) must be strictly separated.
- Endress+Hauser recommends the segmentation of the fieldbus networks according to DIN IEC 62443-3-3.

Network

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

FDI Packages

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

User training

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

Input

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured variables

- Volume flow
- Corrected volume flow
- Reference density

Measuring range

Measuring range for liquids

DN		Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[in]	[t/h]	[tn. sh./h]
300	12	0 to 4 100	0 to 4 520
350	14	0 to 4 100	0 to 4 520
400	16	0 to 4 100	0 to 4 520

Measuring range for gases

The full scale value depends on the density and the speed of sound of the gas used. The full scale value can be calculated with the following formulas:

$$\dot{m}_{\max(G)} = \text{minimum of } (\dot{m}_{\max(F)} \cdot \rho_G : x) \text{ and } (\rho_G \cdot (c_G/2) \cdot d_i^2 \cdot (\pi/4) \cdot 3600 \cdot n)$$

$\dot{m}_{\max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{\max(F)}$	Maximum full scale value for liquid [kg/h]
$\dot{m}_{\max(G)} < \dot{m}_{\max(F)}$	$\dot{m}_{\max(G)}$ can never be greater than $\dot{m}_{\max(F)}$
ρ_G	Gas density in [kg/m ³] at operating conditions
x	Limitation constant for max. gas flow [kg/m ³]
c_G	Speed of sound (gas) [m/s]
d_i	Measuring tube internal diameter [m]
π	Pi
$n = 4$	Number of measuring tubes

DN		x
[mm]	[in]	[kg/m ³]
300	12	200
350	14	200
400	16	200



To calculate the measuring range, use the *Applicator* sizing tool → 98

If calculating the full scale value using the two formulas:

1. Calculate the full scale value with both formulas.

2. The smaller value is the value that must be used.

Recommended measuring range

 Flow limit →  62

Operable flow range

Over 1000 : 1.

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

Input signal

Output and input variants

→  13

External measured values

To increase the measurement accuracy of certain measured variables or to calculate the corrected volume flow for gases, the automation system can continuously write different measured values to the measuring instrument:

- Operating pressure to increase measurement accuracy (Endress+Hauser recommends the use of a pressure measuring instrument for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase measurement accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow for gases

 Various pressure and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section →  99

It is recommended to read in external measured values to calculate the corrected volume flow.

HART protocol

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

- HART protocol
- Burst mode

Current input

The measured values are written from the automation system to the measuring device via the current input →  11.

Digital communication

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

- FOUNDATION Fieldbus
- PROFIBUS DP
- PROFIBUS PA
- Modbus RS485
- Modbus TCP over Ethernet-APL
- EtherNet/IP
- PROFINET
- PROFINET over Ethernet-APL

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 ■ Density

Status input

Maximum input values	■ DC -3 to 30 V ■ If status input is active (ON): $R_i > 3 \text{ k}\Omega$
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 → 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												
FOUNDATION fieldbus			↓	SA											
FOUNDATION fieldbus Ex i				↓	TA										
PROFIBUS DP					↓	LA									
PROFIBUS PA						↓	GA								
PROFIBUS PA Ex i							↓	HA							
Modbus RS485								↓	MA						
Ethernet/IP 2-port switch integrated									↓	NA					
PROFINET 2-port switch integrated										↓	RA				
PROFINET over Ethernet-APL											↓	RB			
PROFINET over Ethernet-APL Ex i												↓	RC		
Modbus TCP over Ethernet-APL 10 Mbit/s, SPE 10 Mbit/s, Ethernet 100 Mbit/s													↓	MB	
Modbus TCP over Ethernet-APL, Ex i, 10 Mbit/s, Ethernet 100 Mbit/s														↓	MC
Order code for "Output; input 2" (021) →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not used	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Current output 4 to 20 mA	B			B		B	B		B	B	B	B		B	
Current output 4 to 20 mA Ex i passive		C	C		C			C					C		C
User-configurable input/output ¹⁾	D			D		D	D		D	D	D	D		D	
Pulse/frequency/switch output	E			E		E	E		E	E	E	E		E	
Double pulse output ²⁾	F								F						
Pulse/frequency/switch output Ex i passive		G	G		G			G					G		G
Relay output	H			H		H	H		H	H	H	H		H	
Current input 0/4 to 20 mA	I			I		I	I		I	I	I	I		I	
Status input	J			J		J	J		J	J	J	J		J	

1) A specific input or output can be assigned to a user-configurable input/output → 22.

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 →  13

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												
FOUNDATION fieldbus			↓	SA											
FOUNDATION fieldbus Ex i				↓	TA										
PROFIBUS DP					↓	LA									
PROFIBUS PA						↓	GA								
PROFIBUS PA Ex i							↓	HA							
Modbus RS485								↓	MA						
Ethernet/IP 2-port switch integrated									↓	NA					
PROFINET 2-port switch integrated										↓	RA				
PROFINET over Ethernet-APL 10 Mbit/s, 2-wire											↓	RB			
PROFINET over Ethernet-APL Ex i, 10 Mbit/s, 2-wire												↓	RC		
Modbus TCP over Ethernet-APL 10 Mbit/s, SPE 10 Mbit/s, Ethernet 100 Mbit/s													↓	MB	
Modbus TCP over Ethernet-APL, Ex i, 10 Mbit/s, Ethernet 100 Mbit/s														↓	MC
Order code for "Output; input 3" (022) →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not used	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Current output 4 to 20 mA	B					B			B	B	B	B		B	
Current output 4 to 20 mA Ex i passive		C	C												
User-configurable input/output	D					D			D	D	D	D		D	
Pulse/frequency/switch output	E					E			E	E	E	E		E	
Double pulse output (slave) ¹⁾	F								F						
Pulse/frequency/switch output Ex i passive		G	G												
Relay output	H					H			H	H	H	H		H	
Current input 0/4 to 20 mA	I					I			I	I	I	I		I	
Status input	J					J			J	J	J	J		J	

1) If double pulse output (F) is selected for output/input 2 (021), only the double pulse output (F) option is available for output/input 3 (022).

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 μ A
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  The range of options increases if the measuring device has one or more application packages.

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 μ A

Damping	Configurable: 0 to 999.9 s
Assignable measured variables	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  The range of options increases if the measuring device has one or more application packages.

FOUNDATION Fieldbus

FOUNDATION Fieldbus	H1, IEC 61158-2, galvanically isolated
Data transfer	31.25 kbit/s
Current consumption	10 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

PROFIBUS DP

Signal encoding	NRZ code
Data transfer	9.6 kBaud...12 MBaud
Terminating resistor	Integrated, can be activated via DIP switches

PROFIBUS PA

PROFIBUS PA	In accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
Data transmission	31.25 kbit/s
Current consumption	10 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

Modbus RS485

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

Modbus TCP over Ethernet-APL

Port 1: Modbus TCP over Ethernet-APL 10 Mbit/s	
Device usage	Device connection to an APL field switch (terminal 26/27) The device may only be operated according to the following APL port classifications: ■ If used in hazardous areas: SLAA or SLAC ¹⁾ ■ If used in non-hazardous areas: SLAX Connection values of APL field switch (corresponds to APL port classification SPCC or SPAA, for instance): ■ Maximum input voltage: 15 V_{DC} ■ Minimum output values: 0.54 W Device connection to an SPE switch ■ In non-hazardous areas, the device can be used with an appropriate SPE switch: ■ Maximum output voltage: 30 V_{DC} ■ Minimum output power: 1.85 W ■ The SPE switch must support the 10BASE-T1L standard and PoDL power classes 10, 11 or 12 and have a function to disable power class detection.
Standards	According to IEEE 802.3cg, APL port profile specification v1.0, galvanically isolated
Data transfer	Full-duplex (APL/SPE)
Current consumption	Terminal 26/27 max. approx. 45 mA
Permitted supply voltage	9 to 30 V
Bus connection	Terminal 26/27 with integrated reverse polarity protection

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

Port 2: Modbus TCP over Ethernet 100 Mbit/s	
Device usage	Device connection to a Fast Ethernet (RJ45) switch In non-hazardous areas, the Ethernet switch must support the standard 100BASE-TX.
Standards	In accordance with IEEE 802.3u
Data transfer	Half-duplex, full-duplex
Current consumption	-
Permitted supply voltage	-
Bus connection	Service interface (RJ45)

EtherNet/IP

Standards	In accordance with IEEE 802.3
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PROFINET

Standards	In accordance with IEEE 802.3
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PROFINET over Ethernet-APL

Device use	Device connection to an APL field switch The device may only be operated according to the following APL port classifications: ■ If used in hazardous areas: SLAA or SLAC ¹⁾ ■ If used in non-hazardous areas: SLAX Connection values of APL field switch (corresponds to APL port classification SPCC or SPAA, for instance): ■ Maximum input voltage: 15 V_{DC} ■ Minimum output values: 0.54 W Device connection to an SPE switch ■ In non-hazardous areas, the device can be used with an appropriate SPE switch: The device can be connected to an SPE switch with a maximum voltage of 30 V_{DC} and a minimum output power of 1.85 W connected. ■ The SPE switch must support the 10BASE-T1L standard and PoDL power classes 10, 11 or 12 and have a function to disable power class detection.
PROFINET	According to IEC 61158 and IEC 61784
Ethernet-APL	According to IEEE 802.3cg, APL port profile specification v1.0, galvanically isolated
Data transfer	10 Mbit/s
Current consumption	Transmitter ■ Max. 400 mA(24 V) ■ Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)
Permitted supply voltage	9 to 30 V
Network connection	With integrated reverse polarity protection

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

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	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  The range of options increases if the measuring device has one or more application packages.

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 μ A
Damping	Configurable: 0 to 999 s
Assignable measured variables	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  The range of options increases if the measuring device has one or more application packages.

Pulse/frequency/switch output

Function	Can be configured as pulse, frequency or switch output
Version	Open collector Can be set to: ■ Active ■ Passive ■ Passive NAMUR  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: $\leq$ 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	■ Mass flow ■ Volume flow ■ Corrected volume flow  The range of options increases if the measuring device has one or more application packages.
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	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  The range of options increases if the measuring device has one or more application packages.
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 ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Totalizer 1-3 ■ Flow direction monitoring ■ Status ■ Partially filled pipe detection ■ Low flow cut off  The range of options increases if the measuring device has one or more application packages.

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	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature  The range of options increases if the measuring device has one or more application packages.

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 ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Totalizer 1-3 ■ Flow direction monitoring ■ Status ■ Partially filled pipe detection ■ Low flow cut off  The range of options increases if the measuring device has one or more application packages.

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
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PROFIBUS PA

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

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
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EtherNet/IP

Device diagnostics	Device condition can be read out in Input Assembly
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PROFINET

Device diagnostics	According to "Application Layer protocol for decentralized periphery", Version 2.3
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PROFINET over Ethernet-APL

Device diagnostics	Diagnostics according to PROFINET PA Profile 4.02
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FOUNDATION Fieldbus

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

Modbus RS485

Failure mode	Choose from: ■ NaN value instead of current value ■ Last valid value
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Modbus TCP over Ethernet-APL/SPE/Fast Ethernet

Failure mode	Choose from: ■ NaN value instead of current value ■ Last valid value
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Current output

Current output 4-20 mA	
Failure mode	Configurable: ■ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ■ 4 to 20 mA in accordance with US ■ Min. value: 3.59 mA ■ Max. value: 22.5 mA ■ Definable value between: 3.59 to 22.5 mA ■ Actual value ■ Last valid value
Current output 4-20 mA	
Failure mode	Configurable: ■ Maximum alarm: 22 mA ■ Definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Configurable: ■ Actual value ■ No pulses
Frequency output	
Failure mode	Configurable: ■ Actual value ■ 0 Hz ■ Definable value between: 2 to 12 500 Hz
Switch output	
Failure mode	Configurable: ■ Current status ■ Open ■ Closed

Relay output

Failure mode	Choose from: ■ Current status ■ Open ■ Closed
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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
 - FOUNDATION Fieldbus
 - PROFIBUS PA
 - PROFIBUS DP
 - Modbus RS485
 - Modbus TCP over Ethernet-APL
 - EtherNet/IP
 - PROFINET
 - PROFINET over Ethernet-APL
- Via service interface
 - Service interface CDI-RJ45
 - Via service interface/port 2: (RJ45)
 - WLAN interface
- Plain text display
 - With information on cause and remedial actions
 - Modbus TCP



Additional information on remote operation → 79

Web browser

Plain text display	With information on cause and remedial measures
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LEDs

Status information	Status indicated by various LEDs The following information is displayed depending on the device version: ■ Supply voltage active ■ Data transmission active ■ Device alarm/error has occurred ■ Network available ¹⁾ ■ Connection established ¹⁾ ■ Diagnostic status ²⁾ ■ PROFINET blinking feature ³⁾
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1) Only available for PROFINET, PROFINET over Ethernet-APL, Modbus over Ethernet-APL, Ethernet/IP

2) Only available for Modbus over Ethernet-APL

3) Only available for PROFINET, PROFINET over Ethernet-APL,

Load

Output signal → 15

Ex connection data

Safety-related values

Order code for "Output; input 1"	Output type	Safety-related values	
		Output; input 1 (Port 1)	Service interface (Port 2)
Option BA	Current output 4-20 mA HART	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option GA	PROFIBUS PA	$U_N = 32\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option LA	PROFIBUS DP	$U_N = 5\text{ V}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option MA	Modbus RS485	$U_N = 5\text{ V}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option MB	Modbus TCP over Ethernet-APL 10 Mbit/s, SPE 10 Mbit/s, Ethernet 100 Mbit/s	APL port profile SLAX SPE PoDL classes 10, 11, 12 $U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option NA	EtherNet/IP	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option RA	PROFINET	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option RB	PROFINET over Ethernet-APL/SPE, 10Mbit/s	APL port profile SLAX SPE PoDL classes 10, 11, 12 $U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$
Option SA	FOUNDATION Fieldbus	$U_N = 32\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	$U_N = 3.3\text{ V}_{AC}$ $U_M = 250\text{ V}_{AC}$

The specifications for U_M only apply to devices with Ex i circuits. Zone 1; Class I, Division 1 devices; Zone 2; Class I Division 2 devices with Ex i sensor.

Order code for "Output; input 2" "Output; input 3"	Output type	Safety-related values	
		Output; input 2	Output; input 3
Option B	Current output 4-20 mA	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	
Option D	Configurable I/O initial setting off	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	
Option E	Pulse/frequency/switch output	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	
Option F	Double pulse output	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	
Option H	Relay output	$U_N = 30\text{ V}_{DC}$ $I_N = 100\text{ mA}_{DC}/500\text{ mA}_{AC}$ $U_M = 250\text{ V}_{AC}$	
Option I	Current input 4-20 mA	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	
Option J	Status input	$U_N = 30\text{ V}_{DC}$ $U_M = 250\text{ V}_{AC}$	

Intrinsically safe values

Zone 1, Zone 21			
Order code for "Output; input 1"	Output type	Intrinsically safe values	
		Output; input 1 (Port 1)	Service interface (Port 2)
Option CA	Current output 4-20mA HART Ex-i passive	Ex ia $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1.25 \text{ W}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 6 \text{ nF}$	Ex ia $U_i = 10 \text{ V}$ $I_i = \text{n. a.}$ $P_i = \text{n. a.}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 200 \text{ nF}$
Option CC	Current output 4-20mA HART Ex-i active	Ex ia $U_0 = 21.8 \text{ V}$ $I_0 = 90 \text{ mA}$ $P_0 = 491 \text{ mW}$ $L_0 = 4.1 \text{ mH(IIC)}/15 \text{ mH(IIIB)}$ $C_0 = 160 \text{ nF(IIC)}/1160 \text{ nF(IIIB)}$ $U_i = 30 \text{ V}$ $I_i = 10 \text{ mA}$ $P_i = 0.3 \text{ W}$ $L_i = 5 \text{ } \mu\text{H}$ $L_i = 4.1 \text{ } \mu\text{H}$ $C_i = 6 \text{ nF}$	Ex ia $U_i = 10 \text{ V}$ $I_i = \text{n. a.}$ $P_i = \text{n. a.}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 200 \text{ nF}$
Option HA	PROFIBUS PA Ex i (STANDARD + FISCO)	Ex ia $U_i = 30 \text{ V}$ $I_i = 570 \text{ mA}$ $P_i = 8.5 \text{ W}$ $L_i = 10 \text{ } \mu\text{H}$ $C_i = 5 \text{ nF}$	Ex ia $U_i = 10 \text{ V}$ $I_i = \text{n. a.}$ $P_i = \text{n. a.}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 200 \text{ nF}$

Zone 1, Zone 21			
Order code for "Output; input 1"	Output type	Intrinsically safe values	
		Output; input 1 (Port 1)	Service interface (Port 2)
Option MC	Modbus TCP over Ethernet-APL, Ex-i, 10Mbit/s	2-WISE power load, APL port profile SLAA ¹⁾ Ex ia $U_i = 17.5 \text{ V}$ $I_i = 380 \text{ mA}$ $P_i = 5.32 \text{ W}$ $L_i = 10 \text{ } \mu\text{H}$ $C_i = 5 \text{ nF}$ Cable specifications according to 2-WISE: $R_c = 15 \text{ to } 150 \text{ } \Omega/\text{km}$ $L_c = 0.4 \text{ to } 1 \text{ mH/km}$ $C_c = 45 \text{ to } 200 \text{ nF/km}$ $C_c = C_c \text{ line/line} + 0,5 C_c \text{ line/screen}$, if both lines are floating, or $C_c = C_c \text{ line/line} + C_c \text{ line/screen}$, if the screen is connected to one line Length of cable (not including cable stubs): $\leq 200 \text{ m}$ (656.2 ft) Length of cable stubs: $\leq 1 \text{ m}$ (3.3 ft)	Ex ia $U_i = 10 \text{ V}$ $I_i = \text{n. a.}$ $P_i = \text{n. a.}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 200 \text{ nF}$
Option RC	PROFINET over Ethernet- APL, Ex-i, 10Mbit/s	2-WISE power load, APL port profile SLAA ¹⁾ Ex ia $U_i = 17.5 \text{ V}$ $I_i = 380 \text{ mA}$ $P_i = 5.32 \text{ W}$ $L_i = 10 \text{ } \mu\text{H}$ $C_i = 5 \text{ nF}$ Cable specifications according to 2-WISE: $R_c = 15 \text{ to } 150 \text{ } \Omega/\text{km}$ $L_c = 0.4 \text{ to } 1 \text{ mH/km}$ $C_c = 45 \text{ to } 200 \text{ nF/km}$ $C_c = C_c \text{ line/line} + 0,5 C_c \text{ line/screen}$, if both lines are floating, or $C_c = C_c \text{ line/line} + C_c \text{ line/screen}$, if the screen is connected to one line Length of cable (not including cable stubs): $\leq 200 \text{ m}$ (656.2 ft) Length of cable stubs: $\leq 1 \text{ m}$ (3.3 ft)	Ex ia $U_i = 10 \text{ V}$ $I_i = \text{n. a.}$ $P_i = \text{n. a.}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 200 \text{ nF}$
Option TA	FOUNDATION Fieldbus Ex i (STANDARD + FISCO)	Ex ia $U_i = 30 \text{ V}$ $I_i = 570 \text{ mA}$ $P_i = 8.5 \text{ W}$ $L_i = 10 \text{ } \mu\text{H}$ $C_i = 5 \text{ nF}$	Ex ia $U_i = 10 \text{ V}$ $I_i = \text{n. a.}$ $P_i = \text{n. a.}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 200 \text{ nF}$

1) For further options see Ethernet-APL Installation Drawing HE_01622.

Zone 2		
Order code for "Output; input 1"	Output type	Intrinsically safe values or NIFW values Output; input 1 (Port 1)
Option HA	PROFIBUS PA Ex i (STANDARD + FISCO)	Ex ic AEx ic, Ex ic, NIFW $U_i = 32 \text{ V}$ $I_i = 570 \text{ mA}$ $P_i = 8.5 \text{ W}$ $L_i = 10 \mu\text{H}$ $C_i = 5 \text{ nF}$
Option MC	Modbus TCP over Ethernet-APL, Ex-i, 10Mbit/s	2-WISE power load, APL port profile SLAC ¹⁾ Ex ic AEx ic, Ex ic, NIFW $U_i = 17.5 \text{ V}$ $I_i = 380 \text{ mA}$ $P_i = 5.32 \text{ W}$ $L_i = 10 \mu\text{H}$ $C_i = 5 \text{ nF}$ Cable specifications according to 2-WISE: $R_c = 15 \text{ to } 150 \Omega/\text{km}$ $L_c = 0.4 \text{ to } 1 \text{ mH/km}$ $C_c = 45 \text{ to } 200 \text{ nF/km}$ $C_c = C_c \text{ line/line} + 0.5 C_c \text{ line/screen}$, if both lines are floating, or $C_c = C_c \text{ line/line} + C_c \text{ line/screen}$, if the screen is connected to one line Length of cable (not including cable stubs): $\leq 200 \text{ m}$ (656.2 ft) Length of cable stubs: $\leq 1 \text{ m}$ (3.3 ft)
Option RC	PROFINET over Ethernet-APL, Ex-i, 10Mbit/s	
Option TA	FOUNDATION Fieldbus Ex i (STANDARD + FISCO)	Ex ic AEx ic, Ex ic, NIFW $U_i = 32 \text{ V}$ $I_i = 570 \text{ mA}$ $P_i = 8.5 \text{ W}$ $L_i = 10 \mu\text{H}$ $C_i = 5 \text{ nF}$

1) For further options see Ethernet-APL Installation Drawing HE_01622.

