Technical Information
Proline t-mass I 500

Thermal mass flowmeter

Insertion flowmeter with long-term stability as remote version with up to 4 I/Os

Application

- Measuring principle is characterized by a high operable flow range and direct mass flow measurement
- Measurement of utility and process gases as well as gas mixtures in circular piping or rectangular ducts

Device properties
- Insertion version for DN 80 to 1500 (3 to 60")
- Bidirectional measurement; high measuring performance
- Patented drift-free sensor with SIL 2
- Remote version with up to 4 I/Os
- Backlit display with touch control and WLAN access
- Standard cable between sensor and transmitter

Your benefits

- Flexible, convenient programming based on 21 standard gases or freely definable gas mixtures thereof
- High level of process control – premium measurement accuracy and repeatability
- Reliable monitoring – detection of process disturbances and reverse flow
- Flexible installation – suitable for large dimensional range and circular pipes or rectangular ducts
- Full access to process and diagnostic information – numerous, freely combinable I/Os and fieldbuses
- Reduced complexity and variety – freely configurable I/O functionality
- Integrated verification – Heartbeat Technology

Endress+Hauser [EH]

People for Process Automation

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About this document

Symbols

Electrical symbols

Symbol	Meaning
⎓	Direct current
∿	Alternating current
⏦	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏛	**Potential equalization connection (PE: protective earth)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: • Interior ground terminal: potential equalization is connected to the supply network. • Exterior ground terminal: device is connected to the plant grounding system.
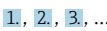
Communication-specific symbols

Symbol	Meaning
📶	**Wireless Local Area Network (WLAN)** Communication via a wireless, local network.
◉	**LED** Light emitting diode is off.
☀	**LED** Light emitting diode is on.
☼	**LED** Light emitting diode is flashing.

Symbols for certain types of information

Symbol	Meaning
✓	**Permitted** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.
✗	**Forbidden** Procedures, processes or actions that are forbidden.
🛈	**Tip** Indicates additional information.
📖	Reference to documentation
📄	Reference to page
🖼	Reference to graphic
👁	Visual inspection

Symbols in graphics

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

Function and system design

Measuring principle

The thermal measuring principle is based on the cooling of a heated resistance thermometer (PT100) from which heat is extracted by the passing medium.
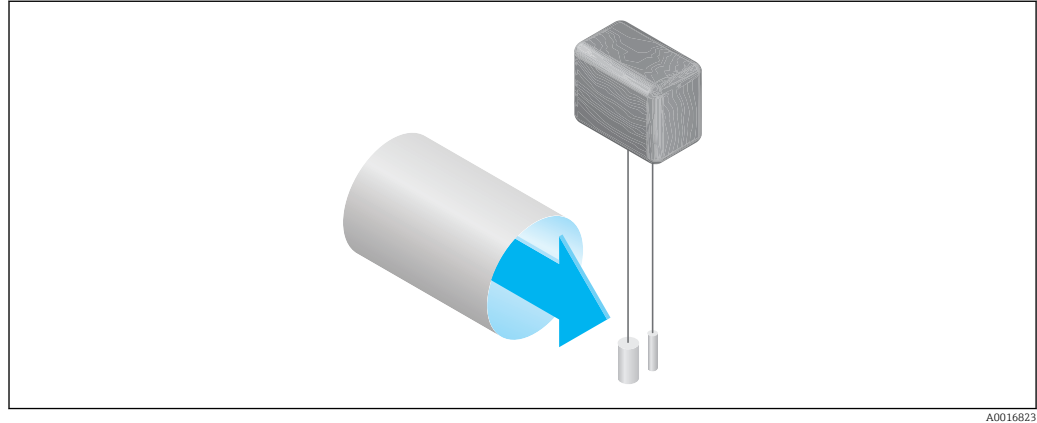
The medium passes two PT100 resistance thermometers in the measurement section. One of these is used in the conventional way as a temperature sensor, while the other serves as a heating element. The temperature sensor monitors and records the effective process temperature while the heated resistance thermometer is kept at a constant differential temperature (compared to the measured process temperature) by controlling the electrical current used by the heating element. The greater the mass flow passing over the heated resistance thermometer, the greater the extent to which cooling takes place and therefore the stronger the current required to maintain a constant differential temperature. This means that the heat current measured is an indicator of the mass flow rate of the medium.

Gas Engine

The integrated Gas Engine functionality ensures maximum measuring performance for flow measurement. The Gas Engine developed by Endress+Hauser is a software-based database of typical standard gases and their specific properties. The Gas Engine calculates the properties of gas mixtures based on the percentage shares of up to 8 gas components.

The Gas Engine functionality enables:
- Calibration with air; no need for expensive and complex calibration with real gas
- Precise conversion of air to other gases; no recalibration required
- Exact measurement of single gases and also of gas mixtures
- Dynamic correction of pressure and temperature changes

The device can be configured for 21 freely selectable gases and water vapor.

Gases available for selection:

- Ammonia
- Argon
- Butane
- Chlorine
- Hydrogen chloride
- Ethane
- Ethylene
- Helium
- Carbon dioxide
- Carbon monoxide
- Krypton
- Air
- Methane
- Neon
- Ozone [1]
- Propane
- Oxygen
- Hydrogen sulfide
- Nitrogen
- Hydrogen
- Xenon

1) Can only be selected as an individual gas or as a gas mixture with oxygen.

Mixtures of these gases, e.g. natural gas, can be programmed easily and quickly on the basis of the percentage shares.

For other gases, contact the Endress+Hauser sales organization responsible for your area.

Bidirectional measurement and reverse flow detection

Conventional thermal mass flowmeters cannot distinguish between forward and reverse flows. They always record flow in both directions with the same algebraic sign. Endress+Hauser's thermal flowmeter is available in this conventional unidirectional design, or as a bidirectional flowmeter. Both versions feature sensors that are protected in stainless steel. The bidirectional version can distinguish between the two flow directions and measure and totalize the flow in both directions with the same degree of accuracy.

The version to detect reverse flow only measures flow in the positive direction. The reverse flow is detected by the device but is not totalized.

Measuring system	The measuring system consists of a transmitter and a sensor. The transmitter and sensor are mounted in physically separate locations. They are interconnected by connecting cables.

Proline 500 – digital transmitter

For use in applications not required to meet special requirements due to ambient or operating conditions.
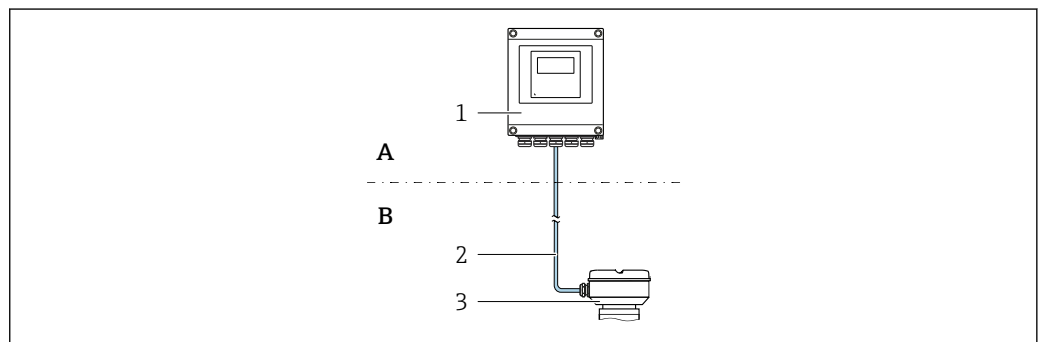
A   Non-hazardous area or Zone 2; Class I, Division 2
B   Non-hazardous area or Zone 2; Class I, Division 2 or Zone 1; Class I, Division 1
1   Transmitter
2   Connecting cable: cable, separate, standard
3   Sensor connection housing with integrated ISEM

- Electronics in the transmitter housing, ISEM (intelligent sensor electronics module) in the sensor connection housing
- Signal transmission: digital
  Order code for "Integrated ISEM electronics", option A "Sensor"

Connecting cable

Connecting cables can be ordered in various lengths → 🕮 80.

- Length:
  - Zone 2; Class I, Division 2: max. 300 m (1 000 ft)
  - Zone 1; Class I, Division 1: max. 150 m (500 ft)
- Standard cable with common shield (pair-stranded)
- Not sensitive to external EMC interference.

Hazardous area

Use in: Zone 2; Class I, Division 2

Mixed installation is possible:
- Sensor: Zone 1; Class I, Division 1
- Transmitter: Zone 2; Class I, Division 2

Housing versions and materials
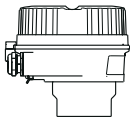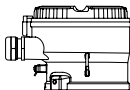
- Transmitter housing
  - Aluminum, coated: aluminum, AlSi10Mg, coated
  - Material: polycarbonate
- Material of window in transmitter housing
  - Aluminum, coated: glass
  - Material: polycarbonate

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 connection:
  - Operating tools (e.g. FieldCare, DeviceCare)
  - Web server (access via Web browser, e.g. Microsoft Internet Explorer, Microsoft Edge)

Sensor connection housing

Different versions of the connection housing are available.

	Order code for "Sensor connection housing", option A, "Aluminum, coated": Aluminum, AlSi10Mg, coated
	Order code for "Sensor connection housing", option L, "Cast, stainless": 1.4409 (CF3M) similar to 316L

Sensor

t-mass I	Insertion version:
	• Sensor lengths: 235 mm (9 ")/335 mm (13 ")/435 mm (17 ")/ 608 mm (24 ") for DN 80 to 1500 (3 to 60")
	• Materials (in contact with medium):
	  • Insertion tube: stainless steel 1.4404 (316/316L)
	  • Sensing element:
	    Stainless steel 1.4404 (316/316L)
	    Alloy C22, 2.4602 as version for corrosive gases
	• Exception: connecting part to transmitter (not in contact with medium): 1.4301 (304)

Equipment architecture
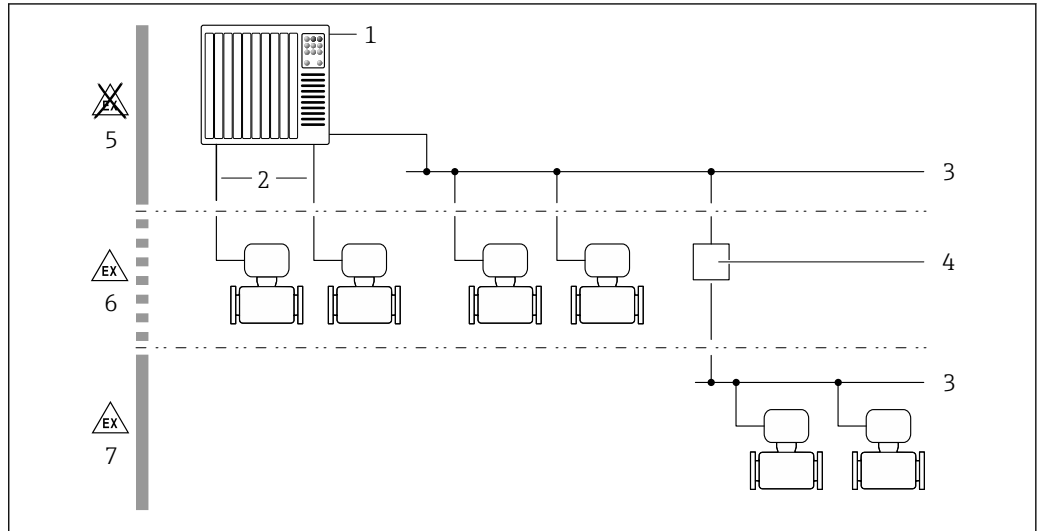
⊠ 1   Possibilities for integrating measuring devices into a system

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

Reliability

IT security

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

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

Device-specific IT security

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

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 🗎 10	Not enabled	On an individual basis following risk assessment
Access code (also applies to web server login or FieldCare connection) → 🗎 10	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) → 🗎 10	Serial number	Assign an individual WLAN passphrase during commissioning
WLAN mode	Access point	On an individual basis following risk assessment
Web server → 🗎 10	Enabled	On an individual basis following risk assessment
CDI-RJ45 service interface→ 🗎 10	–	On an individual basis following risk assessment

Protecting access via hardware write protection

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

Hardware write protection is disabled when the device is delivered.

Protecting access via a password

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

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

User-specific access code

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

WLAN passphrase: Operation as WLAN access point

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

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

Infrastructure mode

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

General notes on the use of passwords

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

Access via web server

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

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

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

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

Access via service interface (CDI-RJ45)

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

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

Input

Measured variable	**Measured process variables** • Mass flow • Temperature **Calculated process variables** • Corrected volume flow • Volume flow • FAD volume flow • Flow velocity • Calorific value • 2nd temperature heat difference • Heat flow • Energy flow • Density **Process variables available for order** Order code for "Sensor version": • Option SB "Bidirectional" measures the flow in both directions (»positive« and »negative« flow) and totalizes the flow in both directions. The device is calibrated in both directions. • Option SC "Reverse flow detection" only measures the flow in the positive direction. The reverse flow is detected by the device but is not totalized. The device is only calibrated in the positive forward flow direction. Order code for "Application package": Option EV "Second gas group" enables the configuration of two different standard gases/gas mixtures in the device and allows the user to switch from one gas group to another using the status input or (if available) via bus communication.
Measuring range	The available measuring range depends on the choice of gas and size of the pipe. Each measuring device is calibrated individually with air under reference operating conditions. No recalibration is required in the case of customer-specific gases, as the device's Gas Engine → 🖺 6 functionality converts from air to these gases. The measuring ranges calibrated for air are indicated in the following section. For information on other gases and process conditions, contact your sales organization or use the Applicator selection software. **SI units** • Order code for "Sensor version; sensor; insertion tube", option SA "Unidirectional; stainless steel; stainless steel" • Order code for "Sensor version; sensor; insertion tube", option HA "Unidirectional; Alloy; stainless steel"

DN [mm]	Full scale value [kg/h] (Air, 20°C, 1.013 bar a)		Full scale value [Nm3/h] (Air, 0°C, 1.013 bar a)	
	Minimum	Maximum	Minimum	Maximum
80	21	2 086	16	1 613
100	33	3 260	25	2 521
150	73	7 335	57	5 672
200	130	13 040	101	10 084
250	204	20 375	158	15 757
300	293	29 340	227	22 689
400	522	52 160	403	40 337
500	815	81 500	630	63 026
600	1 174	117 360	908	90 758
700	1 597	159 740	1 235	123 531

DN [mm]	Full scale value [kg/h] (Air, 20℃, 1.013 bar a)		Full scale value [Nm3/h] (Air, 0℃, 1.013 bar a)	
	Minimum	Maximum	Minimum	Maximum
1000	3260	326000	2521	252105
1500	7335	733501	5672	567236

- Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"

DN [mm]	Full scale value [kg/h] (Air, 20℃, 1.013 bar a)		Full scale value [Nm3/h] (Air, 0℃, 1.013 bar a)	
	Minimum	Maximum	Minimum	Maximum
80	13	1310	10	1012
100	23	2310	17	1786
150	47	4750	36	3673
200	84	8475	65	6553
250	132	13250	102	10246
300	190	19000	146	14692
400	337	33750	260	26099
500	530	53000	409	40986
600	762	76250	589	58966
700	1038	103820	802	80286
1000	2119	211900	1638	163868
1500	4767	476750	3686	368683

US units

- Order code for "Sensor version; sensor; insertion tube", option SA "Unidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube", option HA "Unidirectional; Alloy; stainless steel"

DN [in]	Full scale value [lb/h] (Air, 68℉, 14.7 psi a)		Full scale value [SCFM] (Air, 59℉, 14.7 psi a)	
	Minimum	Maximum	Minimum	Maximum
3	42	4173	9	909
4	74	7419	16	1616
6	167	16693	36	3636
8	297	29677	65	6464
10	464	46371	101	10100
12	668	66774	145	14544
16	1187	118709	259	25856
20	1855	185482	404	40400
24	2671	267094	582	58176
28	3635	363545	792	79184
40	7419	741929	1616	161600
60	16693	1669340	3636	363600

- Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"

DN [in]	Full scale value [lb/h] (Air, 68°F, 14.7 psi a)		Full scale value [SCFM] (Air, 59°F, 14.7 psi a)	
	Minimum	Maximum	Minimum	Maximum
3	29	2 981	6	648
4	52	5 257	11	1 144
6	108	10 810	23	2 354
8	192	19 287	42	4 200
10	301	30 155	65	6 567
12	432	43 241	94	9 417
16	768	76 810	167	16 729
20	1 206	120 620	262	26 272
24	1 735	173 533	377	37 797
28	2 362	236 279	514	51 463
40	4 822	482 253	1 050	105 039
60	10 850	1 085 012	2 363	236 326

The flow rates listed are only representative for the calibrated conditions and do not necessarily reflect the measuring capacity of the measuring device under operating conditions and the actual pipe internal diameters present on site. To make sure that the correct device version and sizing is selected to suit the application, contact the sales organization or use the Applicator selection software.

Special applications

High gas flow velocities (>70 m/s)

In the case of high gas flow velocities, it is advisable to read in the process pressure dynamically or to enter the pressure as accurately as possible, as a velocity-dependent correction is performed.

Light gases (hydrogen, helium)
- The reliable measurement of light gases can be difficult due to their very high thermal conductivity. Depending on the application, the flow rates of light gases are often particularly slow and the flow profiles are not sufficiently developed. The flows are frequently in the laminar flow range, while turbulent flow would actually be needed for optimum measurement.
- Despite loss of accuracy and linearity in applications with light gases and low flow rates, the device measures with a good degree of repeatability and is therefore suitable for monitoring flow conditions (e.g. leak detection).
- The recommended inlet runs must be doubled for light gases.→ 🖺 41

Operable flow range	- 200:1 with factory calibration - Up to 1000:1 with application-specific adjustment
Input signal	Output and input variants → 🖺 16 **External values** The measuring device provides interfaces which allow values measured externally → 🖺 15 to be transmitted to the measuring device: - Analog inputs 4-20 mA - Digital inputs Pressure values can be transmitted as absolute or gauge pressure. For gauge pressure, the atmospheric pressure must be known or specified by the customer.

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 → 🗎 15.

Digital communication

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

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	• 4 to 20 mA (active) • 0/4 to 20 mA (passive)
Resolution	1 µA
Voltage drop	Typically: 0.6 to 2 V for 3.6 to 22 mA (passive)
Maximum input voltage	≤ 30 V (passive)
Open-circuit voltage	≤ 28.8 V (active)
Possible input variables	• Pressure • Temperature • Mol-% (gas analyzer) • External reference flow rate (in-situ adjustment)

Status input

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

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 4. 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, H, I or J is available for output 2 and one of the options A, B, D, E, H, I or J is available for output 3 and 4.

Output/input 1 and options for output/input 2

Options for output/input 3 and 4 → 🗎 17

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

[1]   A specific input or output can be assigned → 🗎 21 to a user-configurable input/output.

Output/input 1 and options for output/input 3 and 4

Options for output/input 2 → 🖺 16

Order code for "Output; input 1" (020) →	Possible options												
Current output 4 to 20 mA HART	BA												
Current output 4 to 20 mA HART Ex i passive	↓	CA											
Current output 4 to 20 mA HART Ex i active		↓	CC										
Modbus RS485								↓	MA				
Order code for "Output; input 3" (022), "Output; input 4" (023) [1] →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not used	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		
User-configurable input/output	D				D			D	D	D	D		
Pulse/frequency/switch output	E				E			E	E	E	E		
Relay output	H				H			H	H	H	H		
Current input 0/4 to 20 mA	I				I			I	I	I	I		
Status input	J				J			J	J	J	J		

1) The order code for "Output; input 4" (023) is only available for the Proline 500-digital transmitter, order code for "Integrated ISEM electronics", option A.

