



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

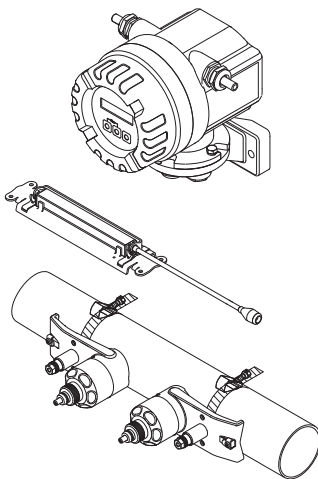


Solutions

## Brief Operating Instructions

# Proline Prosonic Flow 91W

## Ultrasonic flow measuring system



These Brief Operating Instructions are **not** intended to replace the Operating Instructions provided in the scope of supply. Detailed information is provided in the Operating Instructions and the additional documentation on the CD-ROM supplied.

The complete device documentation consists of:

- These Brief Operating Instructions
- Depending on the device version:
  - Operating Instructions and the Description of Device Functions
  - Approvals and safety certificates
  - Special safety instructions in accordance with the approvals for the device (e.g. explosion protection, pressure equipment directive etc.)
  - Additional device-specific information

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# 1 Safety instructions

## 1.1 Designated use




- The measuring device described in these Operating Instructions is to be used only for measuring the flow rate of liquids in closed pipes, e.g.:
  - Ultrapure water with low conductivity
  - water, wastewater etc.
- As well as measuring the volume flow, the sound velocity of the fluid is also always measured. Different fluids can be distinguished or the fluid quality can be monitored.
- Any use other than that described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damage caused by improper or non-designated use.

## 1.2 Installation, commissioning and operation

- The measuring device must only be installed, connected, commissioned and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in these Brief Operating Instructions, the applicable norms, legal regulations and certificates (depending on the application).
- The specialists must have read and understood these Brief Operating Instructions and must follow the instructions they contain. If you are unclear on anything in these Brief Operating Instructions, you must read the Operating Instructions (on the CD-ROM). The Operating Instructions provide detailed information on the measuring device.
- The measuring device may only be modified if such work is expressly permitted in the Operating Instructions (on the CD-ROM).
- Repairs may only be performed if a genuine spare parts kit is available and this repair work is expressly permitted.
- If performing welding work on the piping, the welding unit may not be grounded by means of the measuring device.

## 1.3 Operational safety

- The measuring device is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. Relevant regulations and standards have been observed.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.
- The information on the warning notices, nameplates and connection diagrams affixed to the device must be observed. These contain important data on the permitted operating conditions, the range of application of the device and information on the materials used.
- If the device is not used at atmospheric temperatures, compliance with the relevant marginal conditions as specified in the device documentation supplied (on CD-ROM) is mandatory.
- Observe the technical data on the nameplate.

- The device must be wired as specified in the wiring and connection diagrams. Interconnections must be permitted.
- All parts of the device must be included in the potential equalization of the system.
- Cables, certified cable glands and certified dummy plugs must be suitable to withstand the prevailing operating conditions, (ambient temperature range, process conditions). Housing apertures that are not used must be sealed with certified dummy plugs.
- When hot fluids pass through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- Hazardous areas  
Measuring devices for use in hazardous areas are labeled accordingly on the nameplate. Relevant national regulations must be observed when operating the device in hazardous areas. The Ex documentation on the CD-ROM is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed. The symbol on the front page provides information on the approval and certification body ( Europe,  USA,  Canada). The nameplate also bears the documentation number of this Ex documentation (XA\*\*\*D/..../..).
- Endress+Hauser will be happy to assist in clarifying any questions on approvals, their application and implementation.

## 1.4 Safety conventions



### Warning!

“Warning” indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.



### Caution!

“Caution” indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.



### Note!

“Note” indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

## 2 Installation

### 2.1 Installation conditions

#### 2.1.1 Dimensions

For the dimensions of the measuring device, see the associated Technical Information on the CD-ROM.

#### Mounting location

Correct flow measurement is possible only if the pipe is full. Entrained air or gas forming in the pipe can result in an increase in measuring errors. For this reason avoid the following mounting locations in the pipe:

- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.

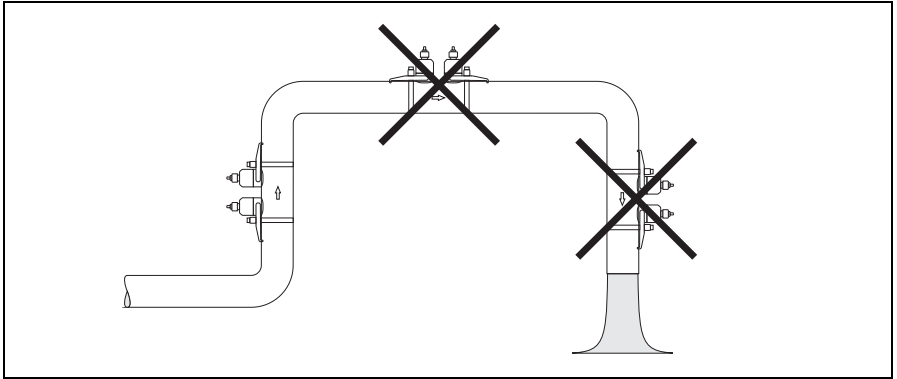


Fig. 1: Mounting location

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#### Down pipes

Notwithstanding the above, the installation proposal below permits installation in an open down pipe. Pipe restrictions or the use of an orifice plate with a smaller cross-section than the nominal diameter prevent the pipe from running empty while measurement is in progress.

