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Technical Information
Proline Teqwave MW 500

Total solids measurement via microwave transmission



Total solids measurement for the water and wastewater industry, remote version with up to 4 I/Os

Application

- Ideal for total solids measurement, e.g. for sludge treatment in water/waste water treatment plants
- Supports sludge treatment processes (from primary sludge to dewatered sludge)

Device properties

- Repeatability (0.02%)
- Short installed length
- Measuring up to 50% solids content
- Remote version with up to 4 I/Os
- Backlit display with touch control and WLAN access
- Standard cable between sensor and transmitter

Your benefits

- Polished tube - less maintenance due to reduced adhesion
- Fewer process measuring points - multivariable measurement (total solids, temperature, conductivity)
- Easy installation - proven sensor construction
- Full access to process and diagnostic information - numerous, freely combinable I/Os
- Onboard load calculation - less effort needed in programming
- Integrated verification - Heartbeat Technology

Endress+Hauser
People for Process Automation

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About this document

Symbols

Electrical symbols

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

Communication-specific symbols

Symbol	Meaning
	**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is flashing.

Symbols for certain types of information

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

Symbols in graphics

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

Function and system design

Measuring principle

Microwave transmission

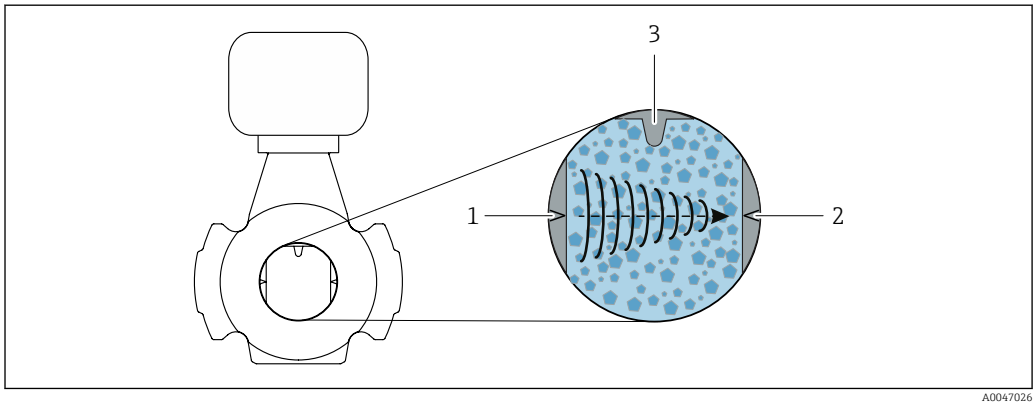
Total solids measurement via microwave transmission: The device measures the time of flight and absorption of microwave transmission between two antennas facing each other in the measuring tube. Based on these variables, the permittivity of the fluid can be calculated, for example.

Since water has a significantly higher permittivity than typical solids, the proportion of solids in the water can be determined in combination with a mixing model for sewage sludge. The device measures the fluid temperature to compensate for temperature-dependent effects.

In practice, it is typically necessary to adjust the measured value to a reference value (e.g. from the laboratory) when commissioning the device for it to achieve optimum measurement performance during subsequent operation. If there are significant changes to the process conditions, repeating this adjustment is recommended.

For detailed information on adjusting the measured value, see the Operating Instructions.→ 61

The fluid temperature is measured via a temperature sensor. The conductivity of the medium is derived from the change in amplitude and phase of the microwave signal. These two variables are also provided as an output signal.



1 Antenna - transmitter
2 Antenna - receiver
3 Temperature sensor

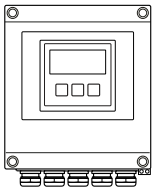
Measuring system

The measuring system consists of a transmitter and a sensor.

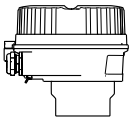
The device is available as a remote version: The transmitter and sensor are mounted separately from each other and are connected to each other via connecting cables.

Transmitter

Proline 500

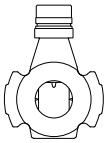
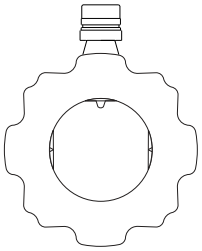
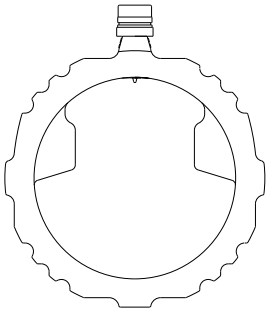
	▪ External operation via 4-line, illuminated graphic local display (LCD) with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning.
	▪ Via service interface or WLAN interface:
	  ▪ operating tools (e.g. FieldCare, DeviceCare)
	  ▪ web server (access via web browser e.g. Microsoft Edge).
	▪ Electronics module in the transmitter housing, ISEM (intelligent sensor electronics module) in the sensor connection housing
	▪ Digital signal transmission
	▪ A standard cable can be used as the connecting cable.

Sensor connection housing

	Connection housing with integrated ISEM (intelligent sensor electronics module) for connecting the connecting cable between the sensor and the transmitter

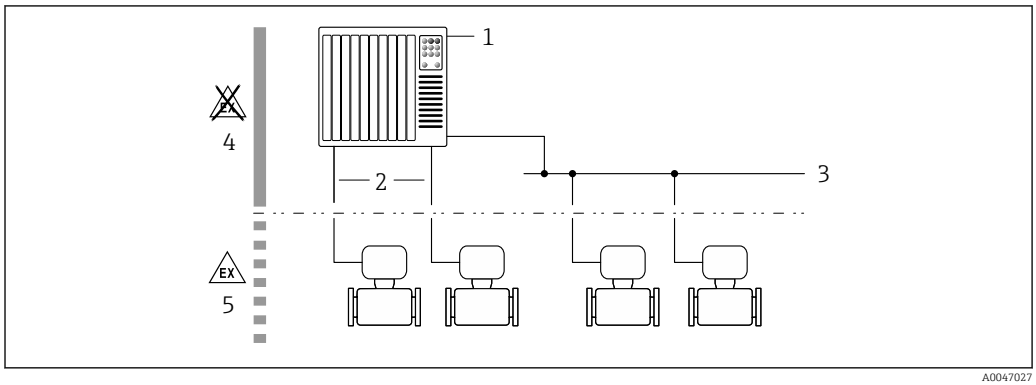
Sensor

Teqwave MW

	Wafer version: DN 50 mm (2 in)
	Wafer version: DN 80 to 200 mm (3 to 8 in)
	Wafer version: DN 250 to 300 mm (10 to 12 in)

Available materials for the measuring system → 📄 44

Device 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 *Non-hazardous area*
5 *Hazardous area: Zone 2; Class I, Division 2*

Safety

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 → 🖹 8	Not enabled	On an individual basis following risk assessment
Access code (also applies to web server login or FieldCare connection) → 🖹 9	Not enabled (0000)	Assign a customized access code during commissioning
WLAN (order option in display module)	Enabled	On an individual basis following risk assessment
WLAN security mode	Enabled (WPA2-PSK)	Do not change
WLAN passphrase (Password) → 🖹 9	Serial number	Assign an individual WLAN passphrase during commissioning
WLAN mode	Access point	On an individual basis following risk assessment
Web server → 🖹 9	Enabled	On an individual basis following risk assessment
CDI-RJ45 service interface→ 🖹 9	–	On an individual basis following risk assessment

Protecting access via hardware write protection

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

Hardware write protection is disabled when the device is delivered.

Protecting access via a password

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

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

User-specific access code

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

WLAN passphrase: Operation as WLAN access point

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

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

Infrastructure mode

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

General notes on the use of passwords

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

Access via web server

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

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

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


For detailed information on device parameters, see:
"Description of device parameters" document → 61.

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

Direct measured variables

- Total solids
- Electrical conductivity
- Medium temperature

Calculated measured variables

Load rate

The load rate can only be calculated with the volume flow of the medium. This measured value must be read in via a flowmeter→ 🖹 10.

Example of calculation:
- Volume flow read in by flowmeter: 100 l/min
- Total solids measured by Teqwave MW 500 : 10 g/l

Calculated load rate: 1 kg/min

Measuring range

Total solids

0 to 500 g/l (0 to 31 lb/ft^3), 0 to 50 %TS

Medium temperature

0 to 80 °C (32 to 176 °F)

Electrical conductivity

To ensure correct measurement, the electrical conductivity of the medium must not exceed the measuring range of the temperature-compensated electrical conductivity.

Measuring range for temperature-compensated electrical conductivity at 25 °C (77 °F)

Nominal diameter		Electrical conductivity
[mm]	[in]	[mS/cm]
50	2	0 to 100
80	3	0 to 85
100	4	0 to 50
150	6	0 to 20
200	8	0 to 14.5
250	10	0 to 14.5
300	12	0 to 14.5

Input signal

Output and input variants

→ 🖹 12

External measured values

To calculate the load rate, you need to know the volume flow of the medium. You can measure this value using a flowmeter, e.g. the Proline Promag W 400.

The volume flow can be read in as an input signal via the HART protocol or via the 4 to 20 mA current input from the Teqwave MW and used to calculate the load rate.

The Proline W Promag 400 flowmeter can be ordered from Endress+Hauser → 🖹 60.

Current input

Measured variables can be transferred from the automation system to the device via the current input → 🖹 11.

Digital communication

Measured variables can be transferred from the automation system to the device via:
- HART protocol
- Modbus RS485

Current input 4 to 20 mA

Order code	"Output; input 2" (021), "Output; input 3" (022) or "Output; input 4" (023): option I: 4 to 20 mA input
Current input	0/4 to 20 mA (active/passive)
Current range	▪ 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	Volume flow of the medium for calculating the load rate

Status input

Order code	"Output; input 2" (021), "Output; input 3" (022) or "Output; input 4" (023): option J: 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 (low): DC −3 to +5 V ▪ High signal (high): DC 12 to 30 V
Assignable functions	▪ Disable ▪ Flow override ▪ Reset totalizer (load rate)

Output

Output and input variants

Depending on the option selected for output/input 1, different options are available for the other outputs and inputs. For each input/input 1 to4, only **one** option can be selected.

The following table must be read vertically (↓).

Output/input 1 and possible options for the outputs/inputs 2 to 4

Possible options for order code "Output; input 1" (020) →	**↓**	**↓**
Current output 4 to 20 mA HART	**BA**	–
Modbus RS485	–	**MA**
Possible options for order code "Output; input 2" (021) →	**↓**	**↓**
Not used	**A**	**A**
Current output 4 to 20 mA	**B**	**B**
User-configurable input/output [1)]	**D**	**D**
Pulse/frequency/switch output	**E**	**E**
Relay output	**H**	**H**
Current input 0/4 to 20 mA	**I**	**I**
Status input	**J**	**J**
Possible options for order code "Output; input 3" (022) →	**↓**	**↓**
Not used	**A**	**A**
Current output 4 to 20 mA	**B**	**B**
User-configurable input/output [1)]	**D**	**D**
Pulse/frequency/switch output	**E**	**E**
Relay output	**H**	**H**
Current input 0/4 to 20 mA	**I**	**I**
Status input	**J**	**J**
Possible options for order code "Output; input 4" (023) →	**↓**	**↓**
Not used	**A**	**A**
Current output 4 to 20 mA	**B**	**B**
User-configurable input/output [1)]	**D**	**D**
Pulse/frequency/switch output	**E**	**E**
Relay output	**H**	**H**
Current input 0/4 to 20 mA	**I**	**I**
Status input	**J**	**J**

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

Output signal

Current output 4 to 20 mA HART

Order code	"Output; input 1" (020): 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 process variables	▪ Total solids ▪ Conductivity ▪ Temperature ▪ Electronics temperature ▪ Totalizer (load rate) ▪ Load rate

Modbus RS485

Order code	"Output; input 1" (020): Option MA: 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" (021), "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 range	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ 0 to 20 mA (only if the signal mode is active) ▪ Fixed current
Maximum output values	22.5 mA
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	0 to 700 Ω
Resolution	0.38 µA

Damping	Configurable: 0 to 999.9 s
Assignable process variables	▪ Total solids ▪ Conductivity ▪ Temperature ▪ Electronics temperature ▪ Load rate

Pulse/frequency/switch output

Order code	"Output; input 2" (021), "Output; input 3" (022) or "Output; input 4" (023): option E: 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 process variables	Totalizer (load rate)
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 process variables	▪ Total solids ▪ Conductivity ▪ Temperature ▪ Electronics temperature ▪ Load rate
Switch output	
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s

Number of switching cycles	Unlimited

Assignable functions	▪ Disable
	▪ On
	▪ Diagnostic behavior
	▪ Limit value:
	  ▪ Total solids
	  ▪ Conductivity
	  ▪ Temperature
	  ▪ Electronics temperature
	  ▪ Partially filled pipe
	  ▪ Totalizer (load rate)
	  ▪ Load rate