Output signal	Current output 4 to 20 mA HART

Order code	"Output; input 1" (20): Option BA: current output 4 to 20 mA HART
Signal mode	Can be set to: • Active • Passive
Current range	Can be set to: • 4 to 20 mA NAMUR • 4 to 20 mA US • 4 to 20 mA • 0 to 20 mA (only if the signal mode is active) • Fixed current
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	• Mass flow • Volume flow • Corrected volume flow • FAD volume flow • Flow velocity • Temperature • Energy flow • Pressure • Density • Heat flow • Electronics temperature • 2nd temperature heat difference For SIL (application package), only mass flow

Current output 4 to 20 mA HART Ex i

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

Damping	Configurable: 0 to 999.9 s
Assignable measured variables	• Mass flow • Volume flow • Corrected volume flow • FAD volume flow • Flow velocity • Temperature • Energy flow • Pressure • Density • Heat flow • Electronics temperature • 2nd temperature heat difference For SIL (application package), only mass flow

Modbus RS485

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

Current output 4 to 20 mA

Order code	"Output; input 2" (21), "Output; input 3" (022) or "Output; input 4" (023): Option B: current output 4 to 20 mA
Signal mode	Can be set to: • Active • Passive
Current span	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 • FAD volume flow • Flow velocity • Temperature • Energy flow • Pressure • Density • Heat flow • Electronics temperature • 2nd temperature heat difference For SIL (application package), only mass flow

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
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Pulse output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Pulse width	Configurable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Configurable
Assignable measured variables	• Mass flow
	• Volume flow
	• Corrected volume flow
	• FAD volume flow
	• Energy flow
	• Heat flow
	For SIL (application package), only mass flow
Frequency output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Output frequency	Configurable: end value frequency 2 to 10 000 Hz (f_{max} = 12 500 Hz)
Damping	Configurable: 0 to 999.9 s
Pulse/pause ratio	1:1
Assignable measured variables	• Mass flow
	• Volume flow
	• Corrected volume flow
	• FAD volume flow
	• Flow velocity
	• Temperature
	• Energy flow
	• Pressure
	• Density
	• Heat flow
	• Electronic temperature
	• 2nd temperature heat difference
	For SIL (application package), only mass flow
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	• Off
	• On
	• Diagnostic behavior
	• Limit value
	  • Off
	  • Mass flow
	  • Volume flow
	  • Corrected volume flow
	  • FAD volume flow
	  • Heat flow
	  • Energy flow
	  • Flow velocity
	  • Density
	  • Calorific value
	  • Temperature
	  • 2nd temperature heat difference
	  • Totalizer 1-3
	  • Electronic temperature
	• Flow direction monitoring
	• Status
	  Low flow cut off

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	• Off
	• On
	• Diagnostic behavior
	• Limit value
	  • Off
	  • Mass flow
	  • Volume flow
	  • Corrected volume flow
	  • FAD volume flow
	  • Heat flow
	  • Energy flow
	  • Flow velocity
	  • Density
	  • Temperature
	  • 2nd temperature heat difference
	  • Totalizer 1-3
	  • Electronics temperature
	• Flow direction monitoring
	• Status
	  Low flow cut off

User-configurable input/output

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

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

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

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

HART current output

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

Modbus RS485

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

Current output 0/4 to 20 mA

4 to 20 mA

Failure mode	Choose from: • 4 to 20 mA in accordance with NAMUR recommendation NE 43 • 4 to 20 mA in accordance with US • Min. value: 3.59 mA • Max. value: 22.5 mA • Definable value between: 3.59 to 22.5 mA • Actual value • Last valid value

0 to 20 mA

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

Pulse/frequency/switch output

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

Relay output

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

Local display

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

i Status signal as per NAMUR recommendation NE 107

Interface/protocol

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

Plain text display	With information on cause and remedial measures

i Additional information on remote operation → 🖹 70

Web browser

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

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

---

Load   Output signal → 🖹 18

Ex connection data   Safety-related values

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

Order code "Output; input 2"; "Output; input 3" "Output; input 4"	Output type	Safety-related values					
		Output; input 2		Output; input 3		Output; input 4	
		24 (+)	25 (−)	22 (+)	23 (−)	20 (+)	21 (−)
Option **B**	Current output 4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}					
Option **D**	User-configurable input/output	U_N = 30 V_{DC} U_M = 250 V_{AC}					
Option **E**	Pulse/frequency/switch output	U_N = 30 V_{DC} U_M = 250 V_{AC}					

Order code "Output; input 2"; "Output; input 3" "Output; input 4"	Output type	Safety-related values					
		Output; input 2		Output; input 3		Output; input 4	
		24 (+)	25 (−)	22 (+)	23 (−)	20 (+)	21 (−)
Option **H**	Relay output	$U_N = 30\ V_{DC}$ $I_N = 100\ mA_{DC}/500\ mA_{AC}$ $U_M = 250\ V_{AC}$					
Option **I**	Current input 4 to 20 mA	$U_N = 30\ V_{DC}$ $U_M = 250\ V_{AC}$					
Option **J**	Status input	$U_N = 30\ V_{DC}$ $U_M = 250\ V_{AC}$					

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

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

Protocol-specific data   **HART**

Manufacturer ID	0x11
Device type ID	0x1160
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 . • Measured variables via HART protocol • Burst Mode functionality

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Response times	• Direct data access: typically 25 to 50 ms • Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	• 03: Read holding register • 04: Read input register • 06: Write single registers • 08: Diagnostics • 16: Write multiple registers • 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: • 06: Write single registers • 16: Write multiple registers • 23: Read/write multiple registers

Supported baud rate	• 1 200 BAUD • 2 400 BAUD • 4 800 BAUD • 9 600 BAUD • 19 200 BAUD • 38 400 BAUD • 57 600 BAUD • 115 200 BAUD
Data transmission mode	• ASCII • RTU
Data access	Each device parameter can be accessed via Modbus RS485. 📖 For Modbus register information
System integration	Information regarding system integration: Operating Instructions . • Modbus RS485 information • Function codes • Register information • Response time • Modbus data map

Power supply

Terminal assignment

Transmitter: supply voltage, input/outputs

HART

Supply voltage		Input/output 1		Input/output 2		Input/output 3		Input/output 4	
1 (+)	2 (−)	26 (+)	27 (−)	24 (+)	25 (−)	22 (+)	23 (−)	20 (+)	21 (−)
				The terminal assignment depends on the specific device version ordered → 🖺 16.					

Modbus RS485

Supply voltage		Input/output 1		Input/output 2		Input/output 3		Input/output 4	
1 (+)	2 (−)	26 (B)	27 (A)	24 (+)	25 (−)	22 (+)	23 (−)	20 (+)	21 (−)
				The terminal assignment depends on the specific device version ordered → 🖺 16.					

Transmitter and sensor connection housing: connecting cable

The sensor and transmitter, which are mounted in separate locations, are interconnected by a connecting cable. The cable is connected via the sensor connection housing and the transmitter housing.

Terminal assignment and connection of the connecting cable:
Proline 500 – digital → 🖺 27

Available device plugs

ℹ️ Device plugs may not be used in hazardous areas!

Device plug for connecting to the service interface:
Order code for "Accessory mounted"
Option **NB**, RJ45 M12 adapter (service interface) → 🖺 26

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

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

Pin assignment, device plug

Service interface

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

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

A0032047

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

Supply voltage

Order code "Power supply"	Terminal voltage		Frequency range
Option **D**	DC 24 V	±20%	–
Option **E**	AC 100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz
Option **I**	DC 24 V	±20%	–
	AC 100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz

Power consumption

Transmitter

Max. 10 W (active power)

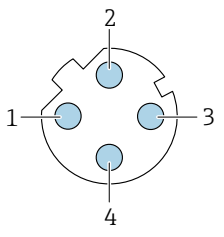| switch-on current	Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21

Current consumption

Transmitter

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

Power supply failure

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

Overcurrent protection element

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

| Electrical connection | Connection of connecting cable: Proline 500 – digital |
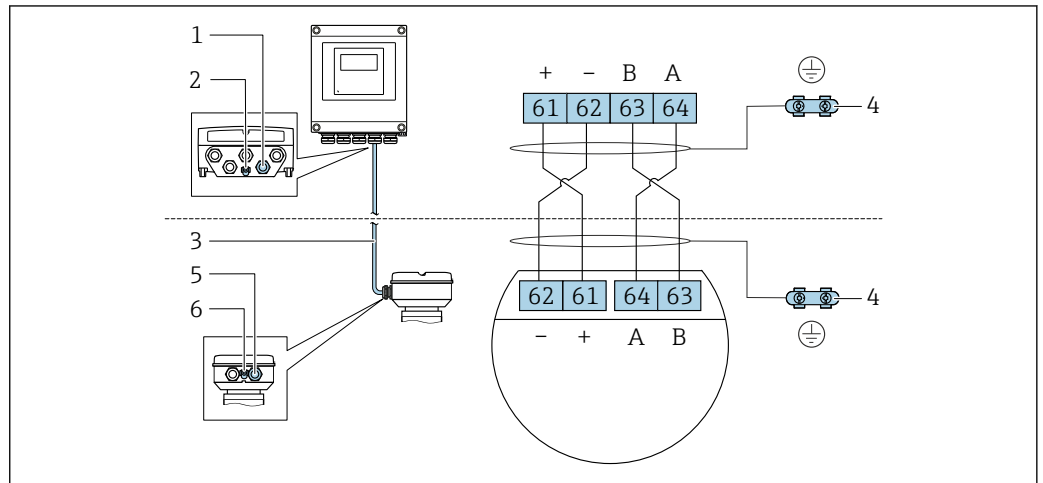
1 Cable entry for cable on transmitter housing
2 Terminal connection for potential equalization (PE)
3 Connecting cable ISEM communication
4 Grounding via ground connection; in the version with a device plug, grounding is ensured through the plug itself
5 Cable entry for cable or connection of device plug on sensor connection housing
6 Terminal connection for potential equalization (PE)

Transmitter connection

- Terminal assignment → 🖹 25
- Device plug pin assignment → 🖹 26

Transmitter connection: Proline 500 – digital
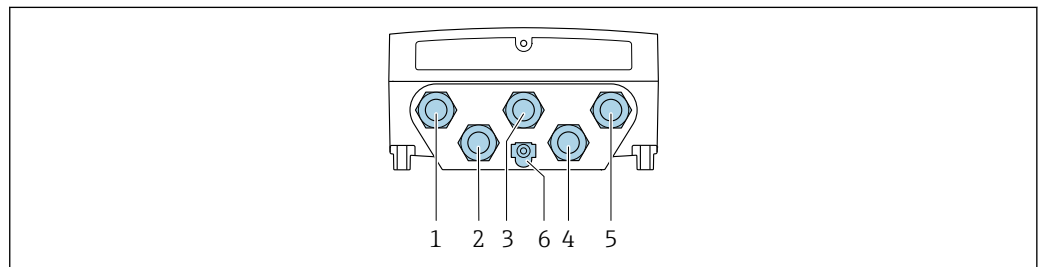
1 Terminal connection for supply voltage
2 Terminal connection for signal transmission, input/output
3 Terminal connection for signal transmission, input/output
4 Terminal connection for connecting cable between sensor and transmitter
5 Terminal connection for signal transmission, input/output; optional: connection for external WLAN antenna
6 Terminal connection for potential equalization (PE)

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

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

Network connection (DHCP client) via service interface (CDI-RJ45) → 🖹 71

Connection examples

Current output 4 to 20 mA HART
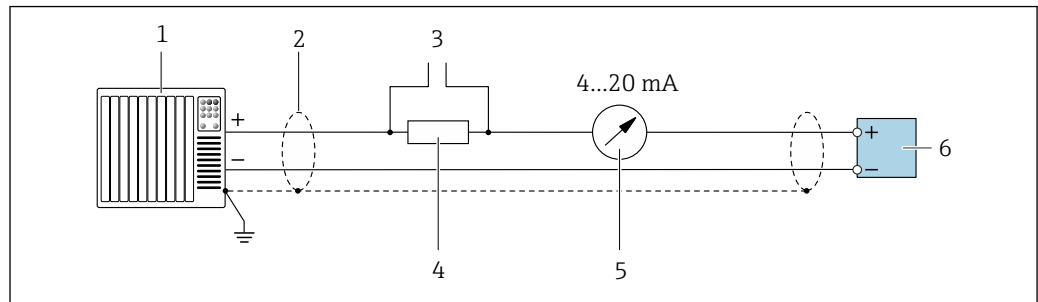
A0029055

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

1   Automation system with current input (e.g. PLC)
2   Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 🖺 32
3   Connection for HART operating devices → 🖺 70
4   Resistor for HART communication (≥ 250 Ω): observe maximum load → 🖺 18
5   Analog display unit: observe maximum load → 🖺 18
6   Transmitter
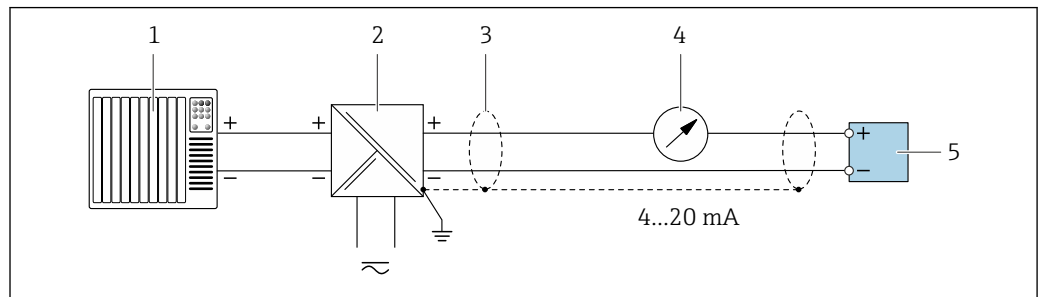
A0028762

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

1   Automation system with current input (e.g. PLC)
2   Power supply
3   Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 🖺 32
4   Analog display unit: observe maximum load → 🖺 18
5   Transmitter

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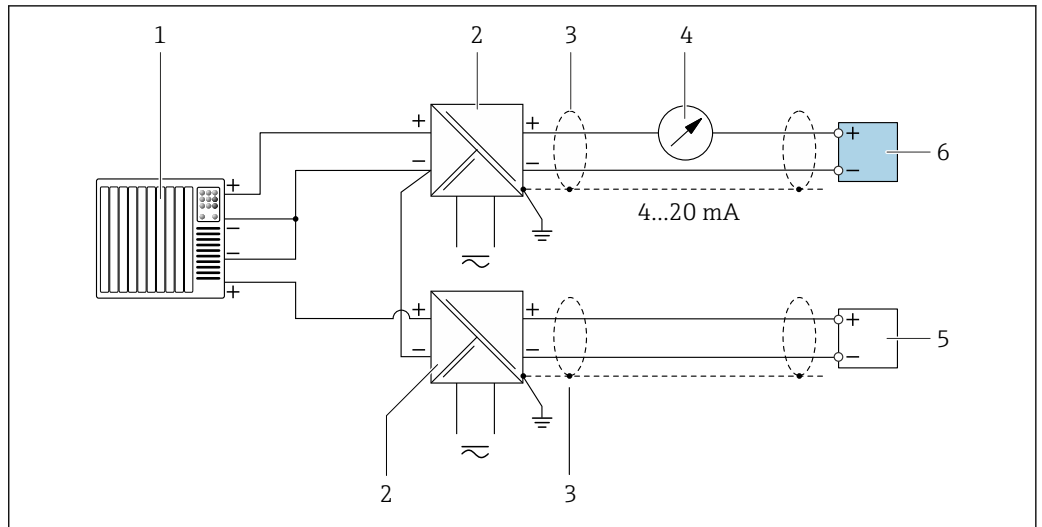
🔲 *4   Connection example for HART input with a common negative (passive)*

1   Automation system with HART output (e.g. PLC)
2   Active barrier for power supply (e.g. RN221N)
3   Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
4   Analog display unit: observe maximum load → 🔳 18
5   Pressure measuring device (e.g. Cerabar M, Cerabar S): observe requirements
6   Transmitter
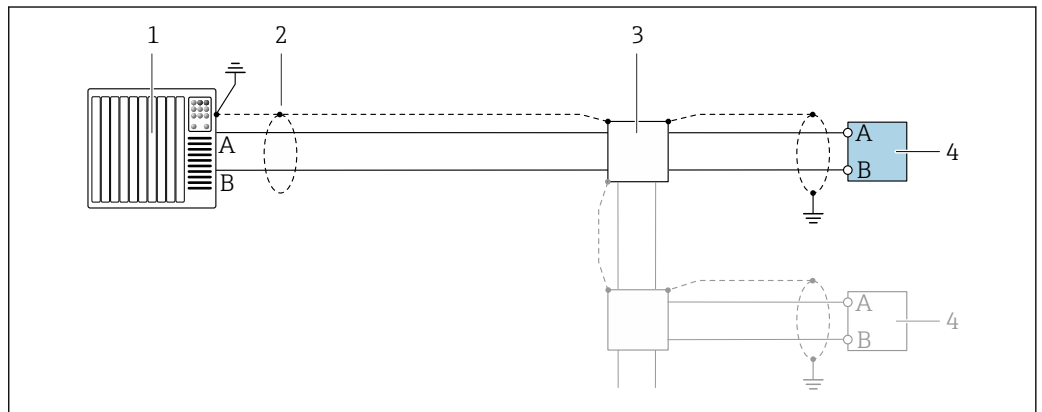
Modbus RS485

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

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

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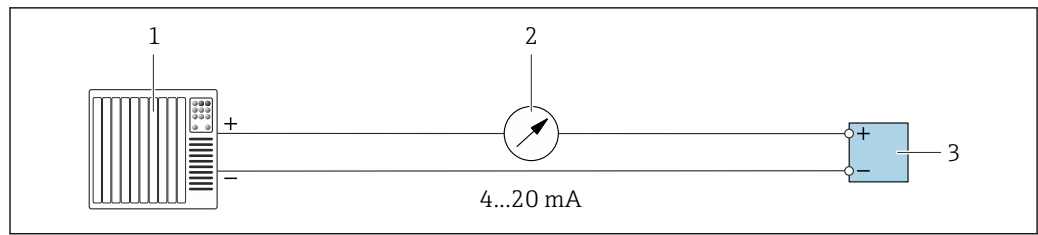
6   Connection example for 4-20 mA current output (active)

1   Automation system with current input (e.g. PLC)
2   Analog display unit: observe maximum load → 🖫 18
3   Transmitter
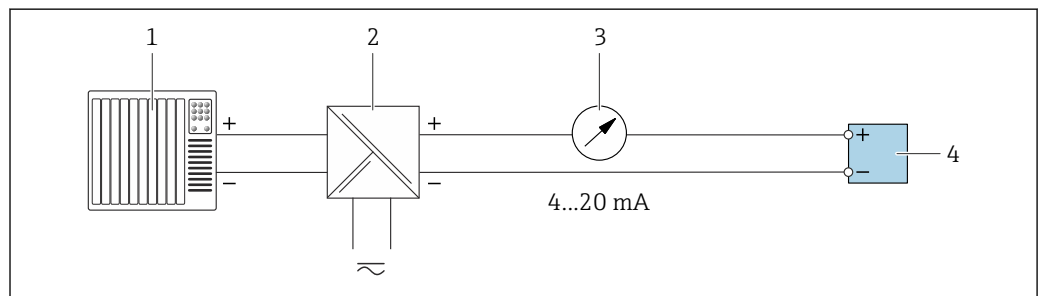
7   Connection example for 4-20 mA current output (passive)