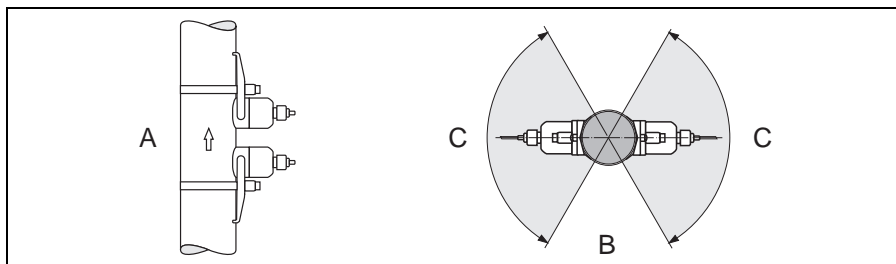
#### Orientation

##### Vertical

Recommended orientation with upward direction of flow (View A). With this orientation, entrained solids will sink and gases will rise away from the sensor when the fluid is stagnant. The piping can be completely drained and protected against solids buildup.

### Horizontal

In the recommended installation range in a horizontal installation position (View B), gas and air collections at the pipe cover and problematic deposits at the bottom of the pipe have a smaller influence on measurement.



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Fig. 2: Orientation

- A Recommended orientation with upward direction of flow
- B Recommended installation range with horizontal orientation
- C Recommended installation range max. 120°

## Inlet and outlet runs

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc. If several flow obstructions are installed, the longest inlet or outlet run must be considered. Compliance with the following inlet and outlet runs is recommended in order to ensure measuring accuracy.

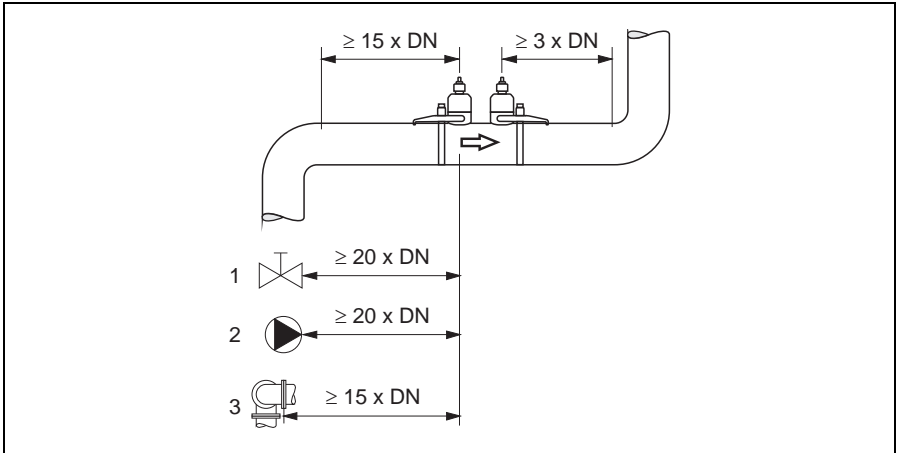


Fig. 3: Ein- und Auslaufstrecken (Draufsicht)

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- 1 Valve (2/3 open)
- 2 Pump
- 3 Two pipe bends in different directions

## 2.2 Preparatory steps prior to installation

Depending on the conditions specific to the measuring point (e.g. Clamp On, number of traverses, fluid etc.), a number of preparatory steps have to be taken before actually installing the sensors:

1. Using the conditions specific to the measuring point, determine which installation distances are necessary for installation.
2. Determine the values for the requisite installation distances.  
A number of methods are available for determining the values:
  - Local operation of the device
  - FieldCare (operating program) → procedure explained in the Operating Instructions on the CD-ROM
  - Applicator (software) → procedure explained in the Operating Instructions on the CD-ROM
3. Mechanical preparation of the "Clamp On" holders for the sensors:
  - Premount the strapping bands (DN 50 to 200 / 2 to 8") or (DN 250 to 4000 / 10 to 160")

### 2.3 Determining the necessary installation distances

The installation distances that are necessary for installation depend on:

- Insertion version: Clamp On with strapping band, installation in pipe
- Number of traverses or single-path/dual-path version

DN 50 to 4000 (2 to 160")	
Clamp On (Strapping band)	
1 traverse	2 traverses
SENSOR DISTANCE	SENSOR DISTANCE
WIRE LENGTH	POSITION SENSOR

### 2.4 Mounting the transmitter

The transmitter can be mounted in the following ways:

- Wall mounting
- Pipe mounting (with separate mounting kit)

☞ Caution!

- The ambient temperature range (-25 to +60 °C / -13 to +140 °F) may not be exceeded at the mounting location. Avoid direct sunlight.
- If a warm pipe is used for the installation, ensure that the housing temperature does not exceed the max. permitted value of +60 °C (+140 °F).

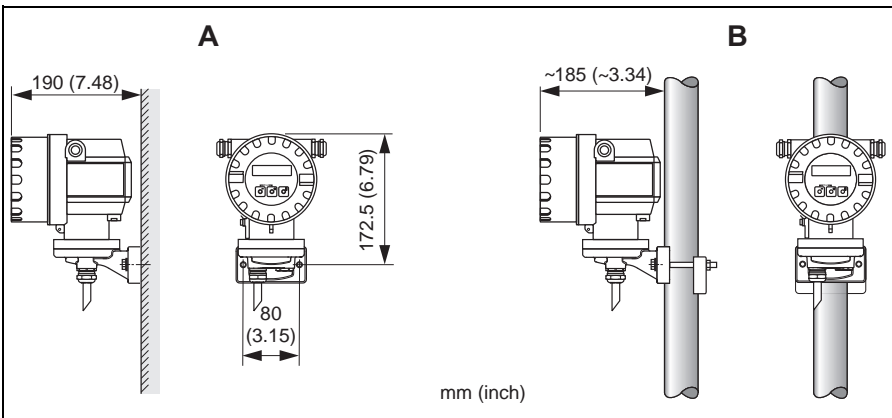


Fig. 4: Mounting the transmitter

A = Direct wall mounting, B = Pipe mounting

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## 2.5 Connecting the power supply



### Warning!

Risk of electric shock. Components carry dangerous voltages.