Relay output

Order code	"Output; input 2" (021), "Output; input 3" (022) or "Output; input 4" (023): option H: 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:
	  ▪ Total solids
	  ▪ Conductivity
	  ▪ Temperature
	  ▪ Partially filled pipe
	  ▪ Totalizer (load rate)
	  ▪ Load rate

User-configurable input/output

Order code	"Output; input 2" (021), "Output; input 3" (022) or "Output; input 4" (023): Option D: user-configurable input/output
Function	**One** specific input or output can be assigned to the user-configurable input/output (configurable I/O) when commissioning the device.
Possible assignment	▪ Current output 4 to 20 mA ▪ Pulse/frequency/switch output ▪ Current input 0/4 to 20 mA ▪ Status input
Technical values of the inputs and outputs	Correspond to the inputs and outputs described in this section

Signal on alarm

HART current output

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

Modbus RS485

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

Current output 0/4 to 20 mA

4 to 20 mA

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

0 to 20 mA

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

Pulse/frequency/switch output

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

Relay output

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

Local display

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

Status signal as per NAMUR recommendation NE 107

Interface/protocol

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

Plain text display	With information on cause and remedial measures

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 → 13

Ex connection data

Safety-related values

Order code for "Output; input 1"

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

Order code for "Output; input 2", "Output; input 3" and "Output; input 4"

Option	Output/input type	Safety-related values for output/input					
		2		3		4	
		24 (+)	25 (–)	22 (+)	23 (–)	20 (+)	21 (–)
B	Current output 4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}					
D	User-configurable input/output	U_N = 30 V_{DC} U_M = 250 V_{AC}					
E	Pulse/frequency/switch output	U_N = 30 V_{DC} U_M = 250 V_{AC}					
H	Relay output	U_N = 30 V_{DC} I_N =100 mA_{DC}/500 mA_{AC} U_M = 250 V_{AC}					
I	Current input 0/4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}					
J	Status input	U_N = 30 V_{DC} U_M = 250 V_{AC}					

Galvanic isolation

The outputs are galvanically isolated from one another and from earth (PE).

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	11B3
HART protocol revision	7

Device description files (DTM, DD)	Information and files available at: www.endress.com
HART load	Min. 250 Ω
System integration	For information on system integration, see Operating Instructions→ 61. ▪ 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 rates	▪ 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, see the description of device parameters → 61.
System integration	For information on system integration, see the Operating Instructions → 61. ▪ 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 → 12.							

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 → 12.							

Transmitter and sensor connection housing: connecting cable

Internal supply voltage		Internal communication	
+	–	B	A
61	62	63	64

Available device plugs

Device plugs may not be used in hazardous areas!

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

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

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

Supply voltage

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

Power consumption

Transmitter

Max. 10 W (active power)

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

Current consumption

Transmitter

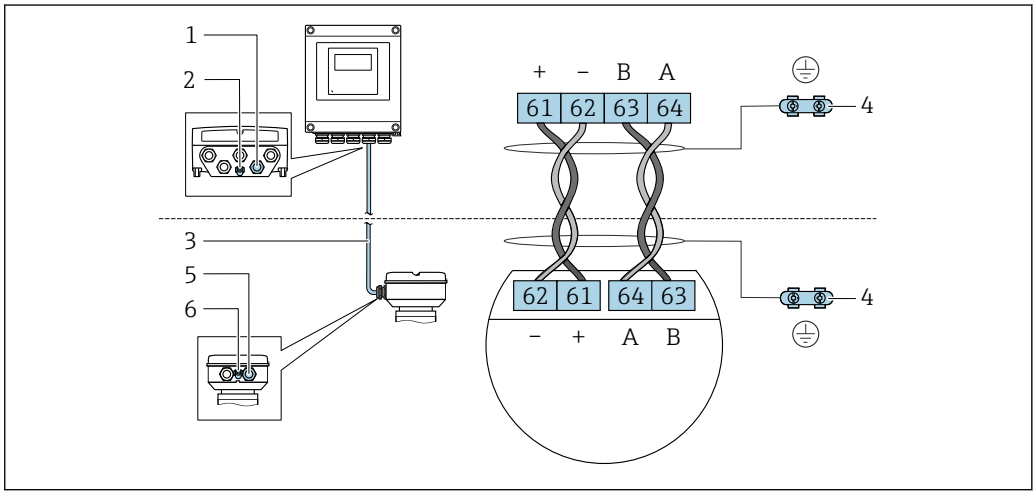
- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)

Power supply failure	▪ Totalizer stops at the last value measured. ▪ Depending on the device version, the configuration is retained in the device memory or in the plug-in memory (HistoROM DAT). ▪ Error messages (incl. total operated hours) are stored.
Overcurrent protection element	The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own. ▪ The circuit breaker must be easy to reach and labeled accordingly. ▪ Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.

Electrical connection

Connecting cable connection

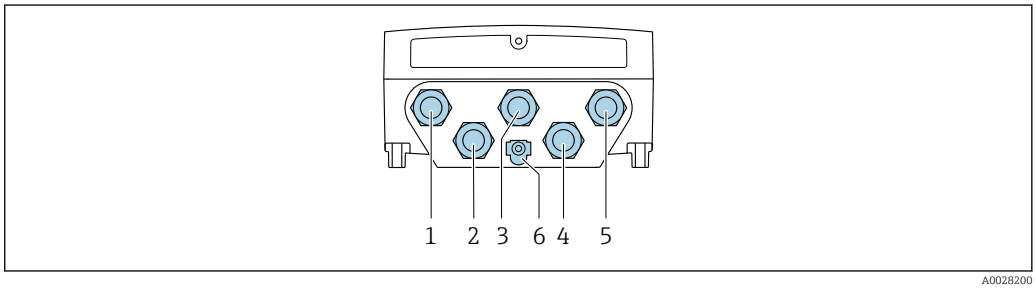
The sensor and transmitter, which are mounted in separate locations, are interconnected by a connecting cable. The cable is connected via the sensor connection housing and the transmitter housing.



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 → 19



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 of external WLAN antenna*
6 *Terminal connection for potential equalization (PE)*

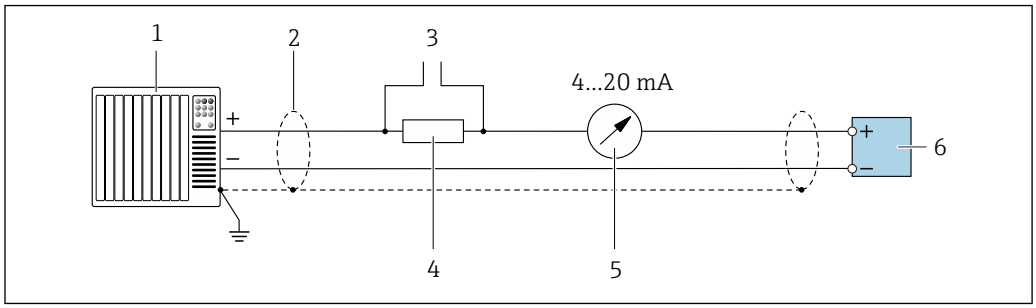
An adapter for the RJ45 to the M12 plug is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

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 via service interface (CDI-RJ45) → 49

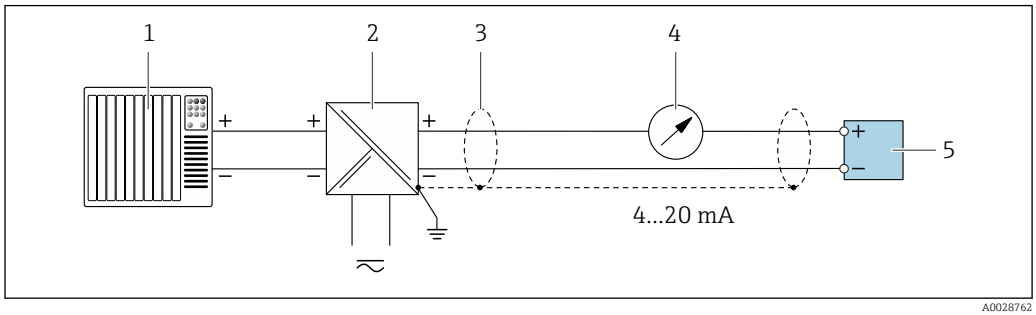
Connection examples

Current output 4 to 20 mA HART



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

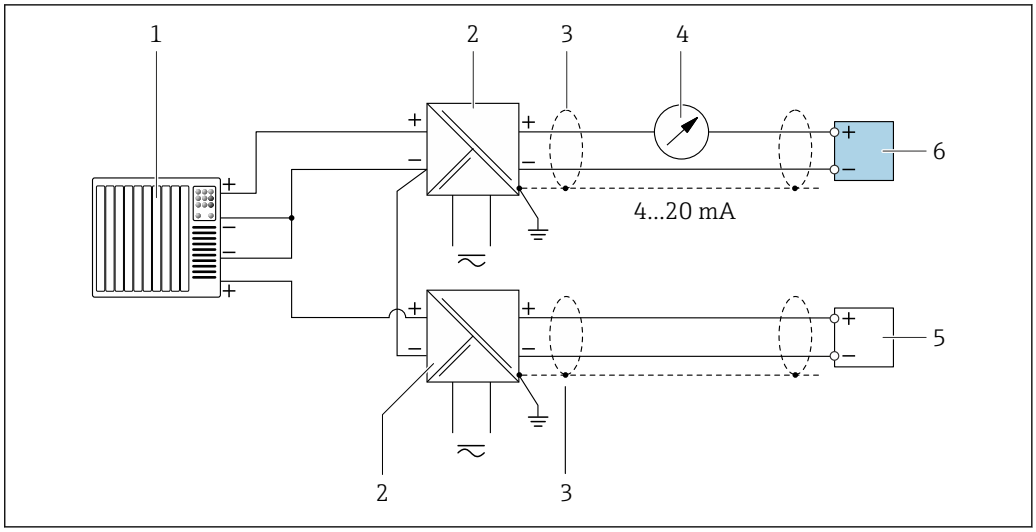
1 *Automation system with current input (e.g. PLC)*
2 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 26*
3 *Connection for HART operating devices → 48*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 13*
5 *Analog display unit: observe maximum load → 13*
6 *Transmitter*



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

1 *Automation system with current input (e.g. PLC)*
2 *Power supply*
3 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 26*
4 *Analog display unit: observe maximum load → 13*
5 *Transmitter*

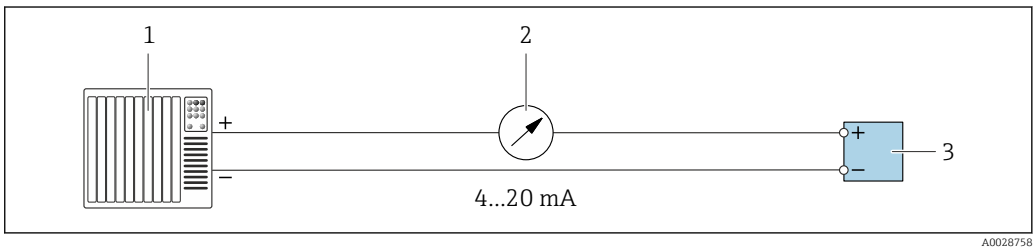
HART input



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

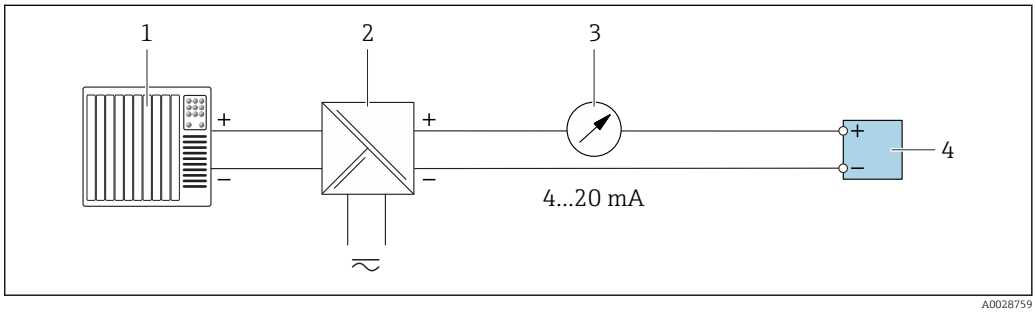
1 *Automation system with HART output (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)* → 🖹 *19*
3 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements. Observe cable specifications.* → 🖹 *26*
4 *Analog display unit: Observe maximum load.* → 🖹 *13*
5 *Flowmeter (e.g. Promag W): Observe requirements.* → 🖹 *11*
6 *Transmitter*