Order code for "Output; input 2" "Output; input 3"	Output type	Intrinsically safe values or NIFW values	
		Output; input 2	Output; input 3
Option C	Current output 4-20mA Ex-i passive	Ex ia Ex ic AEx ic, Ex ic, NIFW $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1.25 \text{ W}$ $L_i = 0$ $C_i = 0$	
Option G	Pulse/frequency/switch output Ex-i passive	Ex ia Ex ic AEx ic, Ex ic, NIFW $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1.25 \text{ W}$ $L_i = 0$ $C_i = 0$	

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 protective ground connection (PE)

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x3B
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 → 100. - Measured variables via HART protocol - Burst Mode functionality

FOUNDATION Fieldbus

Manufacturer ID	0x452B48 (hex)
Ident number	0x103B (hex)
Device revision	1
DD revision	Information and files under: www.endress.com www.fieldcommgroup.org
CFF revision	
Interoperability Test Kit (ITK)	Version 6.2.0
ITK Test Campaign Number	Information: www.endress.com www.fieldcommgroup.org
Link Master capability (LAS)	Yes
Choice of "Link Master" and "Basic Device"	Yes Factory setting: Basic Device
Node address	Factory setting: 247 (0xF7)
Supported functions	The following methods are supported: - Restart - ENP Restart - Diagnostic - Set to OOS - Set to AUTO - Read trend data - Read event logbook
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4
Min. delay between PDU	8

Max. response delay	16
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Cyclic data transmission ▪ Description of the modules ▪ Execution times ▪ Methods

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x156F
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ https://www.endress.com/download On the device product page: PRODUCTS → Product Finder → Links ▪ https://www.profibus.com
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Via operating tools (e.g. FieldCare)
Compatibility with earlier model	If the device is replaced, the measuring device Promass 300 supports the compatibility of the cyclic data with previous models. It is not necessary to adjust the engineering parameters of the PROFIBUS network with the Promass 300 GSD file. Previous model: Promass 83 PROFIBUS DP ▪ ID No.: 1529 (hex) ▪ Extended GSD file: EH3x1529.gsd ▪ Standard GSD file: EH3_1529.gsd  Description of the function scope of compatibility: Operating Instructions →  100.
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Cyclic data transmission ▪ Block model ▪ Description of the modules

PROFIBUS PA

Manufacturer ID	0x11
Ident number	0x156D
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ https://www.endress.com/download On the device product page: PRODUCTS → Product Finder → Links ▪ https://www.profibus.com

Supported functions	■ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ■ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ■ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	■ DIP switches on the I/O electronics module ■ Local display ■ Via operating tools (e.g. FieldCare)
Compatibility with earlier model	If the device is replaced, the measuring device Promass 300 supports the compatibility of the cyclic data with previous models. It is not necessary to adjust the engineering parameters of the PROFIBUS network with the Promass 300 GSD file. Earlier models: ■ Promass 80 PROFIBUS PA ■ ID No.: 1528 (hex) ■ Extended GSD file: EH3x1528.gsd ■ Standard GSD file: EH3_1528.gsd ■ Promass 83 PROFIBUS PA ■ ID No.: 152A (hex) ■ Extended GSD file: EH3x152A.gsd ■ Standard GSD file: EH3_152A.gsd  Description of the function scope of compatibility: Operating Instructions →  100.
System integration	Information regarding system integration: Operating Instructions →  100. ■ Cyclic data transmission ■ Block model ■ Description of the modules

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
Compatibility with earlier model	If the device is replaced, the measuring instrument Promass 300 supports the compatibility of the Modbus registers for the process variables and the diagnostic information with the previous model Promass 83. It is not necessary to change the engineering parameters in the automation system.  Description of the function scope of compatibility: Operating Instructions →  100.
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

Modbus TCP over Ethernet-APL

Port 1: Modbus TCP over Ethernet-APL 10 Mbit/s, SPE 10 Mbit/s	
Protocol	▪ Modbus application protocol V1.1 ▪ TCP
Response times	On Modbus client request: Typically 3 to 5 ms
TCP port	502
Modbus TCP connections	Maximum 4
Communication type	Ethernet Advanced Physical Layer 10BASE-T1L
Data transfer	Full-duplex
Polarity	Automatic correction of crossed "APL signal +" and "APL signal -" signal lines
Device type	Address
Device type ID	0xC43B
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Broadcast support for function codes	▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Supported transfer speed	10 Mbit/s (Ethernet-APL)
Supported features	Address can be configured using DHCP, web server or software
Device description files (FDI)	Information and files available at: www.endress.com → Downloads area
Configuration options for measuring instrument	▪ Asset management software (FieldCare, DeviceCare, Field Expert) ▪ Integrated web server via web browser and IP address ▪ Onsite operation

Supported functions	▪ Device identification using: Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Blinking feature via the local display for simple device identification and assignment ▪ Device operation via asset management software (e.g. FieldCare, DeviceCare)
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Overview and description of the supported function codes ▪ Status coding ▪ Factory setting

Port 2: Modbus TCP over Ethernet 100 Mbit/s	
Protocol	▪ Modbus application protocol V1.1 ▪ TCP
Response times	On Modbus client request: Typically 3 to 5 ms
TCP port	502
Modbus TCP connections	Maximum 4
Communication type	▪ 10BASE-T ▪ 100BASE-TX
Data transfer	Half-duplex, full-duplex
Polarity	Auto-MDIX
Device type	Address
Device type ID	0xC43B
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Broadcast support for function codes	▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Supported transfer speed	▪ 10 Mbit/s ▪ 100 Mbit/s (Fast-Ethernet)
Supported features	Address can be configured using DHCP, web server or software
Device description files (FDI)	Information and files available at: www.endress.com → Downloads area
Configuration options for measuring instrument	▪ Asset management software (FieldCare, DeviceCare, Field Expert) ▪ Integrated web server via web browser and IP address ▪ Onsite operation
Supported functions	▪ Device identification using: Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Device operation via asset management software (e.g. FieldCare, DeviceCare)
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Overview and description of the supported function codes ▪ Status coding ▪ Factory setting

EtherNet/IP

Protocol	■ The CIP Networks Library Volume 1: Common Industrial Protocol ■ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP
Communication type	■ 10Base-T ■ 100Base-TX
Device profile	Generic device (product type: 0x2B)
Manufacturer ID	0x000049E
Device type ID	0x103B
Baud rates	Automatic ¹⁹ / ₁₀₀ Mbit with half-duplex and full-duplex detection
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported CIP connections	Max. 3 connections
Explicit connections	Max. 6 connections
I/O connections	Max. 6 connections (scanner)
Configuration options for measuring device	■ DIP switches on the electronics module for IP addressing ■ Manufacturer-specific software (FieldCare) ■ Add-on Profile Level 3 for Rockwell Automation control systems ■ Web browser ■ Electronic Data Sheet (EDS) integrated in the measuring device
Configuration of the EtherNet interface	■ Speed: 10 MBit, 100 MBit, auto (factory setting) ■ Duplex: half-duplex, full-duplex, auto (factory setting)
Configuration of the device address	■ DIP switches on the electronics module for IP addressing (last octet) ■ DHCP ■ Manufacturer-specific software (FieldCare) ■ Add-on Profile Level 3 for Rockwell Automation control systems ■ Web browser ■ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)
Device Level Ring (DLR)	Yes
System integration	Information regarding system integration: Operating Instructions →  100. ■ Cyclic data transmission ■ Block model ■ Input and output groups

PROFINET

Protocol	Application layer protocol for decentral device periphery and distributed automation, Version 2.3
Communication type	100 Mbit/s
Conformity class	Conformance class B
Netload Class	Netload Class 2 100 Mbit/s
Baud rates	Automatic 100 Mbit/s with full-duplex detection
Periods	From 8 ms
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Media Redundancy Protocol (MRP)	Yes
System redundancy support	System redundancy S2 (2 AR with 1 NAP)
Device profile	Application interface identifier 0xF600 Generic device
Manufacturer ID	0x11
Device type ID	0x843B

Device description files (GSD, DTM, DD)	Information and files available at: ▪ www.endress.com - On the product page for the device: Documents/Software → Device drivers ▪ www.profibus.com
Supported connections	▪ 2 x AR (IO Controller AR) ▪ 1 x AR (IO-Supervisor Device AR connection allowed) ▪ 1 x Input CR (Communication Relation) ▪ 1 x Output CR (Communication Relation) ▪ 1 x Alarm CR (Communication Relation)
Configuration options for measuring instrument	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated web server via web browser and IP address ▪ Device master file (GSD), can be read out via the integrated web server of the measuring instrument. ▪ Onsite operation
Configuration of the device name	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ DCP protocol ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated web server
Supported functions	▪ Identification & Maintenance, simple device identifier via: ▪ Control system ▪ Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Blinking feature via the local display for simple device identification and assignment ▪ Device operation via asset management software (e.g. FieldCare, DeviceCare, SIMATIC PDM)
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Cyclic data transmission ▪ Overview and description of the modules ▪ Status coding ▪ Startup configuration ▪ Factory setting

PROFINET over Ethernet-APL

Protocol	Application layer protocol for decentral device periphery and distributed automation, Version 2.43
Communication type	Ethernet Advanced Physical Layer 10BASE-T1L
Conformance Class	Conformance Class B (PA)
Netload Class	PROFINET Netload Robustness Class 2 10 Mbit/s
Data transfer	10 Mbit/s Full-duplex
Cycle times	64 ms
Polarity	Automatic correction of crossed "APL signal +" and "APL signal -" signal lines
Media Redundancy Protocol (MRP)	Not possible (point-to-point connection to APL field switch)
System redundancy support	System redundancy S2 (2 AR with 1 NAP)
Device profile	PROFINET PA profile 4.02 (Application interface identifier API: 0x9700)
Manufacturer ID	17
Device type ID	0xA43B
Device description files (GSD, DTM, FDI)	Information and files available at: ▪ www.endress.com → Downloads area ▪ www.profibus.com

Supported connections	▪ 2x AR (IO Controller AR) ▪ 2x AR (IO Supervisor Device AR connection allowed)
Configuration options for measuring instrument	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated Web server via Web browser and IP address ▪ Device master file (GSD), can be read out via the integrated Web server of the measuring instrument. ▪ Onsite operation
Configuration of the device name	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ DCP protocol ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated web server
Supported functions	▪ Identification & Maintenance, simple device identifier via: ▪ Control system ▪ Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Blinking feature via the local display for simple device identification and assignment ▪ Device operation via asset management software (e.g. FieldCare, DeviceCare, SIMATIC PDM with FDI package)
System integration	Information regarding system integration: Operating Instructions →  100. ▪ Cyclic data transmission ▪ Overview and description of the modules ▪ Status coding ▪ Factory setting

Power supply

Terminal assignment

Transmitter: supply voltage, input/outputs

HART

Supply voltage		Input/output 1 (Port 1)		Input/output 2		Input/output 3		Service interface (Port 2)
1 (+)	2 (-)	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

FOUNDATION fieldbus

Supply voltage		Input/output 1 (Port 1)		Input/output 2		Input/output 3		Service interface (Port 2)
1 (+)	2 (-)	26 (A)	27 (B)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

PROFIBUS DP

Supply voltage		Input/output 1 (Port 1)		Input/output 2		Input/output 3		Service interface (Port 2)
1 (+)	2 (-)	26 (B)	27 (A)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

PROFIBUS PA

Supply voltage		Input/output 1 (Port 1)		Input/output 2		Input/output 3		Service interface (Port 2)
1 (+)	2 (-)	26 (B)	27 (A)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

Modbus RS485

Supply voltage		Input/output 1 (Port 1)		Input/output 2		Input/output 3		Service interface (Port 2)
1 (+)	2 (-)	26 (B)	27 (A)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

Modbus TCP

Supply voltage		Input/output 1 1 (Port 1) ¹⁾		Input/output 2		Input/output 3		Service interface (Port 2) ¹⁾
1 (+)	2 (-)	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

1) For Modbus TCP communication, either port 1 OR port 2 can be used.

PROFINET

Supply voltage		Input/output 1 (Port 1) ¹⁾	Input/output 2		Input/output 3		Service interface (Port 2) ¹⁾
1 (+)	2 (-)	RJ45	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.							

1) Port can be used for communication or as a service interface (CDI-RJ45).

PROFINET over Ethernet-APL

Supply voltage		Input/output 1 (Port 1)		Input/output 2		Input/output 3		Service interface (Port 2) ¹⁾
1 (+)	2 (-)	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.								

1) No PROFINET communication available on port 2

Ethernet/IP

Supply voltage		Input/output 1 (Port 1) ¹⁾	Input/output 2		Input/output 3		Service interface (Port 2) ¹⁾
1 (+)	2 (-)	RJ45	24 (+)	25 (-)	22 (+)	23 (-)	CDI-RJ45
The terminal assignment depends on the specific device version ordered → 13.							

1) Port can be used for communication or as a service interface (CDI-RJ45).



Terminal assignment of the remote display and operating module → 41.

For information on the pin assignment of the device plugs, see the Operating Instructions for the device.

Available device plugs

Device plugs may not be used in hazardous areas!

Device plugs for Proline 300:

Order code for "Input; output 1"

- Option **SA** "FOUNDATION Fieldbus" → 38
- Option **GA** "PROFIBUS PA" → 39
- Option **NA** "EtherNet/IP" → 39
- Option **RA** "PROFINET" → 39
- Option **RB** "PROFINET over Ethernet-APL" → 39
- Option **MB** "Modbus TCP" → 39

Device plug for connecting to the service interface:

Order code for "Accessory mounted"

Option **NB**, RJ45 M12 adapter (service interface) → 49

Order code for "Input; output 1", option SA "FOUNDATION fieldbus"

Order code for "Electrical connection"	Cable entry/connection → 41	
	2	3
M, 3, 4, 5	7/8" plug	–

Order code for "Input; output 1", option GA "PROFIBUS PA"

Order code for "Electrical connection"	Cable entry/connection → 41	
	2	3
L, N, P, U	Connector M12×1	–

Order code for "Input; output 1", option NA "EtherNet/IP"

Order code for "Electrical connection"	Cable entry/connection → 41	
	2	3
L, N, P, U	Connector M12×1	–
R ^{1) 2)} , S ^{1) 2)} , T ^{1) 2)} , V ^{1) 2)}	Connector M12×1	Connector M12×1

- 1) Not compatible with an external WLAN antenna (order code for "Accessory enclosed", option P8), an RJ45 M12 adapter for the service interface (order code for "Accessory mounted", option NB)
- 2) Suitable for integrating the device into a ring topology.

Order code for "Input; output 1", option RA "PROFINET"

Order code for "Electrical connection"	Cable entry/connection → 41	
	2	3
L, N, P, U	Connector M12×1	–
R ^{1) 2)} , S ^{1) 2)} , T ^{1) 2)} , V ^{1) 2)}	Connector M12×1	Connector M12×1

- 1) Not compatible with an external WLAN antenna (order code for "Accessory enclosed", option P8), an RJ45 M12 adapter for the service interface (order code for "Accessory mounted", option NB)
- 2) Suitable for integrating the device into a ring topology.

Order code for "Input; output 1", option RB "PROFINET over Ethernet-APL"

Order code for "Electrical connection"	Cable entry/connection → 41	
	2	3
L, N, P, U	Connector M12×1	–

Order code for "Input; output 1", option MB "Modbus TCP over Ethernet-APL"

Order code for "Electrical connection"	Accessories	Cable entry/connection → 40	
		2	3
L, N, P, U	–	Connector M12×1 A-coded	–
L, N, P, U	NB ¹⁾	Connector M12×1 A-coded	Connector M12×1 ¹⁾ D-coded
1 ²⁾ , 2 ²⁾ , 7 ²⁾ , 8 ²⁾	–	–	Connector M12×1 D-coded

- 1) Cannot be used as a Modbus TCP port.
- 2) Not compatible with an external WLAN antenna (order code for "Accessory enclosed", option P8, an RJ45 M12 adapter for the service interface (order code for "Accessory mounted", option NB) or a remote operating and display module DKX001.

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

Order code for "Accessory mounted"	Cable entry/connection →  40	
	Cable entry 2	Cable entry 3
NB ¹⁾	–	Connector M12×1

1) Not compatible with electrical connection option 1, 2, 7, 8

Supply voltage	Order code for "Power supply"	Terminal voltage		Frequency range
	Option D	DC 24 V	±20%	–
	Option E	AC 100 to 240 V	–15 to 10%	50/60 Hz
	Option I	DC 24 V	±20%	–
		AC 100 to 240 V	–15 to 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
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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 plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

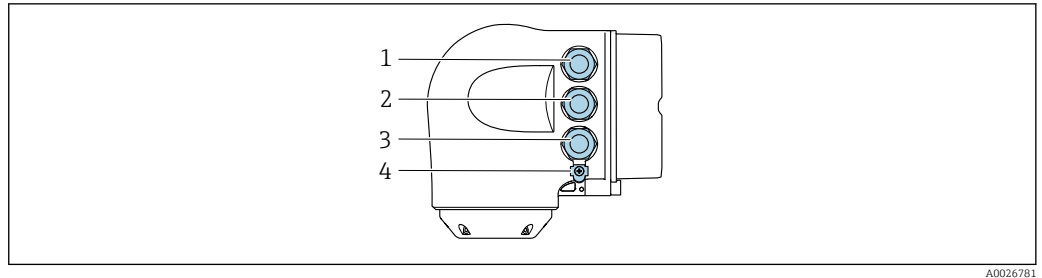
Overcurrent protection element

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 →  37
- Device plugs available →  38



- 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 Protective ground connection (PE)

i An adapter for the RJ45 to the M12 connector 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 connector mounted in the cable entry. The connection to the service interface can be established via an M12 connector without opening the device.

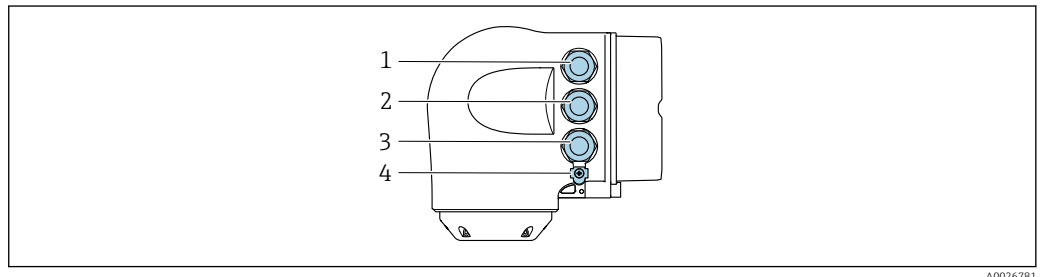
i Network connection via service interface (CDI-RJ45) → 86

Connecting in a ring topology

Device versions with EtherNet/IP and PROFINET communication protocols can be integrated into a ring topology. The device is integrated via the terminal connection for signal transmission (output 1) and the connection to the service interface (CDI-RJ45).

i Integrating the transmitter into a ring topology:

- EtherNet/IP
- PROFINET



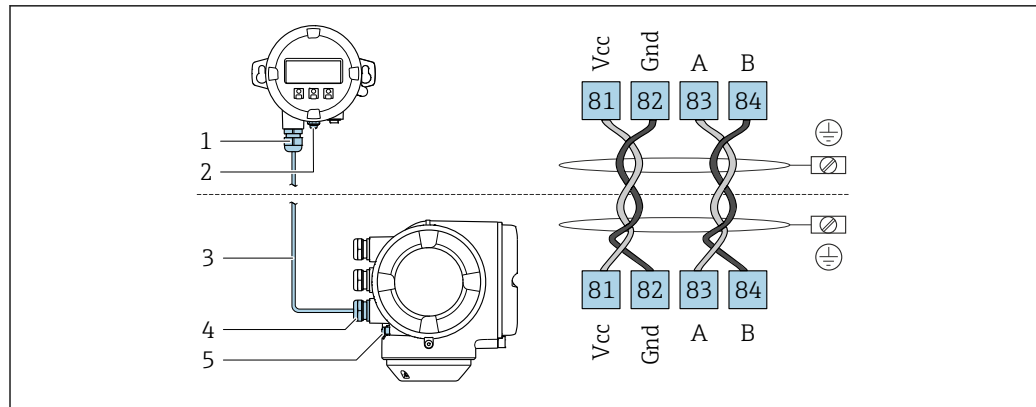
- 1 Terminal connection for supply voltage
- 2 Terminal connection for signal transmission: PROFINET or EtherNet/IP (RJ45 plug)
- 3 Connection to service interface (CDI-RJ45)
- 4 Protective ground connection (PE)

i If the device has additional inputs/outputs, these are routed in parallel via the cable entry for connection to the service interface (CDI-RJ45).

Connecting the remote display and operating module DKX001

i The remote display and operating module DKX001 is available as an optional extra → 97..

- The measuring instrument is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring instrument. 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 instrument display module. Only one display or operation unit may be connected to the transmitter at any one time.