- Never mount or wire the measuring device while it is connected to the power supply.
- Before connecting the power supply, check the safety equipment.
- Route the power supply cable so that it is seated securely.
- Seal the cable entries and covers tight.
- When wiring Ex-certified measuring devices, all the safety instructions, wiring diagrams, technical information etc. of the related Ex documentation must be observed  
→ Ex documentation on the CD-ROM.



### Caution!

Risk of damaging the electronic components!

Connect the power supply in accordance with the connection data on the nameplate.

## 2.6 Mechanical preparation

The way in which the sensors are secured differs on account of the pipe nominal diameter and the sensor type. Depending on the type of sensor, users also have the option of securing the sensors with strapping bands or screws such that they can be later removed, or permanently fixing the sensors in place with welded bolts or welded retainers.

Overview of possible ways to secure the various sensors:

Prosonic Flow	Measuring range	Pipe nominal diameter	Secured by
91W	DN 15 to 65 (½ to 2½")	DN ≤ 32 (1¼")	Sensor holder with U-shaped screws (small nominal diameters) →  9
		DN > 32 (1¼")	Sensor holder with strapping bands (small nominal diameters) →  10
91W	DN 50 to 4000 (2 to 160")	DN ≤ 200 (8")	Strapping bands (medium nominal diameters) →  10
			Welded bolts →  8
		DN > 200 (8")	Strapping bands (large nominal diameters) →  13
			Welded bolts →  8

### 2.6.1 Mounting the sensor holder with U-shaped screws (small nominal diameters)

For mounting on a pipe with a nominal diameter of DN ≤ 32 (1¼")

Sensors: Prosonic Flow (DN 15 to 65 / ½ to 2½")

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the pipe.
3. Put the U-shaped screws through the sensor holder and slightly lubricate the thread.
4. Screw nuts onto the U-shaped screws.
5. Set the holder to the exact position and tighten the nuts evenly.

 **Warning!**

Risk of damaging plastic or glass pipes if the nuts of the U-shaped screws are tightened too much! The use of a metal half-shell is recommended (on the opposite side of the sensor) when working with plastic or glass pipes.

- The visible pipe surface "A" must be smooth to ensure good acoustic contact.

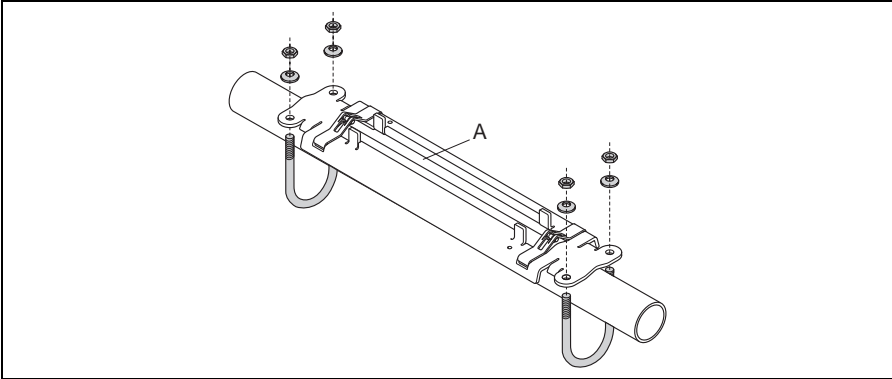


Fig. 5: Mounting the Prosonic Flow-sensor holder (DN 15 to 65 / ½ to 2½") with U-shaped screws

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### 2.6.2 Mounting the sensor holder with strapping bands (small nominal diameters)

For mounting on a pipe with a nominal diameter of DN > 32 (1¼")

For sensor (DN 15 to 65 / ½ to 2½")

- Disconnect the sensor from the sensor holder.
- Position the sensor holder on the pipe.
- Wrap the strapping bands around the sensor holder and pipe without twisting them.
- Guide the strapping bands through the strapping band locks (strapping screw is pushed up).
- Tighten the strapping bands as tight as possible by hand.
- Set the sensor holder to the correct position.
- Push down the strapping screw and tighten the strapping bands so that they cannot slip.
- Where necessary, shorten the strapping bands and trim the cut edges.

 **Warning!**

Risk of injury. To avoid sharp edges, trim the cut edges after shortening the strapping bands.

- The visible pipe surface "A" must be smooth to ensure good acoustic contact.