Current output 4-20 mA



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

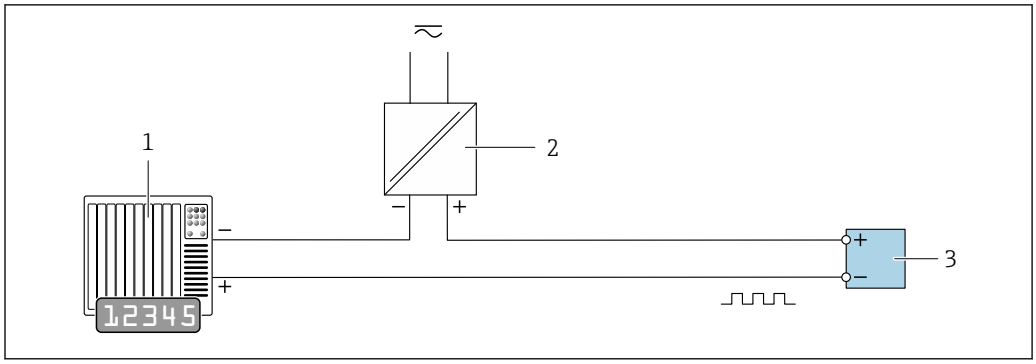
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load* → 🖹 *13*
3 *Transmitter*



6 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* → 🖹 *13*
4 *Transmitter*

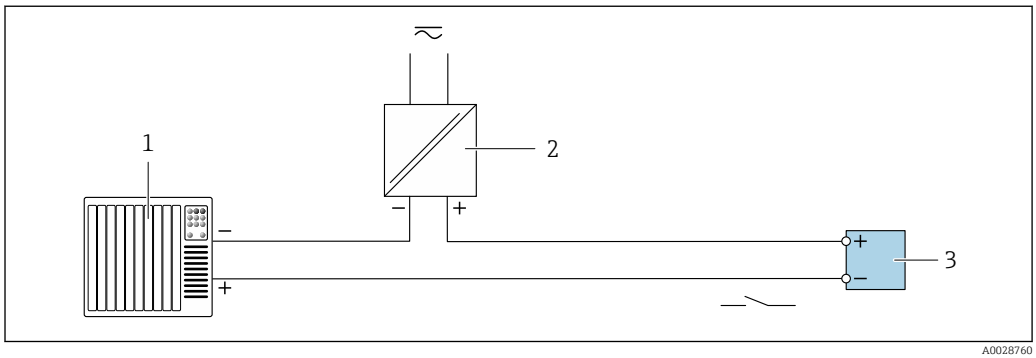
Pulse/frequency output



7 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 → 14

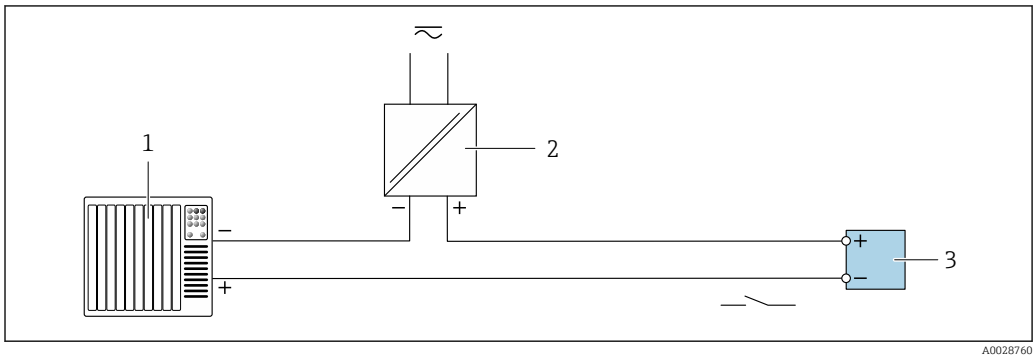
Switch output



8 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 → 14

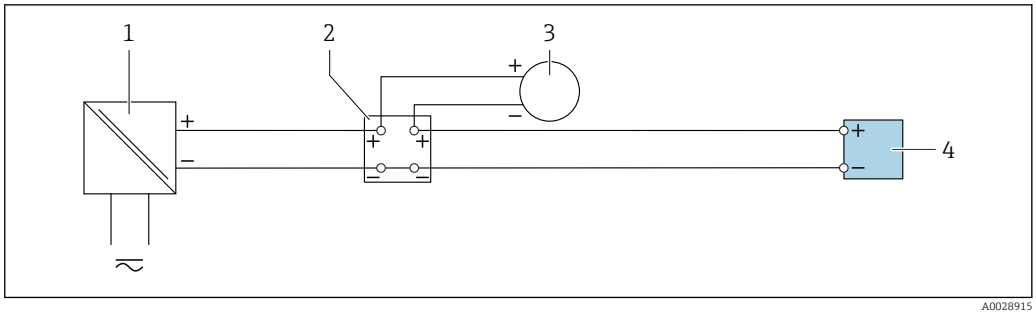
Relay output



9 Connection example for relay output (passive)

1 Automation system with relay input (e.g. PLC)
2 Power supply
3 Transmitter: observe input values → 15

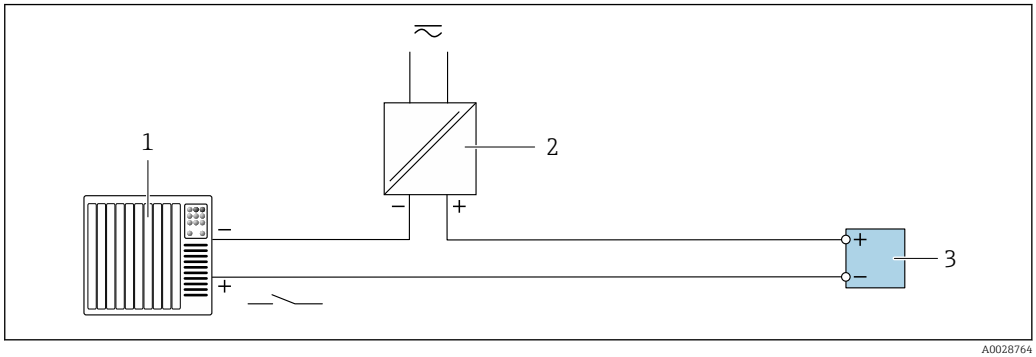
Current input



10 Connection example for 4 to 20 mA current input

1 Power supply
2 Terminal box
3 External device (for reading in the flow rate value in order to calculate the load rate)
4 Transmitter

Status input



11 Connection example for status input

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

Potential equalization

Requirements

- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Connect the medium, sensor connection housing and transmitter to the same electrical potential.
- Use a ground cable with a minimum cross-section of 6 mm^2 (0.0093 in^2) and a cable lug for potential equalization connections

Terminals

Spring-loaded terminals: Suitable for strands and strands with ferrules.
Conductor cross-section 0.2 to 2.5 mm^2 (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

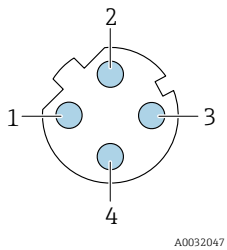
Optional: M12 device plug for connection to the service interface

Order code for "Accessories mounted", option NB: "Adapter RJ45 M12 (service interface)"
→ 26

Pin assignment, device plug

Service interface for

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



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

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

Cable specification

Permitted temperature range

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

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

Standard installation cable is sufficient.

Protective grounding cable for the outer ground terminal

Conductor cross-section < 2.1 mm^2 (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 mm^2 (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

Sensor/transmitter connecting cable

Standard cable

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

Design	4 cores (2 pairs); uninsulated stranded CU wires; pair-stranded with common shield	
Shield	Tin-plated copper braid, optical coverage ≥ 85 %	
Cable length	Maximum 300 m (900 ft), depending on cross-section:	
	Cross-section	*Cable length*
	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)
	1.00 mm² (AWG 17)	240 m (720 ft)
	1.50 mm² (AWG 15)	300 m (900 ft)
	2.50 mm² (AWG 13)	300 m (900 ft)

Optional connecting cable available

A connecting cable can be ordered as an optional extra→ 🖹 58.

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
Shield	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 lengths	The following cable lengths are available: order code for "Cable, sensor connection" ▪ Option B, fixed: 20 m (65 ft) ▪ Option E, variable: user-configurable up to max. 50 m ▪ Option F, variable: user-configurable up to max. 165 ft

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

Overvoltage protection

Mains voltage fluctuations	→ 🖹 19
Overvoltage category	Overvoltage category II
Short-term, temporary overvoltage	Between cable and ground up to 1200 V, for max. 5 s
Long-term, temporary overvoltage	Between cable and ground up to 500 V

Performance characteristics

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

Accuracy	Max. ±50 ppm of the measured value (over the entire ambient temperature range)

Repeatability

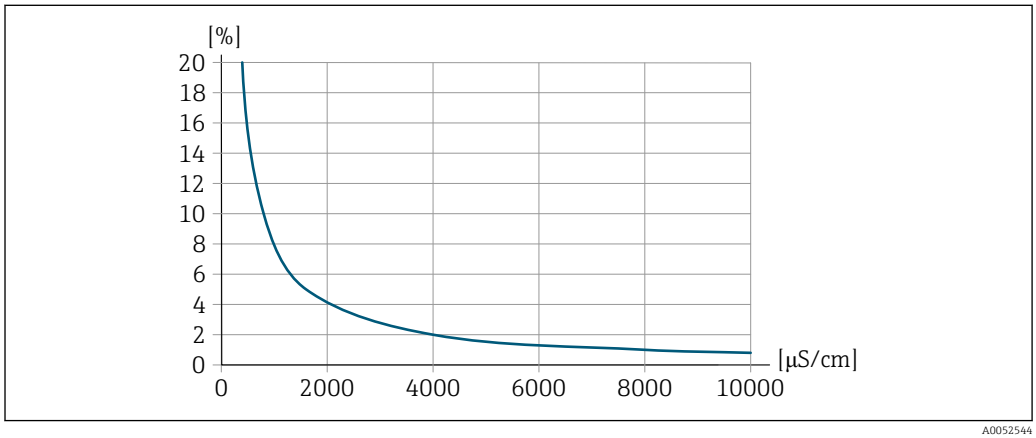
Total solids

Nominal diameter		Standard deviation of total solids
[mm]	**[in]**	**[%TS]**
50 to 80	2 to 3	0.02
100 to 300	4 to 12	0.01

Medium temperature

± 0.5 °C (± 0.9 °F)

Electrical conductivity



12 Repeatability in % of measured value - electrical conductivity [µS/cm]

Influence of ambient temperature

Current output

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

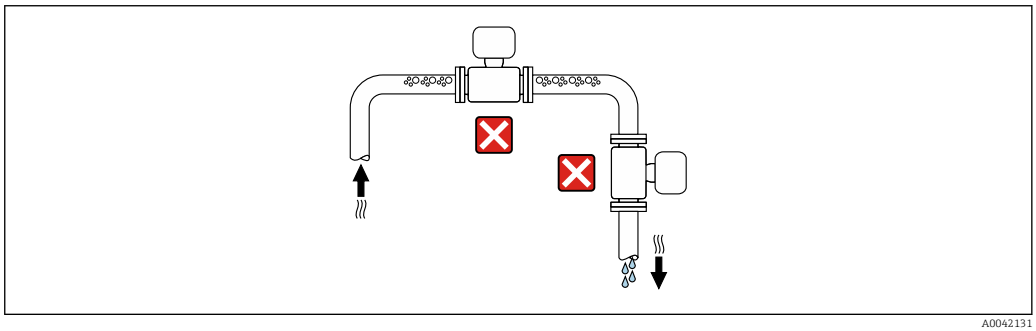
Temperature coefficient	No additional effect.