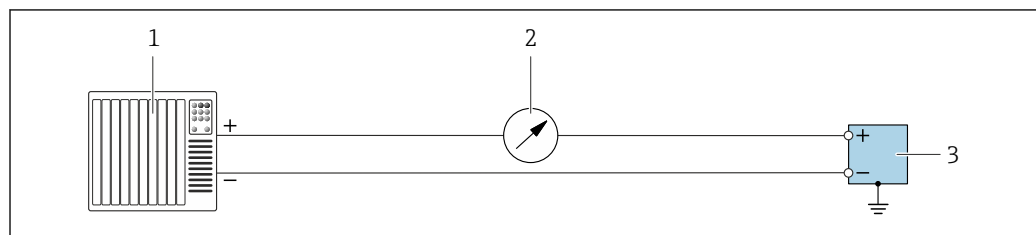


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- 1 Remote display and operating module DKX001
- 2 Protective ground connection (PE)
- 3 Connecting cable
- 4 Measuring instrument
- 5 Protective ground connection (PE)

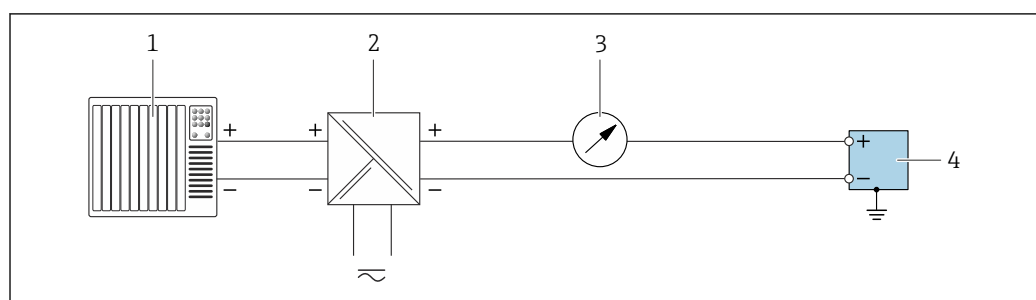
Connection examples

Current output 4 to 20 mA (without HART)



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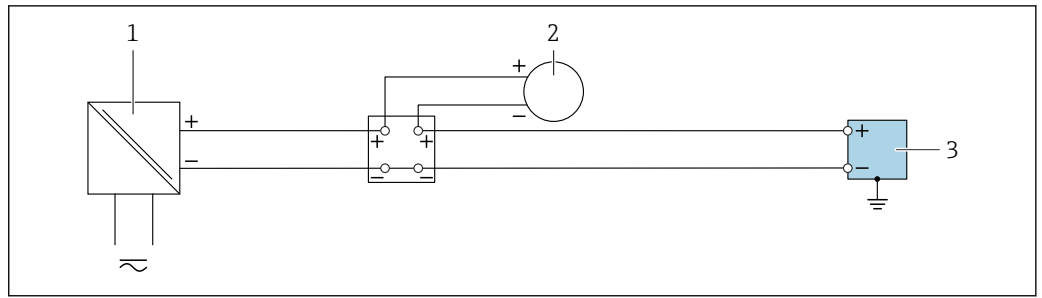
- 2 Connection example for 4 to 20 mA current output (active)
- 1 Automation system with current input (e.g. PLC)
 - 2 Optional additional display unit: Observe maximum load
 - 3 Flowmeter with current output (active)



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- 3 Connection example for 4 to 20 mA current output (passive)
- 1 Automation system with current input (e.g. PLC)
 - 2 Power supply
 - 3 Optional additional display unit: Observe maximum load
 - 4 Transmitter with current output (passive)

Current input 4 to 20 mA

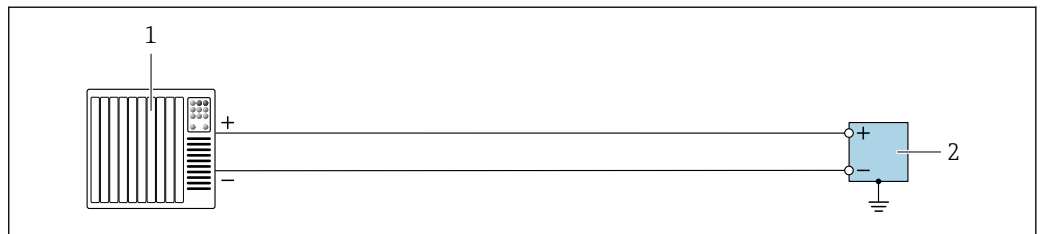


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4 Connection example for 4 to 20 mA current input

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

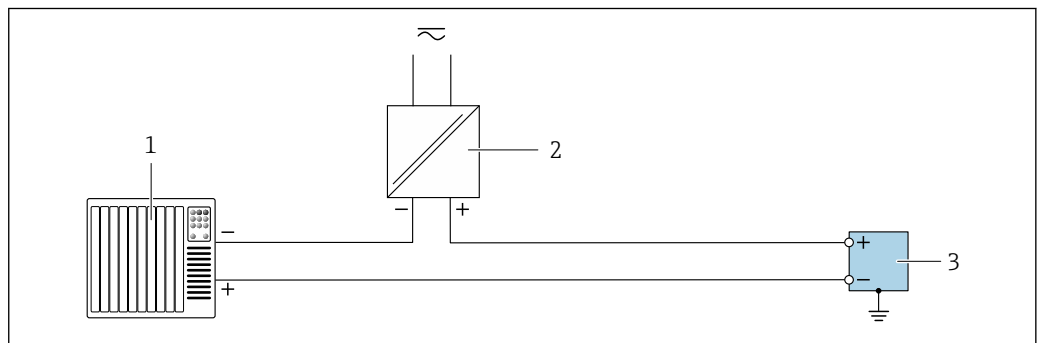
Pulse output/frequency output/switch output



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5 Connection example for pulse output/frequency output/switch output (active)

- 1 Automation system with pulse input/frequency input/switch input (e.g. PLC)
- 2 Transmitter with pulse output/frequency output/switch output (active)

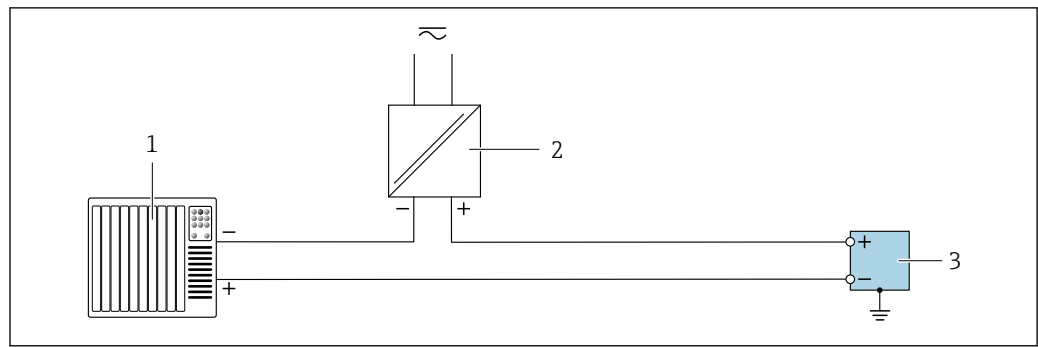


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6 Connection example for pulse output/frequency output/switch output (passive)

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

Relay output

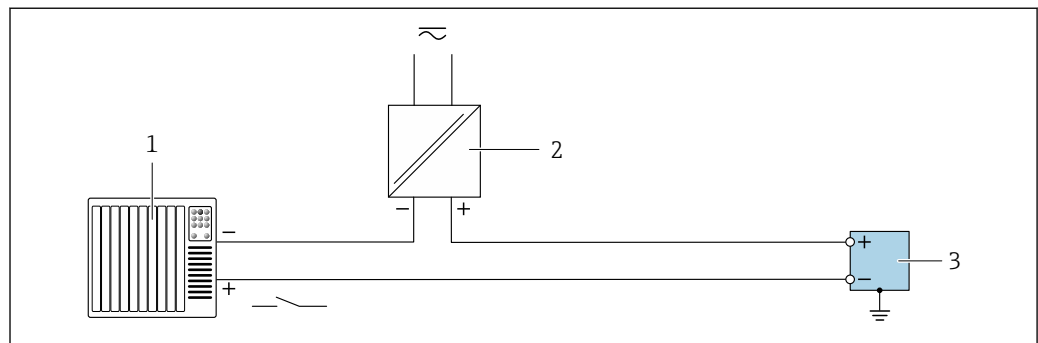


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7 Connection example for relay output

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter with relay output

Status input

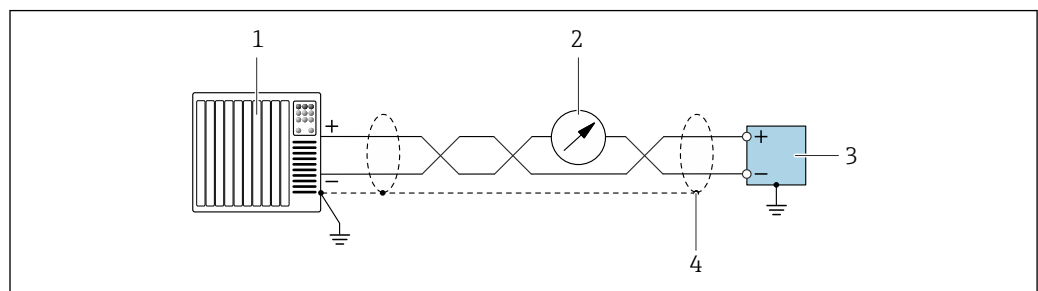


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8 Connection example for status input

- 1 Automation system with switch output passive e.g. PLC)
- 2 Power supply
- 3 Transmitter with status input

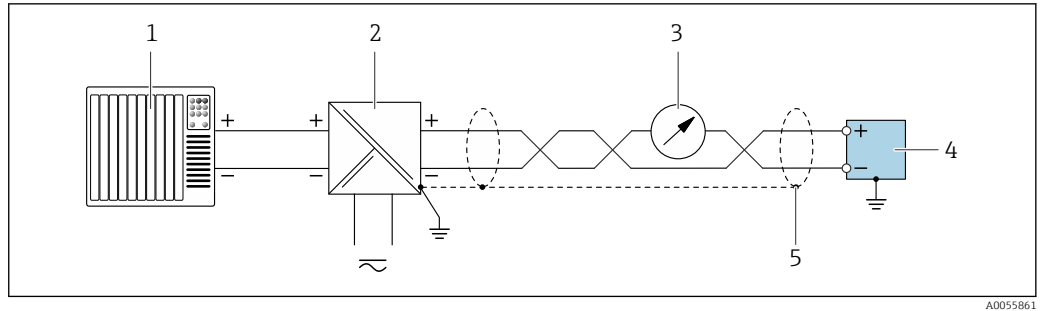
Current output 4 to 20 mA HART



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

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

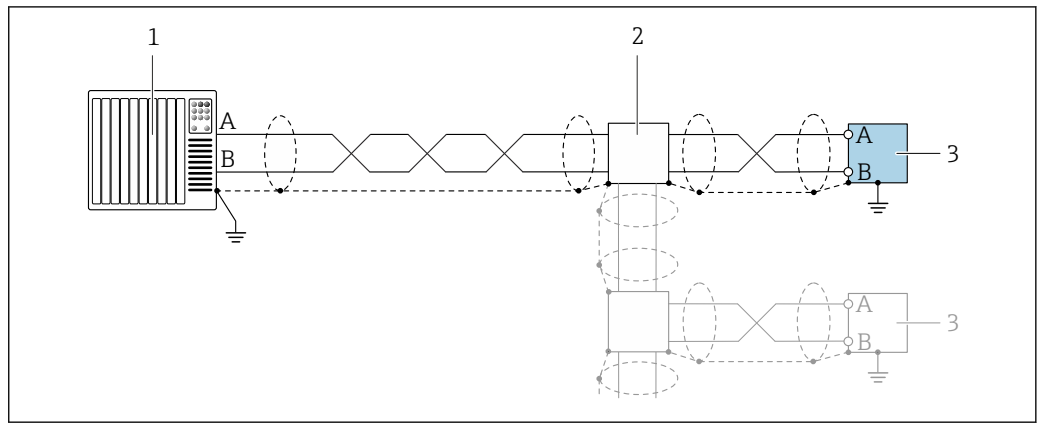


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10 Connection example for 4 to 20 mA current output with HART (passive)

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

Modbus RS485



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11 Connection example for Modbus RS485

- 1 Automation system with Modbus master (e.g. PLC)
- 2 Optional distribution box
- 3 Transmitter with Modbus RS485

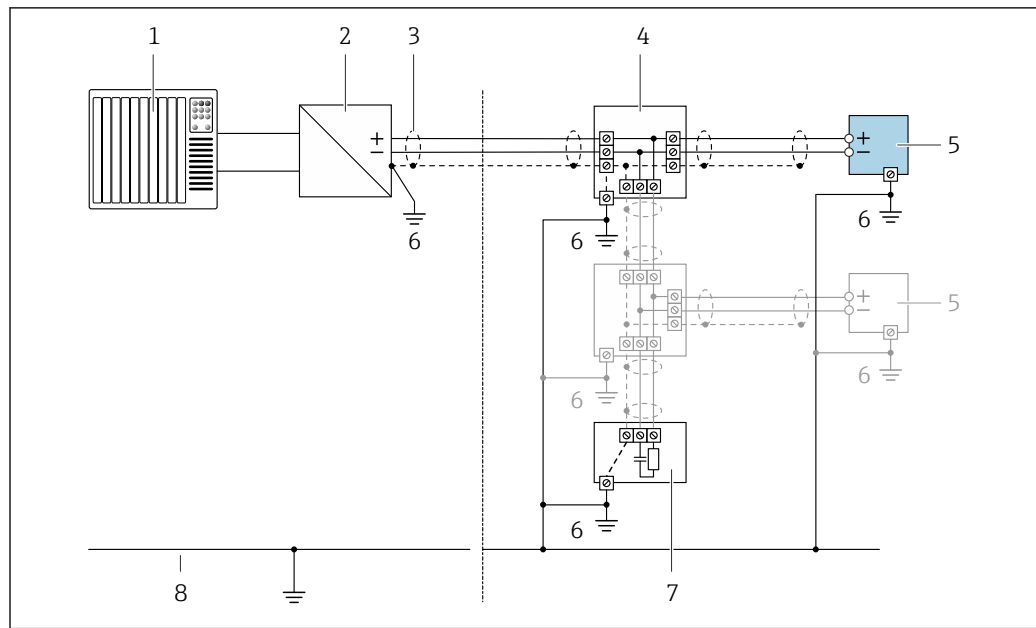
PROFIBUS PA

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

PROFIBUS DP

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

FOUNDATION Fieldbus



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12 Connection example for FOUNDATION Fieldbus

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

PROFINET



See <https://www.profibus.com> "PROFINET Planning guideline".

EtherNet/IP



See <https://www.odva.org> "EtherNet/IP Media Planning & Installation Manual".

Ethernet-APL



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

Potential equalization

Requirements

For potential equalization:

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

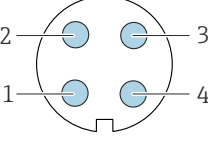
Terminals

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

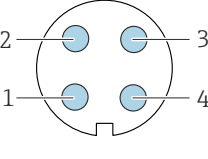
Cable entries

- 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
- Device plug for digital communication: M12
Only available for certain device versions → 38.

Pin assignment, device plug**FOUNDATION Fieldbus**

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

PROFIBUS PA

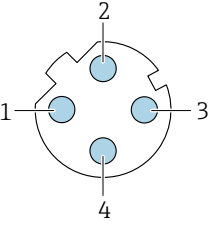
	Pin	Assignment		Coding	Plug/socket
	1	+	PROFIBUS PA +	A	Plug
	2		Grounding		
	3	-	PROFIBUS PA -		
	4		Not used		
	Metal plug housing		Cable shield		



Recommended plug:

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

PROFINET

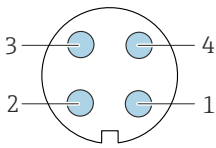
	Pin	Assignment		Coding	Plug/socket
	1	+	TD +	D	Socket
	2	+	RD +		
	3	-	TD -		
	4	-	RD -		
	Metal plug housing		Cable shield		



Recommended plug:

- Binder, series 825, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

PROFINET over Ethernet-APL

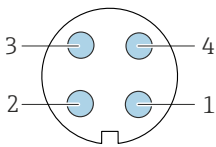
	Pin	Assignment	Coding	Plug/socket
	1	Ethernet-APL signal -	A	Socket
	2	Ethernet-APL signal +		
	3	Cable shield ¹		
	4	Not used		
	Metal plug housing	Cable shield		
¹ If a cable shield is used				



Recommended plug:

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

Modbus TCP over Ethernet-APL 10 Mbit/s

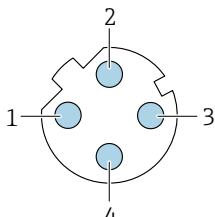
	Pin	Assignment	Coding	Plug/socket
	1	Ethernet-APL signal -	A	Socket
	2	Ethernet-APL signal +		
	3	Cable shield ¹		
	4	Not used		
	Metal plug housing	Cable shield		
¹ If a cable shield is used				



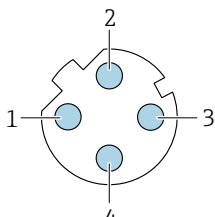
Recommended plug:

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

Modbus TCP over Ethernet 100 Mbit/s



EtherNet/IP

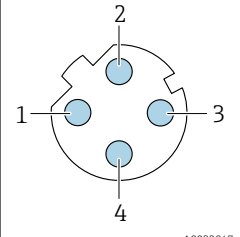
 A0032047	Pin	Assignment		Coding	Plug/socket
	1	+	Tx	D	Socket
	2	+	Rx		
	3	-	Tx		
	4	-	Rx		
	Metal plug housing	Cable shield			



Recommended plug:

- Binder, series 825, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

Service interfaceOrder code for "Accessory mounted", option **NB**: "Adapter RJ45 M12 (service interface)"

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



Recommended plug:

- Binder, series 825, 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 terminalConductor cross-section < 6 mm² (10 AWG)

Larger cross-sections can be connected using a cable lug.

The grounding impedance must be less than 2 Ω.

Signal cable

For custody transfer, all signal lines must be shielded cables (tinned copper braiding, optical coverage ≥ 85 %). The cable shield must be connected on both sides.

4 to 20 mA current input

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Relay output

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

Shielded twisted-pair cable.

See <https://www.fieldcommgroup.org> "HART PROTOCOL SPECIFICATIONS".*Modbus RS485*

Shielded twisted-pair cable.

See <https://modbus.org> "MODBUS over Serial Line Specification and Implementation Guide".

PROFIBUS PA

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



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

PROFIBUS DP

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



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

PROFINET

Only PROFINET cables.



See <https://www.profibus.com> "PROFINET Planning guideline".

EtherNet/IP

Twisted-pair Ethernet CAT 5 or better.



See <https://www.odva.org> "EtherNet/IP Media Planning & Installation Manual".

Ethernet-APL

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



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

FOUNDATION Fieldbus

Twisted, shielded two-wire cable.



For further information on planning and installing FOUNDATION Fieldbus networks see:

- Operating Instructions for "FOUNDATION Fieldbus Overview" (BA00013S)
- FOUNDATION Fieldbus Guideline
- IEC 61158-2 (MBP)

Connecting cable for 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 mm ² (22 AWG)	80 m (270 ft)
0.50 mm ² (20 AWG)	120 m (400 ft)
0.75 mm ² (18 AWG)	180 m (600 ft)
1.00 mm ² (17 AWG)	240 m (800 ft)
1.50 mm ² (15 AWG)	300 m (1 000 ft)

Optionally available connecting cable

Standard cable	2 × 2 × 0.34 mm ² (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	→ 40
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

- Error limits based on ISO 11631
 - Water
 - +15 to +45 °C (+59 to +113 °F)
 - 2 to 6 bar (29 to 87 psi)
 - Data as indicated in the calibration protocol
 - Accuracy based on accredited calibration rigs according to ISO 17025
-  To obtain measured errors, use the *Applicator* sizing tool → 98

Maximum measurement error

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

Base accuracy

 Design fundamentals → 54

Mass flow and volume flow (liquids)

- ±0.05 % o.r. (optional for mass flow: PremiumCal; order code for "Calibration flow", option D)
- ±0.10 % o.r. (standard)

Mass flow (gases)

±0.35 % o.r.

Density (liquids)

Under reference conditions [g/cm ³]	Standard density calibration [g/cm ³]	Extended density calibration ^{1) 2)} [g/cm ³]
±0.0005	±0.0005	±0.0005

- 1) Valid range for extended density calibration: 0 to 2 g/cm³, +20 to +60 °C (+68 to +140 °F)
2) order code for "Application package", option E1 "Extended density"

Temperature

$$\pm 0.5\text{ °C} \pm 0.005 \cdot T\text{ °C} (\pm 0.9\text{ °F} \pm 0.003 \cdot (T - 32)\text{ °F})$$
Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
300	12	137	5.03
350	14	137	5.03
400	16	137	5.03

Flow values

Flow values as turndown parameters depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
300	4 100 000	410 000	205 000	82 000	41 000	8 200
350	4 100 000	410 000	205 000	82 000	41 000	8 200
400	4 100 000	410 000	205 000	82 000	41 000	8 200

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[inch]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
12	150 700	15 070	7 535	3 014	1 507	301.4
14	150 700	15 070	7 535	3 014	1 507	301.4
16	150 700	15 070	7 535	3 014	1 507	301.4

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)
-----------------	---

Repeatabilityo.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature**Base repeatability**

Design fundamentals → 54

Mass flow and volume flow (liquids)

±0.025 % o.r. (PremiumCal)
±0.05 % o.r.

Mass flow (gases)

±0.25 % o.r.

Density (liquids)

±0.00025 g/cm³

Temperature

±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0015 · (T-32) °F)

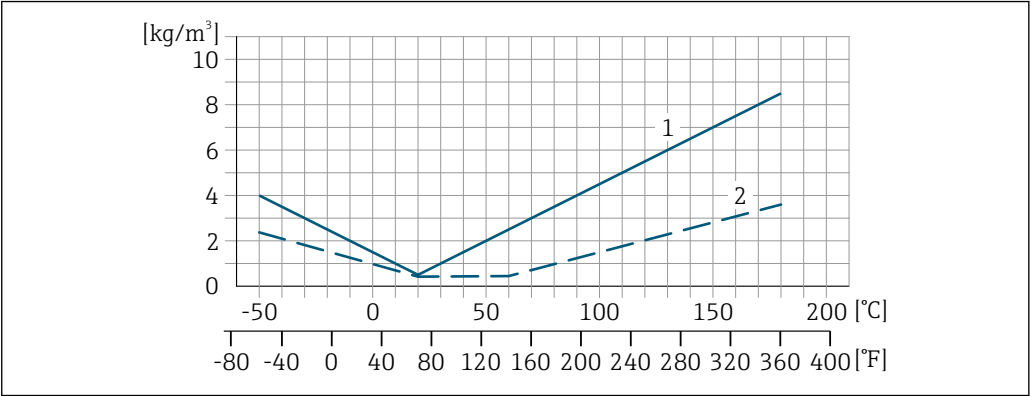
Response time	The response time depends on the configuration (damping).
---------------	---

Influence of ambient temperature	Current output	
	<table><tr><td>Temperature coefficient</td><td>Max. 1 µA/°C</td></tr></table>	Temperature coefficient
Temperature coefficient	Max. 1 µA/°C	

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.
-------------------------	---

Influence of medium temperature	Mass flow o.f.s. = of full scale value If there is a difference between the temperature during zero adjustment and the process temperature, the additional measurement error of the sensors is typically ±0.0002 %o.f.s./°C (±0.0001 % o. f.s./°F). The influence is reduced when the zero adjustment is performed at process temperature.
	Density ■ If there is a difference between the density calibration temperature and the process temperature, the measurement error of the sensors is typically ±0.00005 g/cm³/°C (±0.000025 g/cm³/°F). Field density adjustment is possible. ■
	Extended density specification If the process temperature is outside the valid range (→ 51) the measurement error is ±0.000025 g/cm³ /°C (±0.0000125 g/cm³ /°F)



- 1 Field density adjustment, for example at +20 °C (+68 °F)
- 2 Extended density calibration

Temperature
±0.005 · T °C (± 0.005 · (T - 32) °F)

Influence of medium pressure

The following shows how the process pressure (gauge pressure) affects the accuracy of the mass flow.

o.r. = of reading



It is possible to compensate for the effect by:

- Reading in the current pressure measured value via the current input or a digital input.
- Specifying a fixed value for the pressure in the device parameters.