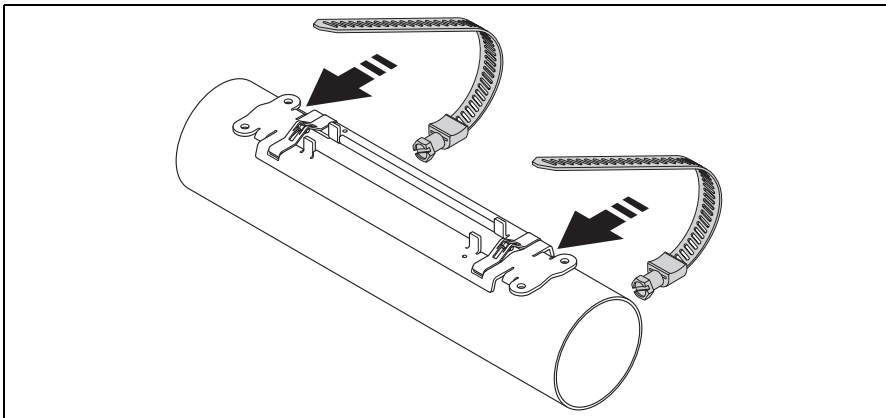


Fig. 6: Positioning the sensor holder and mounting the strapping bands

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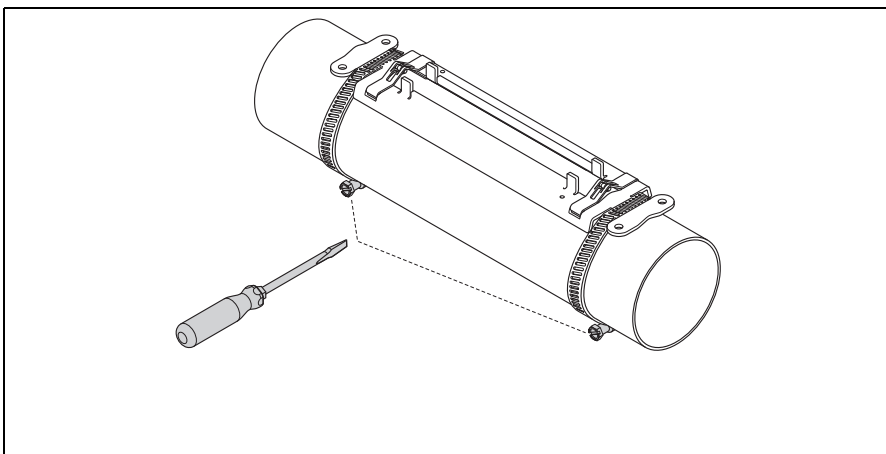


Fig. 7: Tightening the strapping screws of the strapping bands

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### 2.6.3 Premounting the strapping bands (medium nominal diameters)

When mounting on a pipe with a nominal diameter of  $DN \leq 200$  (8")

For sensor ( $DN 50$  to  $4000 / 2$  to  $160$ ")

#### First strapping band

1. Fit the mounting bolt over the strapping band.
2. Wrap the strapping band around the pipe without twisting it.
3. Guide the end of the strapping band through the strapping band lock (strapping screw is pushed up).
4. Tighten the strapping band as tight as possible by hand.
5. Set the strapping band to the desired position.
6. Push down the strapping screw and tighten the strapping band so that it cannot slip.

#### Second strapping band

7. Proceed as for the first strapping band (steps 1 to 7). Only slightly tighten the second strapping band for final mounting. It must be possible to move the strapping band for final alignment.

#### Both strapping bands

8. Where necessary, shorten the strapping bands and trim the cut edges.

 **Warning!**

Risk of injury. To avoid sharp edges, trim the cut edges after shortening the strapping bands.

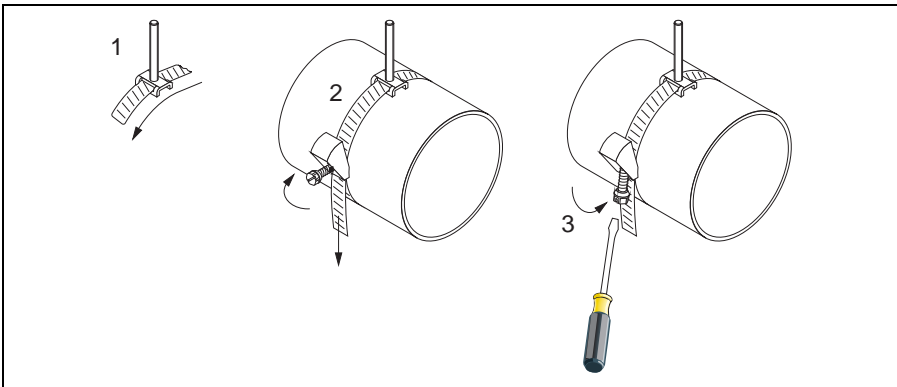


Fig. 8: Premounting strapping bands for pipe diameters  $DN \leq 200$  (8")

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1) Mounting bolt    2) Strapping band    3) Strapping screw

### 2.6.4 Premounting the strapping bands (large nominal diameters)

When mounting on a pipe with a nominal diameter in the range of DN > 600 (24")  
 For sensor (DN 50 to 4000 / 2 to 160")

1. Measure the pipe circumference.
2. Shorten the strapping bands to one length (pipe circumference + 32 cm (12.6 in)) and trim the cut edges.

 **Warning!**

Risk of injury. To avoid sharp edges, trim the cut edges after shortening the strapping bands.

#### *First strapping band*

3. Fit the mounting bolt over the strapping band.
4. Wrap the strapping band around the pipe without twisting it.
5. Guide the end of the strapping band through the strapping band lock (strapping screw is pushed up).
6. Tighten the strapping band as tight as possible by hand.
7. Set the strapping band to the desired position.
8. Push down the strapping screw and tighten the strapping band so that it cannot slip.

#### *Second strapping band*

9. Proceed as for the first strapping band (steps 3 to 8). Only slightly tighten the second strapping band for final mounting. It must be possible to move the strapping band for final alignment.