1   Automation system with current input (e.g. PLC)
2   Active barrier for power supply (e.g. RN221N)
3   Analog display unit: observe maximum load → 🖫 18
4   Transmitter

Pulse/frequency output
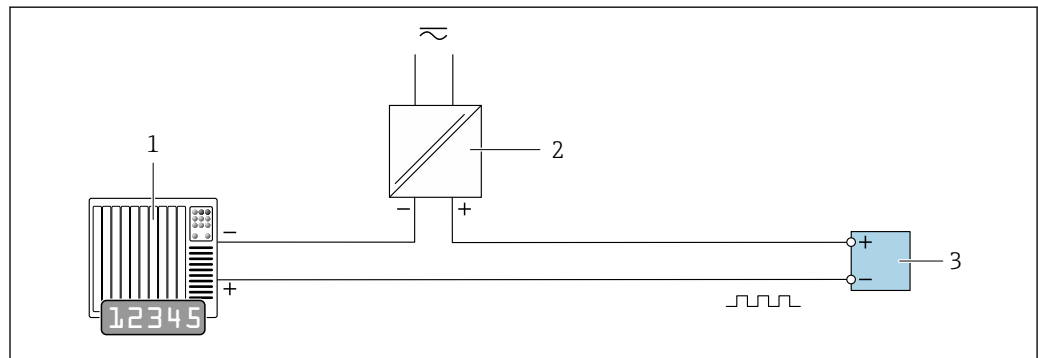
8   Connection example for pulse/frequency output (passive)

1   Automation system with pulse/frequency input (e.g. PLC with 10 kΩ pull-up or pull-down resistor)
2   Power supply
3   Transmitter: observe input values → 🖫 20

Switch output
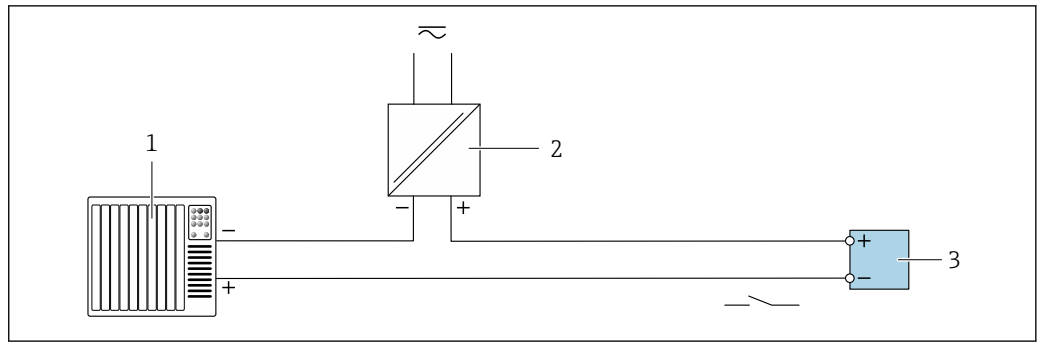
A0028760

⊠ *9   Connection example for switch output (passive)*

1   Automation system with switch input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)

2   Power supply

3   Transmitter: observe input values → 🖪 20

Relay output
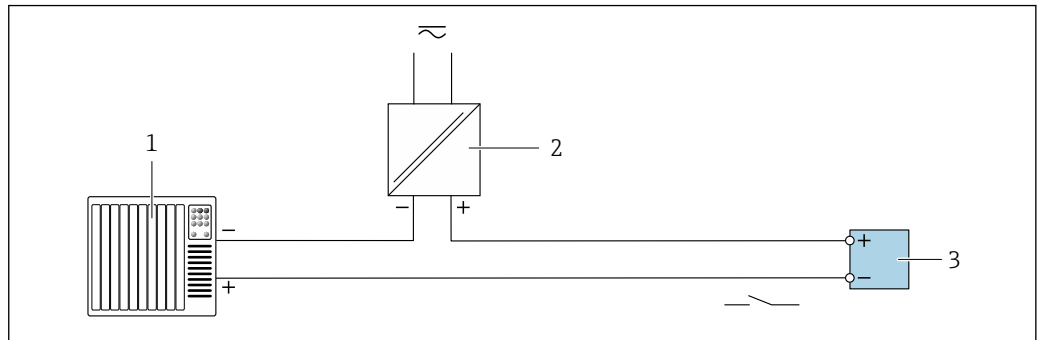
A0028760

⊠ *10   Connection example for relay output (passive)*

1   Automation system with relay input (e.g. PLC)

2   Power supply

3   Transmitter: observe input values → 🖪 21

Current input
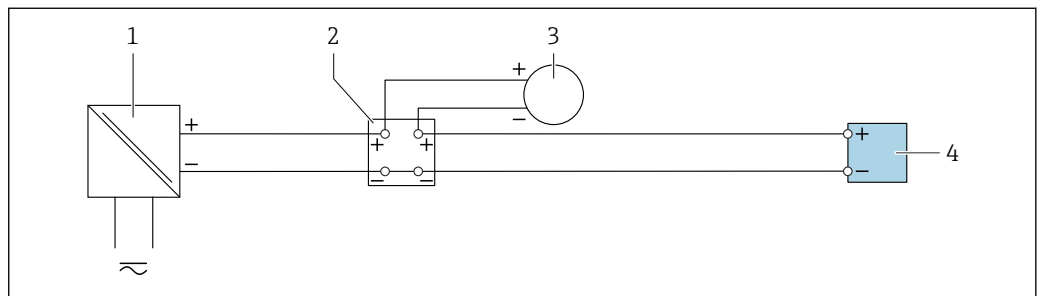
A0028915

⊠ *11   Connection example for 4 to 20 mA current input*

1   Power supply

2   Terminal box

3   External measuring device (to read in pressure or temperature, for instance)

4   Transmitter

Status input
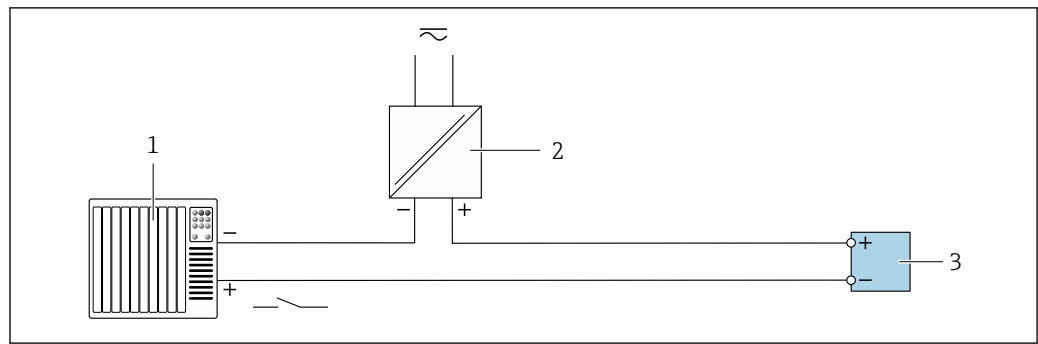
⌧ *12   Connection example for status input*

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

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

Cable specification

Permitted temperature range

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

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

Standard installation cable is sufficient.

Protective grounding cable for the outer ground terminal

Conductor cross-section < 2.1 mm² (14 AWG)

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

The grounding impedance must be less than 2 Ω.

Signal cable

Current output 4 to 20 mA HART

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

Modbus RS485

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

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm² (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km

Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Current output 0/4 to 20 mA

Standard installation cable is sufficient

Pulse /frequency /switch output

Standard installation cable is sufficient

Relay output

Standard installation cable is sufficient.

Current input 0/4 to 20 mA

Standard installation cable is sufficient

Status input

Standard installation cable is sufficient

Choice of connecting cable between the transmitter and sensor

Depends on the type of transmitter and the installation zones
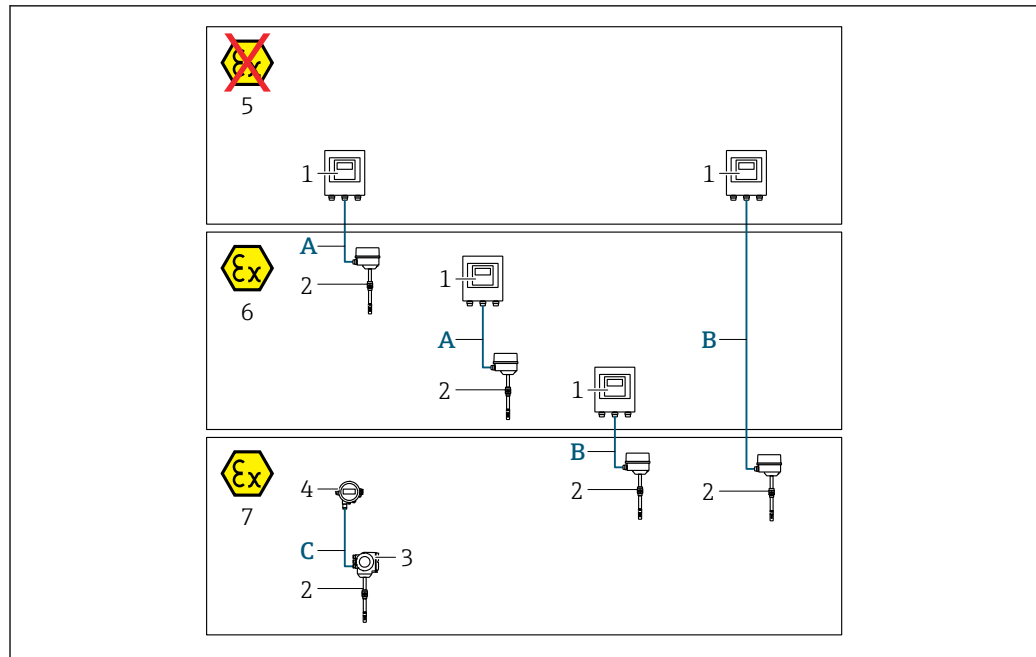
A0042081

1   Proline 500 – digital transmitter
2   Sensor t-mass
3   Proline 300 transmitter
4   Remote display (DKX001)
5   Non-hazardous area
6   Hazardous area: Zone 2; Class I, Division 2
7   Hazardous area: Zone 1; Class I, Division 1
A   Standard cable to transmitter 500 – digital
      Transmitter installed in the non-hazardous area or hazardous area: Zone 2; Class I, Division 2/sensor
      installed in the hazardous area: Zone 2; Class I, Division 2
B   Standard cable to transmitter 500 – digital → ⊟ 35
      Transmitter installed in the hazardous area: Zone 2; Class I, Division 2/sensor installed in the hazardous area:
      Zone 1; Class I, Division 1
C   Standard cable to remote display
      Transmitter 300 and remote display installed in the hazardous area: Zone 1; Class I, Division 1

For applications with operation in Zone 1; Class 1, Division 1, we recommend the use of the compact version with the remote display. In this case, the display of the Proline 300 transmitter is a blind version without local operation.

A: Connecting cable between sensor and transmitter: Proline 500 – digital

Standard cable

A standard cable with the following specifications can be used as the connecting cable.

Design	4 cores; uninsulated stranded CU wires; with common shield
Shielding	Tin-plated copper braid, optical cover ≥ 85 %
Loop resistance	Power supply line (+, –): maximum 10 Ω
Cable length	Maximum 300 m (900 ft), see the following table.
Device plug, side 1	M12 socket, 5-pin, A-coded.
Device plug, side 2	M12 plug, 5-pin, A-coded.

Cross-section	Cable length [max.]
0.34 mm² (AWG 22)	80 m (240 ft)
0.50 mm² (AWG 20)	120 m (360 ft)
0.75 mm² (AWG 18)	180 m (540 ft)

Cross-section	Cable length [max.]
1.00 mm² (AWG 17)	240 m (720 ft)
1.50 mm² (AWG 15)	300 m (900 ft)

Optionally available connecting cable

Design	2 × 2 × 0.34 mm² (AWG 22) PVC cable [1] with common shield (2 pairs, uninsulated stranded CU wires; 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 %
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)
Available cable length	Fixed: 20 m (60 ft); variable: up to maximum 50 m (150 ft)
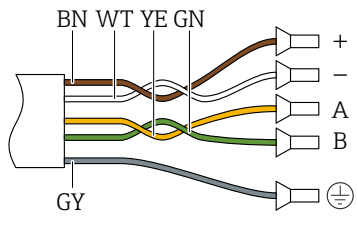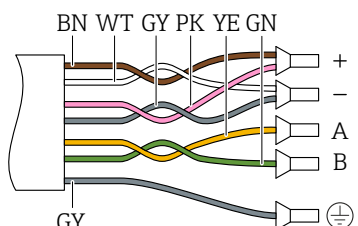
1) UV radiation can impair the cable outer sheath. Protect the cable from direct sunshine where possible.

B: Connecting cable between sensor and transmitter: Proline 500 - digital

Standard cable

A standard cable with the following specifications can be used as the connecting cable.

Design	4, 6, 8 cores (2, 3, 4 pairs); uninsulated stranded CU wires; pair-stranded with common shield
Shielding	Tin-plated copper braid, optical cover ≥ 85 %
Capacitance C	Maximum 760 nF IIC, maximum 4.2 µF IIB
Inductance L	Maximum 26 µH IIC, maximum 104 µH IIB
Inductance/resistance ratio (L/R)	Maximum 8.9 µH/Ω IIC, maximum 35.6 µH/Ω IIB (e.g. according to IEC 60079-25)
Loop resistance	Power supply line (+, −): maximum 5 Ω
Cable length	Maximum 100 m (300 ft), see the following table.

Cross-section	Cable length [max.]	Termination
2 x 2 x 0.50 mm² (AWG 20)	50 m (150 ft)	2 x 2 x 0.50 mm² (AWG 20) BN WT YE GN + − A B ⏚ GY • +, − = 0.5 mm² • A, B = 0.5 mm²
3 x 2 x 0.50 mm² (AWG 20)	100 m (300 ft)	3 x 2 x 0.50 mm² (AWG 20) BN WT GY PK YE GN + − A B ⏚ GY • +, − = 1.0 mm² • A, B = 0.5 mm²

Optionally available connecting cable

Connecting cable for	Zone 1; Class I, Division 1
Standard cable	2 × 2 × 0.5 mm² (AWG 20) 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 %
Operating temperature	When mounted in a fixed position: −50 to +105 ℃ (−58 to +221 ℉); when cable can move freely: −25 to +105 ℃ (−13 to +221 ℉)
Available cable length	Fixed: 20 m (60 ft); variable: up to maximum 50 m (150 ft)

1) UV radiation can impair the cable outer sheath. Protect the cable from direct sunshine where possible.

Overvoltage protection

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

Performance characteristics

Reference operating conditions	• Error limits based on ISO 11631 • Dry air with +20 to +30 °C (+68 to +86 °F) at 0.8 to 1.5 bar (12 to 22 psi) • Specifications as per calibration protocol • Accuracy based on accredited calibration rigs that are traced to ISO 17025.

To obtain measured errors, use the *Applicator* sizing tool → 🖹 83

Maximum measured error
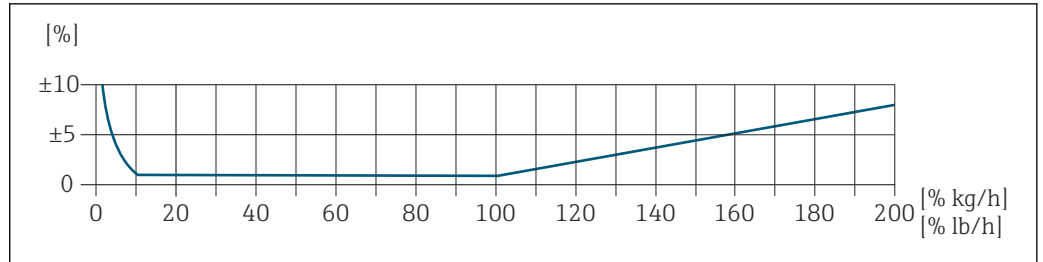
Calibrated measuring range

The measuring accuracy is specified in relation to the mass flow and divided into two ranges:
• ±1.0 % of the current measured value for 100% to 10% of the calibrated measuring range (under reference operating conditions)
• ±0.10 % of the calibrated full scale value for 10% to 1% of the calibrated measuring range (under reference operating conditions)

The measuring device is calibrated and adjusted on an accredited and traceable calibration rig and its accuracy is certified in a calibration report [1] (5 control points).

Order code for "Calibration flow":
• Option G "Factory calibration": calibration report (5 control points)
• Option K "Traceable ISO/IEC17025": Swiss Calibration Services (SCS) calibration report (5 control points) which confirms traceability to the national calibration standard

For information on calibrated measuring ranges and maximum full scale values → 🖹 12

Extended measuring range

The device has an extended measuring range that goes beyond the maximum calibrated value (100%). Here, the last measured values in the calibrated range are taken and then extrapolated. The end of the extrapolated range is only reached once the productive energy of the sensor is exceeded and/or the Mach number is greater than listed below.

Mach number	Order code
0.2	• Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel" • Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"
0.4	• Order code for "Sensor version; sensor; insertion tube:", option SA "Unidirectional; stainless steel; stainless steel" • Order code for "Sensor version; sensor; insertion tube:", option HA "Unidirectional; Alloy; stainless steel"

The accuracy is specified in relation to the mass flow.
±1.0% ±(current measured value in % -100%) × 0.07 for 100% to 200% of the calibrated measuring range (under reference operating conditions)

---

[1] Two calibration reports for the order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

o.r. = of reading

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

Repeatability	±0.25 % of the display value for velocities above 1.0 m/s (3.3 ft/s)
Response time	Typically < 3 s for 63 % of a step change (in both directions)

Influence of ambient temperature

Current output

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

Influence of medium temperature	Air: 0.02 % per °C (0.036 % per °F) of the process temperature change in relation to the reference temperature
Influence of medium pressure	Air: 0.3 % per bar (0.02 % per psi) of the process pressure change (from the set process pressure)
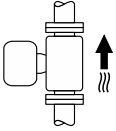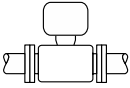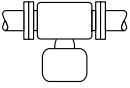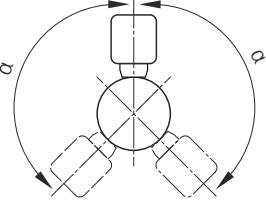
Mounting

As a prerequisite for correct flow measurement, thermal measuring devices require a fully developed flow profile. For this reason, please pay attention to the following points and document sections when installing the device:

- Avoid flow disturbances, as the thermal measuring principle reacts sensitively to them.
- Give priority to dry gases.
- Take measures to avoid or remove condensation (e.g. condensation trap, thermal insulation etc.).

Orientation

The direction of flow must match the direction of the arrow on the sensor. In the case of the bidirectional sensor, the arrow points in the positive direction. When performing bidirectional measurement, the sensing element must be installed with an accuracy of 3°.

Orientation		Recommendation
Vertical orientation	A0015591	☑ [1]
Horizontal orientation, transmitter head up	A0015589	☑☑
Horizontal orientation, transmitter head down	A0015590	☑ [2]
Horizontal orientation, transmitter head at side	A0015592	☑
Inclined orientation, transmitter head down	A0015773	☑ [2]

1) In the case of saturated or impure gases, vertical orientation is preferred in order to minimize condensation or contamination. For bidirectional sensors, select horizontal orientation.
2) Select inclined orientation (α = approx. 135°) for very wet or water-saturated gas (e.g. digester gas, undried compressed air), or if deposits or condensate are constantly present.

Installation instructions

For mechanical reasons and to protect the pipe, support is recommended for heavy sensors (e.g. when installing a hot tap).