Operating Instructions → 100.

DN		[% o.r./bar]	[% o.r./psi]
[mm]	[in]		
300	12	-0.009	-0.0006
350	14	-0.009	-0.0006
400	16	-0.009	-0.0006

Design fundamentals

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

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

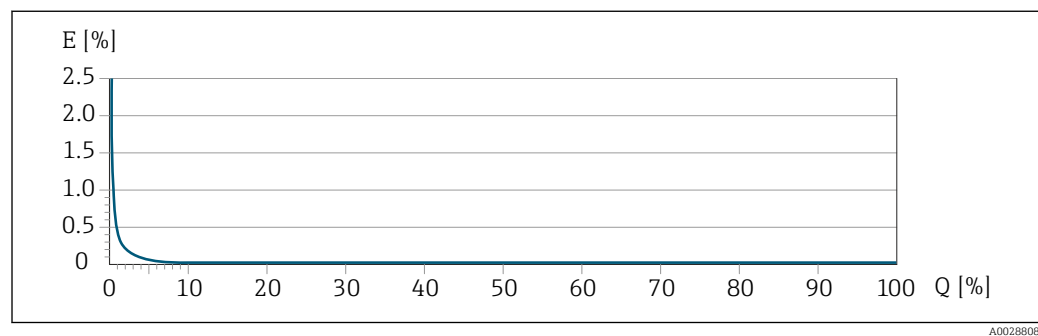
MeasValue = measured value; ZeroPoint = zero point stability

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

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

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

Flow rate	Maximum repeatability in % o.r.
$\geq \frac{\frac{1}{2} \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021335	$\pm \text{BaseRepeat}$ A0021340
$< \frac{\frac{1}{2} \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021336	$\pm \frac{1}{2} \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021337

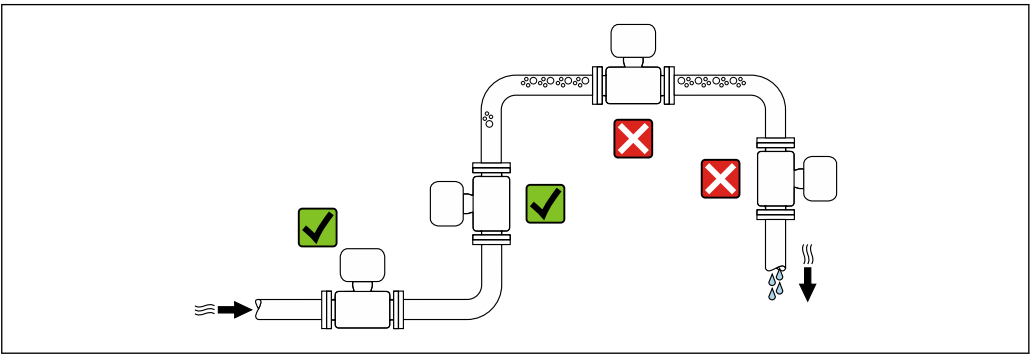
Example of maximum measurement error

E Maximum measurement error in % o.r. (example with PremiumCal)

Q Flow rate in % of maximum full scale value

Installation

Mounting location



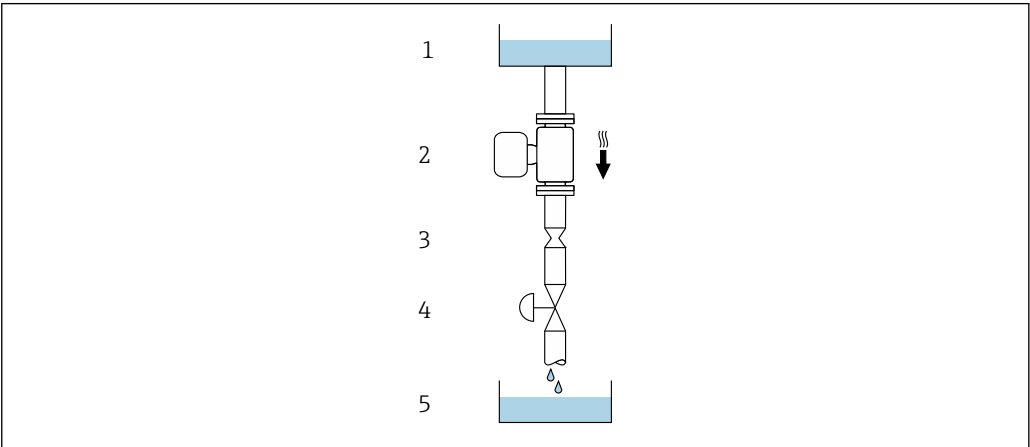
A0028772

To avoid measurement errors caused by gas bubble formation in the measuring tube, avoid the following installation locations in the pipe:

- Highest point of a pipeline
- Directly upstream of a free pipe outlet in a down pipe

Installation in down pipes

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



A0028773

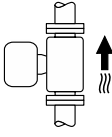
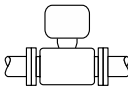
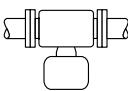
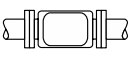
13 Installation in a down pipe (e.g. for batching applications)

- 1 Supply tank
- 2 Sensor
- 3 Orifice plate, pipe restriction
- 4 Valve
- 5 Filling container

DN/NPS		Ø orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
300	12	210	8.27
350	14	210	8.27
400	16	210	8.27

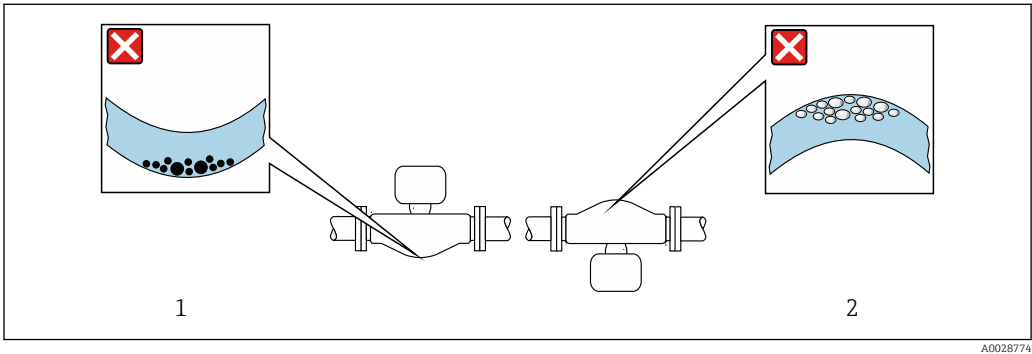
Orientation

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

Orientation			Recommendation
A	Vertical orientation	 A0015591	✓✓✓ ¹⁾
B	Horizontal orientation, transmitter at top	 A0015589	✓✓✓ ²⁾ → ☒ 14, ☒ 56
C	Horizontal orientation, transmitter at bottom	 A0015590	✓✓✓ ³⁾ → ☒ 14, ☒ 56
D	Horizontal orientation, transmitter at side	 A0015592	✓ → ☒ 14, ☒ 56

- 1) This orientation is recommended to ensure self-draining.
- 2) Applications with low process temperatures may reduce the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
- 3) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

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



☒ 14 Orientation of sensor with curved measuring tube

- 1 Avoid this orientation for media with entrained solids: Risk of solids accumulating
- 2 Avoid this orientation for outgassing media: Risk of gas accumulating

Inlet and outlet runs No special precautions need to be taken for fittings that create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs → ☒ 62.

Special installation instructions

Drainability

When installed vertically, the measuring tubes can be drained completely and protected against buildup.

Hygienic compatibility

 When installing in hygienic applications, please refer to the information in the "Certificates and approvals/hygienic compatibility" section

- In the case of measuring devices with the order code for "Housing", option B "Stainless, hygienic", to seal the connection compartment cover, screw it closed finger-tight and tighten it by another 45° (corresponds to 15 Nm).

Rupture disk

Process-related information: → ☒ 62.

⚠ WARNING**Danger from medium escaping!**

Medium escaping under pressure can cause injury or material damage.

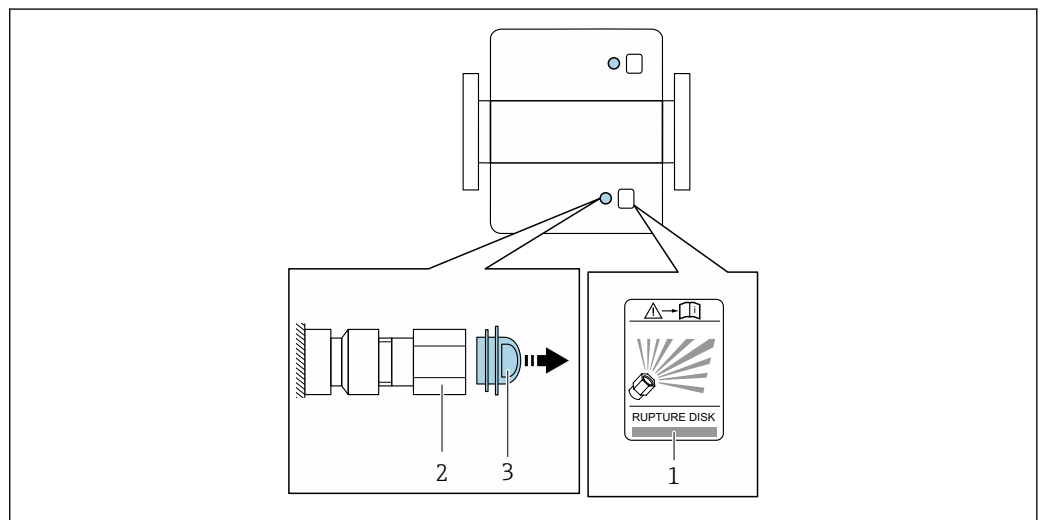
- ▶ Take precautions to prevent danger to persons and damage if the rupture disk is actuated.
- ▶ Observe the information on the rupture disk sticker.
- ▶ Make sure that the function and operation of the rupture disk is not impeded through the installation of the device.
- ▶ Do not use a heating jacket.
- ▶ Do not remove or damage the rupture disk.

The position of the rupture disk is indicated by a sticker affixed beside it.

The transportation guard must be removed.

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

In the event of a failure of the rupture disk, a drain device can be screwed onto the internal thread of the rupture disk in order to drain off any escaping medium.



A0029944

- 1 Rupture disk label
- 2 Rupture disk with 1/2" NPT internal thread and 1" width across flats
- 3 Transport protection

For information on the dimensions, see the "Mechanical construction" section (accessories).

Zero point verification and zero adjustment

All measuring instruments are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 51. Therefore, a zero adjustment in the field is generally not required.

Experience shows that zero adjustment is advisable only in special cases:

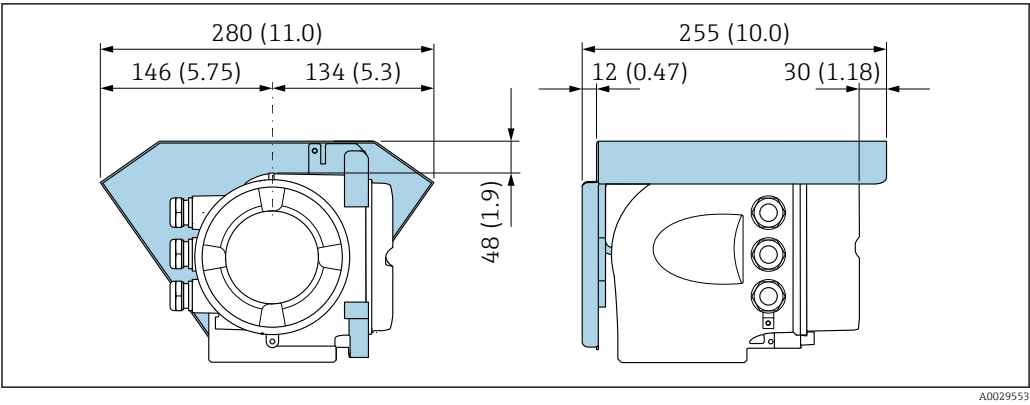
- To achieve maximum measurement accuracy even with low flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity media).
- For gas applications with low pressure.

For information on checking the zero point and performing a zero adjustment, see the Operating Instructions for the device.



To achieve the highest possible measurement accuracy at low flow rates, the installation must protect the sensor from mechanical stress during operation.

Protective cover



15 Unit mm (in)

Environment

Ambient temperature range	Measuring instrument	■ -40 to +60 °C (-40 to +140 °F) ■ 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.

i Dependency of ambient temperature on medium temperature → 59

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

i You can order a weather protection cover from Endress+Hauser. → 97.

Storage temperature	-50 to +80 °C (-58 to +176 °F)
Climate class	DIN EN 60068-2-38 (test Z/AD)
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)
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 Order code for "Sensor options", option CM "IP69" External WLAN antenna IP67

Vibration resistance and shock resistance

Sinusoidal vibration similar to IEC 60068-2-6

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

Broadband random vibration similar to IEC 60068-2-64

- 10 to 200 Hz, 0.003 g²/Hz
- 200 to 2 000 Hz, 0.001 g²/Hz
- Total: 1.54 g rms

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

6 ms 30 g

Rough handling shocks similar to IEC 60068-2-31

Mechanical load

Transmitter housing:

- Protect against mechanical effects, such as shock or impact
- Do not use as a ladder or climbing aid

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21), NAMUR Recommendation 21 (NE 21) is fulfilled when the device is installed in accordance with NAMUR Recommendation 98 (NE 98).
- As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4
- Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784



The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud, an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.



Details are provided in the Declaration of Conformity.



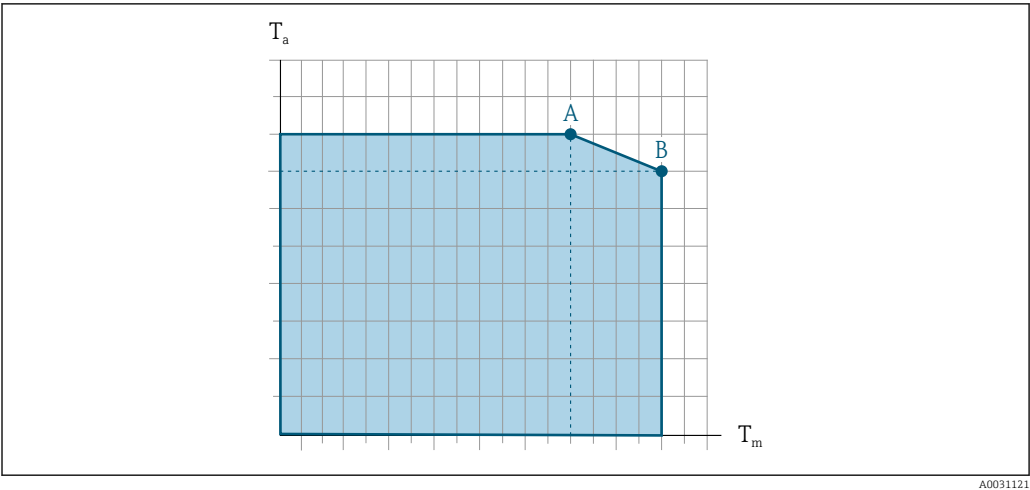
This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

Process

Medium temperature range

–50 to +180 °C (–58 to +356 °F)

Dependency of ambient temperature on medium temperature



16 Exemplary representation, values in the table below.

- T_a Ambient temperature
 T_m Medium temperature
A Maximum permitted medium temperature T_m at $T_{a\max} = 60\text{ °C}$ (140 °F); higher medium temperatures T_m require a reduction in the ambient temperature T_a
B Maximum permitted ambient temperature T_a for the maximum specified medium temperature T_m of the sensor

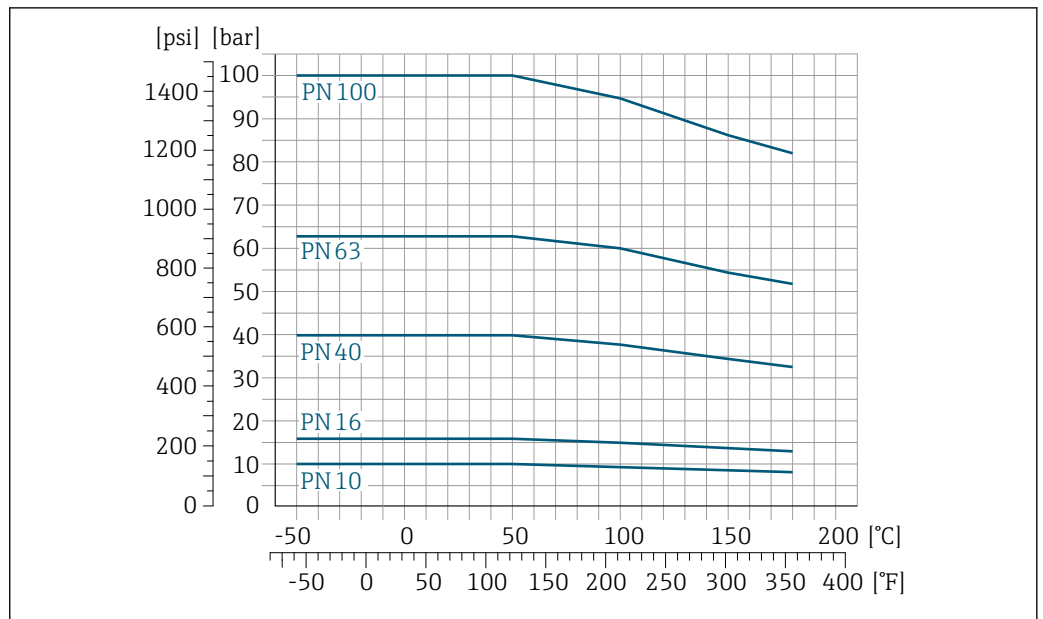
i Values for devices that are used in the hazardous area:
Separate Ex documentation (XA) for the device → 100.

Not insulated				Insulated			
A		B		A		B	
T_a	T_m	T_a	T_m	T_a	T_m	T_a	T_m
60 °C (140 °F)	170 °C (338 °F)	55 °C (131 °F)	180 °C (356 °F)	60 °C (140 °F)	110 °C (230 °F)	50 °C (122 °F)	180 °C (356 °F)

Medium density 0 to 5 000 kg/m³ (0 to 312 lb/cf)

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.

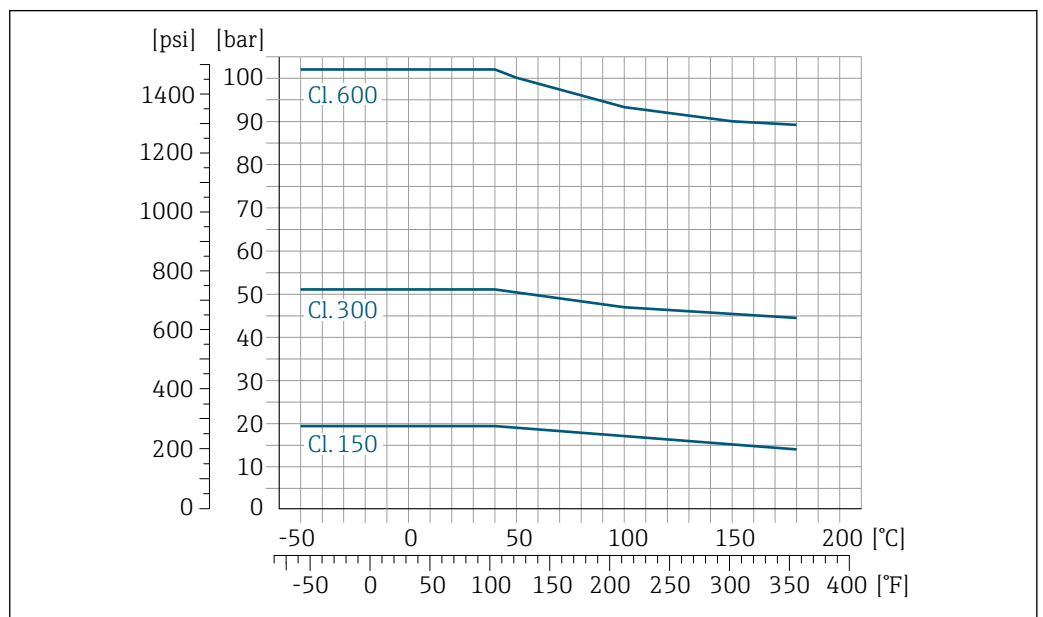
Flange connection similar to EN 1092-1 (DIN 2501)



17 With flange material 1.4404 (316/316L)

A0029911-EN

Flange connection similar to ASME B16.5



18 With flange material 1.4404 (316/316L)

A0029912-EN

Sensor housing

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



If a measuring tube fails (e.g. due to process characteristics like corrosive or abrasive fluids), the fluid will initially be contained by the sensor housing.

In the event of a tube failure, the pressure level inside the sensor housing will rise according to the operating process pressure. If the user judges that the sensor housing burst pressure does not provide an adequate safety margin, the device can be fitted with a rupture disk. This prevents excessively high pressure from forming inside the sensor housing. Therefore, the use of a rupture disk is strongly recommended in applications involving high gas pressures, and particularly in applications in which the process pressure is greater than 2/3 of the sensor housing burst pressure.

If there is a need to drain the leaking medium into a discharge device, the sensor should be fitted with a rupture disk. Connect the discharge to the additional threaded connection →  69.

If the sensor is to be purged with gas (gas detection), it should be equipped with purge connections.

 Do not open the purge connections unless the containment can be filled immediately with a dry, inert gas. Use only low pressure to purge.

Maximum pressure: 2 bar (29.0 psi)

Burst pressure of the sensor housing

The following sensor housing burst pressures are only valid for standard devices and/or devices equipped with closed purge connections (not opened/as delivered).

If a device fitted with purge connections (order code for "Sensor option", option CH "Purge connection") is connected to the purge system, the maximum pressure is determined by the purge system itself or by the device, depending on which component has the lower pressure classification.

If the device is fitted with a rupture disk (order code for "Sensor option", option CA "Rupture disk"), the rupture disk trigger pressure is decisive.