Mounting procedure

Installation point

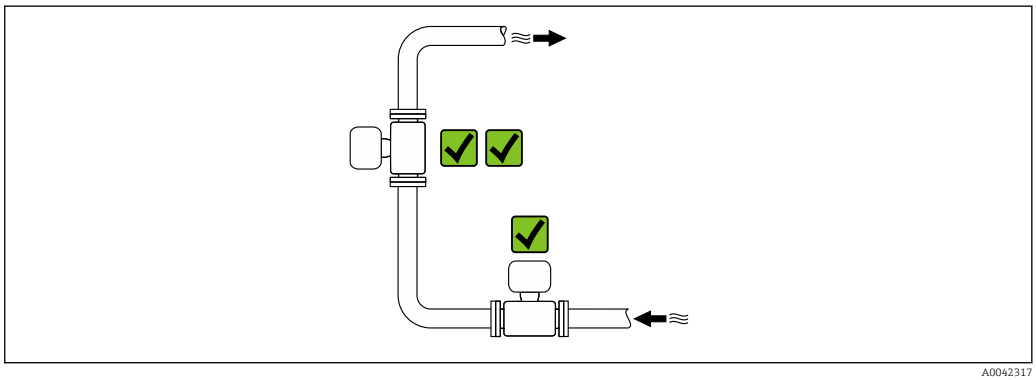
Installation in pipe

Do **not** install the device:
- At the highest point of the pipe (risk of gas bubbles accumulating in the measuring tube)
- Upstream of a free pipe outlet in a down pipe



A0042131

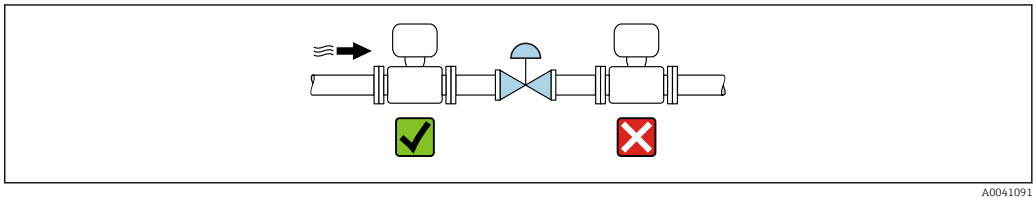
Install the device:
- Ideally in an ascending pipe
- Upstream of an ascending pipe or in areas where the device is filled with medium



A0042317

Installation near valves

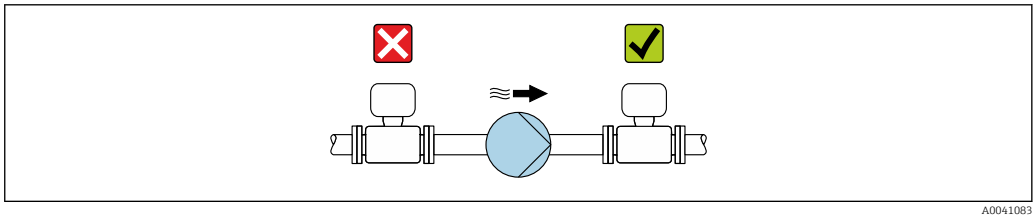
Mount the sensor upstream from control valves if possible.



A0041091

Installation near pumps

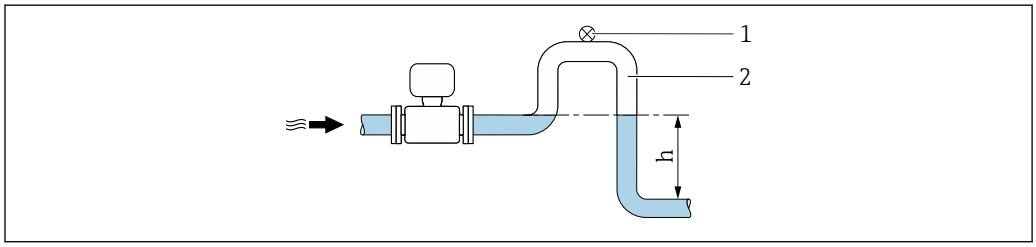
- Install the device in the direction of flow downstream from the pump.
- Also install pulsation dampers if reciprocating, diaphragm or peristaltic pumps are used.



A0041083

Installation upstream from a down pipe

If installing upstream of down pipes with a length h ≥ 5 m (16.4 ft): Install a siphon with a vent valve downstream of the device.

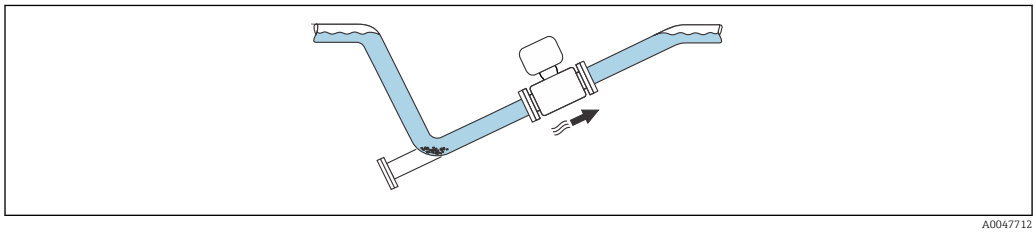


13 This arrangement prevents the flow of liquid stopping in the pipe and the formation of air pockets.

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation with partially filled pipes

- Partially filled pipes with a gradient require a drain-type configuration.
- The installation of a cleaning valve is recommended.

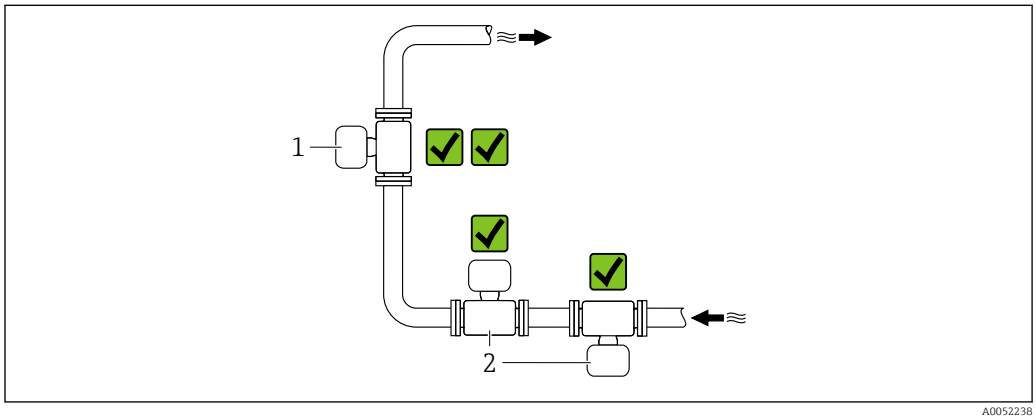


Installation in event of pipe vibrations

Pipe vibrations can damage the device:
Do not expose the device to strong vibrations.

Information on the measuring system's resistance to vibration and shock → 35

Orientation



1 Vertical orientation
2 Horizontal orientation

Vertical orientation

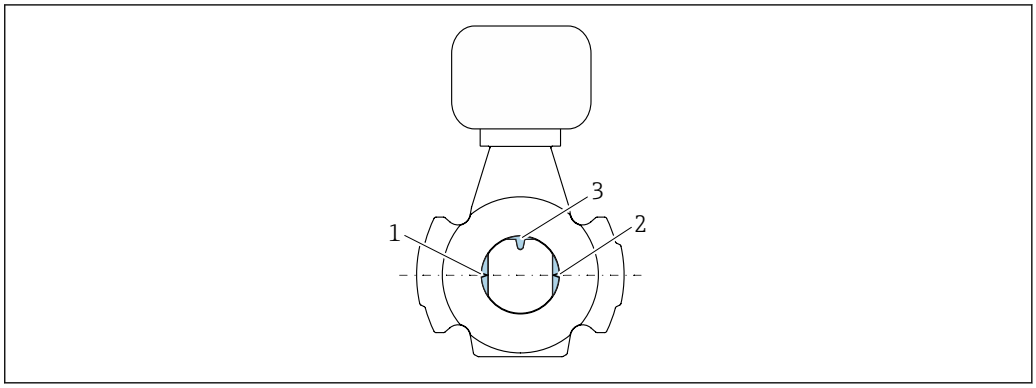
The device should ideally be installed in a rising pipe:
- To avoid having a partially filled pipe
- To avoid any gas accumulation
- The measuring tube can be completely drained and protected against the buildup of deposits.

In the case of total solids of ≥ 20 %TS:

Install the device vertically. If it is installed horizontally, separating layers can form as a result of sedimentation, separating liquid and solids. This can lead to measurement errors.

Horizontal orientation

The antennas (transmitter and receiver) should be positioned horizontally in order to avoid interference to the measurement signal caused by entrained air bubbles.



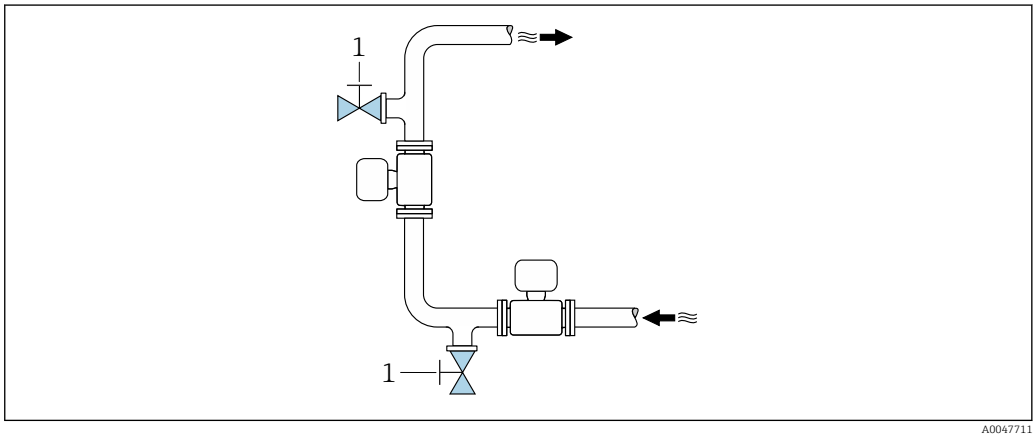
A0047713

1 Antenna - transmitter
2 Antenna - receiver
3 Temperature sensor

Installation instructions

Installation with sampling points

To obtain a representative sample, the sampling points should be installed in the immediate vicinity of the device. This also makes it easier to take the sample and run the wizards via the device's local operation.

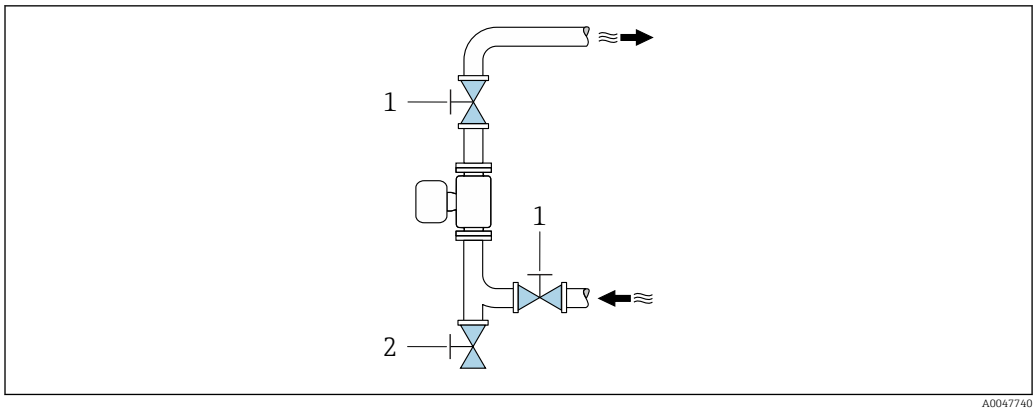


A0047711

1 Sampling point

Installation with option for cleaning

Depending on the process conditions (e.g. grease deposits), it may be necessary to clean the device. Additional components can be fitted to avoid any need to remove the device for cleaning:
- Rinse connection
- Cleaning shaft



1 Shutoff valve
2 Shut-off flap for cleaning

If there is a risk of deposits building up in the measuring tube, as a result of grease for example, a flow velocity of >2 m/s (6.5 ft/s) is recommended.

Flow direction

The device can be installed independently of the flow direction.

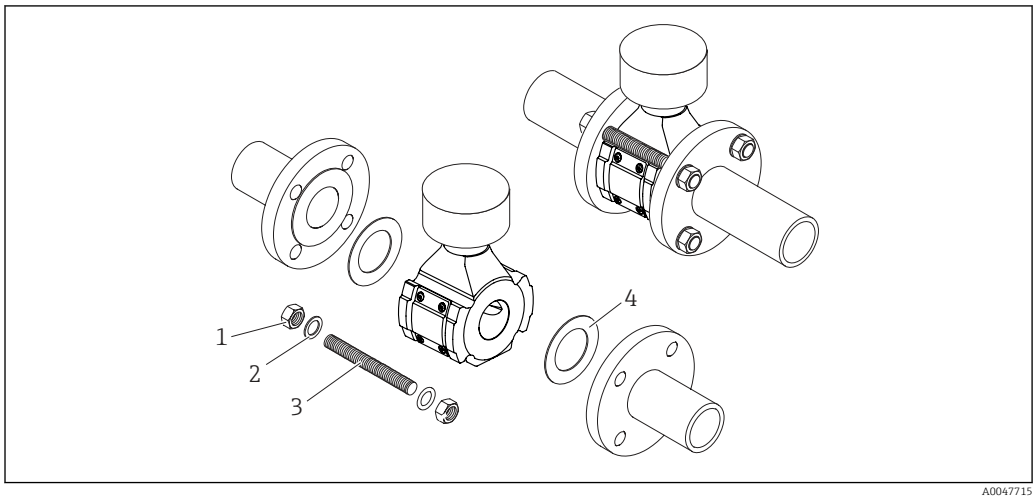
Inlet and outlet runs

When installing the device, no inlet and outlet runs need to be taken into account. No special precautions need to be taken for fittings that create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs.

Mounting the sensor

The sensor is centered between the pipe flanges and mounted in the measuring path.