Pipes

The measuring device must be professionally installed, and the following points must be observed:

- Weld pipes professionally.
- Use seals of the correct size.
- Align flanges and seals correctly.
- Remove protection cap from sensing element.

- Following installation, the pipe must be free from dirt and particles in order to avoid damage to the sensors.
- For further information → ISO standard 14511.

Insertion depth

The minimum length of the insertion version can be determined using the Endress+Hauser Applicator program or with the calculation formula below. The calculated necessary insertion depth must be within the adjusting range of the selected insertion version.

NOTICE

Metal ferrules undergo plastic deformation during the initial installation.
As a result the insertion depth is fixed after initial installation and the ferrules can no longer be replaced.
▶ Pay attention to information on preconditions and on determining the insertion depth.
▶ Check the insertion depth closely before tightening the ferrules.
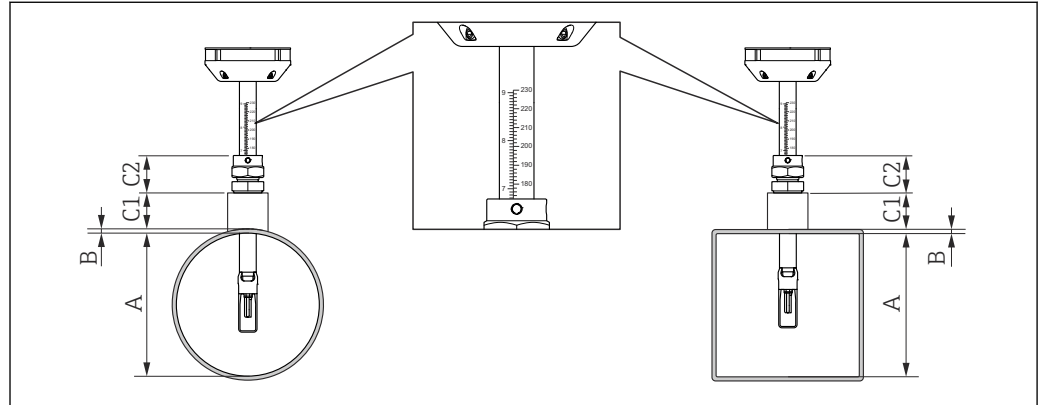
🖻 *13   Determine the dimensions A, B, C1 and C2*

A   *In the case of a circular pipe: the pipe internal diameter (DN); in the case of a duct: the inner dimension*
B   *Thickness of pipe wall or of duct wall*
C1   *Mounting kit*
C2   *Sensor's compression fitting*

Calculating the insertion depth

Insertion depth = (0.3· A) + B + (C1 + C2)

The insertion depth must be at least 100mm.

Determining dimensions C1 and C2

If only Endress+Hauser mounting bosses are used

Mounting boss 1" NPT	C1 + C2 = 112 mm (4.409 in)
Mounting boss G1"	C1 + C2 = 106 mm (4.173 in)
Mounting boss ¾" NPT	C1 + C2 = 108 mm (4.252 in)
Mounting boss G¾"	C1 + C2 = 105 mm (4.134 in)

If a cold/hot tap is used, use dimension "L" → 🕮 54 instead of "C1".

Use Applicator to determine dimensions C1 and C2 if using other E+H mounting kits (e.g. cold/hot taps).

If not exclusively using Endress+Hauser mounting bosses

C1	Length of pipe connection used
C2 (compression fitting with 1" NPT thread)	52 mm (2.047 in)
C2 (compression fitting with G1" thread)	46 mm (1.811 in)
C2 (compression fitting with ¾" NPT thread)	48 mm (1.889 in)
C2 (compression fitting with G¾" thread)	45 mm (1.772 in)

Selecting the length of the insertion version

Select the length of the insertion version using the calculated insertion depth and the following table. The insertion depth must be within the adjusting range of the insertion version.

Length of insertion tube		Adjusting range (insertion depth)	
[mm]	[in]	[mm]	[in]
235	9	100 to 235	3.9 to 9.3
335	13	100 to 335	3.9 to 13.2
435	17	100 to 435	3.9 to 17.1
608	24	100 to 608	3.9 to 23.9

Installation conditions for nipples

Suitable support brackets must be used if installing in rectangular air ducts (or pipes with thin walls).
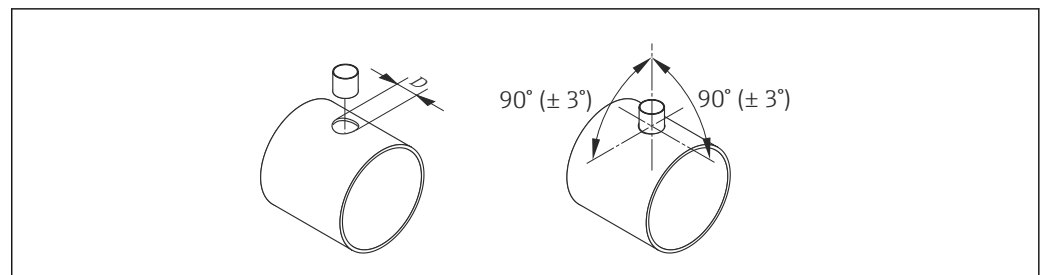
A0040684

D   Ø 31.0 ± 0.5 mm (1.22 ± 0.019 in)

Aligning to the flow direction

The following criteria must be met for optimum flow measurement:

• The sensor is aligned at a 90° angle to the flow direction.
• The arrow engraved on the sensor shaft matches the positive flow direction.
• The scale on the sensor shaft is aligned with the pipe axis.
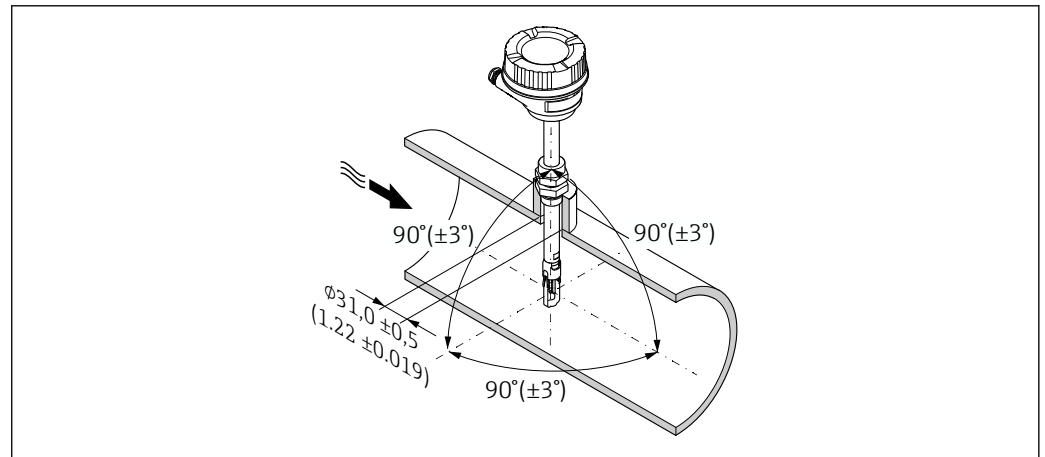
A0039512

🖻 14   Engineering unit: mm (in)

Inlet and outlet runs

A fully developed flow profile is a requirement for optimal thermal flow measurement.

To achieve the best possible measuring performance, observe the following inlet and outlet runs at the very minimum.

• In the case of bidirectional sensors, also observe the recommended inlet run in the opposite direction.
• If several flow disturbances are present, use flow conditioners.
• Use flow conditioners if it is not possible to observe the required inlet runs.
• In the case of control valves, the amount of disturbance depends on the valve type and opening degree. The recommended inlet run for control valves is 50 × DN.
• In the case of very light gases (helium, hydrogen), the recommended inlet run must be doubled.

🔲 15   Reduction

🔲 16   Expansion

🔲 17   90° elbow

🔲 18   2 × 90° elbow

🔲 19   Control valve

🔲 20   2 × 90 ° elbow, 3-dimensional
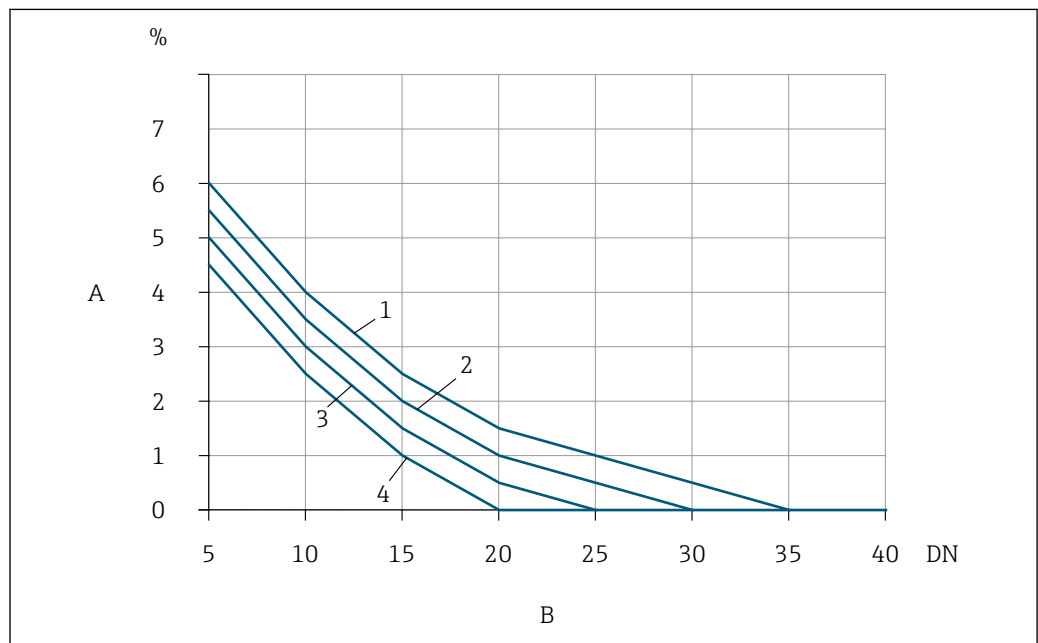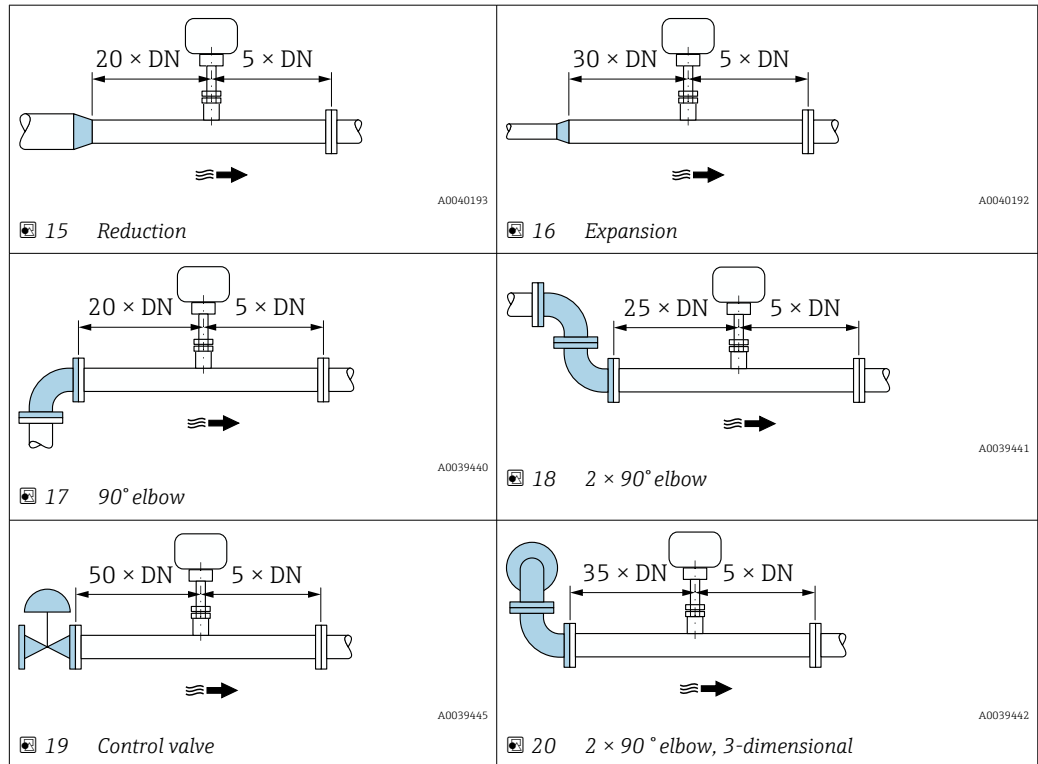
🔲 21   The additional measured error to be expected without flow conditioners depending on the disturbance type and inlet run

A   Additional measured error (%)
B   Inlet run (DN)
1   2 × 90 ° elbow, 3-dimensional
2   Expansion
3   2 × 90° elbow
4   Reduction or 90° elbow

Flow conditioner

Use flow conditioners if it is not possible to observe the required inlet runs. Flow conditioners improve the flow profile and therefore reduce the necessary inlet runs.

Mount the flow conditioner in flow direction in front of the measuring device.

Available in the following flange standards:
- ASME B16.5 Cl. 150/Cl. 300
- EN 1092-1 PN10/PN16/PN25/PN40
- JIS B2220 10K/20K

Available in the following line sizes:
- DN 80 (3")
- DN 100 (4")
- DN 150 (6")
- DN 200 (8")
- DN 250 (10")
- DN 300 (12")
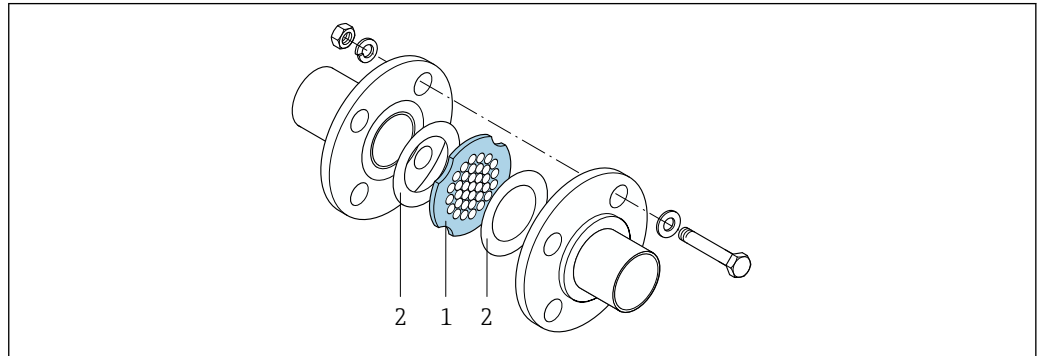
A0039538

1   Flow conditioner
2   Seal
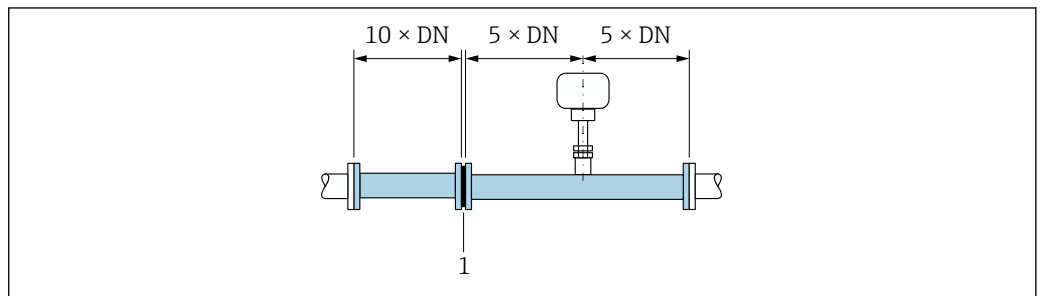
A0039424

🖾 *22   Recommended inlet and outlet runs when using a flow conditioner*

1   Flow conditioner

In the case of bidirectional sensors, also observe the inlet run in the opposite direction.
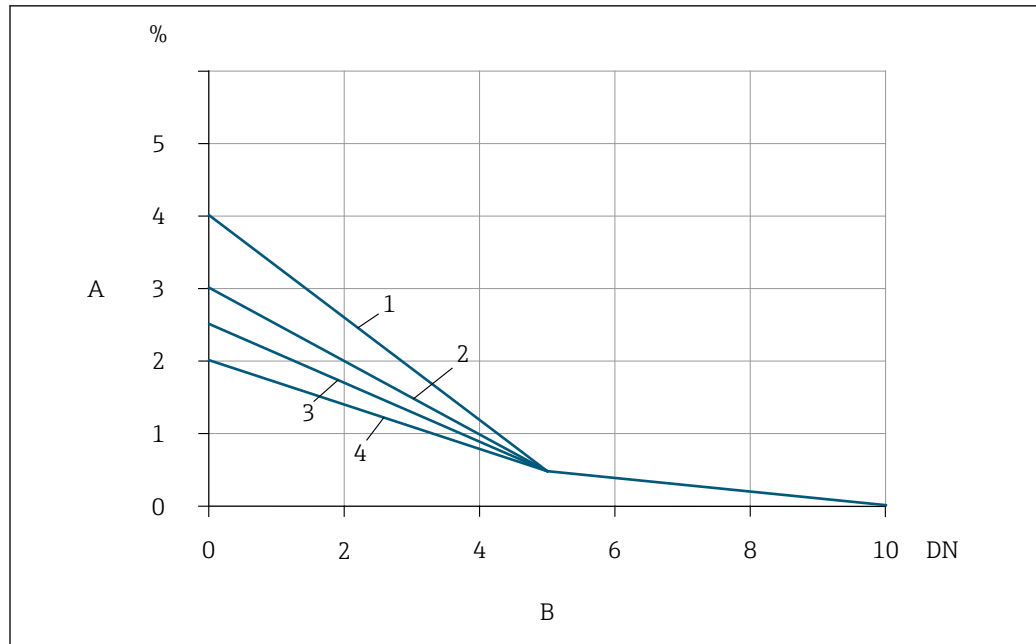
23 *The additional measured error to be expected with flow conditioners depending on the disturbance type and inlet run*

A *Additional measured error (%)*
B *Inlet runs upstream of the flow conditioner (DN)*
1 *2 × 90 ° elbow, 3-dimensional*
2 *Expansion*
3 *2 × 90° elbow*
4 *Reduction or 90° elbow*

The pressure loss for flow conditioners is calculated as follows: $\Delta p \ [\text{mbar}] = 0.0085 \cdot \rho \ [\text{kg/m}^3] \cdot v^2 \ [\text{m/s}]$

Example of air

p = 10 bar abs.

t = 25 °C → ρ = 11.71 kg/m^3

v = 10 m/s

$\Delta p = 0.0085 \cdot 11.71 \cdot 10^2 = 9.95$ mbar

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

Outlet runs with pressure measuring points

Install the pressure measuring point downstream of the measuring system. This prevents the pressure transmitter from potentially affecting the flow in the measuring point.
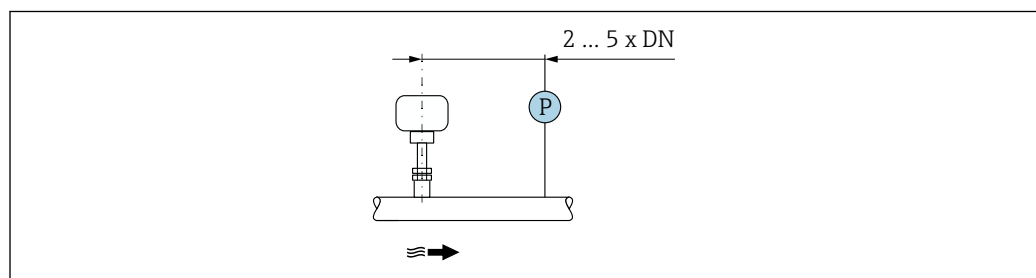
24 *Installation of a pressure measuring point (P = pressure transmitter)*