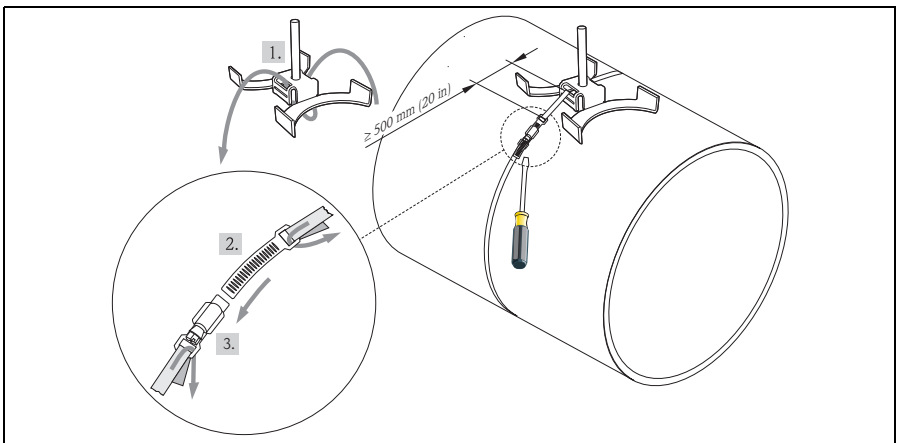


Fig. 9: Premounting strapping bands for pipe diameters DN > 600 (24")

1) Mounting bolt with guide\*      2) Strapping band\*      3) Strapping screw

\* Distance between mounting bolt and strapping band lock min 500 mm (20 in)

## 2.7 Installing Prosonic Flow W sensor

### 2.7.1 Installing Prosonic Flow W (DN 15 to 65 / ½ to 2½")

#### Prerequisites

- The installation distance (sensor distance) is known → 8.
- The sensor holder is already mounted → 9.

#### Material

The following material is needed for mounting:

- Sensor incl. adapter cable
- Connecting cable for connecting to the transmitter
- Coupling fluid for an acoustic connection between the sensor and pipe

#### Procedure

1. Set the distance between the sensors as per the value determined for the sensor distance. Press the sensor down slightly to move it.

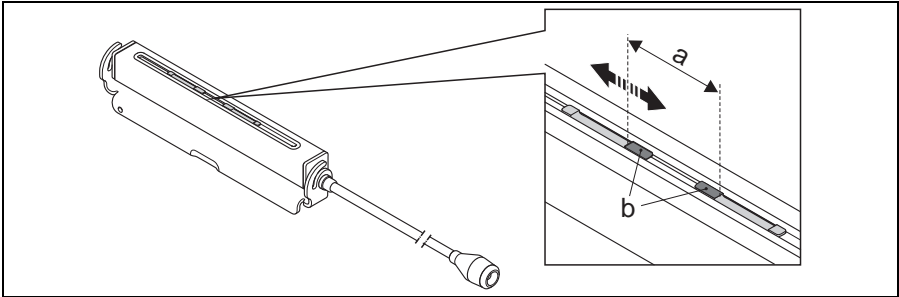


Fig. 10: Setting the distance between the sensors as per the value for the sensor distance

a) Sensor distance      b) Contact surface of the sensor

2. Coat the contact surfaces of the sensors with an even layer of coupling fluid (approx. 0.5 to 1 mm / 0.02 to 0.04 inch) thick.
3. Fit the sensor housing on the sensor holder.

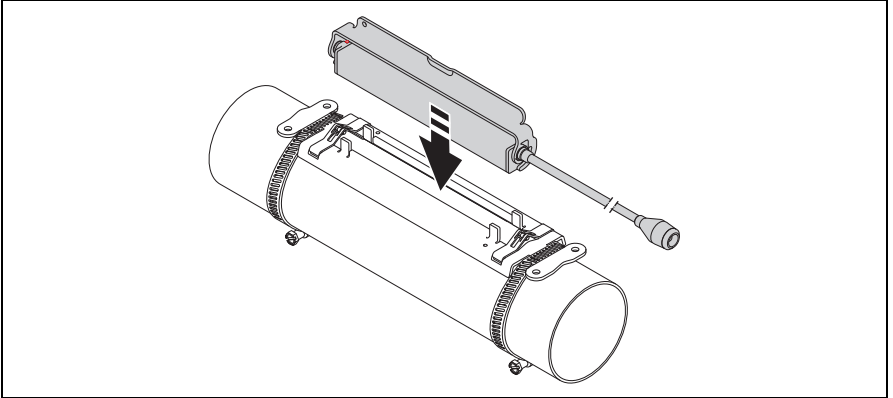


Fig. 11: Fitting the sensor housing

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4. Fix the sensor housing with the bracket.

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- If necessary, the holder and sensor housing can be secured with a screw/nut or a lead-seal (not part of the scope of supply).
- The bracket can only be released using an auxiliary tool.

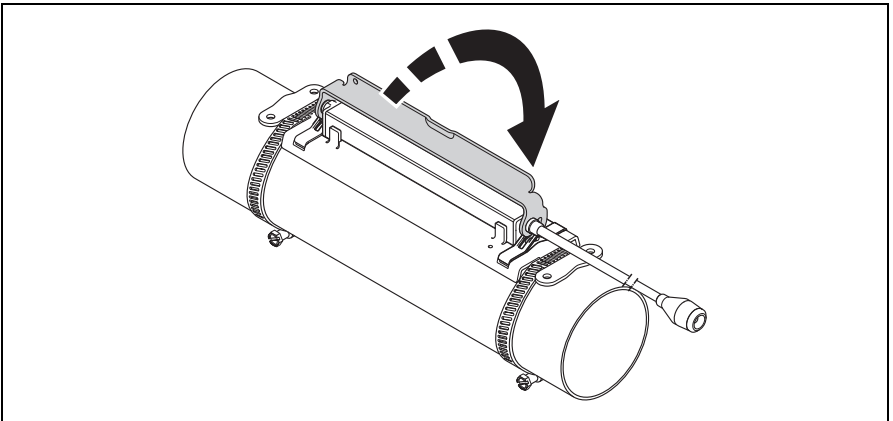



Fig. 12: Fixing the sensor housing

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5. Connect the connecting cable to the adapter cable.

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables →  23.