The sensor housing burst pressure refers to a typical internal pressure which is reached prior to mechanical failure of the sensor housing and which was determined during type testing. The corresponding type test declaration can be ordered with the device (order code for "Additional approval", option LN "Sensor housing burst pressure, type test").

DN		Sensor housing burst pressure	
[mm]	[in]	[bar]	[psi]
300	12	28	406
350	14	28	406
400	16	28	406

For information on the dimensions: see the "Mechanical construction" section →  66

Rupture disk

To increase the level of safety, a device version with a rupture disk with a trigger pressure of 5.5 to 6.5 bar (80 to 94 psi) can be used (order code for "Sensor option", option CA "rupture disk").

For information on the dimensions: see the "Mechanical construction" section (Accessories) →  69

Flow limit

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

 For an overview of the full scale values for the measuring range, see the "Measuring range" section →  10

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value
- For the most common applications, 20 to 50 % of the maximum full scale value can be considered ideal
- A low full scale value must be selected for abrasive media (such as liquids with entrained solids): flow velocity < 1 m/s (< 3 ft/s).
- For gas measurement the following rules apply:
 - The flow velocity in the measuring tubes should not exceed half the speed of sound (0.5 Mach)
 - The maximum mass flow depends on the density of the gas: formula

 To calculate the flow limit, use the *Applicator* sizing tool →  98

Pressure loss

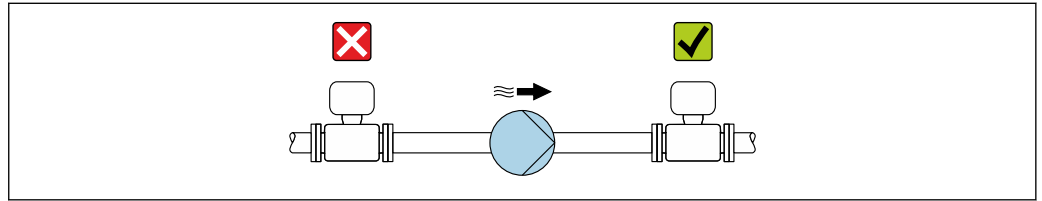
 To calculate the pressure loss, use the *Applicator* sizing tool →  98

Static pressure

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

For this reason, the following mounting locations are recommended:

- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of vacuum)



A0028777

Thermal insulation

In the case of some fluids, it is important to keep the heat radiated from the sensor to the transmitter to a low level. A wide range of materials can be used for the required insulation.

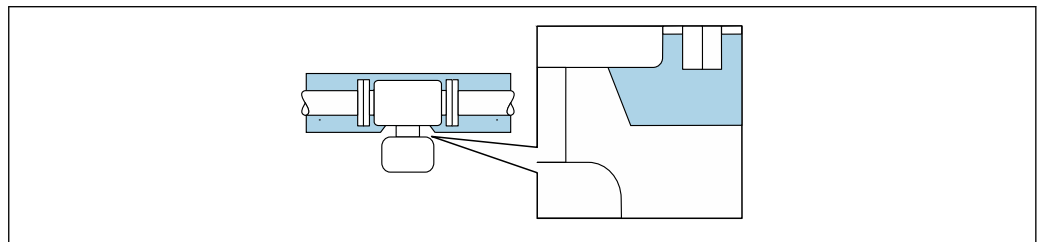
The following device versions are recommended for applications with thermal insulation:
Version with extended neck:

Order code for "Measuring tube material", option SA with an extended neck length of 105 mm (4.13 in).

NOTICE

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 exposed extension neck: We recommend that you do not insulate the extension neck in order to ensure optimum dissipation of heat.



A0034391

19 Thermal insulation with exposed extension neck

Heating

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

Heating options

- Electrical heating, e.g. with electric band heaters ¹⁾
- Via pipes carrying hot water or steam
- Via heating jackets



Under critical climatic conditions, in particular, it is important to ensure that the temperature difference between the ambient temperature and the medium temperature is not >100 K. Suitable measures must be taken, such as heating or insulation.

NOTICE

Danger of overheating when heating

- ▶ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F).
- ▶ Ensure that sufficient convection takes place at the transmitter neck.
- ▶ Ensure that a sufficiently large area of the transmitter neck remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.
- ▶ When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation. For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

1) The use of parallel electric band heaters is generally recommended (bidirectional electricity flow). Particular considerations must be made if a single-wire heating cable is to be used. Additional information is provided in the document EA01339D "Installation instructions for electrical trace heating systems" → 102

Vibrations

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

Custody transfer

The measuring device is optionally tested in accordance with OIML R117 and has an EU type evaluation certificate which authorizes the use in EU type-examination certificates according to Measuring Instruments Directive 2014/32/EU for service subject to legal metrological control ("custody transfer") for liquids other than water (Annex VII).

The measuring device is optionally tested according to OIML R137 and has an EU type-examination certificate according to Measuring Instruments Directive 2014/32/EU for service subject to legal metrological control ("custody transfer") as a gas meter (Annex IV).

The device is used with a legally controlled totalizer display on the local display and optionally with outputs subject to legal metrological control.

Measuring devices subject to legal metrological control totalize in both directions, i.e. all the outputs consider flow components in the positive (forward) and negative (reverse) flow direction.

Generally a measuring device subject to legal metrological control is secured against tampering by seals on the transmitter or sensor. These seals may normally only be opened by a representative of the competent authority for legal metrology controls.

After putting the device into circulation or after sealing the device, operation is only possible to a limited extent.

Detailed ordering information is available from your local Endress+Hauser sales center for national approvals, which are based on the OIML certificates, for applications with liquids other than water or gases.

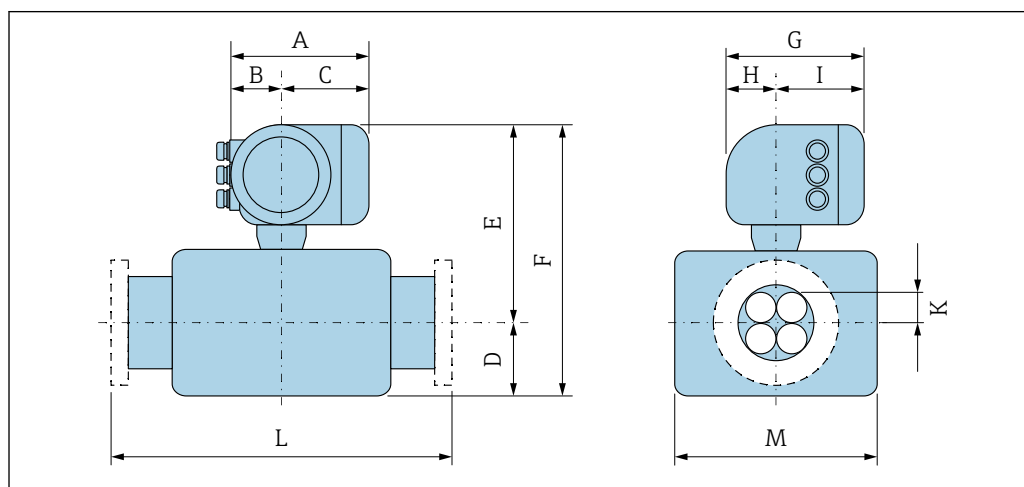


More information is provided in the supplementary documentation.

Mechanical construction

Dimensions in SI units

Compact version



A0033799

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

DN	A ¹⁾	B ¹⁾	C	D	E	F	G ²⁾	H	I ²⁾	K	L	M
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
300	169	68	101	140	499	639	200	59	141	102.3	³⁾	1227
350	169	68	101	140	499	639	200	59	141	102.3	³⁾	1227
400	169	68	101	140	499	639	200	59	141	102.3	³⁾	1227

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

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

DN	A ¹⁾	B	C	D	E	F	G ²⁾	H	I ²⁾	K	L	M
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
300	188	85	103	140	499	639	217	58	159	102.3	³⁾	1227
350	188	85	103	140	499	639	217	58	159	102.3	³⁾	1227
400	188	85	103	140	499	639	217	58	159	102.3	³⁾	1227

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

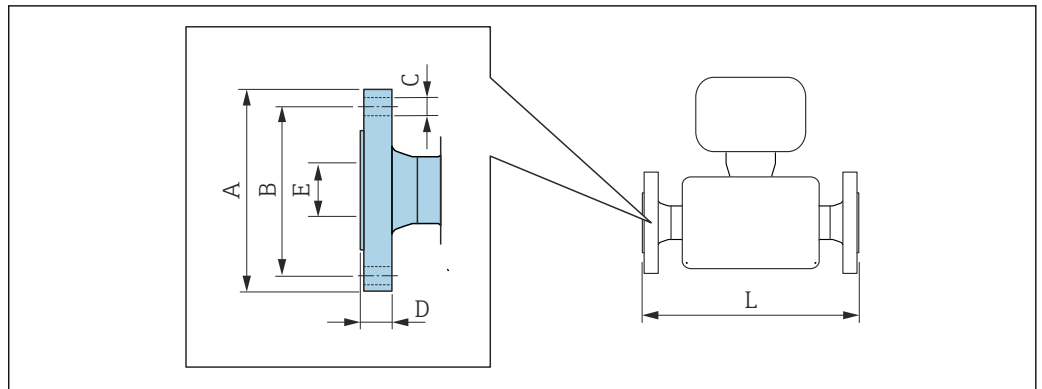
Order code for "Housing", option L "Cast, stainless"

DN	A ¹⁾	B	C	D	E	F	G	H	I	K	L	M
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
300	186	85	101	140	499	639	217	60	157	102.3	²⁾	1227
350	186	85	101	140	499	639	217	60	157	102.3	²⁾	1227
400	186	85	101	140	499	639	217	60	157	102.3	²⁾	1227

1) Depending on the cable gland used: values up to + 30 mm

2) Depending on the process connection

Fixed flange connections EN 1092-1, ASME B16.5



A0015621

20 Unit mm (in)

i Length tolerance for dimension L in mm:
±4

**Flange similar to EN 1092-1 (DIN 2501 / DIN 2512N): PN 10
1.4404 (F316/F316L)**

Order code for "Process connection", option DAS

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	445	400	12 × Ø22	26	309.7	1707
350	505	460	16 × Ø22	26	341.4	1707
400	565	515	16 × Ø26	26	392.2	1716

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

**Flange similar to EN 1092-1 (DIN 2501/DIN 2512N): PN 16
1.4404 (F316/F316L)**

Order code for "Process connection", option D1S

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	460	410	12 × Ø26	28	309.7	1727
350	520	470	16 × Ø26	30	339.6	1734
400	580	525	12 × Ø30	32	390.4	1741

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

**Flange according to EN 1092-1 (DIN 2501/DIN 2512N): PN40
1.4404 (F316/F316L)**

Order code for "Process connection", option D2S

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	515	450	16 × Ø33	42	307.9	1800
350	580	510	16 × Ø36	46	338.0	1818
400	660	585	16 × Ø39	50	384.4	1836

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

**Flange according to EN 1092-1 (DIN 2501/DIN 2512N): PN63
1.4404 (F316/F316L)**
Order code for "Process connection", option D3S

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	530	460	16 × Ø36	52	301.9	1844
350	600	525	16 × Ø39	56	330.6	1863
400	670	585	16 × Ø42	60	378.0	1880

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

**Flange according to EN 1092-1 (DIN 2501/DIN 2512N): PN100
1.4404 (F316/F316L)**
Order code for "Process connection", option D4S)

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	585	500	16 × Ø42	68	295.5	1901
350	655	560	16 × Ø48	74	323.6	1936
400	715	620	16 × Ø48	82.2	364.9	1936

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

**Flange similar to ASME B16.5: Cl 150
1.4404 (F316/F316L)**
Order code for "Process connection", option AAS

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	482.6	431.8	12 × Ø25.4	32.2	304.8	1794
350	533.4	476.3	16 × Ø28.4	35.5	336.5	1820
400	596.9	539.8	16 × Ø28.4	37.0	387.3	1820

Surface roughness (flange): Ra 3.2 to 6.3 µm

**Flange similar to ASME B16.5: Cl 300
1.4404 (F316/F316L)**
Order code for "Process connection", option ABS

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	520.7	450.9	16 × Ø31.8	51.3	304.8	1826
350	584.2	514.4	16 × Ø31.8	54.4	336.5	1852
400	647.7	571.5	16 × Ø35.1	57.6	387.3	1858

Surface roughness (flange): Ra 3.2 to 6.3 µm

**Flange similar to ASME B16.5: Cl 600
1.4404 (F316/F316L)**
Order code for "Process connection", option ACS

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
300	558.8	489.0	20 × Ø35.1	73.7	288.8	1875
350	603.3	527.1	20 × Ø38.1	77.0	317.5	1891

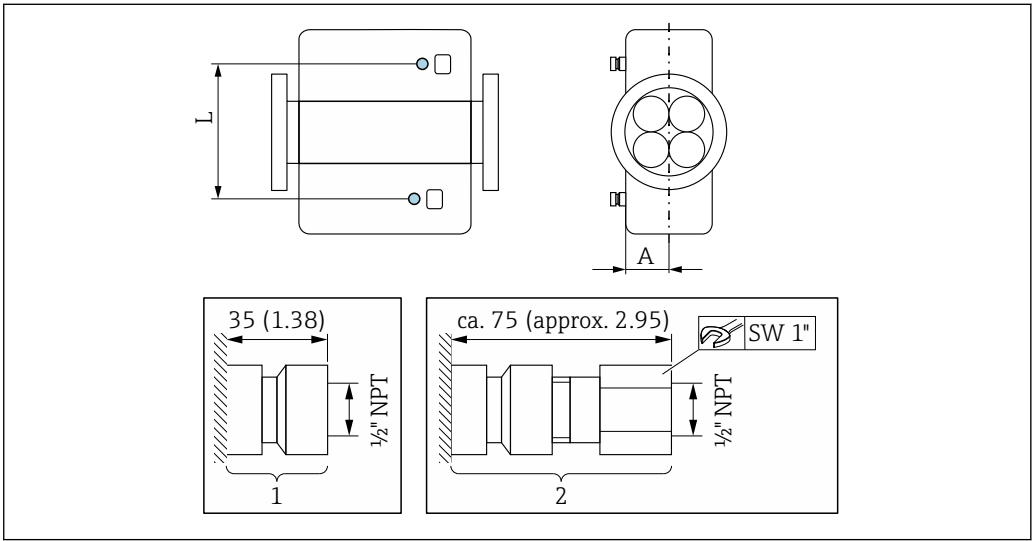
Flange similar to ASME B16.5: CI 600
1.4404 (F316/F316L)
Order code for "Process connection", option ACS

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
400	685.8	603.3	20 × Ø41.1	83.2	363.3	1912

Surface roughness (flange): Ra 3.2 to 6.3 µm

Accessories

Rupture disk/purge connections



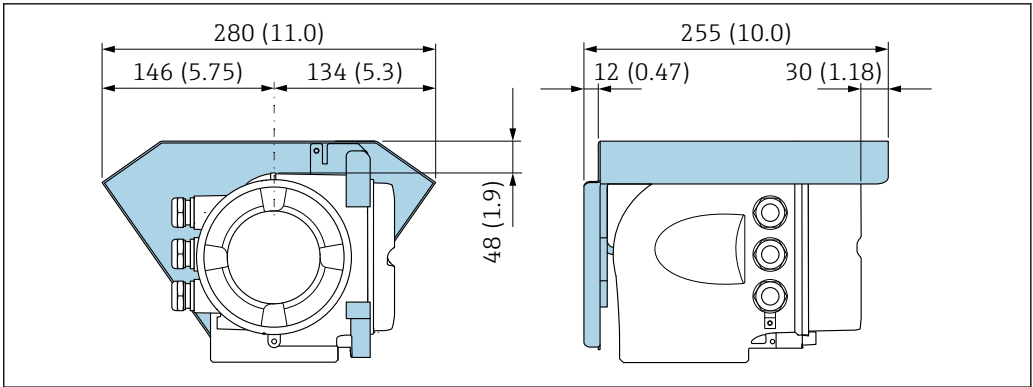
A0029972

21

- 1 Connection nipple for purge connections: order code for "Sensor options", option CH "Purge connection"
- 2 Connection nipple with rupture disk: order code for "Sensor option", option CA "Rupture disk"

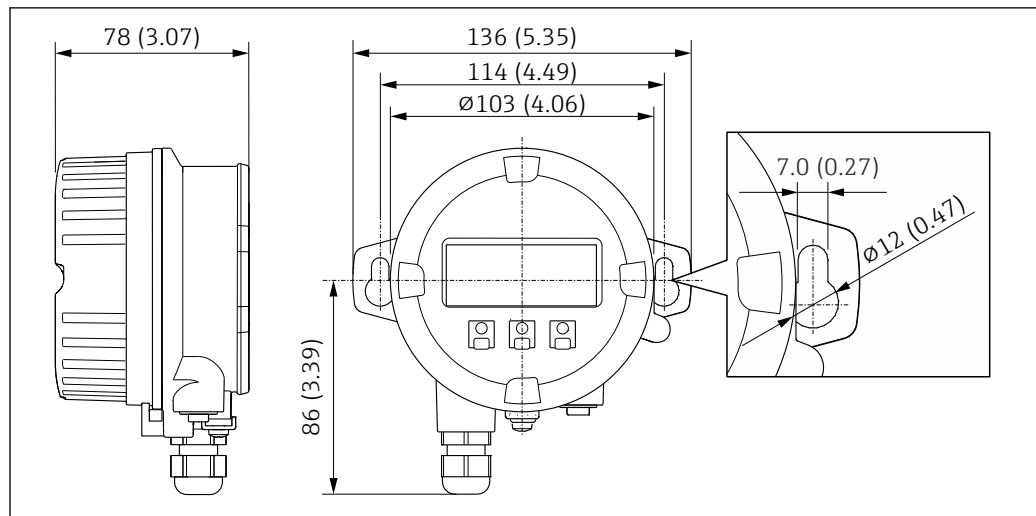
DN [mm]	A [mm]	L [mm]
300	182	547
350	182	547
400	182	547

Protective cover



A0029553

22 Unit mm (in)

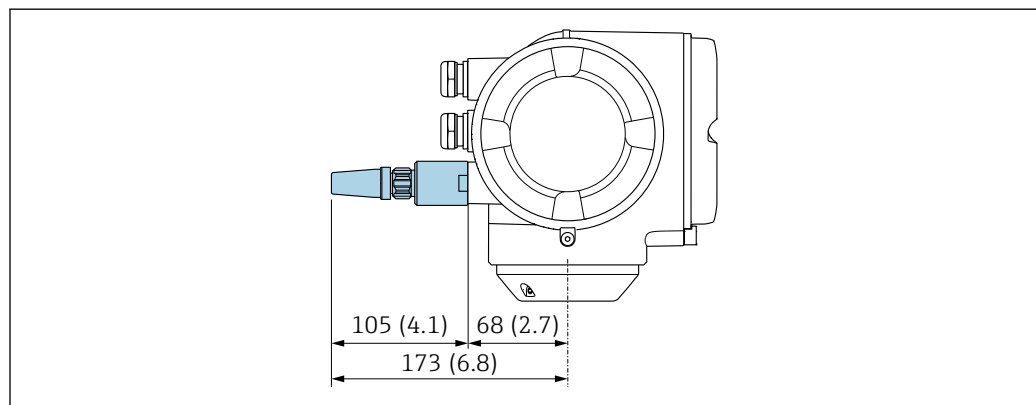
Remote display and operating module DKX001

A0028921

23 Unit mm (in)

External WLAN antenna

i The external WLAN antenna is not suitable for use in hygienic applications.

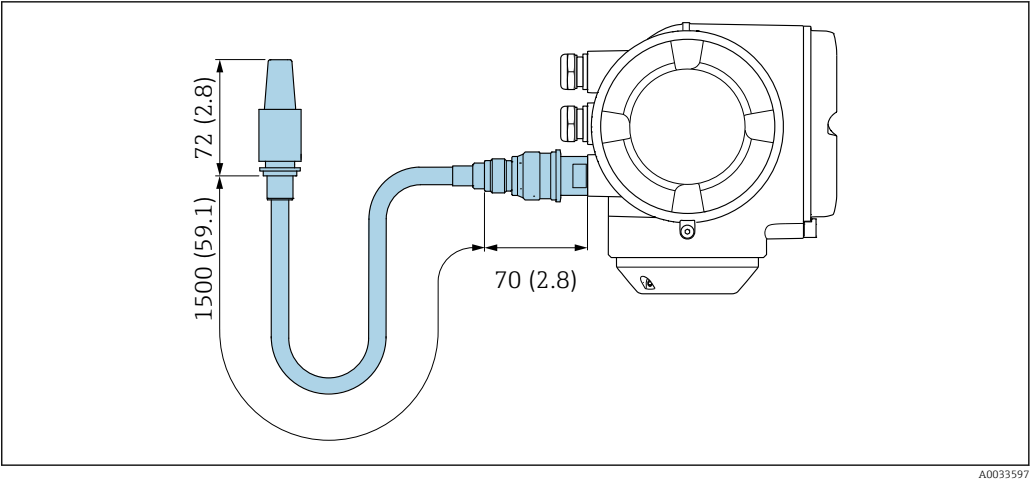
External WLAN antenna mounted on device

A0028923

24 Unit mm (in)

External WLAN antenna mounted with cable

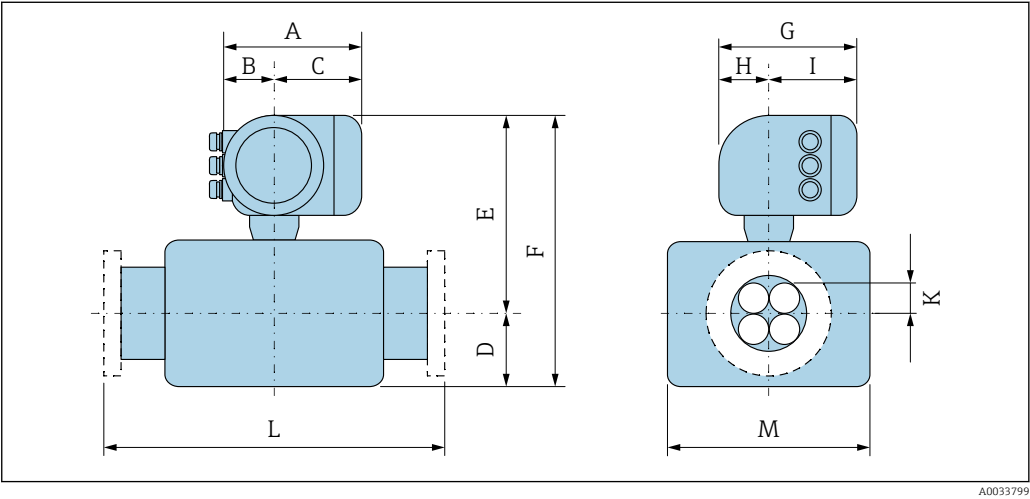
The external WLAN antenna can be mounted separately from the transmitter if the transmission/reception conditions at the transmitter mounting location are poor.