Mounting the transmitter housing	**Proline 500 – digital transmitter**

Pipe mounting

Required tools:
- Open-ended wrench AF 10
- Torx screwdriver TX 25
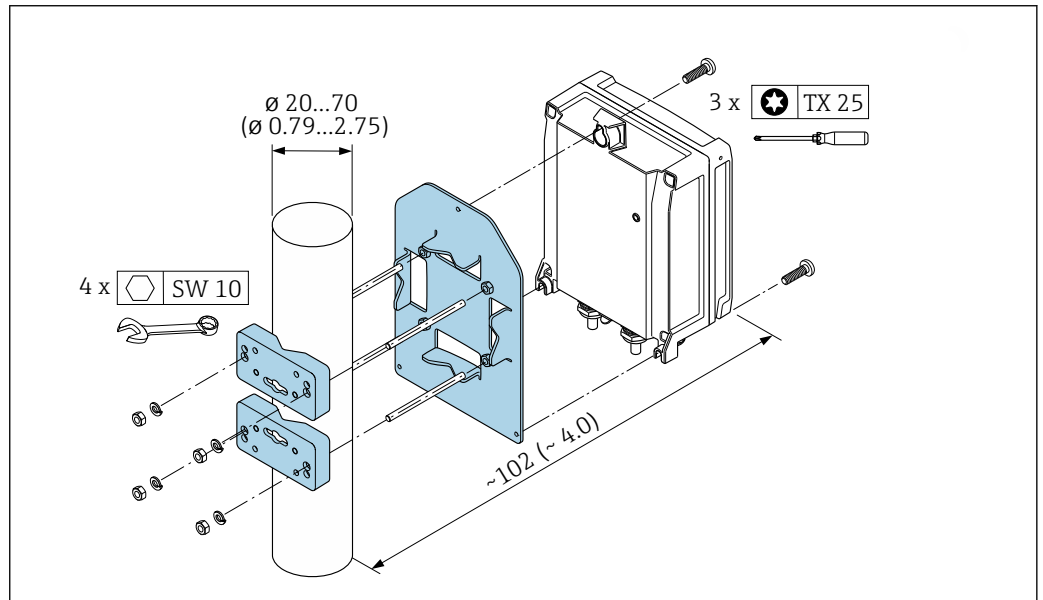
⊞ 25   Engineering unit mm (in)

Wall mounting

Required tools:
Drill with drill bit ⌀ 6.0 mm
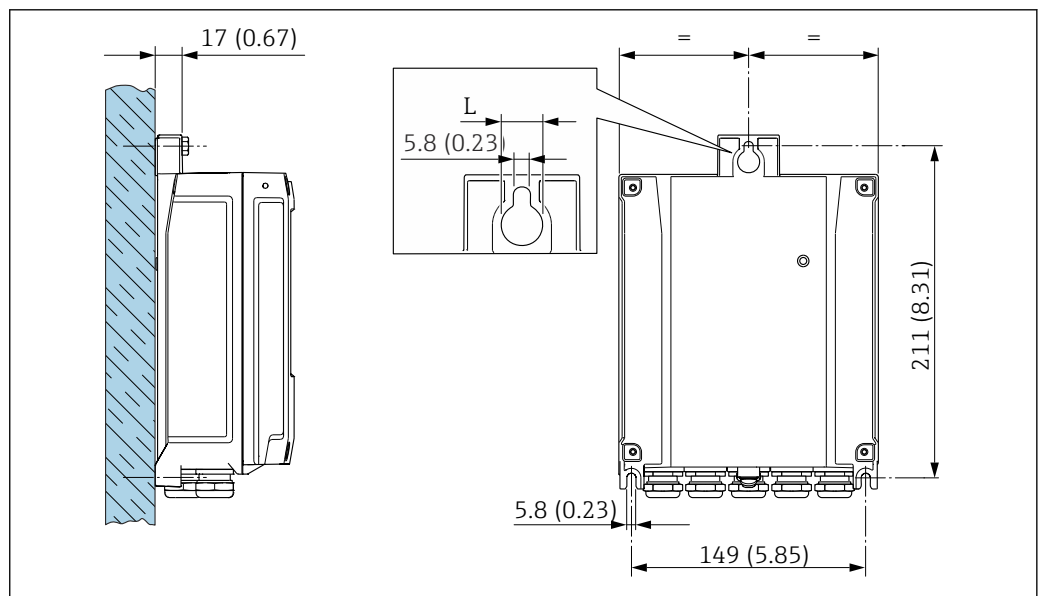
⊞ 26   Engineering unit mm (in)

L   Depends on order code for "Transmitter housing"

Order code for "Transmitter housing"
- Option **A**, aluminum, coated: L = 14 mm (0.55 in)
- Option **D**, polycarbonate: L = 13 mm (0.51 in)

Environment

Ambient temperature range	Measuring device	• −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.

NOTICE

Danger of overheating

▸ 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.
▸ 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.
▸ 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.

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

🛈 You can order a weather protection cover from Endress+Hauser→ 🖹 80.

Storage temperature	−50 to +80 °C (−58 to +176 °F), preferably at +20 °C (+68 °F)

Atmosphere	If a plastic transmitter housing is permanently exposed to certain steam and air mixtures, this can damage the housing.

🛈 In cases of doubt, please contact the Sales Center.

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 **Sensor** • IP66/67, Type 4X enclosure, suitable for pollution degree 4 • When the housing is open: IP20, Type 1 enclosure, suitable for pollution degree 2 *Optional* Order code for "Sensor options", option CC "IP68, Type 6P, Cust-potted" **External WLAN antenna** IP67

Vibration- and shock-resistance	**Vibration sinusoidal, in accordance with IEC 60068-2-6** Sensor • 2 to 8.4 Hz, 3.5 mm peak • 8.4 to 2 000 Hz, 1 g peak Transmitter • 2 to 8.4 Hz, 7.5 mm peak • 8.4 to 2 000 Hz, 2 g peak **Vibration broad-band random, according to IEC 60068-2-64**

Sensor
- 10 to 200 Hz, 0.003 g^2/Hz
- 200 to 2000 Hz, 0.001 g^2/Hz
- Total: 1.54 g rms

Transmitter
- 10 to 200 Hz, 0.01 g^2/Hz
- 200 to 2000 Hz, 0.003 g^2/Hz
- Total: 2.70 g rms

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

- Sensor
  6 ms 30 g
- Transmitter
  6 ms 50 g

Rough handling shocks according to IEC 60068-2-31

Interior cleaning	Suitable for cleaning-in-place (CIP) and sterilization-in-place (SIP).
	Manufacturer options for delivery of parts • Oil- and grease-free wetted parts, no declaration. Order code for "Service", option HA. • Oil- and grease-free wetted parts as per IEC/TR 60877-2.0 and BOC 50000810-4, with declaration. Order code for "Service", option HB. The plant operator must ensure that the measuring device meets the requirements of the operator's oxygen application.
Electromagnetic compatibility (EMC)	As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) 📖 Details are provided in the Declaration of Conformity. ℹ This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

Process

Medium temperature range	Sensor
	−40 to +180 °C (−40 to +356 °F)
	
	Seals
	• Sealing rings:
	  • EPDM −40 to +140 °C (−40 to +284 °F)
	  • FKM −40 to +180 °C (−40 to +356 °F)
	• Ferrule:
	  • PEEK −40 to +140 °C (−40 to +284 °F)
	  • PVDF −20 to +110 °C (−4 to +230 °F)
	  • 1.4404 −40 to +180 °C (−40 to +356 °F)

> ℹ️ Ferrule in 1.4404: ferrule has a fixed position on the shaft. Restriction for repeat calibrations (observe minimum insertion depth → 🖹 39)

Medium pressure range	Minimum 0.5 bar absolute. Maximum permitted medium pressure → 🖹 48

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.

Ferrule
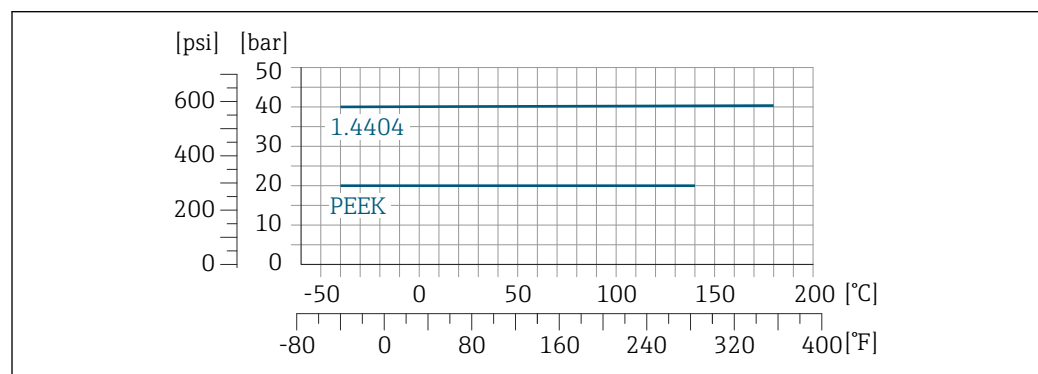
🖻 27   With compression fitting material 1.4404/F316L/F316
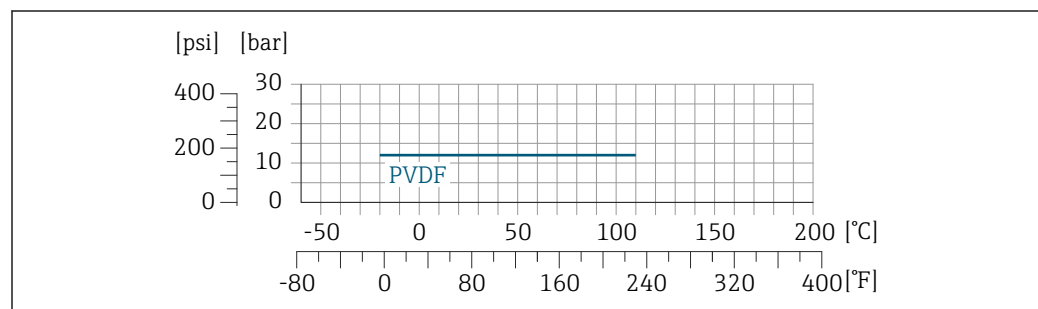
🖻 28   With compression fitting material 1.4404/F316L/F316

Flow limit	ℹ️ Measuring range → 🖹 12

The maximum flow depends on the gas type and the pipe nominal diameter used. The end of the measuring range is reached when the Mach number listed below is reached.

Mach number	Order code
0.2	• Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel" • Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"
0.4	• Order code for "Sensor version; sensor; insertion tube:", option SA "Unidirectional; stainless steel; stainless steel" • Order code for "Sensor version; sensor; insertion tube:", option HA "Unidirectional; Alloy; stainless steel"

Use the Applicator to size the device.

Pressure loss

Use the Applicator for precise calculations.

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.

If the gas is very wet or saturated with water (e.g. digester gas), the pipe and the sensor housing should be insulated, and heated where necessary, to prevent water droplets condensing on the sensing element.

NOTICE

Electronics overheating on account of thermal insulation!
▶ Recommended orientation: horizontal orientation, sensor connection housing pointing downwards.
▶ Do not insulate the sensor connection housing.
▶ Maximum permissible temperature at the lower end of the sensor connection housing: 80 ℃ (176 ℉)
▶ Thermal insulation with not isolated extended neck: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.
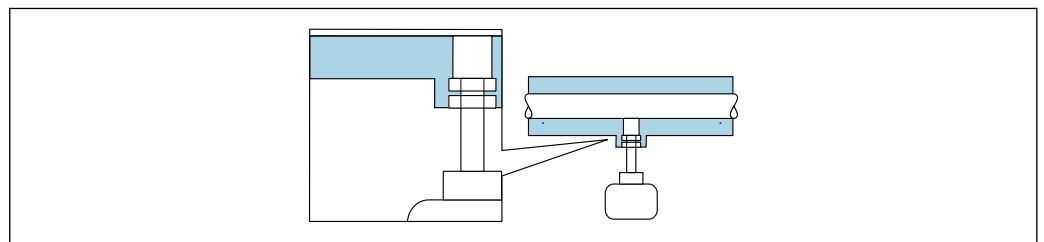
A0039420

🖾 *29   Thermal insulation with not isolated extended neck*

Heating

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

Heating options
• Electrical heating, e.g. with electric band heaters
• Via pipes carrying hot water or steam

NOTICE

Electronics overheating on account of thermal insulation!
▶ Recommended orientation: horizontal orientation, sensor connection housing pointing downwards.
▶ Do not insulate the sensor connection housing.
▶ Maximum permissible temperature at the lower end of the sensor connection housing: 80 ℃ (176 ℉)
▶ Thermal insulation with extended neck free: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.

> **NOTICE**
>
> **Danger of overheating when heating**
> ▸ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 ℃ (176 ℉).
> ▸ Ensure that sufficient convection takes place at the transmitter neck.
> ▸ 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.
> ▸ 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.

Hot tap, process pressure	Only use the hot tap for mounting and removal at process pressure for non-toxic, innocuous gases. Medium pressure version • Max. process pressure: 20 bar (290 psi) • Max. extraction pressure: 16 bar (230 psi) • Max. extraction temperature: +50 ℃ (+122 ℉) • Min. insertion sensor length: 435mm (17") Low pressure version • Max. process pressure: 20 bar (290 psi) • Max. extraction pressure: 4.5 bar (65 psi) • Max. extraction temperature: +50 ℃ (+122 ℉) • Min. insertion sensor length: 335mm (13")
Cold tap, ambient pressure	Cold tap for mounting and removal at ambient pressure. • Max. process pressure: 20 bar (290 psi) • Max. extraction pressure: 1 bar (14.5 psi) • Max. extraction temperature: +50 ℃ (+122 ℉) • Min. insertion sensor length: 335mm (13")
Mounting boss	To mount the device directly on the process pipe. Max. process pressure: 40 bar (580 psi)

Mechanical construction

Dimensions in SI units   Housing of Proline 500 – digital transmitter

Non-hazardous area or hazardous area: Zone 2; Class I, Division 2

A0033789
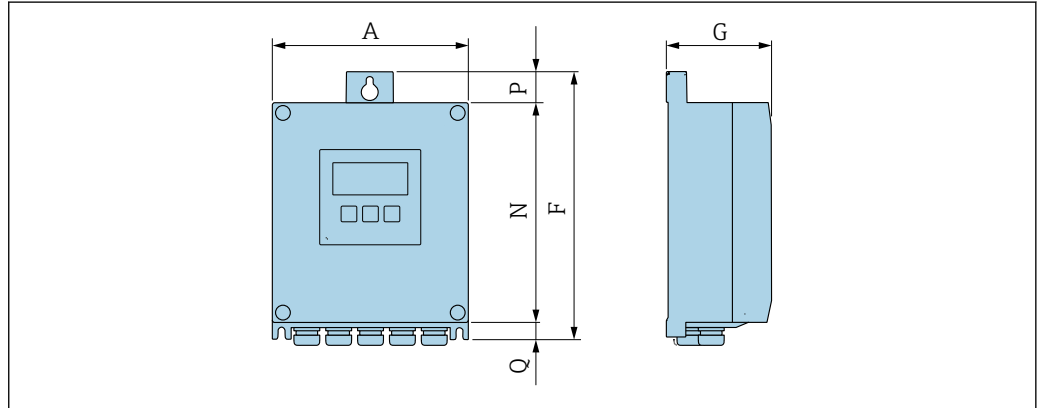
Order code for "Transmitter housing", option A "Aluminum, coated" and order code for "Integrated ISEM electronics", option A "Sensor"

A [mm]	F [mm]	G [mm]	N [mm]	P [mm]	Q [mm]
167	232	89	187	24	21

Order code for "Transmitter housing", option D "Polycarbonate" and order code for "Integrated ISEM electronics", option A "Sensor"

A [mm]	F [mm]	G [mm]	N [mm]	P [mm]	Q [mm]
177	234	89	197	17	22

Sensor connection housing
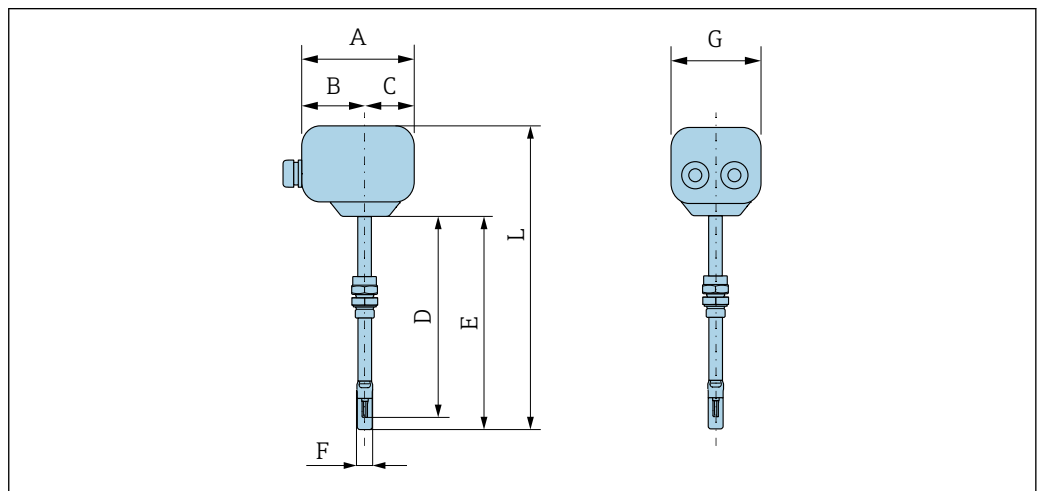
A0041077

Order code for "Sensor connection housing", option A "Aluminum, coated"

A [1)	B [1)	C	G
[mm]	[mm]	[mm]	[mm]
148	94	54	136

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

Order code for "Sensor connection housing", option L "Cast, stainless"

A [1)	B	C	G
[mm]	[mm]	[mm]	[mm]
145	86	59	136

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

Order code for "Sensor connection housing", option A "Aluminum, coated"

Installed length	D	E	F	L [1)
[mm]	[mm]	[mm]	[mm]	[mm]
235	281	298	22.4	408
335	381	398	22.4	508
435	481	498	22.4	608
608	652	669	22.4	779

1)   With order code for "Sensor connection housing", option L "Cast, stainless" + 24 mm

Accessories

Welding socket
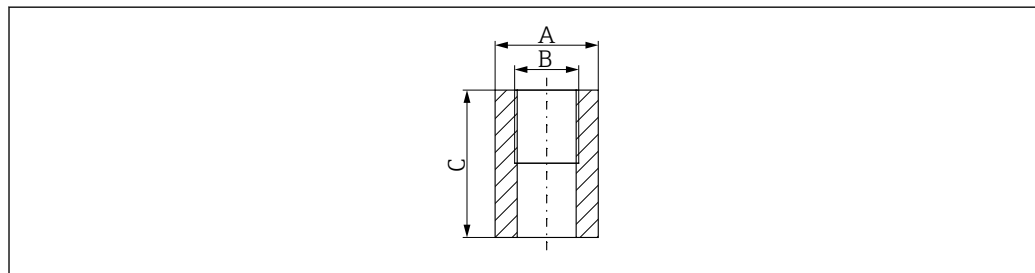
A0041333

A   45 mm
B   Order code for "Accessory enclosed", option "Welding socket"
C   60 mm