## 2.7.2 Installing Prosonic Flow W (DN 50 to 400 0 / 2" to 160")

### Installation for measurement via one traverse (DN 600 to 2000 / 24" to 80")

#### Prerequisites

- The installation distances (sensor distance and wire length) are known → 8.
- The strapping bands are already mounted → 10.

#### Material

The following material is needed for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 10)
- Two measuring wires, each with a cable lug and a fixer to position the strapping bands
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

#### Procedure

1. Prepare the two measuring wires:
  - Arrange the cable lugs and fixer such that the distance they are apart corresponds to the wire length (SL).
  - Screw the fixer onto the measuring wire.

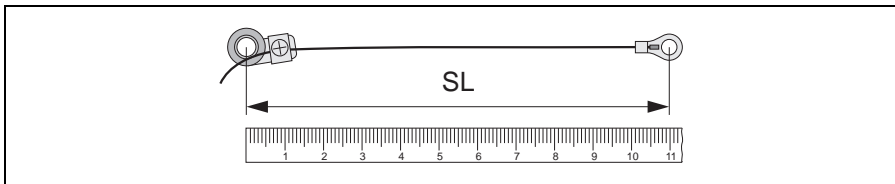


Fig. 13: Fixer (a) and cable lugs (b) at a distance that corresponds to the wire length (SL)

2. With the first measuring wire:
  - Fit the fixer over the mounting bolt of the strapping band that is already securely mounted.
  - Run the measuring wire **clockwise** around the pipe.
  - Fit the cable lug over the mounting bolt of the strapping band that can still be moved.
3. With the second measuring wire:
  - Fit the cable lug over the mounting bolt of the strapping band that is already securely mounted.
  - Run the measuring wire **counterclockwise** around the pipe.
  - Fit the fixer over the mounting bolt of the strapping band that can still be moved.



4. Take the still movable strapping band, incl. the mounting bolt, and move it until both measuring wires are evenly tensioned and tighten the strapping band so that it cannot slip.

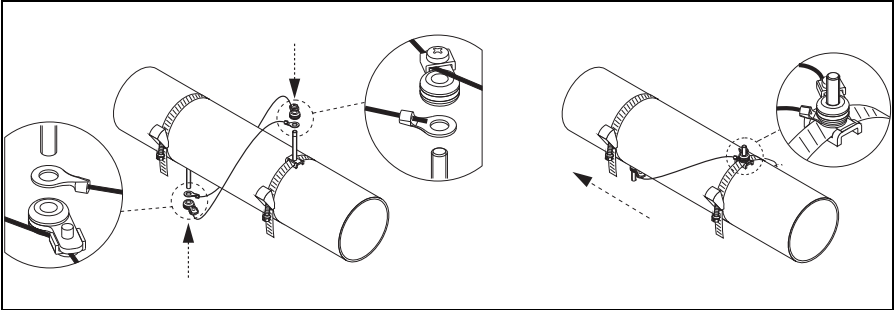


Fig. 14: Positioning the strapping bands (steps 2 to 4)

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5. Loosen the screws of the fixers on the measuring wires and remove the measuring wires from the mounting bolt.
6. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.

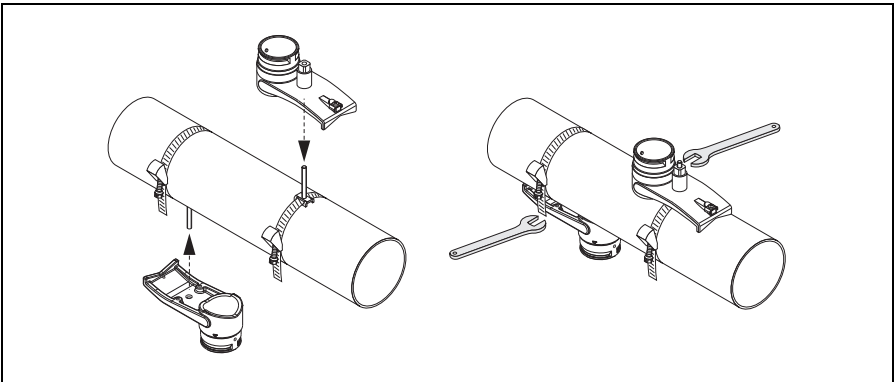
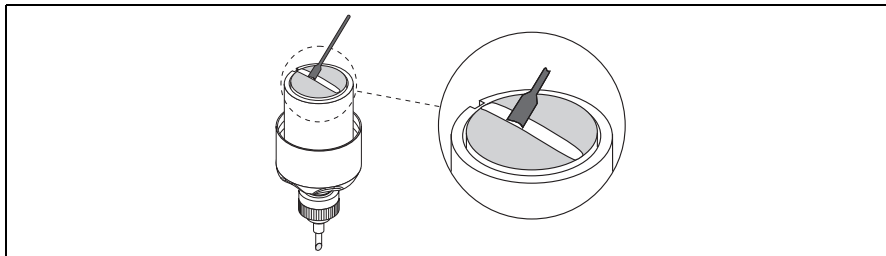


Fig. 15: Mounting the sensor holders

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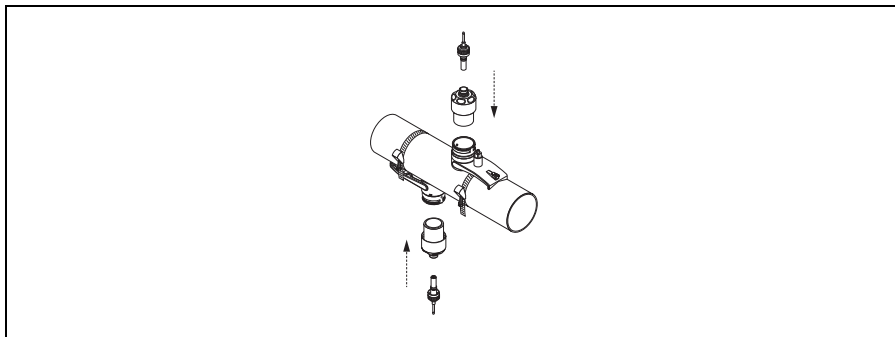
7. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04 inch) thick, going from the groove through the center to the opposite edge.