A mounting kit consisting of screws/mounting bolts, seals, nuts and washers can be ordered as an optional extra:
- Directly with the device: Order code for "Accessory enclosed", option PE
- Order separately as an accessory → 58



14 *Mounting the sensor*

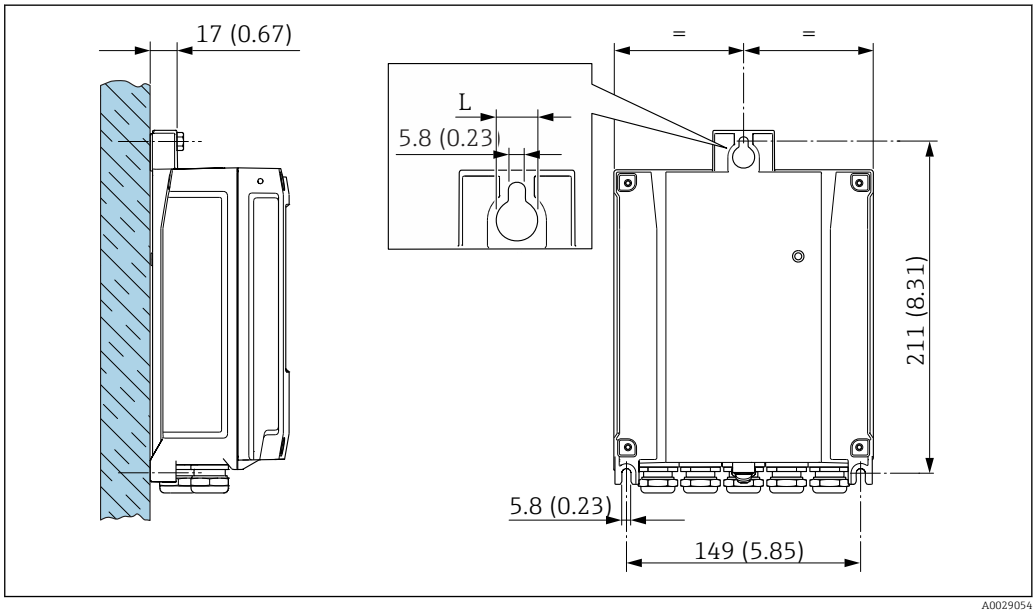
1 Nut
2 Washers
3 Screw/mounting bolt
4 Seal

Mounting procedure
Mounting the transmitter

The transmitter can be mounted in the following ways:
- Wall mounting → 33
- Pipe mounting→ 34

Wall mounting

Required tools:
Drill with drill bit Ø 6.0 mm



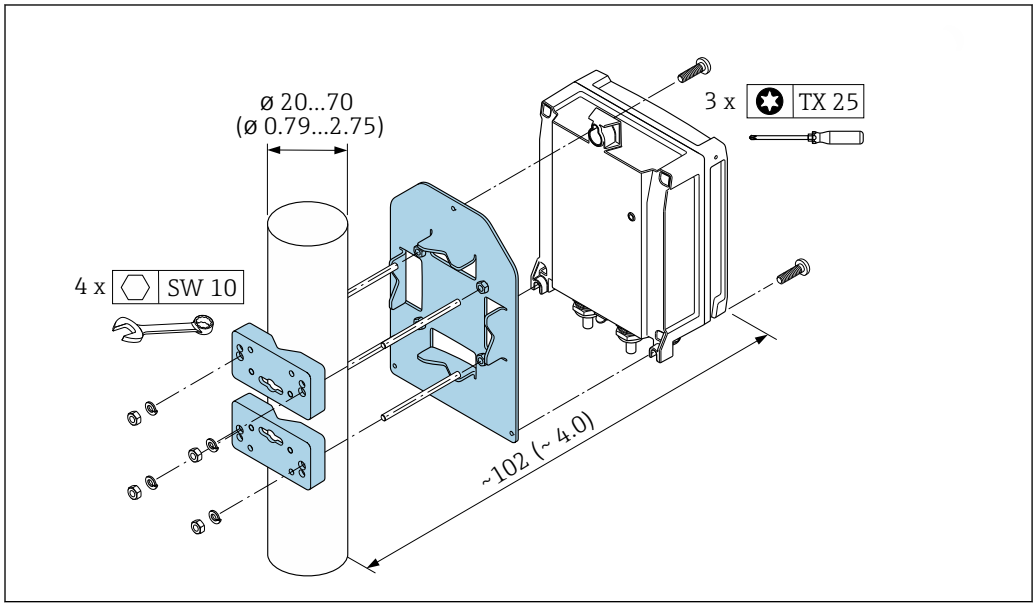
15 Engineering unit mm (in)

L Depends on order code for "Transmitter housing"

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

Pipe mounting

Required tools:
- Open-ended wrench AF 10
- Torx screwdriver TX 25

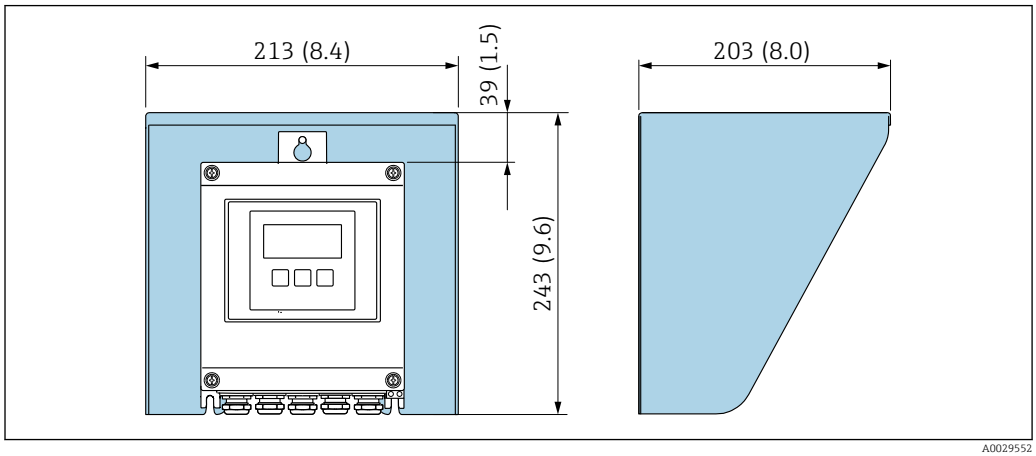


16 *Engineering unit mm (in)*

The pipe mounting set can be ordered:
- Directly with the device: order code for "Accessory enclosed", option PC
- Separately as an accessory → 58

Special mounting instructions

Weather protection cover



17 *Unit mm (in)*

A weather protection cover is available as an accessory.→ 58

Environment

Ambient temperature range

Transmitter and sensor
−20 to +60 °C (−4 to +140 °F)

Readability of the display may be impaired at temperatures outside the temperature range.

If operating the device outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.
- Protect the display against impact.
- Protect the display from abrasion, e.g. caused by sand in desert areas.

A weather protection cover is available as an accessory.→ 58

Storage temperature

−20 to +60 °C (−4 to +140 °F)

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device.

Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 4 to 95%.

Operating height

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

Degree of protection

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

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

External WLAN antenna

IP67

Vibration and shock resistance

Sensor connection housing
- Sinusoidal vibration according to IEC 60068-2-6
  - 2 to 8.4 Hz, 7.5 mm peak
  - 8.4 to 2 000 Hz, 2 g peak
- Broadband random vibration according to IEC 60068-2-64
  - 10 to 200 Hz, 0.01 g^2/Hz
  - 200 to 2 000 Hz, 0.003 g^2/Hz
  - Total: 2.70 g rms
- Half-sine shocks according to IEC 60068-2-27
  6 ms 50 g
- Rough handling shocks according to IEC 60068-2-31

Mechanical load

Transmitter housing and sensor connection housing:
- Protect against mechanical effects, such as shock or impact.
- Do not use as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

As per IEC/EN 61326

Process

Medium temperature range

0 to +80 °C (+32 to +176 °F)

Electrical conductivity

To ensure correct measurement, the electrical conductivity of the medium must not exceed the measuring range of the temperature-compensated electrical conductivity.

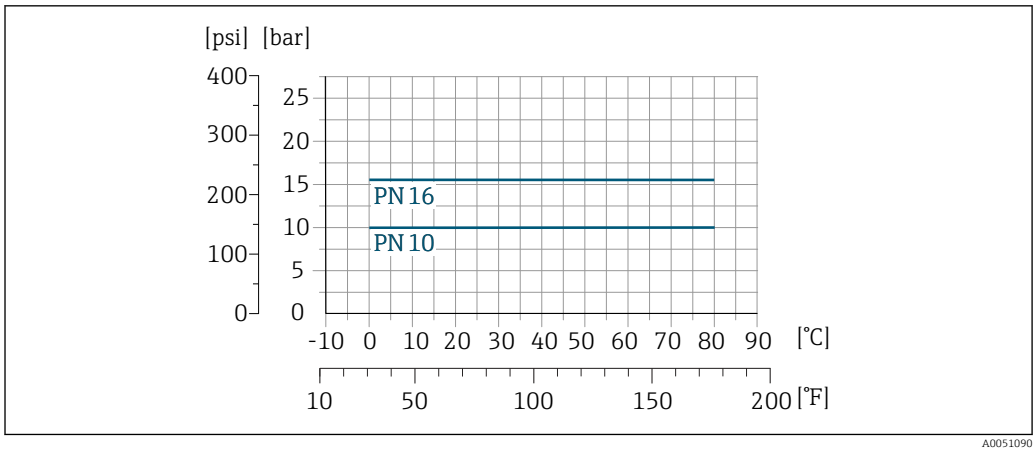
Measuring range for temperature-compensated electrical conductivity at 25 °C (77 °F)

Nominal diameter		Electrical conductivity
[mm]	[in]	[mS/cm]
50	2	0 to 100
80	3	0 to 85
100	4	0 to 50
150	6	0 to 20
200	8	0 to 14.5
250	10	0 to 14.5
300	12	0 to 14.5

Pressure/temperature ratings

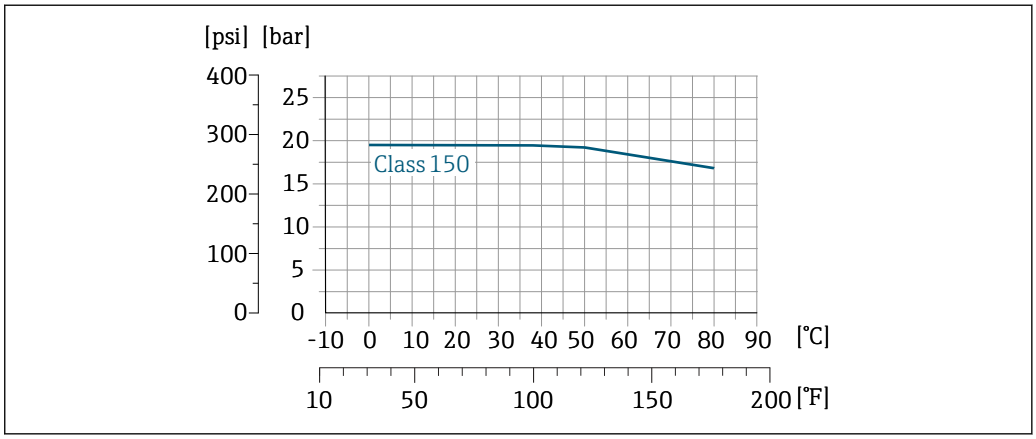
The following pressure-temperature ratings refer to all pressure-bearing parts of the device. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.