Order code for *"Accessory enclosed"*:
- Option PC *"Welding socket G 1'"*
- Option PD *"Welding socket 1" NPT"*
- Option PE *"Welding socket G ¾'"*
- Option PF *"Welding socket ¾" NPT"*

Cold tap, ambient pressure

A0042224

🖼 *30   Dimensions: mm (in)*

A   Order code for "Accessory enclosed", option "Welding socket"

Order code for *"Accessory enclosed"*:
- Option PR *"Cold tap G 1", ambient pressure"*
- Option PS *"Cold tap 1" NPT, ambient pressure"*
- Option PT *"Cold tap G ¾", ambient pressure"*
- Option PU *"Cold tap ¾" NPT, ambient pressure"*

Cold/hot tap, process pressure

Low-pressure version

> Available for order as:
> - Order code for *"Accessory enclosed"*
>   - Option PG *"Cold/hot tap G 1", low pressure = 4.5 bar/65 psig"*
>   - Option PH *"Cold/hot tap 1" NPT, low pressure = 4.5 bar/65 psig"*
>   - Option PK *"Cold/hot tap G ¾", low pressure = 4.5 bar/65 psig"*
>   - Option PL *"Cold/hot tap ¾" NPT, low pressure = 4.5 bar/65 psig"*
>   - The low-pressure version as "Accessory enclosed" comprises: V2 → 🖼 31, 🖺 54
> - Can be ordered separately as "Accessories": DK6003 → 🖺 81
>   Versions V1, V2 and V3 can be ordered via DK6003

> - Can only be used with the following installed lengths:
>   - Order code for "Installed length", option L2 "335mm (13")"
>   - Order code for "Installed length", option L3 "435mm (17")"
>   - Order code for "Installed length", option L4 "608mm (24")"
> - Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (140°C for PEEK and 110°C for PVDF)
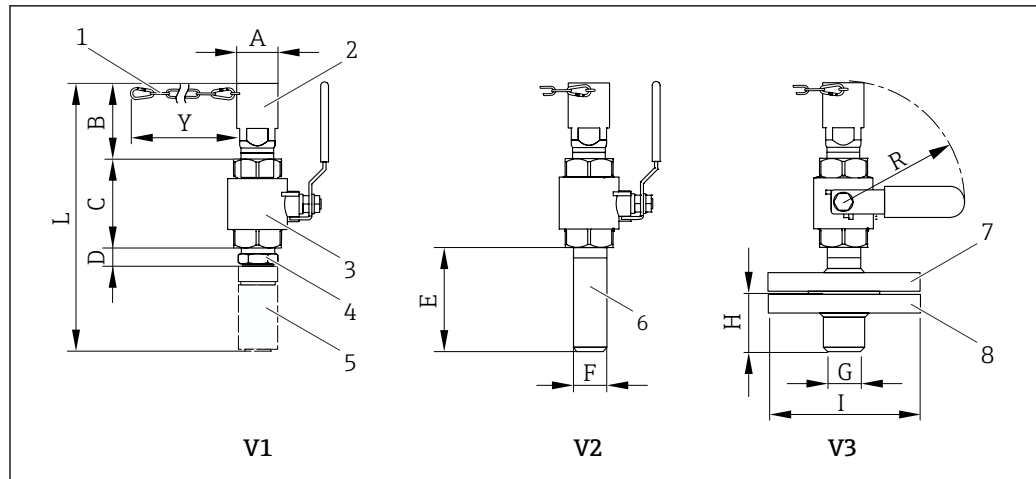
A0041359

⊠ 31   Versions available for order

1   Safety chain for low-pressure version
2   Sensor connection
3   Ball valve
4   Retrofit adapter (for subsequent installation with existing welding socket (DK6MB))
5   Welding socket (DK6MB) only G1"/1" NPT
6   Process connection welding socket
7   Flange adapter
8   Process connection flange
V1   Version with retrofit adapter
V2   Version with welding socket
V3   Version with flange

A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	L [mm]	R [mm]	Y [1) [mm]
41.4	~85	88	~30	95	33.4	33.4	54	108 to 125	~268	165	620

1)   Safety chain (for p ≤ 4.5 bar) only in conjunction with low-pressure version

Weight [kg]		
V1	V2	V3
2.8	2.4	4.9

Medium-pressure version

Available for order as:
- Order code for *"Accessory enclosed"*
  - Option PI *"Cold/hot tap G 1", medium pressure = 16 bar/230 psig"*
  - Option PJ *"Cold/hot tap 1" NPT, medium pressure = 16 bar/230 psig"*
  - Option PM *"Cold/hot tap G ¾", medium pressure = 16 bar/230 psig"*
  - Option PN *"Cold/hot tap ¾" NPT, medium pressure = 16 bar/230 psig"*
  - The medium-pressure version comprises: V2 → ⊠ 31, 🖺 54 and extractor assembly
- Can be ordered separately as "Accessories": DK6003 → 🖺 81
  Versions V1, V2 and V3 → ⊠ 31, 🖺 54 can be ordered via DK6003

- Can only be used with the following installed lengths:
  - Order code for "Installed length", option L3 "435mm (17")"
  - Order code for "Installed length", option L4 "608mm (24")"
- Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (140℃ for PEEK and 110℃ for PVDF)

Extractor assembly for medium-pressure version

ⓘ Order code for *"Accessory enclosed"*:
- Option PI *"Cold/hot tap G 1", medium pressure maximum 16 bar/230 psig"*
- Option PJ *"Cold/hot tap 1" NPT, medium pressure maximum 16 bar/230 psig"*
- Option PM *"Cold/hot tap G ¾", medium pressure maximum 16 bar/230 psig"*
- Option PN *"Cold/hot tap ¾" NPT, medium pressure maximum 16 bar/230 psig"*

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🖾 *32   Extractor assembly*

L [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	Weight [kg]
930	740	40	700	120	180	8.4

Flow conditioner

A0033504

Used in combination with flanges according to DIN EN 1092-1: PN 10 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1)]/D2 [2)]	s [mm]
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D1	26.3

Used in combination with flanges according to DIN EN 1092-1: PN 10 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
250	330.0	D2	33.0
300	380.0	D2	39.6

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

Used in combination with flanges according to DIN EN 1092-1: PN 16 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

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

Used in combination with flanges according to DIN EN 1092-1: PN 25 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
80	145.3	D2	10.1
100	171.3	D1	13.3
150	227.0	D2	20.0
200	280.0	D1	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

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

Used in combination with flanges according to DIN EN 1092-1: PN 40 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
80	145.3	D2	10.1
100	171.3	D1	13.3
150	227.0	D2	20.0
200	294.0	D2	26.3

Used in combination with flanges according to DIN EN 1092-1: PN 40 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
250	355.0	D2	33.0
300	420.0	D1	39.6

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

Used in combination with flanges according to ASME B16.5: Class 150 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
80	138.4	D1	10.1
100	176.5	D2	13.3
150	223.5	D1	20.0
200	274.0	D2	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

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

Used in combination with flanges according to ASME B16.5: Class 300 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
80	151.3	D1	10.1
100	182.6	D1	13.3
150	252.0	D1	20.0
200	309.0	D1	26.3
250	363.0	D1	33.0
300	402.0	D1	39.6

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

| Used in combination with flanges according to JIS B2220: 10K 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1]/D2 [2]	s [mm]
80	136.3	D2	10.1
100	161.3	D2	13.3
150	221.0	D2	20.0
200	271.0	D2	26.3

Used in combination with flanges according to JIS B2220: 10K 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1)]/D2 [2)]	s [mm]
250	330.0	D2	33.0
300	380.0	D2	39.6

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

Used in combination with flanges according to JIS B2220: 20K 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [mm]	Centering diameter [mm]	D1 [1)]/D2 [2)]	s [mm]
80	142.3	D1	10.1
100	167.3	D1	13.3
150	240.0	D1	20.0
200	284.0	D1	26.3
250	355.0	D2	33.0
300	404.0	D1	39.6

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

Weather protection cover
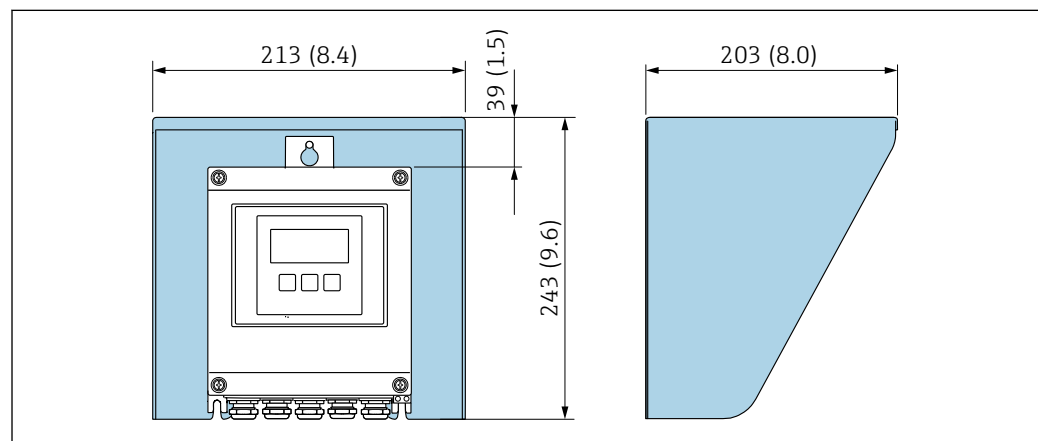
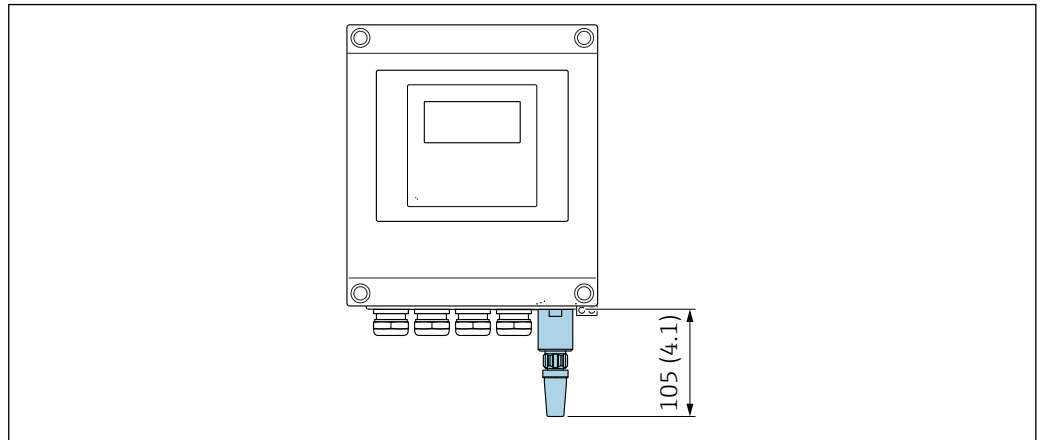

🖼 *33   Weather protection cover for Proline 500 – digital; engineering unit mm (in)*

External WLAN antenna

Proline 500 – digital
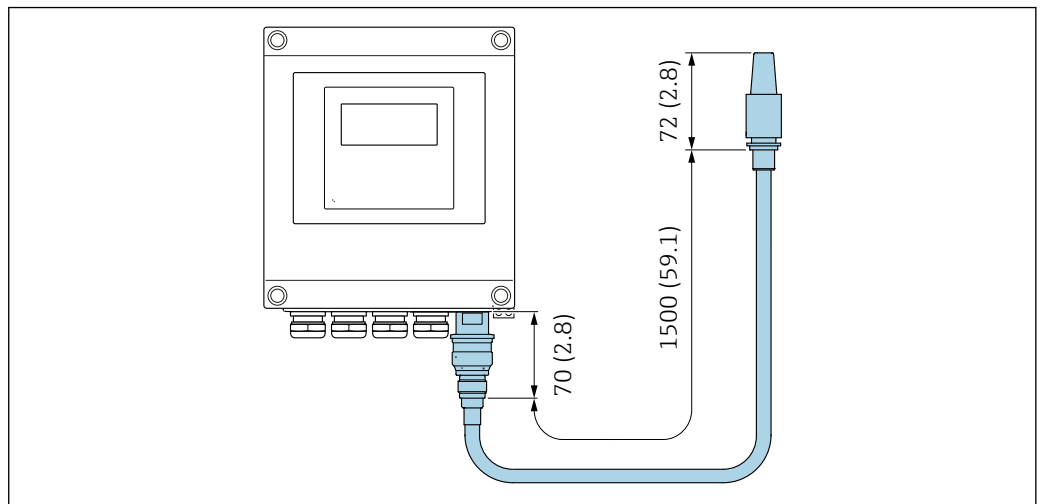
External WLAN antenna mounted on device

⊠ 34   Engineering unit mm (in)

External WLAN antenna mounted with cable

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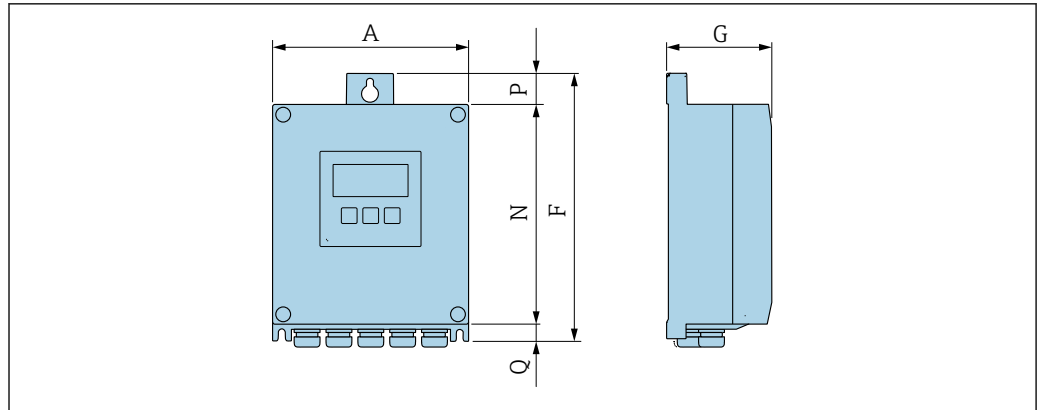

⊠ 35   Engineering unit mm (in)

Dimensions in US units **Housing of Proline 500 – digital transmitter**

Non-hazardous area or hazardous area: Zone 2; Class I, Division 2

Order code for "Transmitter housing", option A "Aluminum, coated" and order code for "Integrated ISEM electronics", option A "Sensor"

A [in]	F [in]	G [in]	N [in]	P [in]	Q [in]
6.57	9.13	3.50	7.36	0.94	0.83

Order code for "Transmitter housing", option D "Polycarbonate" and order code for "Integrated ISEM electronics", option A "Sensor"

A [in]	F [in]	G [in]	N [in]	P [in]	Q [in]
6.97	9.21	3.50	7.76	0.67	0.87

Sensor connection housing
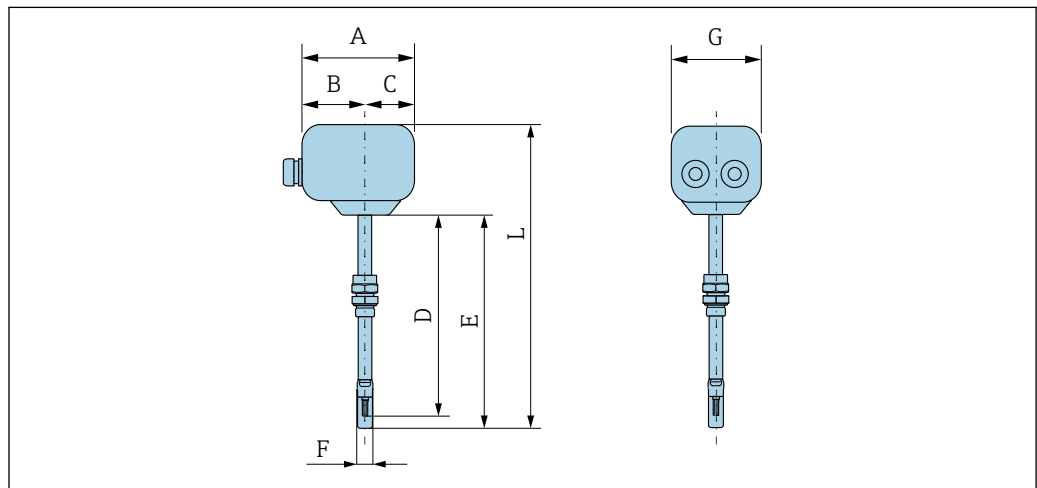
Order code for "Sensor connection housing", option A "Aluminum, coated"

A [1] [in]	B [1] [in]	C [in]	G [in]
5.83	3.70	2.13	5.35

1) Depending on the cable gland used: values up to + 1.18 in

Order code for "Sensor connection housing", option L "Cast, stainless"

A [1)	B	C	G
[in]	[in]	[in]	[in]
5.71	3.39	2.32	5.35

1)   Depending on the cable gland used: values up to + 1.18 in

Order code for "Sensor connection housing", option A "Aluminum, coated"

Installed length	D	E	F	L [1)
[in]	[in]	[in]	[in]	[in]
9	11.06	11.73	0.88	16.06
13	15	15.67	0.88	20
17	18.94	19.61	0.88	23.94
24	25.67	26.34	0.88	30.67

1)   With order code for "Sensor connection housing", option L "Cast, stainless" + 0.94 in
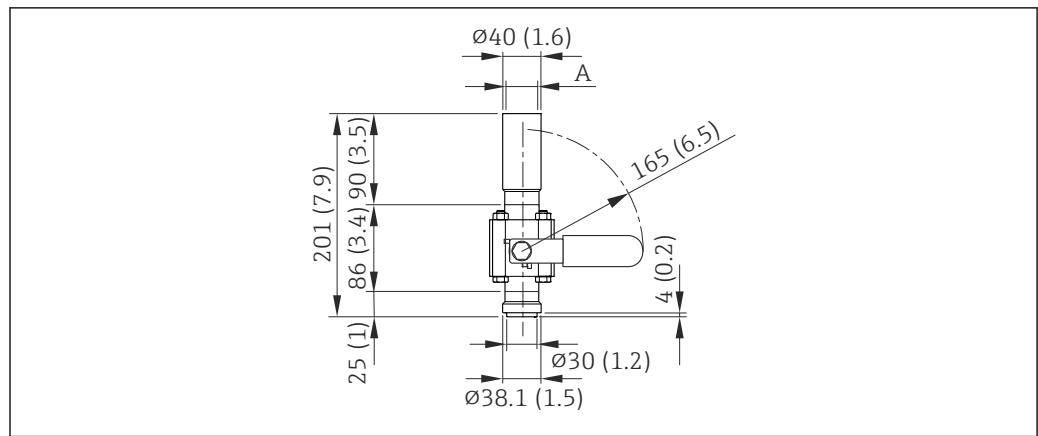
Accessories

Welding socket
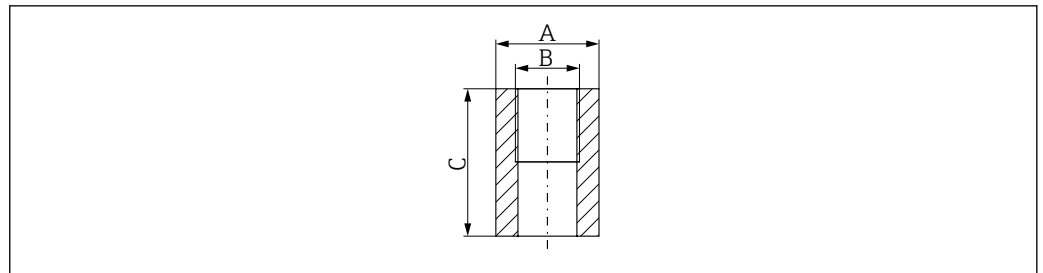
A0041333

A   1.77 in
B   Order code for "Accessory enclosed", option "Welding socket"
C   2.36 in