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Fig. 16: Coating the contact surfaces of the sensor with coupling fluid

8. Insert the sensor into the sensor holder.
9. Fit the sensor cover on the sensor holder and turn until:
  - The sensor cover engages with a click
  - The arrows (▲ / ▼ "close") are pointing towards one another.
10. Screw the connecting cable into the individual sensor.



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Fig. 17: Mounting the sensor and connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 9.

## *Installation for measurement via two traverses (DN 50 to 600 /2" to 24")*

### *Prerequisites*

- The installation distance (position sensor) is known → 8.
- The strapping bands are already mounted → 10.

### *Material*

The following material is needed for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 10)
- A mounting rail to position the strapping bands
- Two mounting rail retainers
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

### *Mounting rail and POSITION SENSOR installation distance*

The mounting rail has two rows with bores. The bores in one of the rows are indicated by letters and the bores in the other row are indicated by numerical values. The value determined for the POSITION SENSOR installation distance is made up of a letter and a numerical value.

The bores that are identified by the specific letter and numerical value are used to position the strapping bands.

### *Procedure*

1. Position the strapping bands with the aid of the mounting rail.
  - Slide the mounting rail with the bore identified by the letter from POSITION SENSOR over the mounting bolt of the strapping band that is permanently fixed in place.
  - Position the movable strapping band and slide the mounting rail with the bore identified by the numerical value from POSITION SENSOR over the mounting bolt.

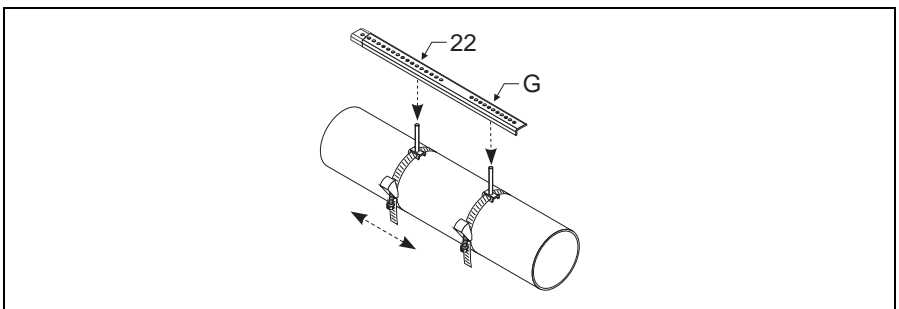
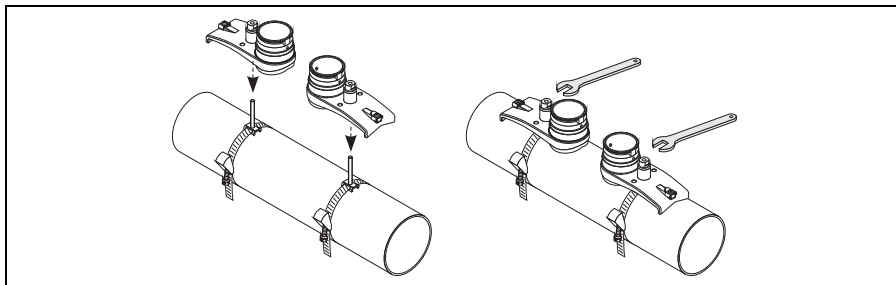


Fig. 18: Determining the distance in accordance with the mounting rail (e.g. POSITION SENSOR G22)

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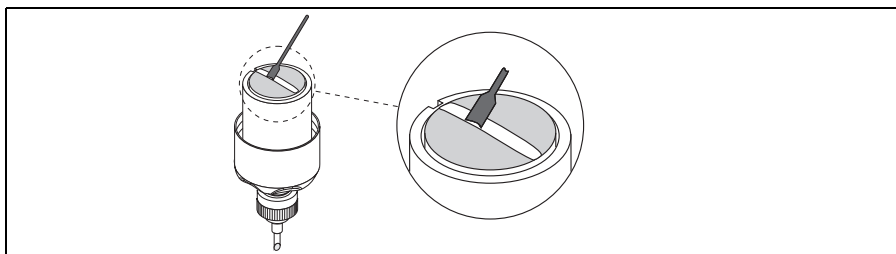
2. Tighten the strapping band so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.



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Fig. 19: Mounting the sensor

5. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.



A0011373

Fig. 20: Coating the contact surfaces of the sensor with coupling fluid

6. Insert the sensor into the sensor holder.
7. Fit the sensor cover on the sensor holder and turn until:
  - The sensor cover engages with a click
  - The arrows (▲ / ▼ "close") are pointing towards one another.
8. Screw the connecting cable into the individual sensor.