25 Unit mm (in)

Dimensions in US units

Compact version



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

DN	A ¹⁾	B ¹⁾	C	D	E	F	G ²⁾	H	I ²⁾	K	L	M
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
12	6.65	2.68	3.98	5.51	19.65	25.16	7.87	2.32	5.55	4.03	³⁾	48.31
14	6.65	2.68	3.98	5.51	19.65	25.16	7.87	2.32	5.55	4.03	³⁾	48.31
16	6.65	2.68	3.98	5.51	19.65	25.16	7.87	2.32	5.55	4.03	³⁾	48.31

- 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

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]
12	7.40	3.35	4.06	5.51	19.65	25.16	8.54	2.28	6.26	4.03	³⁾	48.31
14	7.40	3.35	4.06	5.51	19.65	25.16	8.54	2.28	6.26	4.03	³⁾	48.31
16	7.40	3.35	4.06	5.51	19.65	25.16	8.54	2.28	6.26	4.03	³⁾	48.31

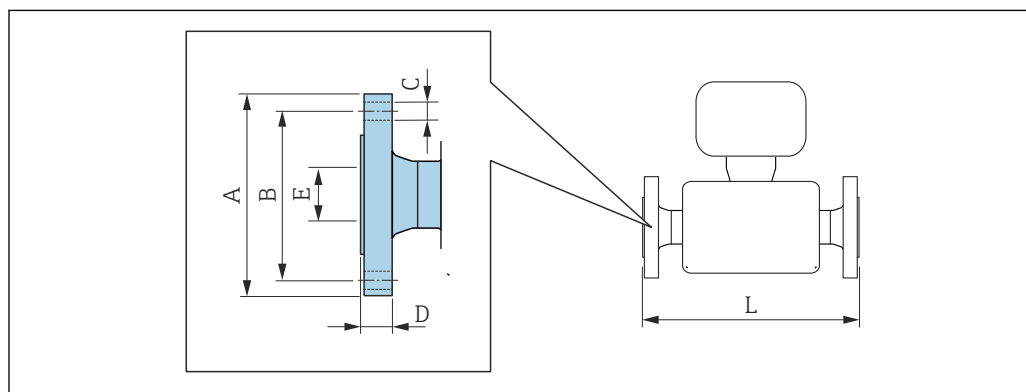
- 1) Depending on the cable gland used: values up to + 1.18 in
 2) For version without local display: values - 1.57 in
 3) Depending on the process connection

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]
12	7.32	3.35	3.98	5.51	19.65	25.16	8.54	2.36	6.18	4.03	²⁾	48.31
14	7.32	3.35	3.98	5.51	19.65	25.16	8.54	2.36	6.18	4.03	²⁾	48.31
16	7.32	3.35	3.98	5.51	19.65	25.16	8.54	2.36	6.18	4.03	²⁾	48.31

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

Fixed flange connections ASME B16.5



A0015621

26 Unit mm (in)



Length tolerance for dimension L in inches:
 ± 0.16

Flange similar to ASME B16.5: Cl 150 1.4404 (F316/F316L)

Order code for "Process connection", option AAS

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
12	19.00	17.00	12 × Ø1.00	1.27	12.00	70.63
14	21.00	18.75	16 × Ø1.12	1.40	13.25	71.65
16	23.50	21.25	16 × Ø1.12	1.46	15.25	71.65

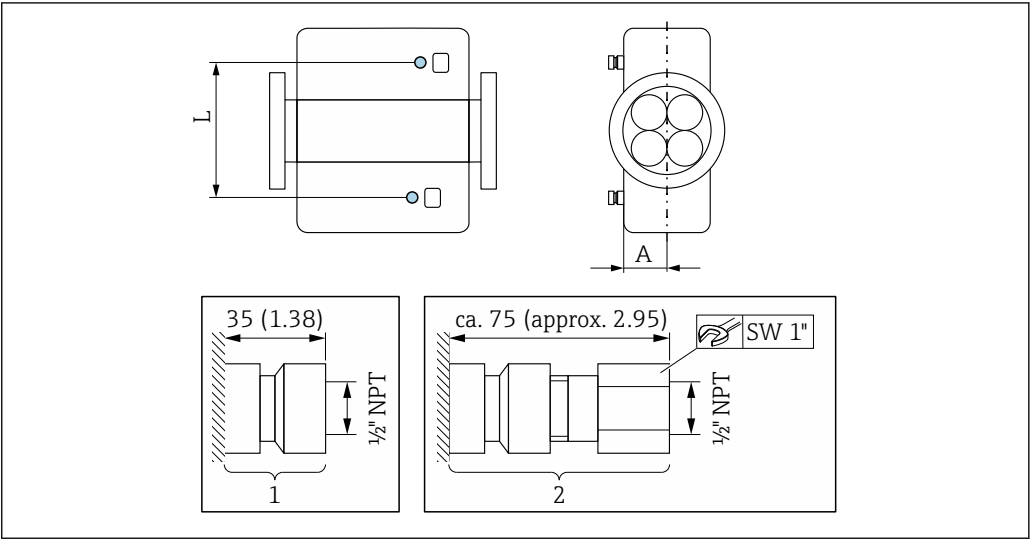
Surface roughness (flange): Ra 125 to 250 µin

Flange similar to ASME B16.5: CI 300 1.4404 (F316/F316L) <i>Order code for "Process connection", option ABS</i>						
DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
12	20.50	17.75	16 × Ø1.25	2.02	12.00	71.89
14	23.00	20.25	16 × Ø1.25	2.14	13.25	72.91
16	25.50	22.50	16 × Ø1.38	2.27	15.25	73.15
Surface roughness (flange): Ra 125 to 250 µin						

Flange similar to ASME B16.5: CI 600 1.4404 (F316/F316L) <i>Order code for "Process connection", option ACS</i>						
DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
12	22.00	19.25	20 × Ø1.38	2.90	11.37	73.82
14	23.75	20.75	20 × Ø1.50	3.03	12.50	74.45
16	27.00	23.75	20 × Ø1.62	3.28	14.30	75.28
Surface roughness (flange): Ra 125 to 250 µin						

Accessories

Rupture disk/purge connections

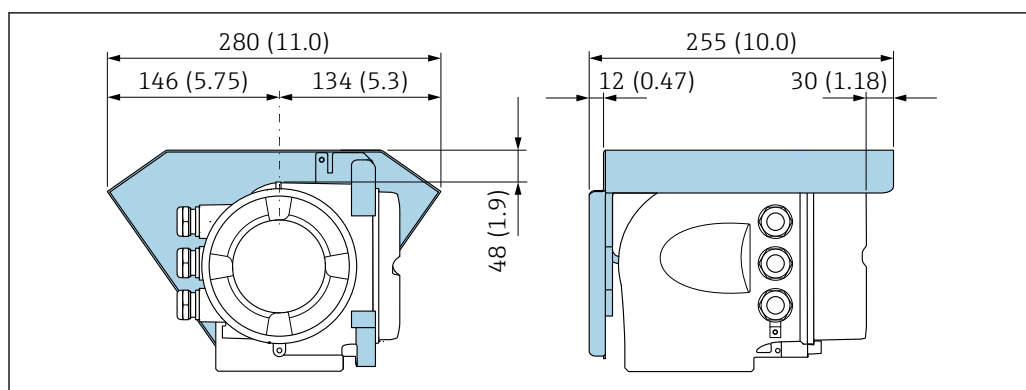


A0029972

27

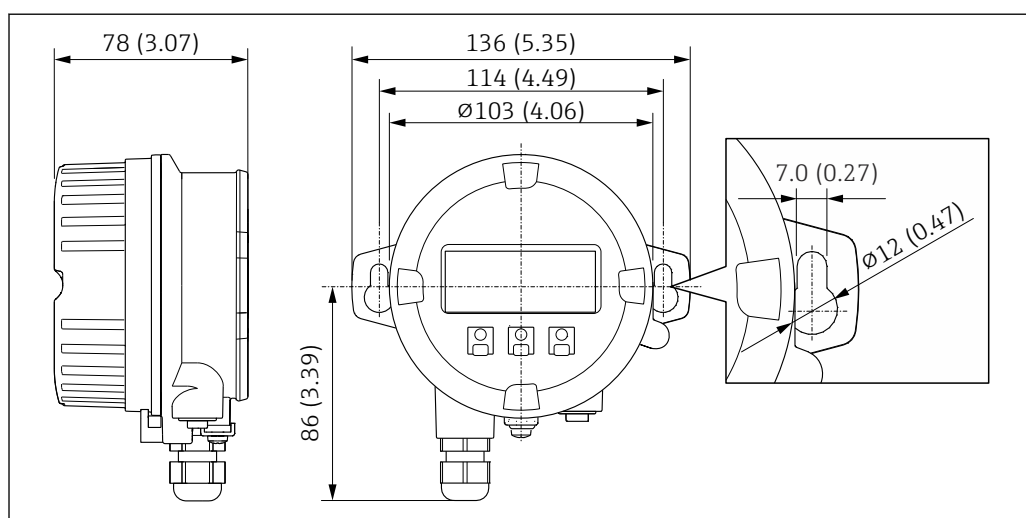
- 1 Connection nipple for purge connections: order code for "Sensor options", option CH "Purge connection"
- 2 Connection nipple with rupture disk: order code for "Sensor option", option CA "Rupture disk"

DN	A	L
[in]	[in]	[in]
12	7.17	21.54
14	7.17	21.54
16	7.17	21.54

Protective cover

A0029553

28 Unit mm (in)

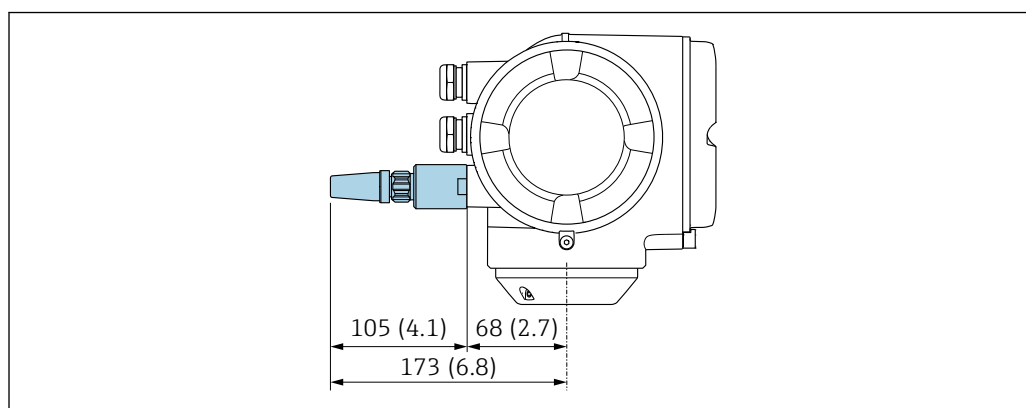
Remote display and operating module DKX001

A0028921

29 Unit mm (in)

External WLAN antenna

i The external WLAN antenna is not suitable for use in hygienic applications.

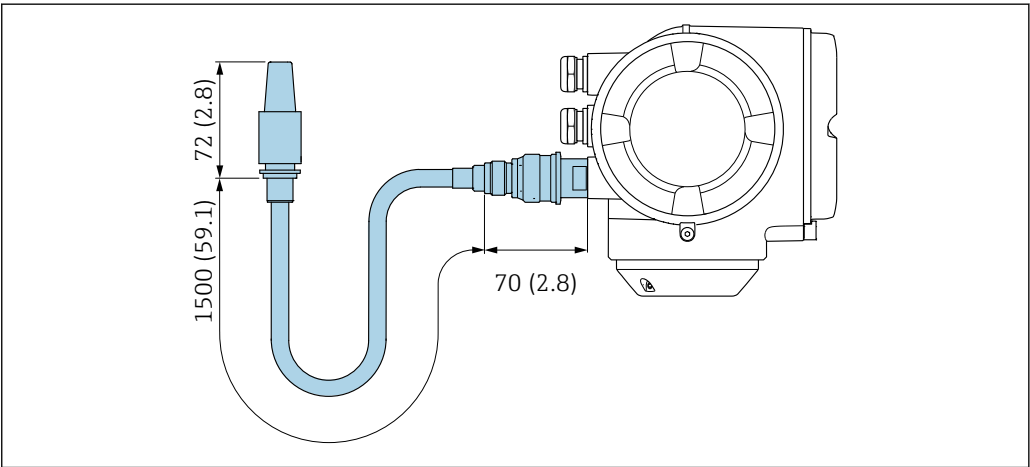
External WLAN antenna mounted on device

A0028923

30 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.



A0033597

31 Unit mm (in)

Weight

All values (weight exclusive of packaging material) refer to devices with ASME B16.5 Class 150 flanges. Weight specifications 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

DN [mm]	Weight [kg]
300	553
350	577
400	601

Weight in US units

DN [in]	Weight [lbs]
12	1219
14	1272
16	1325

Materials

Transmitter housing

Order code for "Housing":

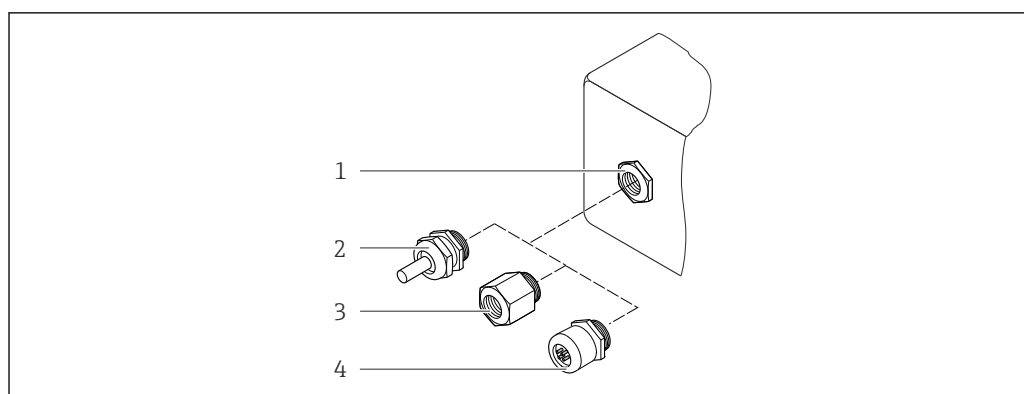
- Option A "Aluminum, coated": aluminum, AlSi10Mg, coated
- Option L "Cast, stainless": cast, stainless steel, 1.4409 (CF3M) similar to 316L

Window material

Order code for "Housing":

- Option A "Aluminum, coated": glass
- Option L "Cast, stainless": glass

Cable entries/cable glands



A0028352

32 Possible cable entries/cable glands

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

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

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

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

Device plug

Electrical connection	Material
Plug M12x1	■ Socket: Stainless steel, 1.4404 (316L) ■ Contact housing: Polyamide ■ Contacts: Gold-plated brass

Sensor housing

- Acid and alkali-resistant outer surface
- Stainless steel, 1.4404 (316L)

Measuring tubes

Stainless steel, 1.4404 (316/316L);
Manifold: stainless steel, 1.4404 (316/316L)

Process connections

Flanges in accordance with EN 1092-1 (DIN2501) / ASME B 16.5:
Stainless steel, 1.4404 (F316/F316L)



Available process connections →  77

Seals

Welded process connections without internal seals

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

Fixed flange connections:

- EN 1092-1 (DIN 2501) flange
- EN 1092-1 (DIN 2512N) flange
- ASME B16.5 flange



Process connection materials →  77

Surface roughness

All data relate to parts in contact with medium.

The following surface roughness categories can be ordered:
Not polished

Operability

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

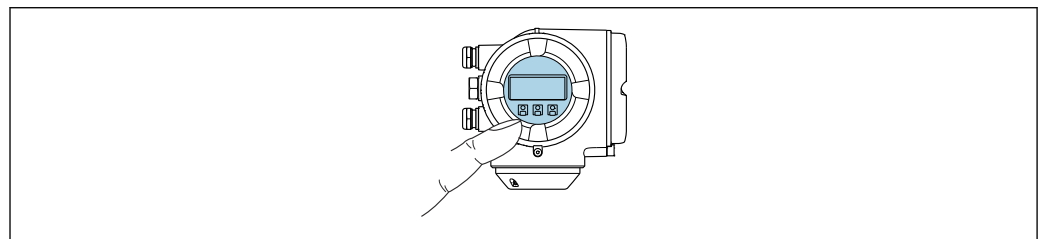
Via display module

Equipment level:

- 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 → 86



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33 Operation with touch control

Display elements

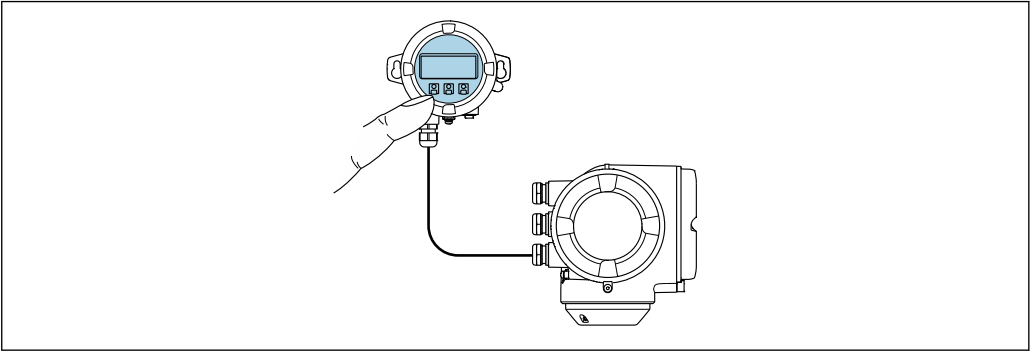
- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

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 →  97..
- The measuring instrument is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring instrument. 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 instrument display module. Only one display or operation unit may be connected to the transmitter at any one time.



A0026786

 34 *Operation via remote display and operating module DKX001*

Display and operating elements

The display and operating elements correspond to those of the display module →  78.

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	Material
Option A "Aluminum, coated"	AlSi10Mg, coated	AlSi10Mg, coated
Option L "Cast, stainless"	Cast stainless steel, 1.4409 (CF3M) similar to 316L	1.4409 (CF3M)

Cable entry

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

Connecting cable

→  50

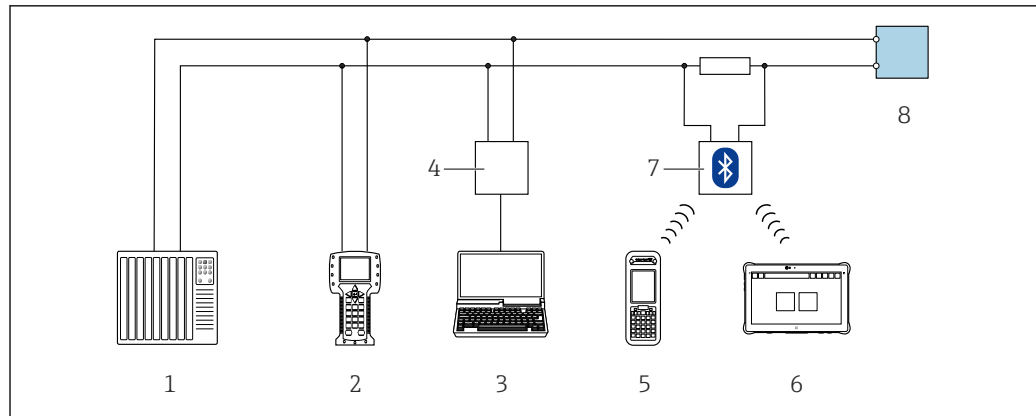
Dimensions

→  70

Remote operation

Via HART protocol

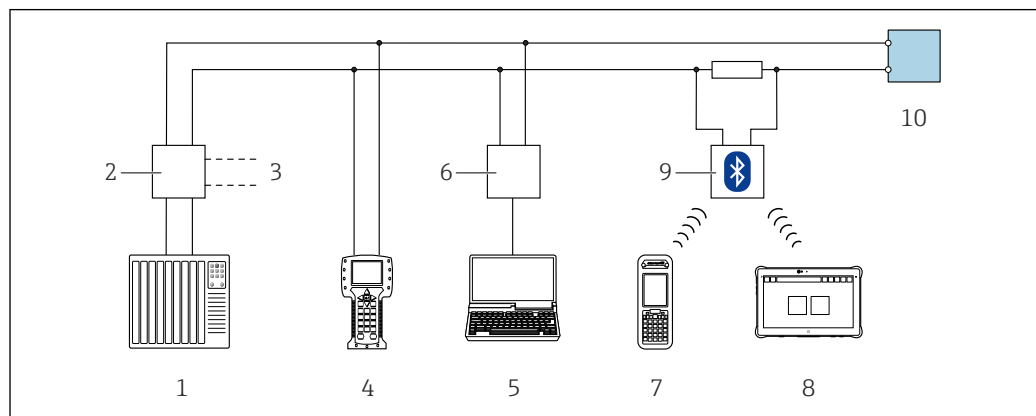
This communication interface is available in device versions with a HART output.