Order code for *"Accessory enclosed"*:
• Option PC *"Welding socket G 1"*
• Option PD *"Welding socket 1" NPT"*
• Option PE *"Welding socket G ¾"*
• Option PF *"Welding socket ¾" NPT"*

Cold tap, ambient pressure

A0042224

⊠ *36   Dimensions: mm (in)*

A   *Order code for "Accessory enclosed", option "Welding socket"*

Order code for *"Accessory enclosed"*:
• Option PR *"Cold tap G 1", ambient pressure"*
• Option PS *"Cold tap 1" NPT, ambient pressure"*
• Option PT *"Cold tap G ¾", ambient pressure"*
• Option PU *"Cold tap ¾" NPT, ambient pressure"*

Cold/hot tap, process pressure

Low-pressure version

Available for order as:
• Order code for *"Accessory enclosed"*
  • Option PG *"Cold/hot tap G 1", low pressure = 4.5 bar/65 psig"*
  • Option PH *"Cold/hot tap 1" NPT, low pressure = 4.5 bar/65 psig"*
  • Option PK *"Cold/hot tap G ¾", low pressure = 4.5 bar/65 psig"*
  • Option PL *"Cold/hot tap ¾" NPT, low pressure = 4.5 bar/65 psig"*
  • The low-pressure version as "Accessory enclosed" comprises: V2 → ⊠ 37, 🖺 63
• Can be ordered separately as "Accessories": DK6003 → 🖺 81
  Versions V1, V2 and V3 can be ordered via DK6003

• Can only be used with the following installed lengths:
  • Order code for "Installed length", option L2 "335mm (13")"
  • Order code for "Installed length", option L3 "435mm (17")"
  • Order code for "Installed length", option L4 "608mm (24")"
• Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (284℉ for PEEK and 230℉ for PVDF)
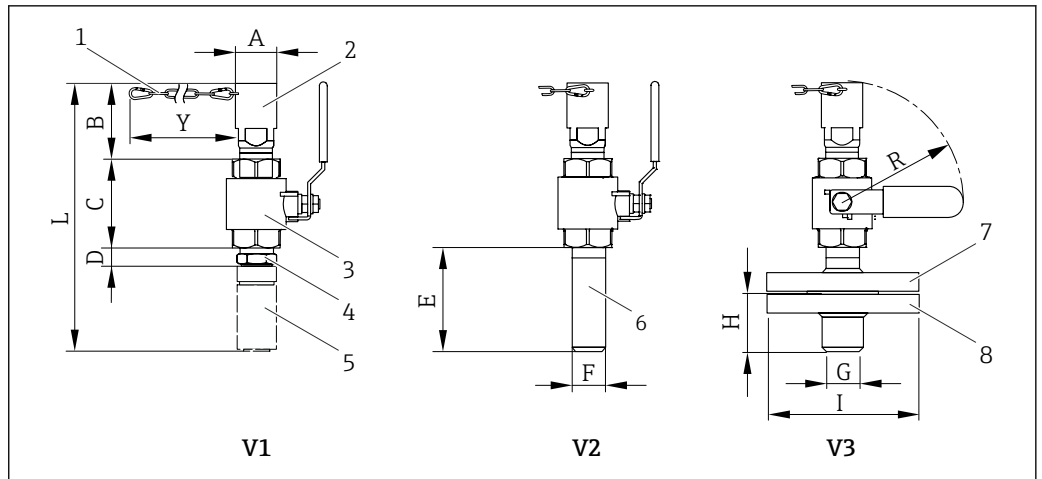
37   Versions available for order

1   Safety chain for low-pressure version
2   Sensor connection
3   Ball valve
4   Retrofit adapter (for subsequent installation with existing welding socket (DK6MB))
5   Welding socket (DK6MB) only G1"/1" NPT
6   Process connection welding socket
7   Flange adapter
8   Process connection flange
V1   Version with retrofit adapter
V2   Version with welding socket
V3   Version with flange

A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	I [in]	L [in]	R [in]	Y [1] [in]
1.67	~3.35	3.46	~1.18	3.74	1.31	1.31	2.13	4.25 to 4.92	~10.6	6.50	24.4

1)   Safety chain (for p ≤ 65 psi g) only in conjunction with low-pressure version
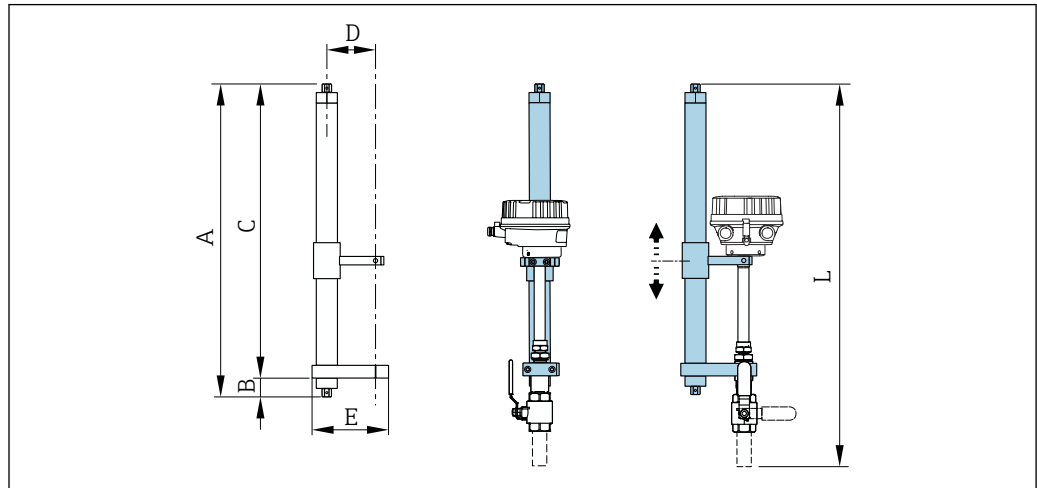
Weight [lbs]		
V1	V2	V3
6	5	11

Medium-pressure version

Available for order as:
- Order code for *"Accessory enclosed"*
  - Option PI *"Cold/hot tap G 1", medium pressure = 16 bar/230 psig"*
  - Option PJ *"Cold/hot tap 1" NPT, medium pressure = 16 bar/230 psig"*
  - Option PM *"Cold/hot tap G ¾", medium pressure = 16 bar/230 psig"*
  - Option PN *"Cold/hot tap ¾" NPT, medium pressure = 16 bar/230 psig"*
  - The medium-pressure version comprises: V2 → 🖾 37, 🖺 63 and extractor assembly → 🖾 38, 🖺 64
- Can be ordered separately as "Accessories": DK6003 → 🖺 81
  Versions V1, V2 and V3 → 🖾 37, 🖺 63 can be ordered via DK6003

- Can only be used with the following installed lengths:
  - Order code for "Installed length", option L3 "435mm (17")"
  - Order code for "Installed length", option L4 "608mm (24")"
- Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (140℃ for PEEK and 110℃ for PVDF)

Extractor assembly for medium-pressure version

ℹ️ Order code for *"Accessory enclosed"*:
- Option PI *"Cold/hot tap G 1", medium pressure maximum 16 bar/230 psig"*
- Option PJ *"Cold/hot tap 1" NPT, medium pressure maximum 16 bar/230 psig"*
- Option PM *"Cold/hot tap G ¾", medium pressure maximum 16 bar/230 psig"*
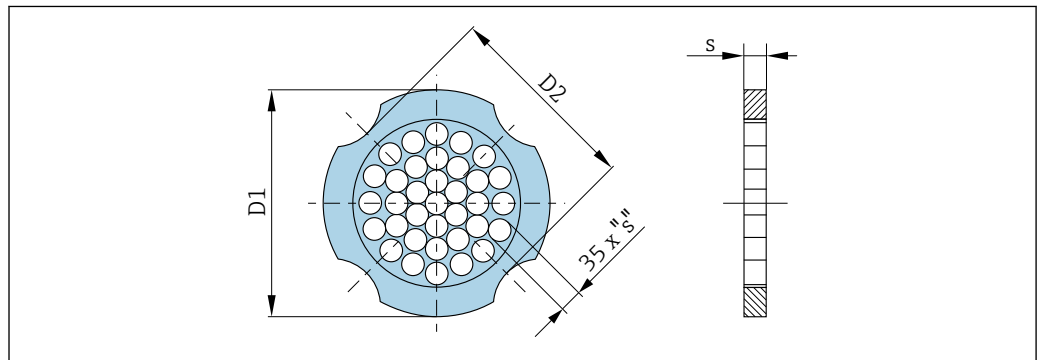- Option PN *"Cold/hot tap ¾" NPT, medium pressure maximum 16 bar/230 psig"*

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🔲 *38   Extractor assembly*

L [in]	A [in]	B [in]	C [in]	D [in]	E [in]	Weight [lbs]
36.61	29.13	1.57	27.56	4.72	7.09	18.5

Flow conditioner

A0033504

| Used in combination with flanges according to ASME B16.5: Class 150 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [in]	Centering diameter [in]	D1 [1)]/D2 [2)]	s [in]
3	5.45	D1	0.40
4	6.95	D2	0.52
6	8.81	D1	0.79
8	10.80	D2	1.04

| Used in combination with flanges according to ASME B16.5: Class 150 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [in]	Centering diameter [in]	D1 [1)]/D2 [2)]	s [in]
10	13.40	D1	1.30
12	15.90	D1	1.56

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

Used in combination with flanges according to ASME B16.5: Class 300 1.4404 (316, 316L) Can be ordered separately as "Accessories": DK6004			
DN [in]	Centering diameter [in]	D1 [1)]/D2 [2)]	s [in]
3	5.96	D1	0.40
4	7.19	D1	0.52
6	9.92	D1	0.79
8	12.20	D1	1.04
10	14.30	D1	1.30
12	15.80	D1	1.56

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

Weather protection cover

A0029552
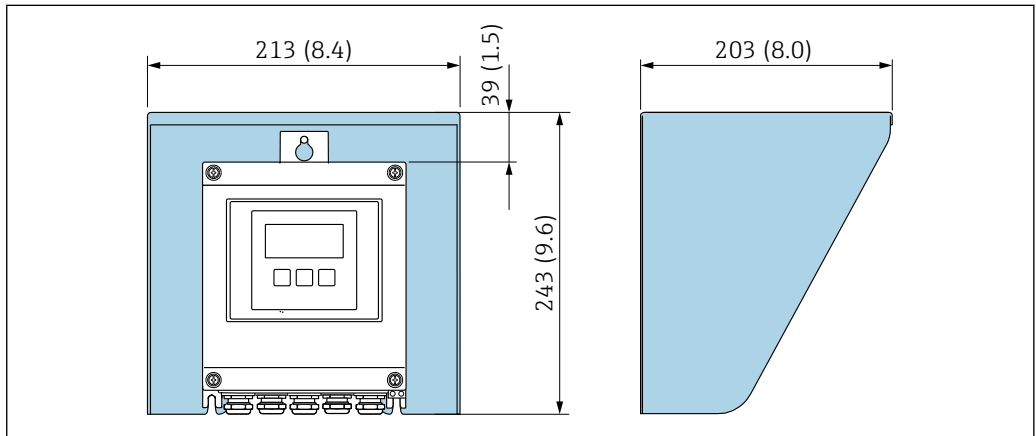
🔲 *39   Weather protection cover for Proline 500 – digital; engineering unit mm (in)*
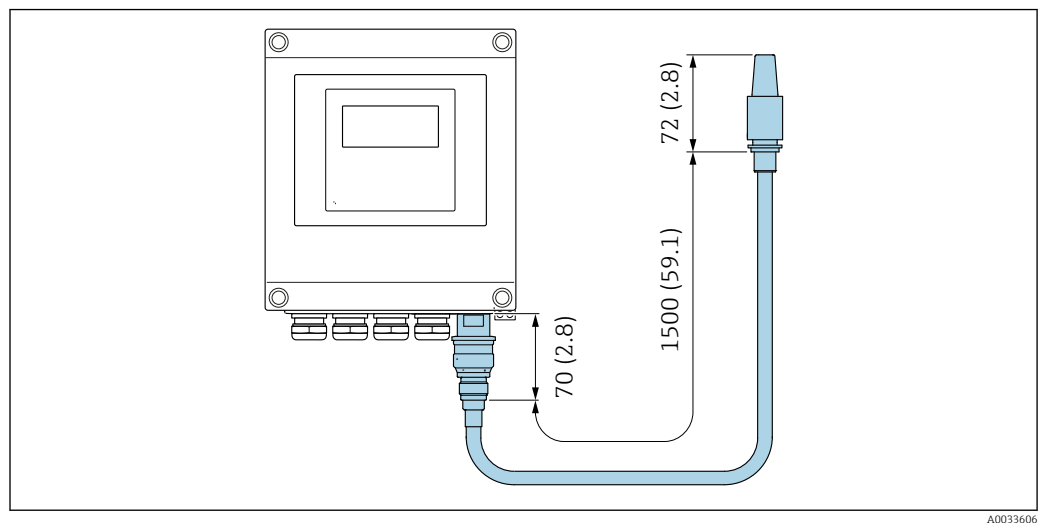
External WLAN antenna

Proline 500 – digital

External WLAN antenna mounted on device
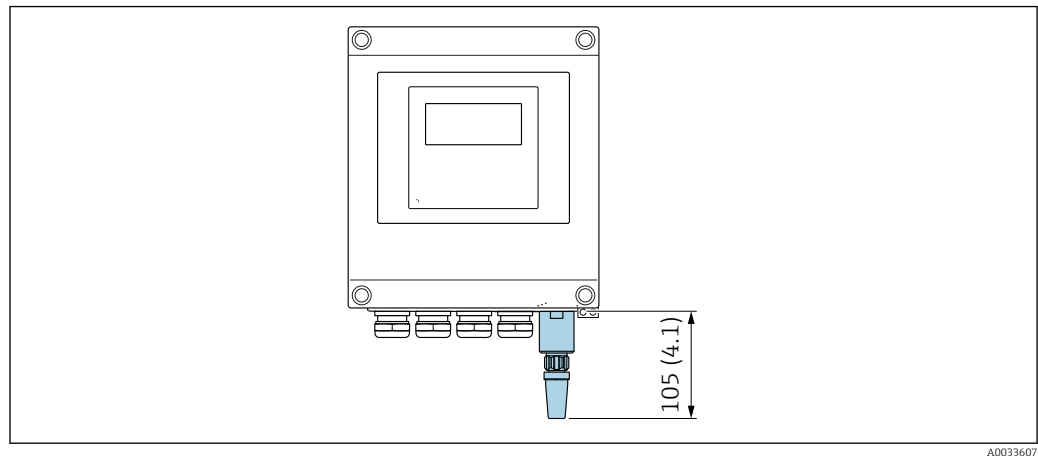
⊠ *40   Engineering unit mm (in)*

External WLAN antenna mounted with cable

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

⊠ *41   Engineering unit mm (in)*

Materials

Transmitter housing

Housing of Proline 500 – digital transmitter

Order code for "Transmitter housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **D** "Polycarbonate": polycarbonate

Window material

Order code for "Transmitter housing":
- Option **A** "Aluminum, coated": glass
- Option **D** "Polycarbonate": plastic

Sensor connection housing

Order code for "Sensor connection housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **L** "Cast, stainless": 1.4409 (CF3M) similar to 316L

Cable entries/cable glands
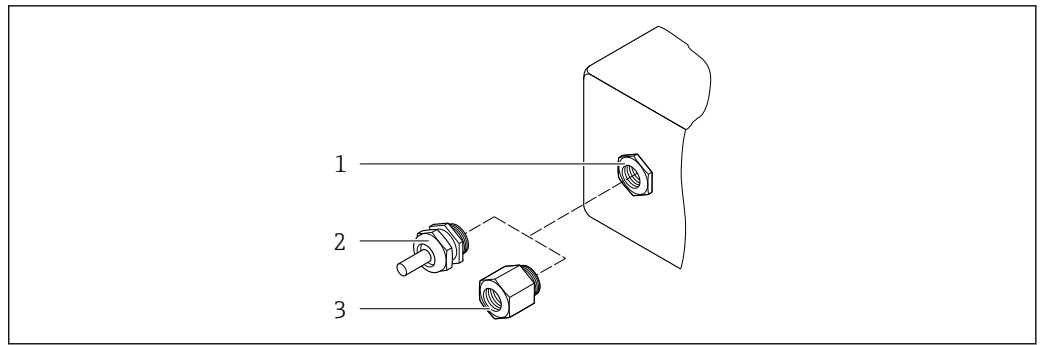
□ 42   Possible cable entries/cable glands

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

Cable entries and adapters	Material
Cable gland M20 × 1.5	Plastic
• Adapter for cable entry with female thread G ½" • Adapter for cable entry with female thread NPT ½" Only available for certain device versions: • Order code for "Transmitter housing": 　• Option A "Aluminum, coated" 　• Option D "Polycarbonate" • Order code for "Sensor connection housing": 　Proline 500 – digital: 　Option A "Aluminum coated" 　Option B "Stainless"	Nickel-plated brass

Materials for insertion tube

Stainless steel, 1.4404 (316/316L)

Process connections, process coupling

Stainless steel, 1.4404 (316/316L)

Sensing element

Unidirectional
• Stainless steel, 1.4404 (316/316L)
• Alloy C22, 2.4602 (UNS N06022);

Bidirectional
Stainless steel, 1.4404 (316/316L)

Reverse flow detection
Stainless steel, 1.4404 (316/316L)

Ferrules

• PEEK
• PVDF
• 1.4404 (316/316L)

Flat ring seal

• EPDM
• FKM

For aggressive media (e.g. chlorine or ozone), we recommend special materials (Alloy for sensing element, PVDF or 1.4404 for ferrules and FKM for flat seal). For any requests, please contact the Endress+Hauser sales organization responsible for your area.