Pressure-temperature ratings in accordance with DIN EN 1092-1 (2018), material group 14E0 (1.4408)



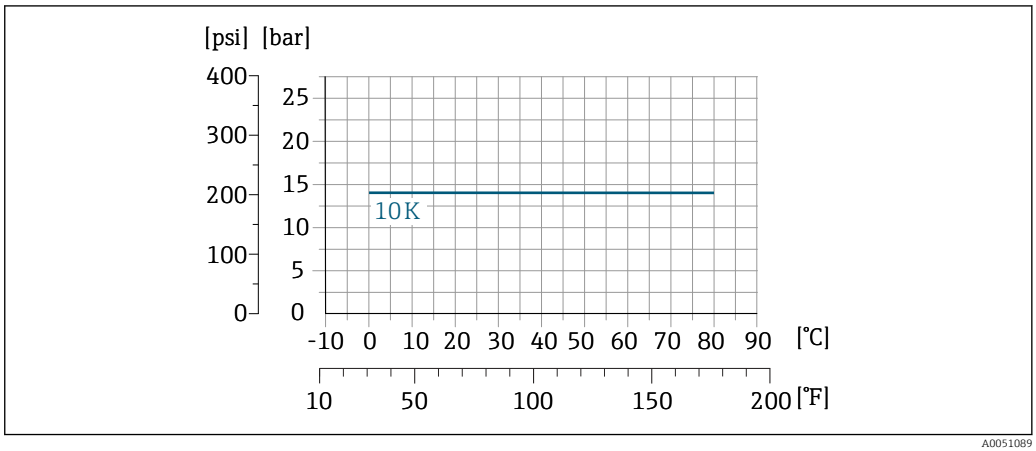
A0051090

Pressure-temperature ratings in accordance with ASME B16.5 (2020), material group 2.2 (CF3M)



A0051088

Pressure-temperature ratings in accordance with JIS 2220 (2012), material group 2.2 (CF3M), division 1



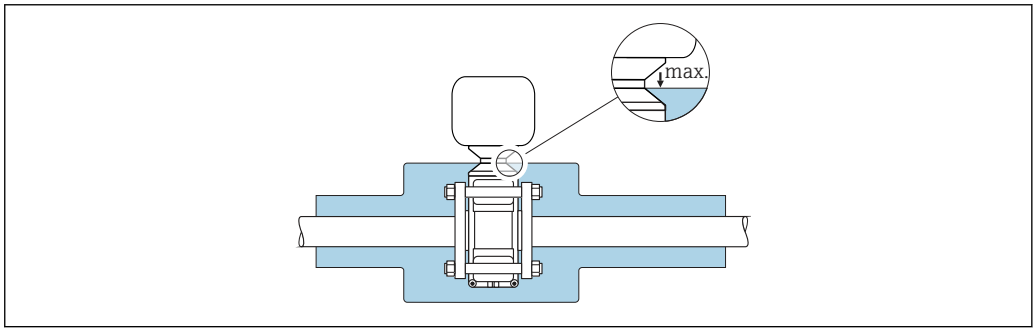
A0051089

Flow velocity

If there is a risk of deposits building up in the measuring tube, as a result of grease for example, a flow velocity of >2 m/s (6.5 ft/s) is recommended.

Thermal insulation

- For very hot media: To reduce energy losses and prevent accidental contact with hot pipes
- In cold environments: To prevent cooling of the pipe wall and the sensor from the outside, which could promote the formation of grease deposits



A0052236

⚠ WARNING

Electronics overheating on account of thermal insulation!

- ▶ Do not insulate the sensor connection housing.
- ▶ Insulation may be provided as far as the connection between the sensor and the sensor connection housing.
- ▶ Maximum permitted temperature at the lower end of the sensor connection housing: 75 °C (167 °F)

Static pressure

≥ 1.5 bar (21.8 psi), to avoid outgassing of the medium

Installation near pumps → 29

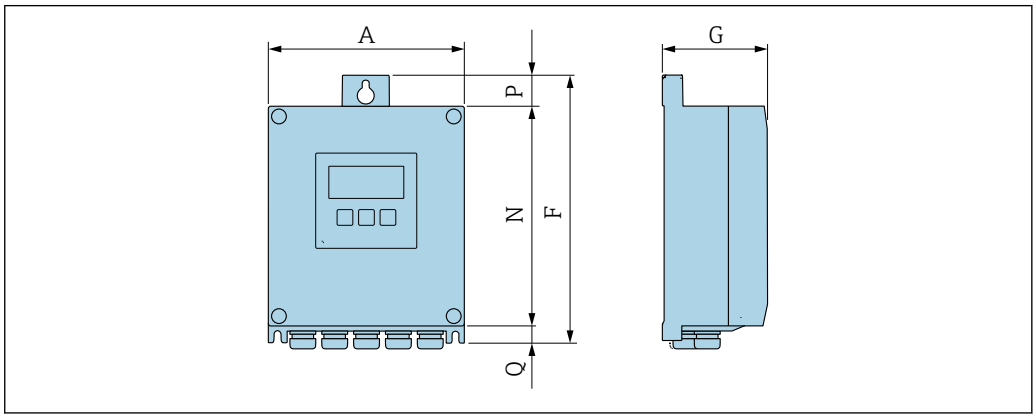
Vibrations

Information on the measuring system's resistance to vibration and shock → 35

Mechanical Construction

Dimensions in SI units

Transmitter housing



A0033789

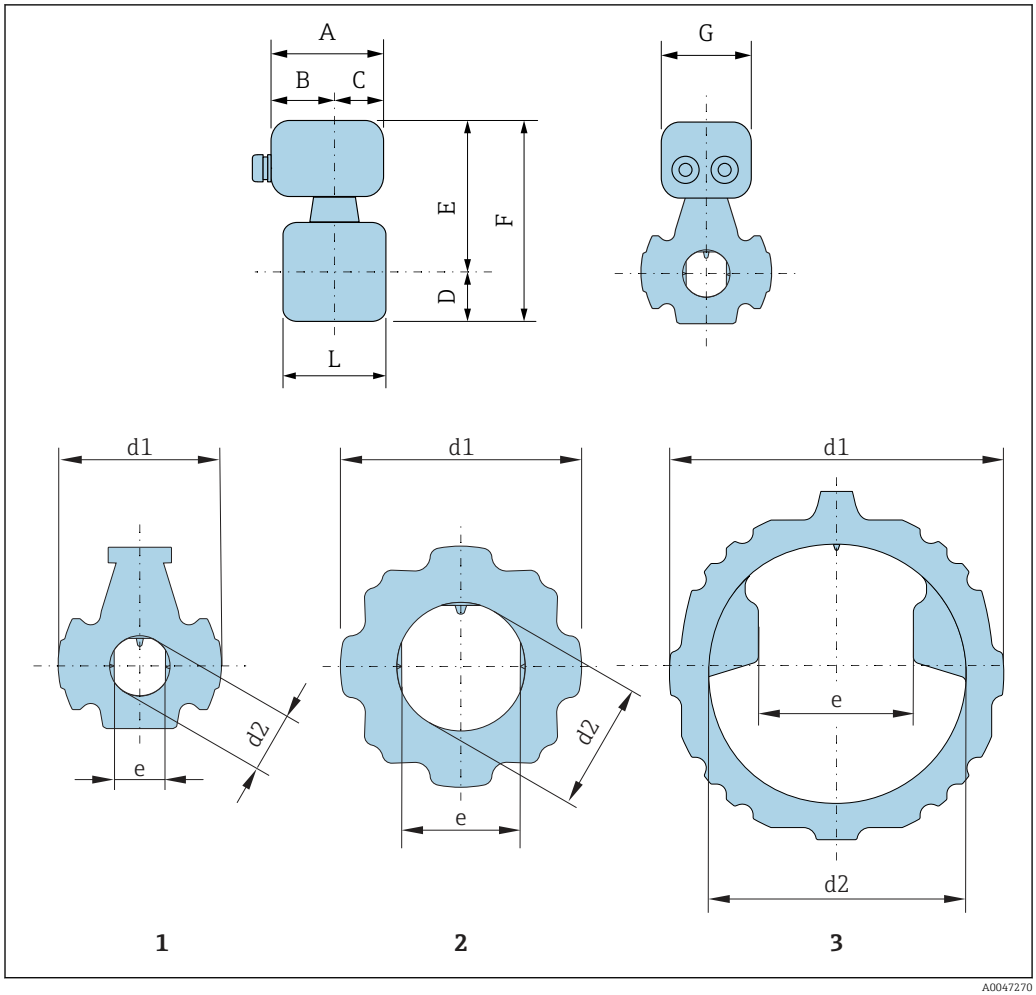
Order code for "Transmitter housing", option A "Aluminum, coated"

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"

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

Connection housing and sensor



1 Nominal diameter: DN 50 mm
2 Nominal diameter: DN 80 to 200 mm
3 Nominal diameter: DN 250 to 300 mm

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

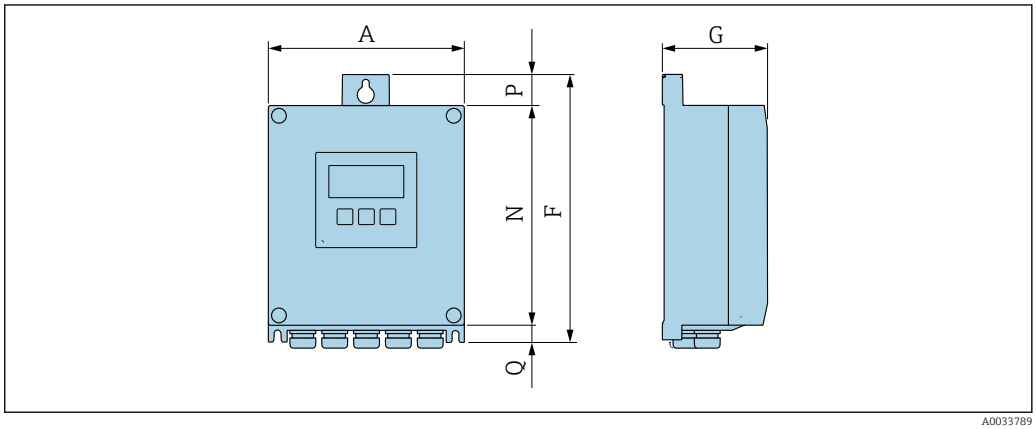
A [mm]	B [mm]	C [mm]	G [mm]
148	94	54	136

DN [mm]	D [mm]	E [mm]	F [mm]	L [1)] [mm]	d1 [mm]	d2 [mm]	e [2)] [mm]
50	56	228	284	100	142	53	44
80	71	240	311	100	142	78	56
100	84	253	337	100	167	102	84
150	114	279	393	100	224	154	146
200	141	303	444	120	278	203	180
250	169	329	498	120	343	254	180
300	195	354	549	120	393	305	180

1) Length tolerance for dimension L: 0/- 2 mm
2) Distance between the two antenna

Dimensions in US units

Transmitter housing



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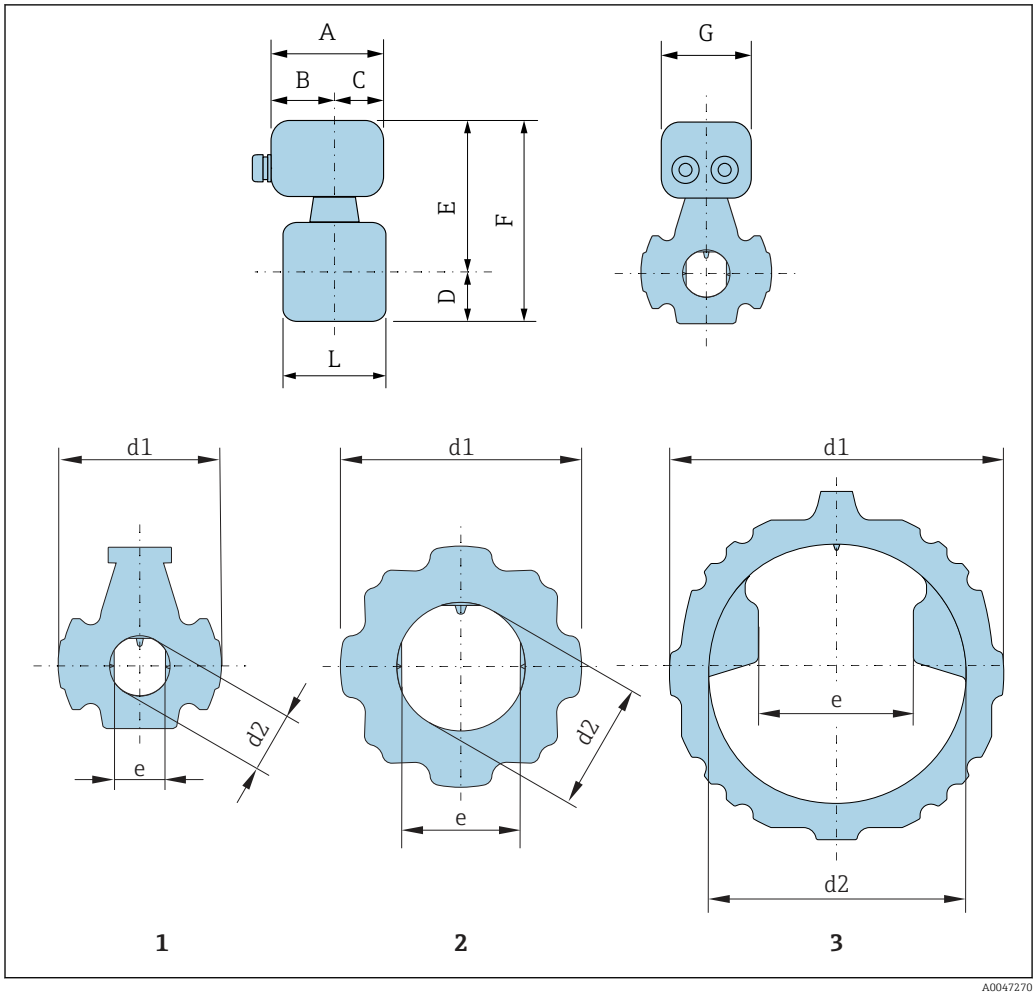
Order code for "Transmitter housing", option A "Aluminum, coated"

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"