A0028747

35 Options for remote operation via HART protocol (active)

- 1 Automation system (e.g. PLC)
- 2 Field Communicator 475
- 3 Computer with web browser for accessing 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 connection cable
- 8 Transmitter



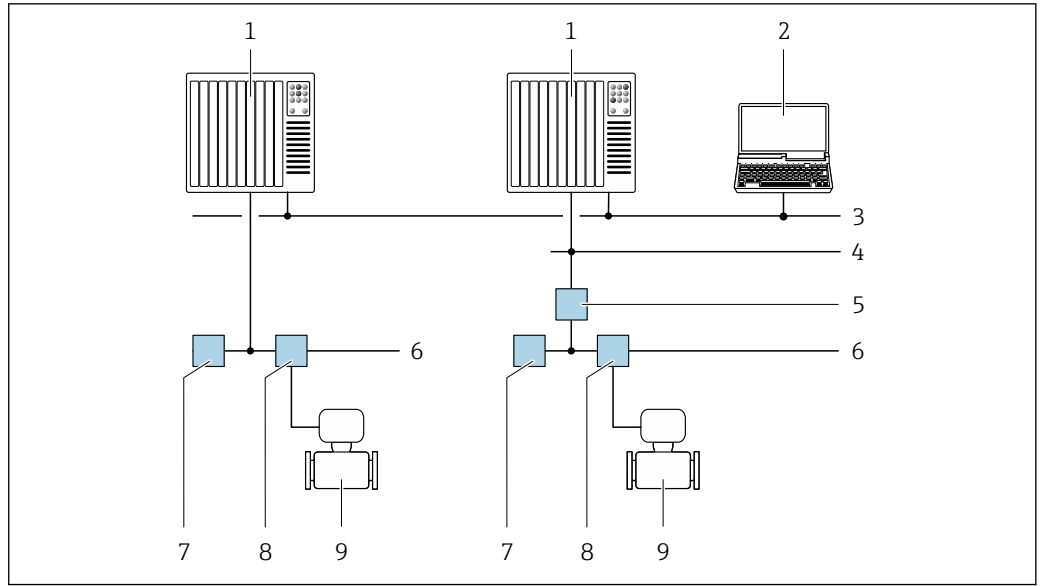
A0028746

36 Options for remote operation via HART protocol (passive)

- 1 Automation system (e.g. PLC)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA195 and Field Communicator 475
- 4 Field Communicator 475
- 5 Computer with web browser for accessing 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 connection cable
- 10 Transmitter

Via FOUNDATION Fieldbus network

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



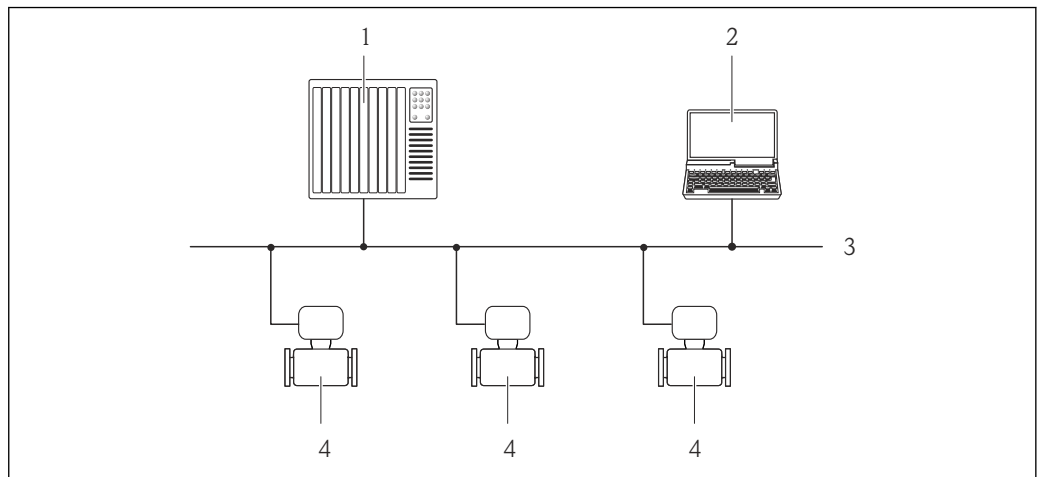
A0028837

37 Options for remote operation via FOUNDATION Fieldbus network

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

Via PROFIBUS DP network

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



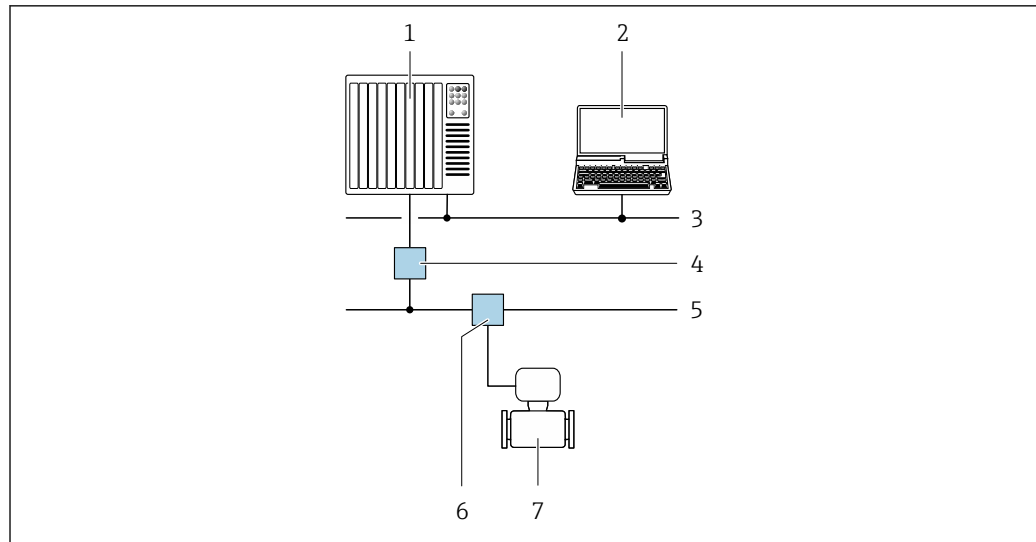
A0020903

38 Options for remote operation via PROFIBUS DP network

- 1 Automation system
- 2 Computer with PROFIBUS network card
- 3 PROFIBUS DP network
- 4 Measuring instrument

Via PROFIBUS PA network

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



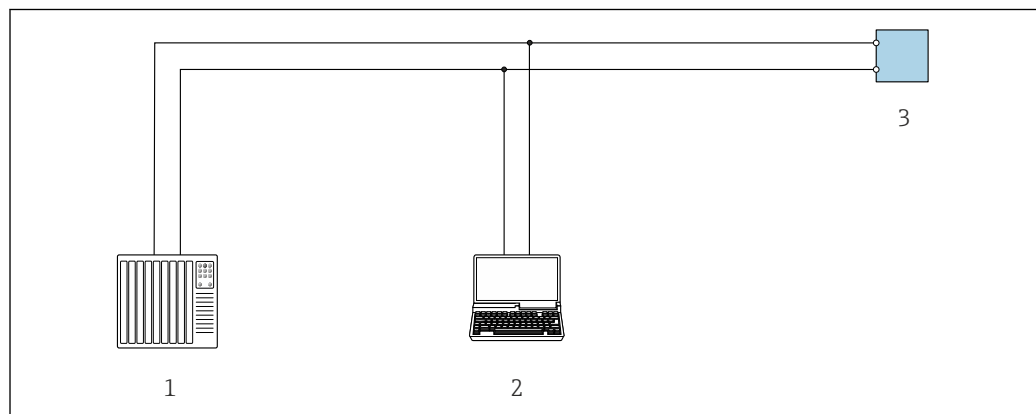
A0028838

39 Options for remote operation via PROFIBUS PA network

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

Via Modbus RS485 protocol

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



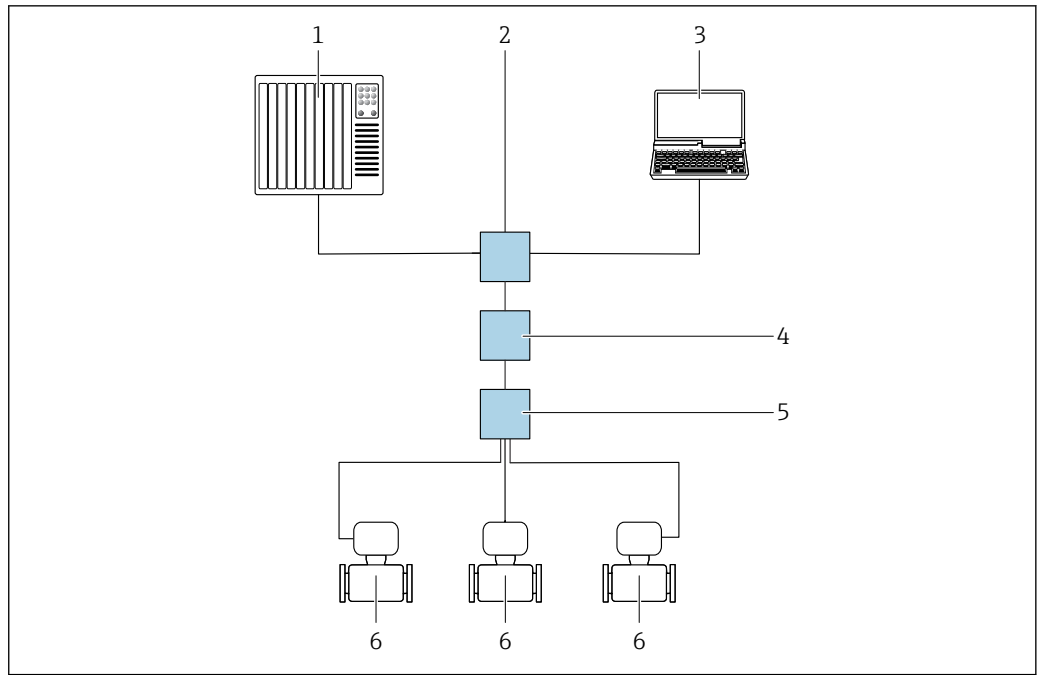
A0029437

40 Options for remote operation via Modbus RS485 protocol (active)

- 1 Automation system (e.g. PLC)
- 2 Computer with web browser for accessing 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

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

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



A0046117

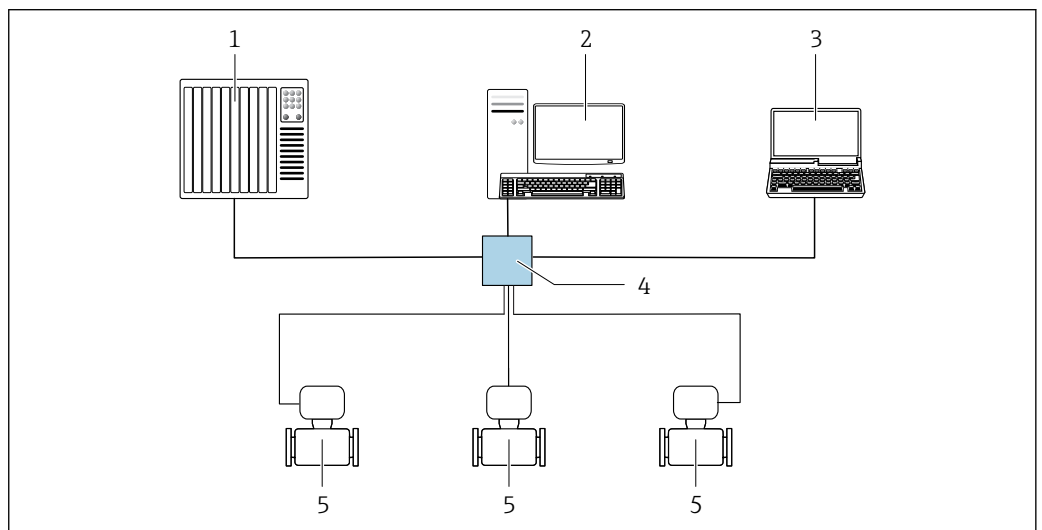
41 Options for remote operation via Modbus TCP over Ethernet-APL protocol (active)

- 1 Automation system, e.g. Simatic S7 (Siemens)
- 2 Ethernet switch, e.g. Scalance X204 (Siemens)
- 3 Computer with web browser or operating tool
- 4 APL power switch/SPE power switch (optional)
- 5 APL field switch/SPE field switch
- 6 Measuring instrument/communication via port 1 (terminal 26 + 27)

Via Modbus TCP over Ethernet 100 Mbit/s

This communication interface is available on port 2 in device versions with a Modbus TCP over Ethernet-APL output.

Star topology



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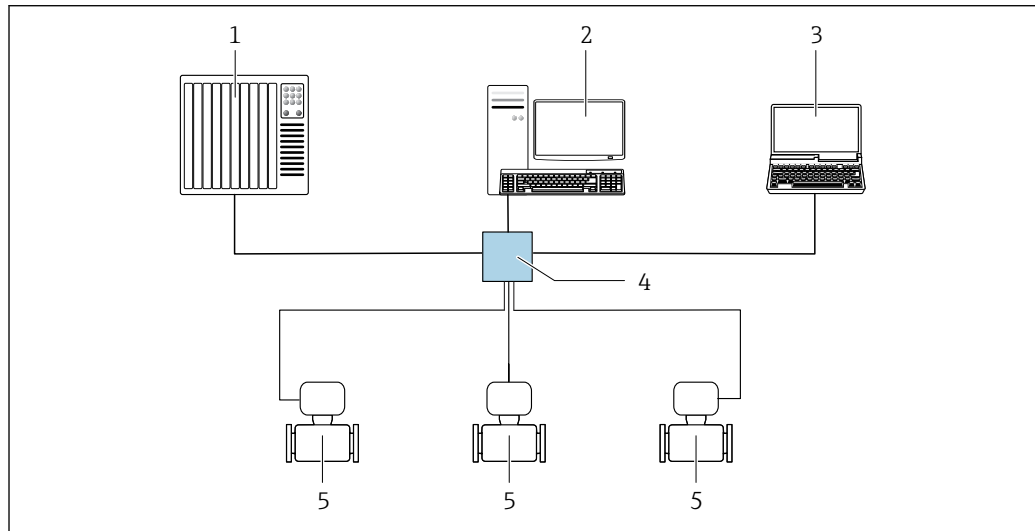
42 Options for remote operation via Modbus TCP over Ethernet - 100 Mbit/s: Star topology

- 1 Automation system, z. B. RSLogix (Rockwell Automation)
- 2 Workstation for measuring instrument operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)
- 3 Computer with web browser or operating tool
- 4 Standard Ethernet switch, e.g. Stratix (Rockwell Automation)
- 5 Measuring instrument/communication via port 2 (RJ45 connector)

Via EtherNet/IP network

This communication interface is available in device versions with EtherNet/IP.

Star topology



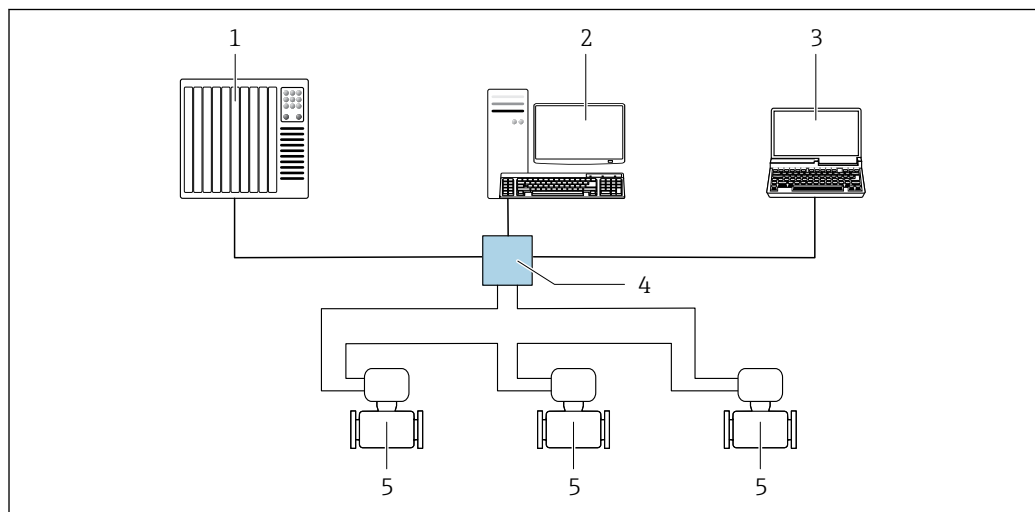
A0032078

43 Options for remote operation via EtherNet/IP network: star topology

- 1 Automation system, z. B. "RSLogix" (Rockwell Automation)
- 2 Workstation for measuring instrument operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)
- 3 Computer with web browser for accessing the integrated web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"
- 4 Standard Ethernet switch, e.g. Scalance X204 (Siemens)
- 5 Measuring instrument

Ring topology

The device is integrated via the terminal connection for signal transmission (output 1) and the service interface (CDI-RJ45).



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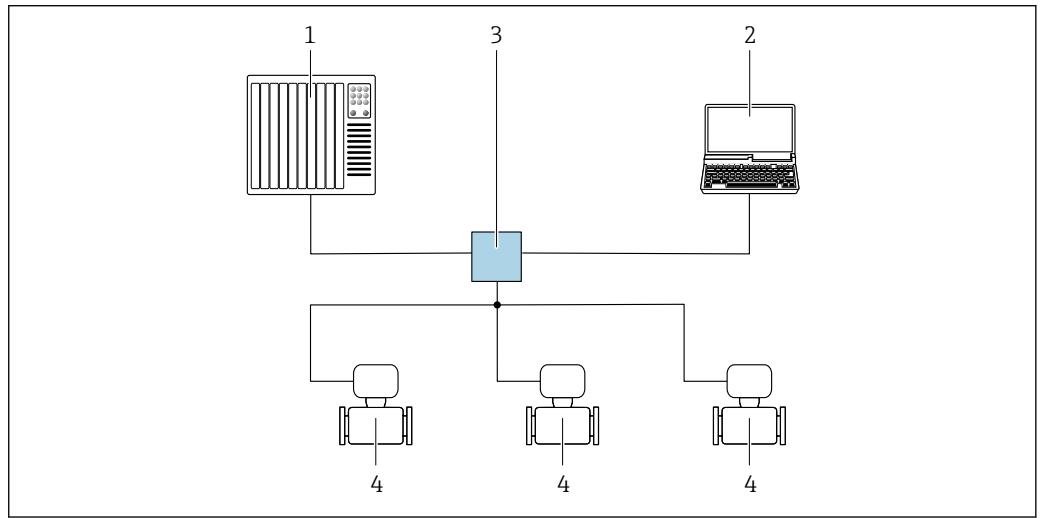
44 Options for remote operation via EtherNet/IP network: ring topology

- 1 Automation system, z. B. "RSLogix" (Rockwell Automation)
- 2 Workstation for measuring instrument operation: with Custom Add-On Profile for RSLogix 5000 (Rockwell Automation) or with Electronic Data Sheet (EDS)
- 3 Computer with web browser for accessing the integrated web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"
- 4 Standard Ethernet switch, e.g. Scalance X204 (Siemens)
- 5 Measuring instrument

Via PROFINET network

This communication interface is available in device versions with PROFINET.

Star topology



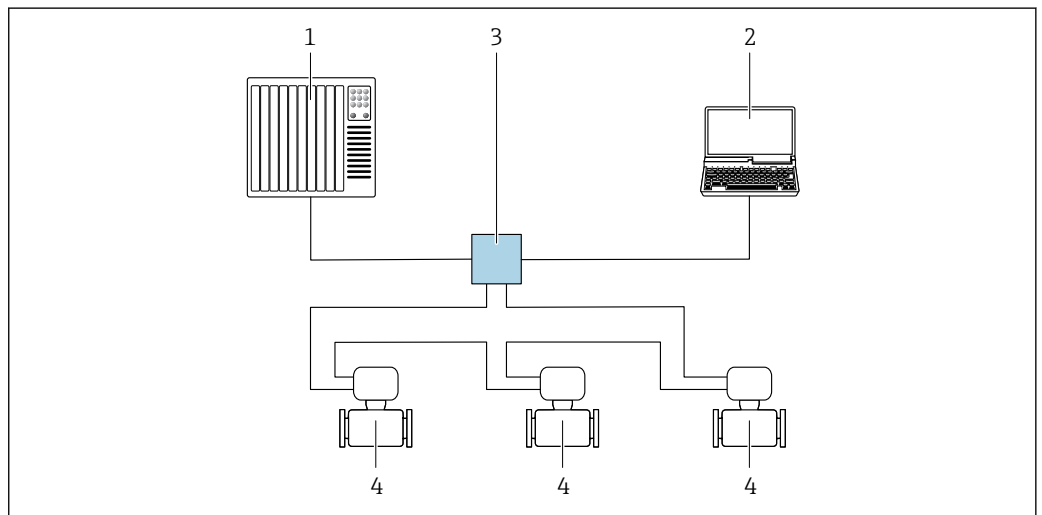
A0026545

45 Options for remote operation via PROFINET network: star topology

- 1 Automation system, e.g. Simatic S7 (Siemens)
- 2 Computer with web browser for accessing integrated web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 3 Standard Ethernet switch, e.g. Scalance X204 (Siemens)
- 4 Measuring instrument

Ring topology

The device is integrated via the terminal connection for signal transmission (output 1) and the service interface (CDI-RJ45).



A0033719

46 Options for remote operation via PROFINET network: ring topology

- 1 Automation system, e.g., Simatic S7 (Siemens)
- 2 Computer with web browser for accessing integrated web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 3 Standard Ethernet switch, e.g. Scalance X204 (Siemens)
- 4 Measuring instrument

Service interface

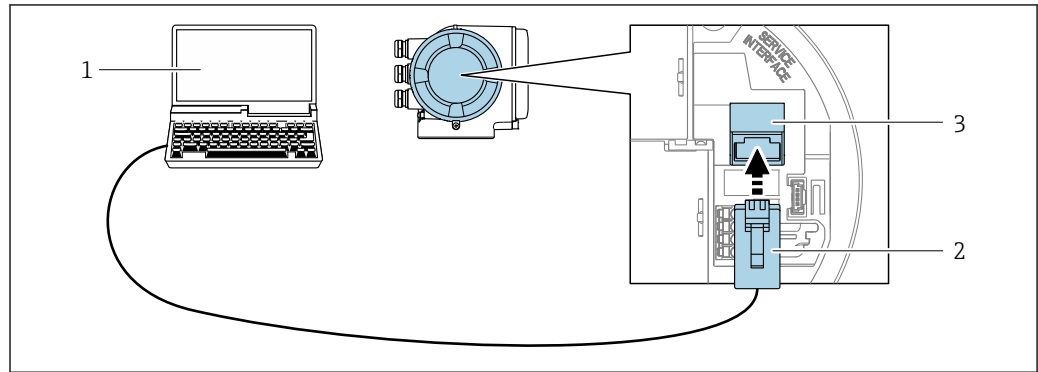
Via service interface (CDI-RJ45)

To configure the device on site, a point-to-point connection can be established. Alternatively, a connection via Modbus TCP can be used. The connection is made with the housing open, directly via the device's service interface (CDI-RJ45).

i An adapter for the RJ45 to the M12 connector 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 connector mounted in the cable entry. The connection to the service interface can be established via an M12 connector without opening the device.