Sensor guard

Stainless steel, 1.4404 (316/316L)

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

Mounting boss (DK6MB)

Stainless steel, 1.4404 (316/316L)

Cold/hot tap, low pressure and medium pressure

Welding socket

Stainless steel 1.4404 (316L)

Ball valve

- Stainless cast steel CF3M or CF8M
- Seal: PTFE

Sensor connection

Stainless steel, 1.4404 (316/316L)

Cold tap, atmospheric pressure

- Stainless steel, 1.4404 (316/316L)
- Stainless cast steel CF3M or CF8M
- Seal: PTFE

Weight

Transmitter
- Proline 500 – digital polycarbonate: 1.4 kg (3.1 lbs)
- Proline 500 – digital aluminum: 2.4 kg (5.3 lbs)

Sensor
- Sensor with cast connection housing version, stainless: +3.7 kg (+8.2 lbs)
- Sensor with aluminum connection housing version:

Weight in SI units

Installed length [mm]	Weight [kg]
235	2.2
335	2.3
435	2.4
608	2.5

Weight in US units

Installed length [in]	Weight [lbs]
9	4.9
13	5.1

Installed length [in]	Weight [lbs]
17	5.3
24	5.5

Process connections

- G¾", ISO 228/1 compression fitting
- G1", ISO 228/1, compression fitting
- ¾" NPT, compression fitting
- 1" NPT, compression fitting

For information on the different materials used in the process connections → 🖺 67

Display and user interface

Operation concept

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

Fast and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with short explanations 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 availability
- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Languages

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

Local operation

Via display module

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

Information about WLAN interface → 🖺 71

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
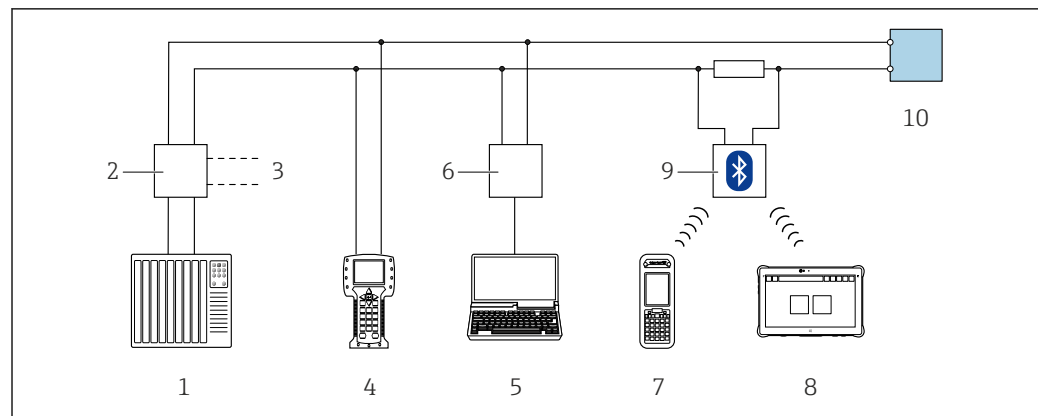
Remote operation   **Via HART protocol**

This communication interface is available in device versions with a HART output.
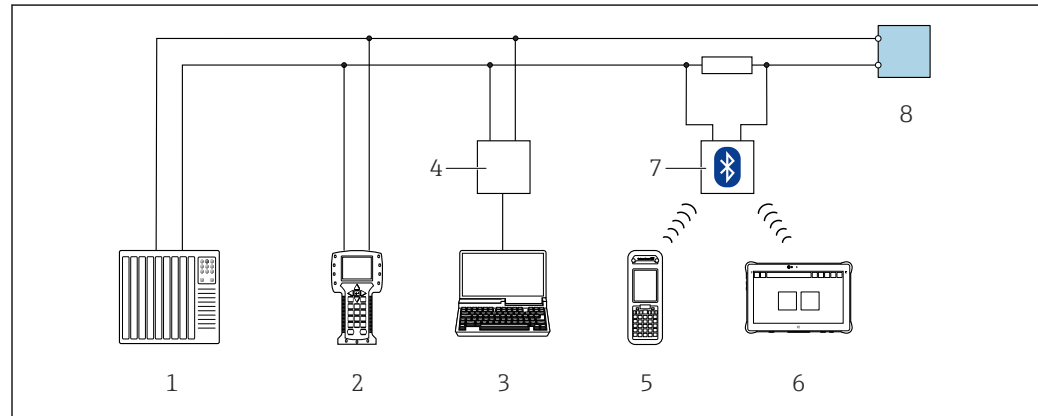
◐ *43   Options for remote operation via HART protocol (active)*

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

◐ *44   Options for remote operation via HART protocol (passive)*

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

Via Modbus RS485 protocol

This communication interface is available in device versions with a Modbus RS485 output.
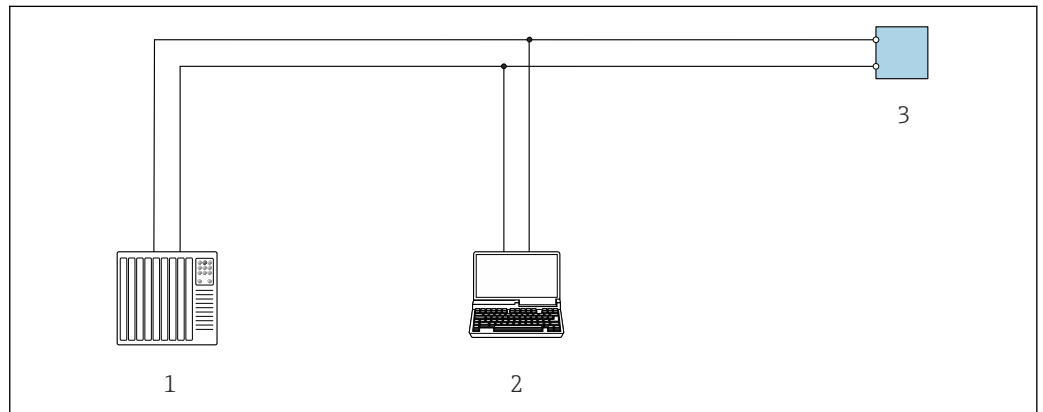
A0029437

⊞ *45   Options for remote operation via Modbus RS485 protocol (active)*

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

Service interface   **Via service interface (CDI-RJ45)**

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

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

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

Proline 500 – digital transmitter
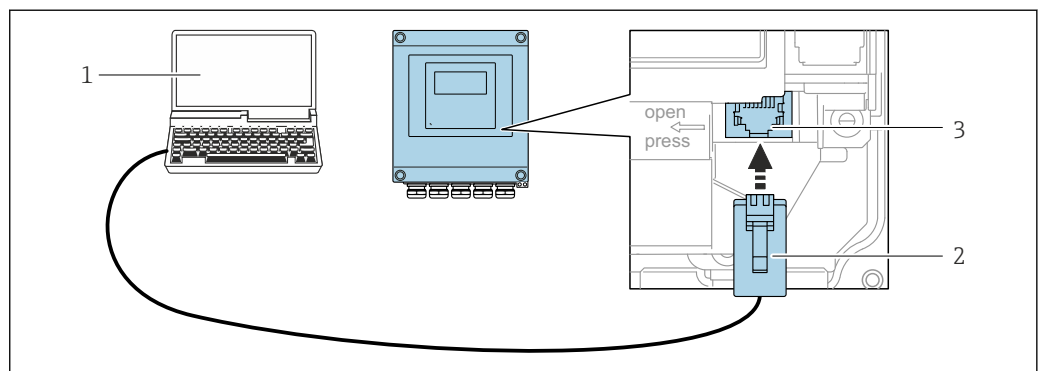
A0029163

⊞ *46   Connection via service interface (CDI-RJ45)*

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

Via WLAN interface

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

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

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

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with web browser	• CDI-RJ45 service interface • WLAN interface	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	• CDI-RJ45 service interface • WLAN interface • Fieldbus protocol	→ 🖹 83
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	• CDI-RJ45 service interface • WLAN interface • Fieldbus protocol	→ 🖹 83
Field Xpert	SMT70/77/50	• All Fieldbus protocols • WLAN interface • Bluetooth • CDI-RJ45 service interface	Operating Instructions BA01202S Device description files: Use update function of handheld terminal
SmartBlue app	Smart phone or tablet with iOs or Android	WLAN	→ 🖹 83

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

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

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

Web server

With the integrated web server, the device can be operated and configured via a web browser service interface (CDI-RJ45) or WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is displayed and can be used to monitor device health. Furthermore the device data can be managed and the network parameters can be configured.

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

Supported functions
Data exchange between the operating unit (such as a notebook, for example,) and measuring device:
• Upload the configuration from the measuring device (XML format, configuration backup)
• Save the configuration to the measuring device (XML format, restore configuration)
• Export event list (.csv file)
• Export parameter settings (.csv file or PDF file, document the measuring point configuration)
• Export the Heartbeat verification log (PDF file, only available with the **Heartbeat Verification** → 🖻 79 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→ 🖻 79)

📖 Special Documentation for web server

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

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

Additional information on the data storage concept

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

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

Data backup

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

Manual

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

Data transmission

Manual

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

Event list

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

Data logging

Manual

If the **Extended HistoROM** application package (order option) is enabled:
- Recording of 1 to 4 channels of up to 1000 measured values (up to 250 measured values per channel)
- User configurable recording interval
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

Certificates and approvals

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

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

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

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

Contact address Endress+Hauser UK:
Endress+Hauser Ltd.
Floats Road
Manchester M23 9NF
United Kingdom
www.uk.endress.com |
| **RCM marking** | The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)". |
| **Ex approval** | The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate. |

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

Proline 500 – digital

ATEX/IECEx

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

Ex db

Transmitter		Sensor	
Category	Type of protection	Category	Type of protection
II(1)G	[Ex ia] IIC	II1/2G	Ex db ia IIC T4...T1 Ga/Gb
II(1)G	[Ex ia] IIC	II2G	Ex db ia IIC T4...T1 Gb
II3G	Ex ec nC [ia Ga] IIC T5...T1 Gc	II1/2G	Ex db ia IIC T4...T1 Ga/Gb
II3G	Ex ec nC [ia Ga] IIC T5...T1 Gc	II2G	Ex db ia IIC T4...T1 Gb

Ex tb

Transmitter		Sensor	
Category	Type of protection	Category	Type of protection
II(1)D	[Ex ia] IIIC	II2D	Ex tb IIIC T** °C Db

Non-Ex / Ex ec

Transmitter		Sensor	
Category	Type of protection	Category	Type of protection
Non - Ex	Non-Ex	II3G	Ex ec IIC T4...T1 Gc
II3G	Ex ec nC IIC T5...T1 Gc	II3G	Ex ec IIC T4...T1 Gc

cCSA_US

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

IS (Ex nA, Ex i)

Transmitter	Sensor
Class I Division 2 Groups A - D	Class I, II, III Division 1 Groups A-G

NI (Ex nA)

Transmitter	Sensor
Class I Division 2 Groups A - D	Class I Division 2 Groups A - D

Ex db

Transmitter	Sensor
Ex ec nC [ia Ga] IIC T5...T1 Gc	Ex db ia IIC T4...T1 Gb
Ex ec nC [ia Ga] IIC T5...T1 Gc	Ex db ia IIC T4...T1 Ga/Gb

Ex nA

Transmitter	Sensor
Class I, Zone 2 AEx/ Ex nA IIC T5...T4 Gc	Class I, Zone 2 AEx/ Ex nA IIC T5...T1 Gc

Ex tb

Transmitter	Sensor
Non - Ex	Zone 21, AEx/Ex ia tb IIIC T** °C Db

Functional safety

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

The following types of monitoring in safety equipment are possible:
Mass flow

Functional safety manual with information and restrictions for the SIL device → 🖹 85

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)

Radio approval

The measuring device has radio approval.

For detailed information on the radio approval, see the Special Documentation → 🖹 85

Additional certification	**CRN approval** Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device.
External standards and guidelines	• EN 60529 Degrees of protection provided by enclosure (IP code) • EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements • IEC/EN 61326-2-3 Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements). • NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment • NAMUR NE 32 Data retention in the event of a power failure in field and control instruments with microprocessors • NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal. • NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics • NAMUR NE 105 Specifications for integrating fieldbus devices in engineering tools for field devices • NAMUR NE 107 Self-monitoring and diagnosis of field devices • NAMUR NE 131 Requirements for field devices for standard applications • ETSI EN 300 328 Guidelines for 2.4 GHz radio components. • EN 301489 Electromagnetic compatibility and radio spectrum matters (ERM).
Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01	Endress+Hauser devices are designed in accordance with ANSI/ISA 12.27.01. allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These devices comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. Further information can be found in the control drawings of the relevant devices.

Ordering information

Detailed ordering information is available as follows:

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

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

Application packages

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

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

Detailed information on the application packages:
Special Documentation → 🖺 85

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

Comprises extended functions concerning the event log and the activation of the measured value memory.

Event log:
Memory volume is extended from 20 message entries (standard version) to up to 100 entries.

Data logging (line recorder):
• Memory capacity for up to 1000 measured values is activated.
• 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user.
• Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

📖 For detailed information, see the Operating Instructions for the device. |
| **Heartbeat Technology** | Order code for "Application package", option EB "Heartbeat Verification + Monitoring"

Heartbeat Verification
Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".
• Functional testing in the installed state without interrupting the process.
• Traceable verification results on request, including a report.
• Simple testing process via local operation or other operating interfaces.
• Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications.
• Extension of calibration intervals according to operator's risk assessment.

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 on the measuring performance over time.
• Schedule servicing in time.
• Monitor the process or product quality , e.g. process stability.

📖 Special Documentation SD02712D |

Second gas group

Package	Description
Second gas group	This application package enables the configuration of two different standard gases/gas mixtures in the device and allows the user to switch from one gas group to another using the status input or (if available) via bus communication.

Accessories

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

Device-specific accessories

For the transmitter

Accessories	Description
Transmitter Proline 500 – digital	Transmitter for replacement or storage. Use the order code to define the following specifications: • Approvals • Output • Input • Display/operation • Housing • Software ℹ Proline 500 – digital transmitter: Order number: 6X5BXX-*********A ℹ Proline 500 transmitter for replacement: It is essential to specify the serial number of the current transmitter when ordering. On the basis of the serial number, the device-specific data (e.g. calibration factors) of the replaced device can be used for the new transmitter. 📖 Proline 500 – digital transmitter: Installation Instructions EA01287D
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". ℹ • The external WLAN antenna is not suitable for use in hygienic applications. • Additional information regarding the WLAN interface → 🖺 71. ℹ Order number: 71351317 📖 Installation Instructions EA01238D
Pipe mounting set	Pipe mounting set for transmitter. ℹ Proline 500 – digital transmitter Order number: 71346427 📖 Installation Instructions EA01195D
Weather protection cover Transmitter Proline 500 – digital	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. ℹ Proline 500 – digital transmitter Order number: 71343504 📖 Installation Instructions EA01191D

|	
Display guard Proline 500 – digital	Is used to protect the display against impact or scoring, for example from sand in desert areas. ℹ️ Order number: 71228792 📖 Installation Instructions EA01093D
Connecting cable Proline 500 – digital Sensor – Transmitter	The connecting cable can be ordered directly with the measuring device (order code for "Cable, sensor connection) or as an accessory (order number). The following cable lengths are available: order code for "Cable, sensor connection" • Option B: 20 m (65 ft) • Option E: User-configurable up to 50 mmax. • Option F: User-configurable up to 165 ftmax. ℹ️ Maximum possible cable length for a Proline 500 – digital connecting cable: 300 m (1 000 ft)

For the sensor

Accessories	Description
Mounting boss	**Order code for "Accessory enclosed"** • Option PC "Mounting boss, G1" • Option PD "Mounting boss, 1" NPT" • Option PE "Mounting boss, G¾" • Option PF "Mounting boss, ¾" NPT" ℹ️ Can be ordered separately: order code DK6MB
Cold tap (ambient pressure)	**Order code for "Accessory enclosed"** • Option PR "Cold tap G1", ambient pressure" • Option PS "Cold tap 1" NPT, ambient pressure" • Option PT "Cold tap G¾", ambient pressure" • Option PU "Cold tap ¾" NPT, ambient pressure" ℹ️ Can be ordered separately: order code DK6ML
Hot tap (low pressure)	**Order code for "Accessory enclosed"** • Option PG "Hot tap G1", low pressure max. 4.5 bar/65 psig" • Option PH "Hot tap 1" NPT, low pressure max. 4.5 bar/65 psig" • Option PK "Hot tap G¾", low pressure max. 4.5 bar/65 psig" • Option PL "Hot tap ¾" NPT, low pressure max. 4.5 bar/65 psig" ℹ️ Mounting set contains mounting boss (process connection), sensor connection with safety chain and ball valve. To insert or remove the sensor at process pressures up to max. 4.5 barg (65 psi). ℹ️ If the accessory is ordered separately, individual combinations can be selected. Order code DK6003

Hot tap (medium pressure)	**Order code for "Accessory enclosed"** • Option PI "Hot tap G1", medium pressure max. 16 bar/230 psig" • Option PJ "Hot tap 1" NPT, medium pressure max. 16 bar/230 psig" • Option PM "Hot tap G¾", medium pressure max. 16 bar/230 psig" • Option PN "Hot tap ¾" NPT, medium pressure max. 16 bar/230 psig" ℹ️ Mounting set contains mounting boss (process connection), sensor connection, ball valve and extractor assembly. To insert or remove the sensor at process pressures up to max. 16 barg (230 psi). ℹ️ If the accessory is ordered separately, individual combinations can be selected. Order code DK6003
Flow conditioner	ℹ️ Can be ordered separately: order code DK6004 **Available for the following pipe diameters:** • DN 80 (3") • DN 100 (4") • DN 150 (6") • DN 200 (8") • DN 250 (10") • DN 300 (12") **Available for the following process connections:** • PN10, EN1092-1 • PN16, EN1092-1 • PN25, EN1092-1 • PN40, EN1092-1 • Cl.150, ASME B16.5 • Cl.300, ASME B16.5 • 10K, JIS B2220 • 20K, JIS B2220 ℹ️ Screws and seals are not included in the delivery.

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB port. 📖 Technical Information TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. 📖 • Technical Information TI00429F • Operating Instructions BA00371F
Fieldgate FXA42	Transmission of the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices 📖 • Technical Information TI01297S • Operating Instructions BA01778S • Product page: www.endress.com/fxa42
Field Xpert SMT50	The Field Xpert SMT70 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 TI01342S • Operating Instructions BA01709S • Product page: www.endress.com/smt50

Field Xpert SMT70	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. • Technical Information TI01342S • Operating Instructions BA01709S • Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. • Technical Information TI01418S • Operating Instructions BA01923S • Product page: www.endress.com/smt77

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: • Choice of measuring devices for industrial requirements • Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. • Graphic illustration of the calculation results • Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: • Via the Internet: https://portal.endress.com/webapp/applicator • As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle. W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: www.endress.com/lifecyclemanagement
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S

System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick. • Technical Information TI00133R • Operating Instructions BA00247R
Ceraphant PTC31B	The pressure transmitter for measuring the absolute and gauge pressure in gases, steam, liquids and dusts. It can be used to read in the operating pressure value. • Technical Information TI01130P • Operating Instructions BA01270P

Accessories	Description
Cerabar PMC21	The pressure transmitter for measuring the absolute and gauge pressure in gases, steam, liquids and dusts. It can be used to read in the operating pressure value. • Technical Information TI01133P • Operating Instructions BA01271P
Cerabar S PMC71	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

Endress+Hauser

Documentation

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

Standard documentation

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

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline t-mass I	KA01443D

Brief Operating Instructions for the transmitter

Measuring device	Documentation code	
	HART	Modbus RS485
Proline 500 – digital	KA01446D	KA01447D

Operating Instructions

Measuring device	Documentation code	
	HART	Modbus RS485
t-mass I 500	BA01997D	BA01999D

Description of Device Parameters

Measuring device	Documentation code	
	HART	Modbus RS485
t-mass 500	GP01145D	GP01146D

Supplementary device-dependent documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEx Ex d/Ex de	XA01970D
ATEX/IECEx Ex ec	XA01971D
cCSAus XP	XA01974D
cCSAus Ex d/ Ex de	XA01972D
cCSAus Ex nA	XA01973D

Remote display and operating module DKX001

Contents	Documentation code
ATEX/IECEx Ex i	XA01494D
ATEX/IECEx Ex ec	XA01498D
cCSAus IS	XA01499D

Contents	Documentation code
cCSAus Ex nA	XA01513D
INMETRO Ex i	XA01500D
INMETRO Ex ec	XA01501D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D

Functional safety manual

Contents	Documentation code
Proline t-mass 500	SD02484D

Special documentation

Contents	Documentation code	
	HART	Modbus RS485
Functional Safety Manual	SD02484D	–
Heartbeat Technology	SD02479D	SD02480D
Web server	SD02487D	SD02488D

Installation Instructions

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

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