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



1 Nominal diameter: NPS 2 in
2 Nominal diameter: NPS 3 to 8 in
3 Nominal diameter: NPS 10 to 12 in

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

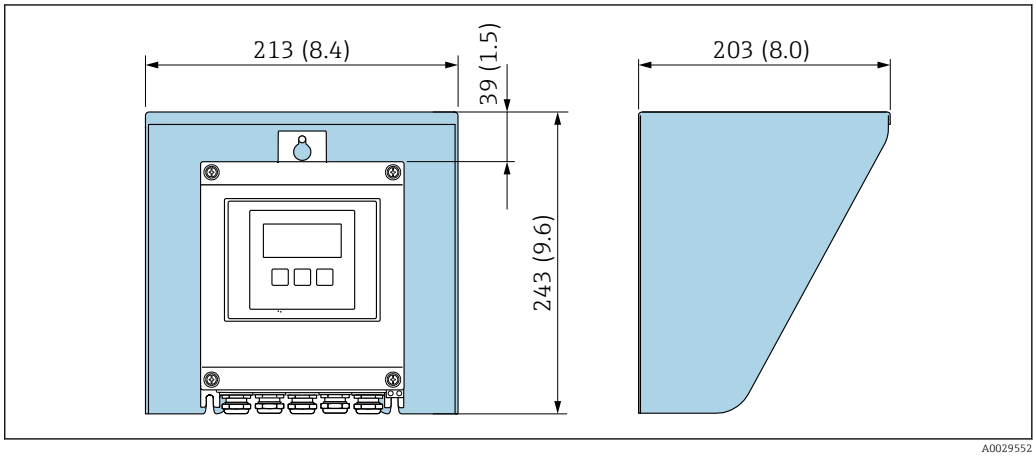
A [in]	B [in]	C [in]	G [in]
5.83	3.70	2.13	5.35

NPS [in]	D [in]	E [in]	F [in]	L [1)] [in]	d1 [in]	d2 [in]	e [2)] [in]
2	2.20	8.96	11.17	3.94	5.59	2.07	1.73
3	2.80	9.43	12.22	3.94	5.59	3.07	2.20
4	3.31	9.94	13.25	3.94	6.57	4.02	3.31
6	4.49	10.97	15.45	3.94	8.82	6.06	5.75
8	5.54	11.92	17.46	4.72	10.94	7.99	7.09
10	6.60	12.94	19.59	4.72	13.50	10.00	7.09
12	7.68	13.93	21.61	4.72	15.47	12.01	7.09

1) Length tolerance for dimension L: 0/- 0.08 in
2) Distance between the two antenna

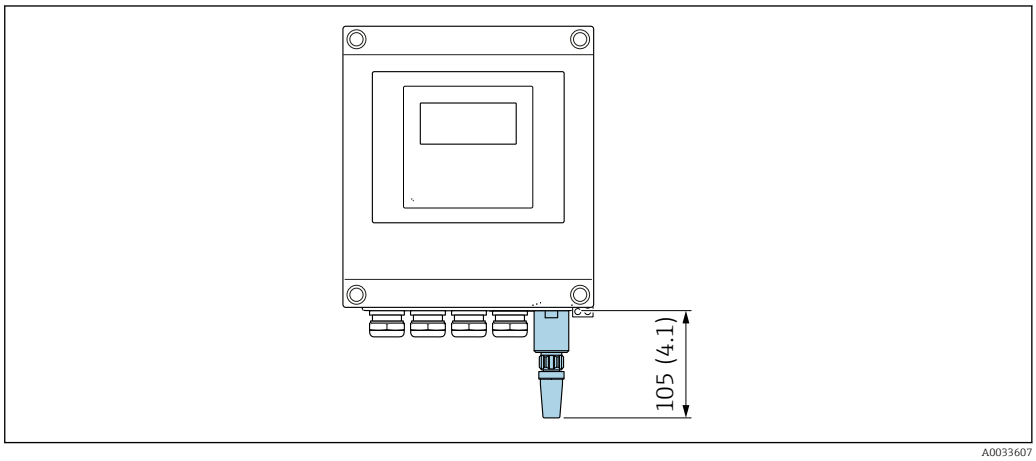
Accessories

Weather protection cover



18 *Protective cover for Proline 500; unit mm (in)*

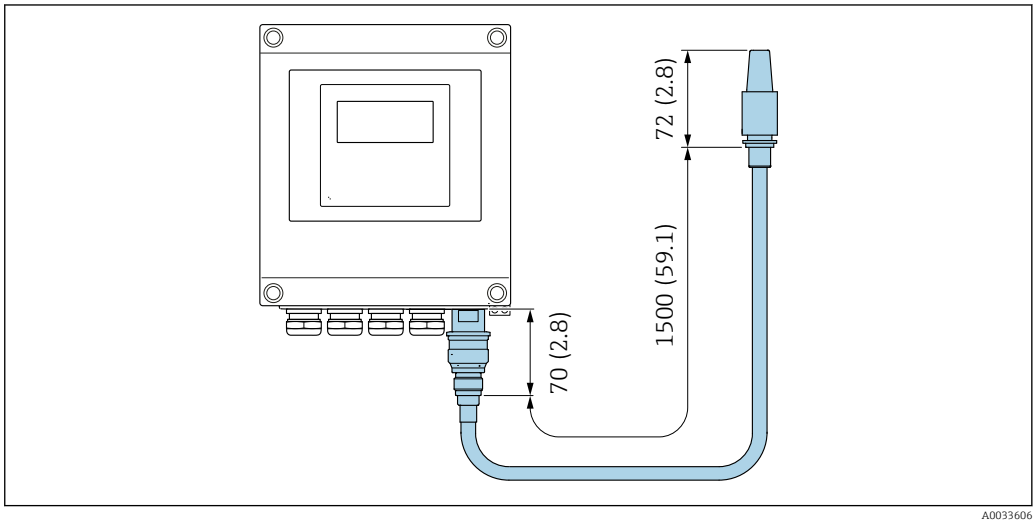
External WLAN antenna mounted on device



19 *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.



20 *Unit mm (in)*

Weight

All values: weight without packaging material

Transmitter

- Order code for "Transmitter housing", option A "Aluminum, coated": 2.45 kg (5.4 lb)
- Order code for "Transmitter housing", option D "Polycarbonate":1.4 kg (3.1 lb)

Connection housing and sensor

Nominal diameter		Weight
[mm]	[in]	
50	2	8.1 kg (17.8 lb)
80	3	8.4 kg (18.4 lb)
100	5	10.0 kg (22.0 lb)
150	6	14.5 kg (32.1 lb)
200	8	21.3 kg (47.0 lb)
250	10	30.2 kg (66.6 lb)
300	12	35.2 kg (77.6 lb)

Materials

Transmitter

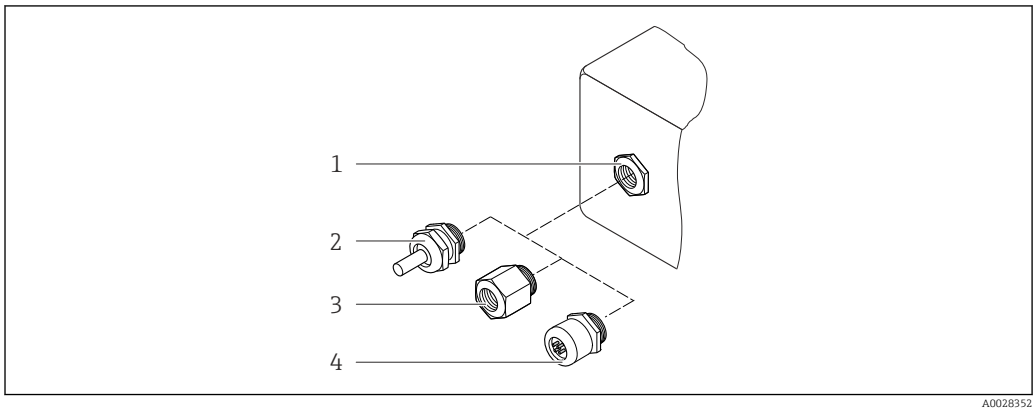
Housing

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

Cable entries/cable glands



21 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"
4 Device plug

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": ▪ Option A "Aluminum coated" ▪ Option L "Cast, stainless"	Nickel-plated brass
▪ 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 L "Cast, stainless" ▪ Order code for "Sensor connection housing": Option L "Cast, stainless"	Stainless steel, 1.4404 (316L)

Device plug

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

Connecting cable

PVC cable with copper shield

Sensor connection housing

Aluminum, AlSi10Mg, coated

Measuring pipe

Stainless steel: 1.4408 as per DIN EN 10213 (CF3M as per ASME A351)

Antennas

- Parts in contact with medium: ceramic
- Antenna bracket: stainless steel: 1.4435 (316L)

Temperature sensor

Stainless steel: 1.4435 (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 kit

For installing the sensor
- Screws/mounting bolts, nuts and washers: stainless steel, 1.4301/304, 1.4306/1.4307
- Gaskets: aramid fibers, with NBR binder

Pipe mounting

For mounting the transmitter on a pipe
- Screws, threaded bolts, washers, nuts: stainless steel, 1.4301/304, 1.4306/1.4307
- Metal plates: stainless steel, 1.4301 (304)

Display and user interface

Operation concept

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

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

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

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

Languages

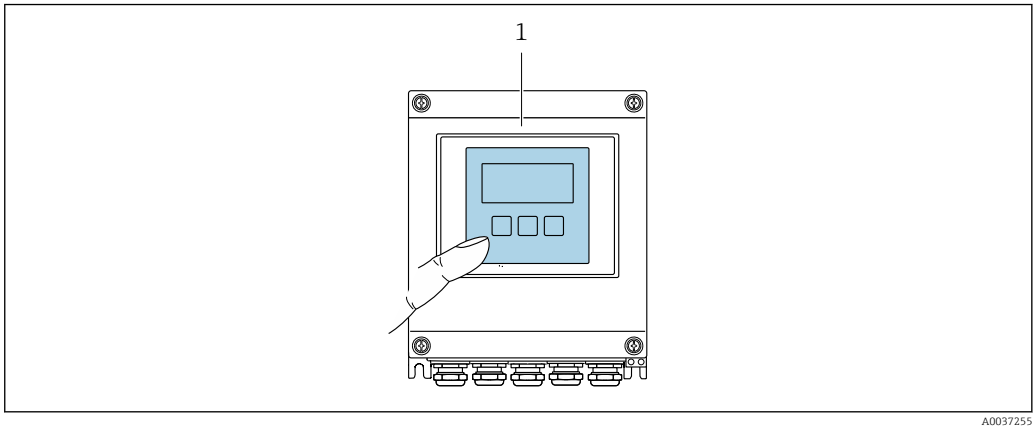
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Czech, Swedish
- Via web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish,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