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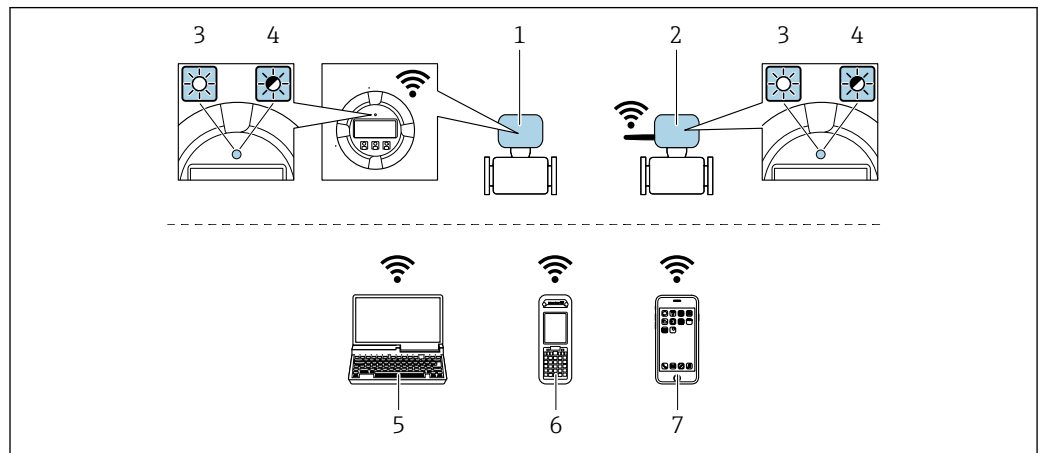
47 Connection via service interface (CDI-RJ45)

- 1 Computer with web browser for accessing the integrated web server or computer with operating tool, e.g. "FieldCare", "DeviceCare", with COM DTM "CDI Communication TCP/IP" or Modbus DTM or operating tool
- 2 Standard Ethernet connecting cable with RJ45 connector
- 3 Service interface (CDI-RJ45) of the measuring instrument 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"



A0034570

- 1 Transmitter with integrated WLAN antenna
- 2 Transmitter with external WLAN antenna
- 3 LED lit constantly: WLAN reception is enabled on measuring instrument
- 4 LED flashing: WLAN connection established between operating unit and measuring instrument
- 5 Computer with WLAN interface and web browser for accessing integrated device web server or with operating tool e.g. FieldCare, DeviceCare)
- 6 Mobile handheld terminal with WLAN interface and web browser for accessing integrated device web server or operating tool (e.g. FieldCare, DeviceCare)
- 7 Smartphone 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	IP66/67
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

Network integration



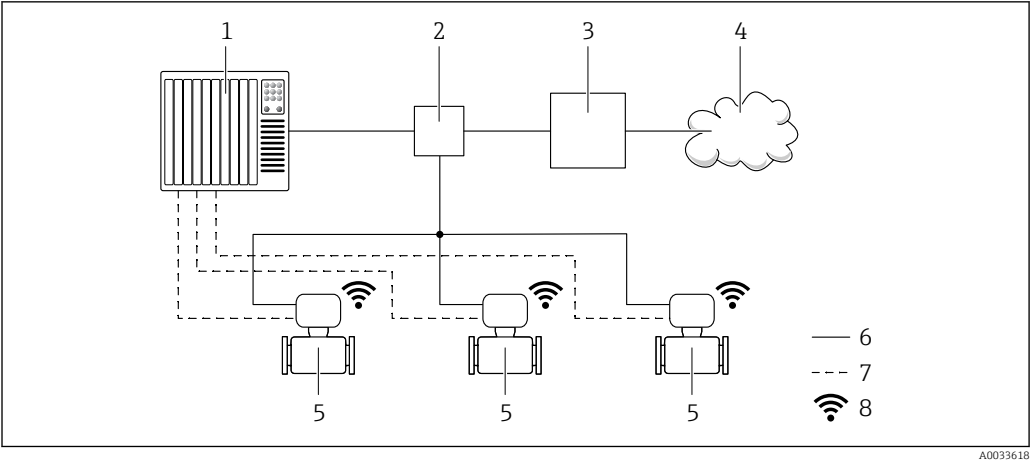
Network integration is only available for the HART communication protocol.

With the optional "OPC UA Server" application package, the device can be integrated into an Ethernet network via the service interface (CDI-RJ45 and WLAN) and communicate with OPC UA clients. If the device is used in this way, IT security must be considered.



For detailed information on connecting transmitters with an Ex de approval, see separate document "Safety instructions" (XA) for the device.

For permanent access to device data and for device configuration via the web server, the device is incorporated directly in a network via the service interface (CDI-RJ45). In this way, the device can be accessed any time from the control station. The measured values are processed separately via the inputs and outputs through the automation system.



- 1 Automation system, e.g. Simatic S7 (Siemens)
- 2 Ethernet switch
- 3 Edge Gateway
- 4 Cloud
- 5 Measuring instrument
- 6 Ethernet network
- 7 Measured values via inputs and outputs
- 8 Optional WLAN interface

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

b Special Documentation for the OPC UA Server application package → 101.

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	■ Service interface CDI-RJ45 ■ WLAN interface ■ Ethernet-based fieldbus (EtherNet/IP, PROFINET, Modbus TCP over Ethernet-APL)	Special Documentation for device → 101
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	■ Service interface CDI-RJ45 ■ WLAN interface ■ Fieldbus protocol ■ Modbus TCP over Ethernet-APL	→ 98

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	- Service interface CDI-RJ45 - WLAN interface - Fieldbus protocol	→  98
Field Xpert	SMT70/77/50	- All fieldbus protocols - WLAN interface - Bluetooth - Service interface CDI-RJ45	Operating Instructions BA01202S Device description files: Use update function of handheld terminal

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

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

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

Web server

The integrated web server can be used to operate and configure the device via a web browser via Ethernet-APL, via service interface (CDI-RJ45) or via 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 instrument:

- Upload the configuration from the measuring instrument (XML format, configuration backup)
- Save the configuration to the measuring instrument (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 Technology verification report (PDF file, only available with the **Heartbeat Verification** →  95 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 →  95)

HistoROM data management

The measuring instrument 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 ■ Driver for system integration for exporting via web server, e.g.: ■ GSD for PROFIBUS DP ■ GSD for PROFIBUS PA ■ GSD for PROFINET ■ EDS for EtherNet/IP ■ DD for FOUNDATION Fieldbus	■ 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)
- Transmission of the drivers for system integration via web server, e.g.:
 - GSD for PROFIBUS DP
 - GSD for PROFIBUS PA
 - GSD for PROFINET
 - EDS for Ethernet/IP
 - DD for FOUNDATION fieldbus

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.

Devices with the order code for "Approval; transmitter + sensor", option BA, BB, BC or BD have equipment protection level (EPL) Ga/Gb (Zone 0 in the measuring tube).



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

Functional safety

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

The following types of monitoring in safety equipment are possible:

- Mass flow
- Volume flow
- Density



Functional safety manual with information for the SIL device → 100

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)
FOUNDATION Fieldbus certification	FOUNDATION Fieldbus interface The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications: ■ Certified in accordance with FOUNDATION Fieldbus H1 ■ Interoperability Test Kit (ITK), revision version 6.2.0 (certificate available on request) ■ Physical Layer Conformance Test ■ The device can also be operated with certified devices of other manufacturers (interoperability)
Certification PROFIBUS	PROFIBUS interface The measuring device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e.V./ PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications: ■ Certified according to PA Profile 3.02 ■ The device can also be operated with certified devices of other manufacturers (interoperability)
EtherNet/IP certification	The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications: ■ Certified in accordance with the ODVA Conformance Test ■ EtherNet/IP Performance Test ■ EtherNet/IP PlugFest compliance ■ The device can also be operated with certified devices of other manufacturers (interoperability)
Certification PROFINET	PROFINET interface The measuring instrument is certified and registered by the PROFIBUS Nutzerorganisation e.V. (PNO). The measuring system meets all the requirements of the following specifications: ■ Certified according to: ■ Test specification for PROFINET devices ■ PROFINET Netload Class 2 100 Mbit/s ■ The device can also be operated with certified devices of other manufacturers (interoperability). ■ The device supports PROFINET S2 system redundancy.
PROFINET over Ethernet-APL certification	PROFINET interface The measuring instrument is certified and registered by the PROFIBUS Nutzerorganisation e.V. (PNO). The measuring system meets all the requirements of the following specifications: ■ Certified according to: ■ Test specification for PROFINET devices ■ PROFINET PA Profile 4.02 ■ PROFINET Netload Robustness Class 2 10 Mbit/s ■ APL conformance test ■ The device can also be operated with certified devices of other manufacturers (interoperability) ■ The device supports PROFINET S2 system redundancy.
Pressure Equipment Directive	The measuring instruments can be ordered with or without PED or PESR. If a device with PED or PESR is required, this must be ordered explicitly. A UK order option must be selected for PESR under the order code for "Approvals".

- With the marking
 - a) PED/G1/x (x = category) or
 - b) PESR/G1/x (x = category)
 on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements"
 - a) specified in Annex I of the Pressure Equipment Directive 2014/68/EU or
 - b) Schedule 2 of Statutory Instruments 2016 No. 1105.
- Devices bearing this marking (PED or PESR) are suitable for the following types of medium:
 - Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to 0.5 bar (7.3 psi)
 - Unstable gases
- Devices not bearing this marking (without PED or PESR) are designed and manufactured according to sound engineering practice. They meet the requirements of
 - a) Art. 4, Section 3 of the Pressure Equipment Directive 2014/68/EU or
 - b) Part 1, Section 8 of Statutory Instruments 2016 No. 1105.
 The scope of application is indicated
 - a) in diagrams 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU or
 - b) in Schedule 3, Section 2 of Statutory Instruments 2016 No. 1105.

Radio approval

The measuring instrument has radio approval.



For detailed information on the radio approval, see the Special Documentation → 101

Measuring instrument approval

The measuring instrument is (optionally) approved as a gas meter (MI-002) or component in measuring systems (MI-005) in service subject to legal metrological control in accordance with the European Measuring Instruments Directive 2014/32/EU (MID).

The measuring instrument is qualified to OIML R117 or OIML R137 OIML R117 and has an OIML Certificate of Conformity (optional).

Additional certification**Marine approval**

Currently valid certificates are available:

- In the Downloads area of the Endress+Hauser website: www.endress.com → Downloads
- Specify the following details:
 - Product root, e.g. 8E3B
 - Search: Approval & Certificates → Marine

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

- ISO 23277 ZG2x (PT) + ISO 10675-1 ZG1 (RT) measuring tube (PT) + process connection (RT) welded seam, test report
- Penetrant+Radiographic testing ASME B31.3 NFS (RT) measuring tube (PT) + process connection (RT) welded seam, test report
- Penetrant+Radiographic testing ASME VIII Div.1 (RT) measuring tube (PT) + process connection (RT) welded seam, test report
- Visual+Penetrant+Radiographic testing NORSOK M-601 (RT) measuring tube (VT+PT) + process connection. (VT + RT) welded seam, test report
- EN10204-3.1 material certificate, wetted parts
- Pressure test, internal process, test report (order code for "Test, certificate", option JB)
- Material identification check (PMI), internal procedure, wetted parts, test report (option JK)

Testing of welded connections

Option	Test standard				Component	
	ISO 23277 AL2x (PT) ISO 10675-1 AL1 (RT, DR)	ASME B31.3 NFS	ASME VIII Div.1 Appx. 4+8	NORSOK M-601	Measuring tube	Test procedure
KF	x				PT	RT
KK		x			PT	RT

Option	Test standard				Component	
	ISO 23277 AL2x (PT) ISO 10675-1 AL1 (RT, DR)	ASME B31.3 NFS	ASME VIII Div.1 Appx. 4+8	NORSOK M-601	Measuring tube	Test procedure
KP			x		PT	RT
KR				x	VT, PT	VT, RT
PT = penetrant testing, RT = radiographic testing, VT = visual testing All options with test report						

External standards and guidelines

- EN 60529
Degrees of protection provided by enclosure (IP code)
- IEC/EN 60068-2-6
Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal).
- IEC/EN 60068-2-31
Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices.
- EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- GB 30439.5
Safety requirements for industrial automation products - Part 5: Flowmeter safety requirements
- EN 61326-1/-2-3
EMC requirements for electrical equipment for measurement, control and laboratory use
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 80
The application of the pressure equipment directive to process control devices
- NAMUR NE 105
Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
Self-monitoring and diagnostics of field devices
- NAMUR NE 131
Requirements for field devices for standard applications
- NAMUR NE 132
Coriolis mass meter
- NACE MR0103
Materials resistant to sulfide stress cracking in corrosive petroleum refining environments.
- NACE MR0175/ISO 15156-1
Materials for use in H₂S-containing Environments in Oil and Gas Production.
- ETSI EN 300 328
Guidelines for 2.4 GHz radio components.
- EN 301489
Electromagnetic compatibility and radio spectrum matters (ERM).

Ordering information

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

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

3. Select **Configuration**.



Product Configurator - the tool for individual product configuration

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

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 → 100

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 in accordance with DIN ISO 9001:2015 Clause 7.6 a) "Control of monitoring and measuring equipment".

- Functional testing in the installed state without interrupting the process.
- Traceable verification results on request, including a report.
- Simple testing process via local operation or other operating interfaces.
- Clear measuring point assessment (pass/fail) with high total test coverage within the framework of manufacturer specifications.
- Extension of calibration intervals according to operator's risk evaluation.

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 process influences (e.g. corrosion, abrasion, deposit buildup etc.) have on measuring performance over time.
- Schedule servicing in time.
- Monitor the process or product quality, e.g. gas pockets.



Detailed information on Heartbeat Technology:
Special Documentation → 100

Concentration measurement

Order code for "Application package", option ED "Concentration"

Calculation and outputting of fluid concentrations.

The measured density is converted to the concentration of a substance of a binary mixture using the "Concentration" application package:

- Choice of predefined fluids (e.g. various sugar solutions, acids, alkalis, salts, ethanol etc.).
- Common or user-defined units (°Brix, °Plato, % mass, % volume, mol/l etc.) for standard applications.
- Concentration calculation from user-defined tables.



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

Extended density

Order code for "Application package", option E1 "Extended density"

For volume-based applications, the device can calculate and output a volume flow rate by dividing the mass flow rate by the measured density.

This application package is the standard calibration for custody transfer applications according to national and international standards (e.g. OIML, MID). It is recommended for volume-based fiscal dosing applications over a wide temperature range.

The calibration certificate supplied describes the density performance in air and water at various temperatures in detail.



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

Petroleum

Order code for "Application package", option EJ "Petroleum"

The most important parameters for the Oil & Gas Industry can be calculated and displayed with this application package.

- Corrected volume flow and calculated reference density in accordance with the "API Manual of Petroleum Measurement Standards, Chapter 11.1"
- Water content, based on density measurement
- Weighted mean of the density and temperature



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

Petroleum & locking function

Order code for "Application package", option EM "Petroleum & locking function"

The most important parameters for the Oil & Gas Industry can be calculated and displayed with this application package. It is also possible to lock the settings.

- Corrected volume flow and calculated reference density in accordance with the "API Manual of Petroleum Measurement Standards, Chapter 11.1"
- Water content, based on density measurement
- Weighted mean of the density and temperature



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

OPC-UA Server

Order code for "Application package", option EL "OPC-UA Server"

The application package provides an integrated OPC-UA server for comprehensive device services for IoT and SCADA applications.



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

Accessories

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

www.endress.com.

Device-specific accessories

For the transmitter

Accessory	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: 8X3BXX  Installation Instructions EA01200D
Remote display and operating module DKX001	▪ If ordered directly with the measuring instrument: Order code for "Display; operation", option O "Remote display 4-line, illuminated; 10 m (30 ft) cable; touch control" ▪ If ordered separately: ▪ Measuring instrument: 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 →  79.  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. ▪ Further information on the WLAN interface →  86.  Order number: 71351317  Installation Instructions EA01238D
Protective cover	Is used to protect the measuring instrument 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 interface.  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 instruments, as well as digital measuring instruments  ■ Technical Information TI01297S ■ Operating Instructions BA01778S ■ Product page: www.endress.com/fxa42
Field Xpert SMT50	The Field Xpert SMT50 tablet PC for device configuration enables mobile plant asset management in non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.  ■ Technical Information TI01555S ■ Operating Instructions BA02053S ■ Product page: www.endress.com/smt50
Field Xpert SMT70	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.  ■ Technical Information TI01342S ■ Operating Instructions BA01709S ■ Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.  ■ Technical Information TI01418S ■ Operating Instructions BA01923S ■ Product page: www.endress.com/smt77

Service-specific accessories

Accessory	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring instruments: ■ Choice of measuring instruments for industrial requirements ■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and measurement accuracy. ■ Graphic display of the calculation results ■ Determining the partial order code. Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator
Netilion	IIoT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem, Endress+Hauser allows you to optimize your plant performance, digitize workflows, share knowledge, and enhance collaboration. Based on decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem that enables you to gain useful insights from data. These insights can be used to optimize processes, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.  Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices.  ■ Technical Information: TI01134S ■ 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
Cerabar M	The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value.  ■ Technical Information TI00426P and TI00436P ■ Operating Instructions BA00200P and BA00382P
Cerabar S	The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value.  ■ Technical Information TI00383P ■ Operating Instructions BA00271P
iTEMP	The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature.  "Fields of Activity" document FA00006T

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 instrument	Documentation code
Proline Promass X	KA01288D

Brief Operating Instructions for the transmitter

Measuring instrument	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485
Proline 300	KA01309D	KA01229D	KA01227D	KA01386D	KA01311D

Brief Operating Instructions for the transmitter

Measuring instrument	Documentation code			
	EtherNet/IP	PROFINET	PROFINET over Ethernet-APL	Modbus TCP
Proline 300	KA01339D	KA01341D	KA01517D	KA01733D

Operating Instructions

Measuring instrument	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485
Promass X 300	BA01492D	BA01525D	BA01514D	BA01864D	BA01503D

Measuring instrument	Documentation code			
	EtherNet/IP	PROFINET	PROFINET over Ethernet-APL	Modbus TCP
Promass X 300	BA01735D	BA01746D	BA02118D	BA02411D

Description of Device Parameters

Measuring instrument	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485
Promass 300	GP01057D	GP01094D	GP01058D	GP01134D	GP01059D

Measuring instrument	Documentation code			
	EtherNet/IP	PROFINET	PROFINET over Ethernet-APL	Modbus TCP
Promass 300	GP01114D	GP01115D	GP01168D	GP01235D

Device-dependent additional documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEX Ex d	XA01405D
ATEX/IECEX Ex ec	XA01439D
cCSAus XP	XA01373D
cCSAus Ex d	XA01372D
cCSAus Ex ec	XA01507D
EAC Ex d	XA01656D
EAC Ex ec	XA01657D
JPN Ex d	XA01778D
KCs Ex d	XA03285D
INMETRO Ex d	XA01468D
INMETRO Ex ec	XA01470D
NEPSI Ex d	XA01469D
NEPSI Ex ec	XA01471D
UKEX Ex d	XA02566D
UKEX Ex ec	XA02568D

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
EAC Ex i	XA01664D
EAC Ex ec	XA01665D
INMETRO Ex i	XA01500D
INMETRO Ex ec	XA01501D
JPN	XA01781D
KCs Ex i	XA03280D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D
UKCA Ex i	XA01494D
UKCA Ex ec	XA01498D

Functional Safety Manual

Contents	Documentation code
Proline Promass 300	SD01727D

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
OPC UA server ¹⁾	SD02039D
Modbus TCP system integration	SD03408D

1) This Special Documentation is only available for device versions with a HART output.

Contents	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485
Web server	SD01662D	SD01665D	SD01664D	SD02226D	SD01663D
Heartbeat Technology	SD01642D	SD01696D	SD01698D	SD02202D	SD01697D
Concentration measurement	SD01644D	SD01706D	SD01708D	SD02212D	SD01707D
Petroleum	SD02097D	–	SD02291D	SD02216D	SD02098D
Petroleum & locking function	SD02499D	–	–	–	SD02500D
Gas fraction handler	SD02584D	–	–	–	SD02584D
Custody transfer (counter for liquids other than water)	SD01688D	–	–	–	SD01689D

Contents	Documentation code				
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485
Custody transfer (counter for gas)	SD02415D	–	–	–	SD02463D
Custody transfer (counter for gas, in accordance with the German Measurement and Calibration Ordinance (Mess- und Eichverordnung))	SD02580D	–	–	–	SD02581D

Contents	Documentation code			
	PROFINET	EtherNet/IP	PROFINET over Ethernet- APL	Modbus TCP
Web server	SD01969D	SD01968D	SD02762D	–
Heartbeat Technology	SD01988D	SD01982	SD02731D	SD03350D
Concentration measurement	SD02005D	SD02004D	SD02735D	SD03354D
Petroleum	SD02099D	SD02096D	SD02739D	SD03358D
Petroleum & locking function	–	–	SD02739D	–
Gas fraction handler	SD02584D	–	SD02584D	SD02584D
Custody transfer (counter for liquids other than water)	–	–	–	–
Custody transfer (counter for gas)	–	–	–	–
Custody transfer (counter for gas, in accordance with the German Measurement and Calibration Ordinance (Mess- und Eichverordnung))	–	–	–	–

Installation Instructions

Contents	Note
Installation instructions for spare part sets and accessories	The corresponding documentation code is listed with the relevant accessory. →  97.

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, Texas USA

PROFIBUS®

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

FOUNDATION™ fieldbus

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

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

Ethernet/IP™

Trademark of ODVA, Inc.

Ethernet-APL™

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

PROFINET®

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



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