22 *Operation with touch control*

Display elements

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

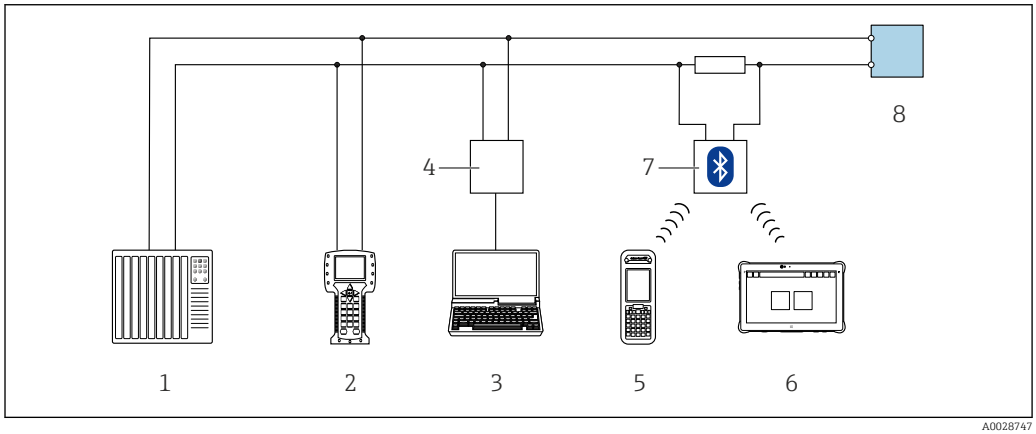
Operating elements

External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, Ⓔ

Remote operation

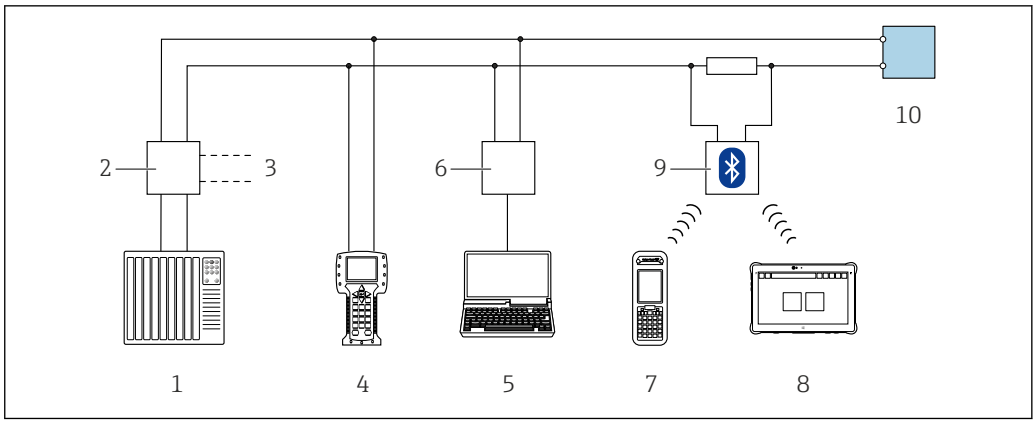
Via HART protocol

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



23 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

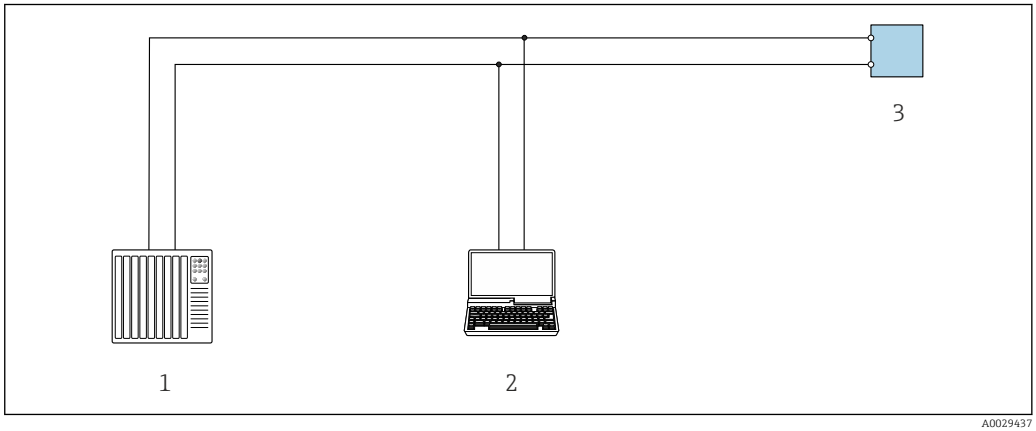


24 *Options for remote operation via HART protocol (passive)*

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.



25 *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

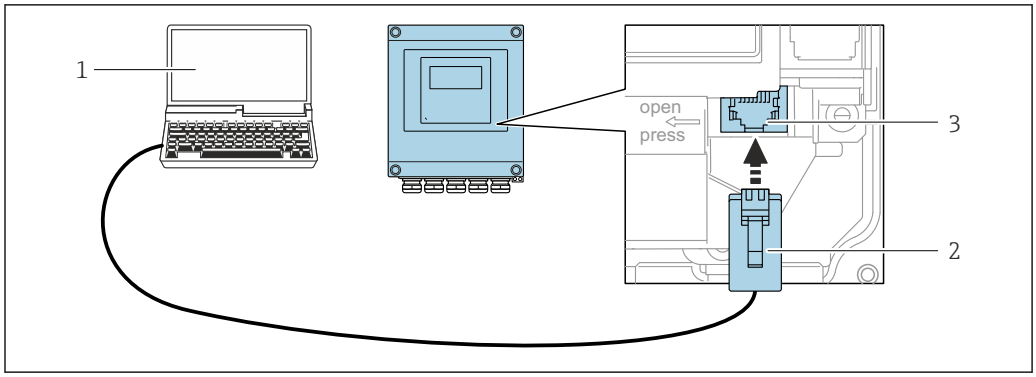
Via service interface (CDI-RJ45)

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

An adapter for the RJ45 to the M12 plug is optionally available:
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.

Transmitter

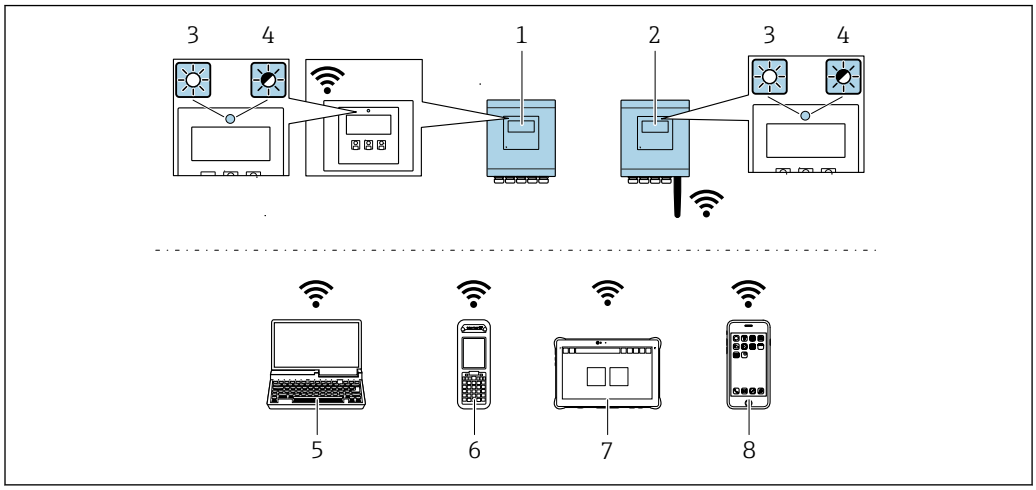


26 Connection via service interface (CDI-RJ45)

1 *Computer with web browser (e.g. Microsoft Edge) for accessing the integrated web server or with "FieldCare" operating tool, "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"



1 *Transmitter with integrated WLAN antenna*
2 *Transmitter with external WLAN antenna*
3 *LED lit constantly: WLAN reception is enabled on measuring device*
4 *LED flashing: WLAN connection established between operating unit and measuring device*
5 *Computer with WLAN interface and web browser (e.g. Microsoft Edge) for accessing the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare)*
6 *Field Xpert SFX350 or SFX370*
7 *Field Xpert SMT70*
8 *Smartphone or tablet with WLAN interface and web browser (e.g. Microsoft Edge) for accessing the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare)*

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 one antenna active in each case!
Range	▪ Internal antenna: typically 10 m (32 ft) ▪ External antenna: typically 50 m (164 ft)
Materials (external antenna)	▪ Antenna: ASA plastic (acrylonitrile-styrene-acrylic ester) 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 the device → 🖹 61
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	Service-specific accessories → 🖹 60 Sources for obtaining device descriptions www.endress.com → Download-Area
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	Service-specific accessories → 🖹 60 Sources for obtaining device descriptions www.endress.com → Download-Area

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

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

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

Web server

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

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN".

The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

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

HistoROM data management

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

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

Additional information on the data storage concept

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

	HistoROM backup	T-DAT	S-DAT
Available data	▪ Event logbook, e.g. diagnostic events ▪ Parameter data record backup ▪ Device firmware package	▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Indicator (minimum/maximum values) ▪ Totalizer value	▪ Sensor data: e.g. nominal diameter ▪ Serial number ▪ 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 1 000 measured values (up to 250 measured values per channel)
- User configurable recording interval
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

Certificates and approvals

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

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

CE mark

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

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

UKCA marking

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

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

RCM marking

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

Ex-approval

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

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

ATEX, IECEx

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

Ex ec

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

cCSAus

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

NI

Transmitter	Sensor
Class I Division 2 Groups A - D	

Ex ec

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

HART certification

HART interface

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

Modbus RS485 certification

The measuring device meets all the requirements of the MODBUS RS485 conformity test and has the "MODBUS RS485 Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.

Radio approval

The measuring device has radio approval.

For detailed information on the radio approval, see the Special Documentation → 61

Pressure Equipment Directive

Devices with pressure measuring device approval (Pressure Equipment Directive, PED Cat. I/II/III) are optionally available: order code for "Additional approval", option LK

Additional certification

Canadian Registration Number (CRN) approval

Devices with Canadian Registration Number (CRN) approval are optionally available: order code for "Additional approval", option LD.

Tests and certificates

- EN10204-3.1 Material certificate, wetted parts and sensor housing
- Pressure test, internal procedure, inspection certificate
- EN10204-2.1 Confirmation of compliance with the order and EN10204-2.2 test report

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- EN 61326-1/-2-3
  EMC requirements for electrical equipment for measurement, control and laboratory use
- ETSI EN 301 489-1/-17
  Guidelines for 2.4 GHz radio components
- IEC/EN 60068-2-6
  Environmental influences: Test procedure - Test Fc: vibration (sinusoidal)
- IEC/EN 60068-2-27
  Environmental influences: Test procedure - Test Ea: shocks
- IEC/EN 60068-2-64
  Environmental influences: Test Fh: vibration, broadband random (digital control)
- IEC/EN 60068-2-31
  Environmental influences: Test procedure - Test Ec: rough handling shocks, primarily for devices
- 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

Order information

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

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

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of 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.

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. → 61

The application package can also be ordered subsequently: order number DK4011.

Heartbeat Technology

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

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

For detailed information, see the Special Documentation for the device → 61

The application package can also be ordered subsequently: order number DK4011.

Accessories

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

Device-specific accessories

For the transmitter

Accessories	Description
Proline 500 – digital transmitter	Transmitter for replacement Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software Order code: 4X5BXX Installation instructions EA01xxxD
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". Further information on the WLAN interface Order number: 71351317 Installation Instructions EA01238D
Pipe mounting set	Pipe mounting set for transmitter. Order number: 71346427 Installation Instructions EA01195D
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Order number: 71343504 Installation Instructions EA01191D
Display guard	Is used to protect the display against impact or scoring, for example from sand in desert areas. Order number: 71228792 Installation Instructions EA01093D
Connecting cable 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 DK4012). The following cable lengths are available: order code for "Cable, sensor connection" ▪ Option B: 20 m (60 ft) ▪ Option E: User-configurable up to max. 50 m ▪ Option F: User-configurable up to max. 165 ft Maximum possible cable length for a Proline 500 connecting cable: 300 m (1000 ft)

For the sensor

Accessories	Description
Mounting kit	Consists of: ▪ Screws/mounting bolts ▪ Gaskets ▪ Washers ▪ Nuts Order number: DK4M

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 ▪ Graphic display of the calculation results ▪ Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator
Netilion	IIoT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem, Endress+Hauser enables you to optimize your plant's performance, digitize workflows, share knowledge and improve collaboration. Drawing on decades of experience in process automation, Endress+Hauser offers process industries an IIoT ecosystem that provides customers with data-driven insights. These insights can be used to optimize processes, thus leading to higher plant availability, efficiency and reliability - and ultimately to greater profitability. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S
Retrofit kit for display/WLAN	Retrofitting the device with a display or a display with WLAN The retrofit kit contains all the necessary parts. ▪ Order number: DKZ002 ▪ You must state the serial number of the device to be converted when placing the order.
Retrofit kit for inputs/outputs	▪ For subsequent switching of the functionality of inputs/outputs 2, 3 and 4 using a serial number-based license code ▪ For subsequent hardware expansion of empty slots for inputs/outputs 2, 3 and 4 using serial number-based license codes and hardware Order number: DKZ004

System components

Accessories	Description
Proline flowmeter Promag 400	To calculate the load rate, you need to know the volume flow of the medium. You can measure this value using a flowmeter, e.g. the Proline Promag W 400. The measured value can be read in as an input signal via the HART protocol or via the 4 to 20 mA current input from the Teqwave MW and used to calculate the load rate. The calculated load rate can be shown on the local display and output as an output signal. Technical Information Proline Promag W 400: TI01046D Order number Proline Promag W 400: 5W4C**-

Supplemental documentation

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

Standard documentation

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

Brief Operating Instructions

Brief Operating Instructions for the sensor

Sensor	Documentation code
Proline Teqwave MW	KA01671D

Brief Operating Instructions for the transmitter

Transmitter	Documentation code
Proline 500 HART	KA01315D
Proline 500 Modbus RS485	KA01319D

Operating instructions

Device	Documentation code
Proline Teqwave MW 500 HART	BA02322D
Proline Teqwave MW 500 Modbus RS485	BA02323D

Description of device parameters

Device	Documentation code
Proline Teqwave M 500 HART	GP01213D
Proline Teqwave M 500 Modbus RS485	GP01214D

Supplementary device-dependent documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX: II3G, IECEx: Zone 2	XA03187D
cCSAus: Class I Zone 2, Class I Division 2	XA03189D

Special documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
Heartbeat Verification application package (HART)	SD03170D
Heartbeat Verification application package (Modbus RS485)	SD03171D

Installation instructions

Contents	Note
Installation instructions for spare part sets and accessories	▪ Call up an overview of all available spare part sets available using *Device Viewer*: www.endress.com/deviceviewer ▪ Accessories available for order with Installation Instructions → 🖹 58

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