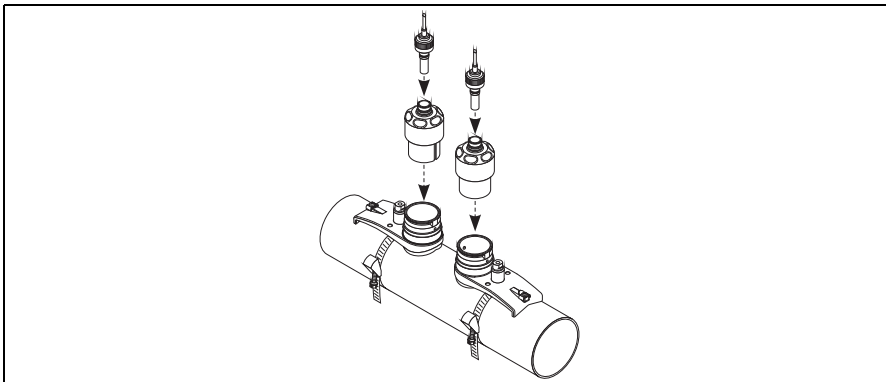


Fig. 21: Connecting the connecting cable

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This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → [23](#).

## 2.8 Post-installation check

- Are cables or the device damaged (visual inspection)?
- Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, minimum fluid conductivity, measuring range, etc.?
- Are the measuring point number and labeling correct (visual inspection)?
- Have the inlet and outlet runs been observed?
- Is the measuring device protected against moisture and direct sunlight?

## 3 Hardware and software settings

Diverse hardware and software settings are possible or necessary (e.g. device address configuration) for measuring devices with PROFIBUS DP or FOUNDATION Fieldbus type of communication. For a description of the possible settings and the exact procedure that applies for the different types of communication, see the associated Operating Instructions on the CD.

## 4 Wiring


### Warning!

Risk of electric shock. Components carry dangerous voltages.

- Never mount or wire the measuring device while it is connected to the power supply.
- Before connecting the power supply, check the safety equipment.
- Route the power supply and signal cables so they are securely seated.
- Seal the cable entries and covers tight.

### Caution!

Risk of damaging the electronic components!

- Connect the power supply (takes place at a later stage →  27)
- Connect the signal cable in accordance with the connection data in the Operating Instructions or the Ex documentation on the CD-ROM.

### **In addition, for measuring devices with fieldbus communication:**

### Caution!

Risk of damaging the electronic components!

- Observe the cable specification of the fieldbus cable → Operating Instructions on the CD-ROM.
- Keep the stripped and twisted lengths of cable shield as short as possible.
- Screen and ground the signal lines → Operating Instructions on the CD-ROM.
- When using in systems without potential equalization → Operating Instructions on the CD-ROM.

### **In addition, for Ex-certified measuring devices:**

### Warning!

When wiring Ex-certified measuring devices, all the safety instructions, wiring diagrams, technical information, etc. of the related Ex documentation must be observed  
→ Ex documentation on the CD-ROM.

## 4.1 Sensor/transmitter connecting cable



Warning!

- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the terminal on the housing before the power supply is applied.



Note!

To ensure correct measuring results, route the cable well clear of electrical machines and switching elements.



Note!

There is a wiring procedure for the sensor DN50–DN4000 and DN15 to 65 respectively. Cable and cable entry are distinct different for the two sensor connection types.

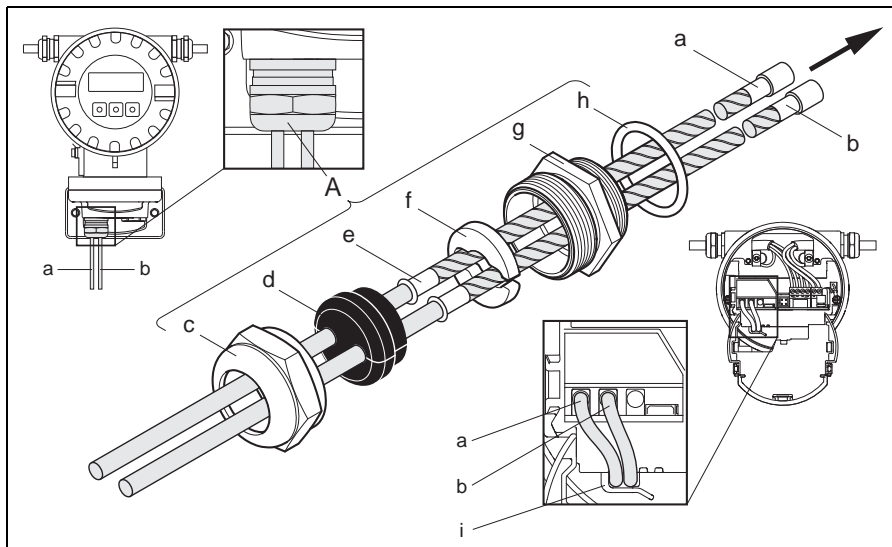
### 4.1.1 Procedure



Note!

The outer shield of the sensor connecting cable (triaxial cable) is grounded by a ground disk in the cable feedthrough (A). This grounding is absolutely essential to ensure correct measurement.

1. Unscrew the cover (c) of the cable gland (A). Remove the rubber seal (d).
2. Guide the sensor connecting cables (a, b) through the cover of the cable gland.
3. Guide the sensor connecting cables individually through the ground disk in the cable gland holder (g) and into the connection compartment.
4. Plug in the connectors of the sensor connecting cables.  
Left sensor upstream (a), right sensor downstream (b).  
The connector engages with a click when correctly plugged in.
5. Spread the rubber seal (d) along side slits (e.g. using a screwdriver) and fix the cables in place appropriately. Push up the rubber seal in the cable gland until the sensor cable sleeves are pressed against the ground disk.
6. Close the cover of the cable gland (c) so that it is tight.
7. In the connection compartment, fix the two sensor connecting cables in place in the holder (i) provided.



A0005843

Fig. 22: Connecting the measuring system with two single core connection cables

- a, b* Sensor connecting cables
- c* Cable gland cover
- d* Rubber seal
- e* Cable fixing sleeves
- f* Ground disk
- g* Cable gland holder
- h* Seal
- i* Cable holder

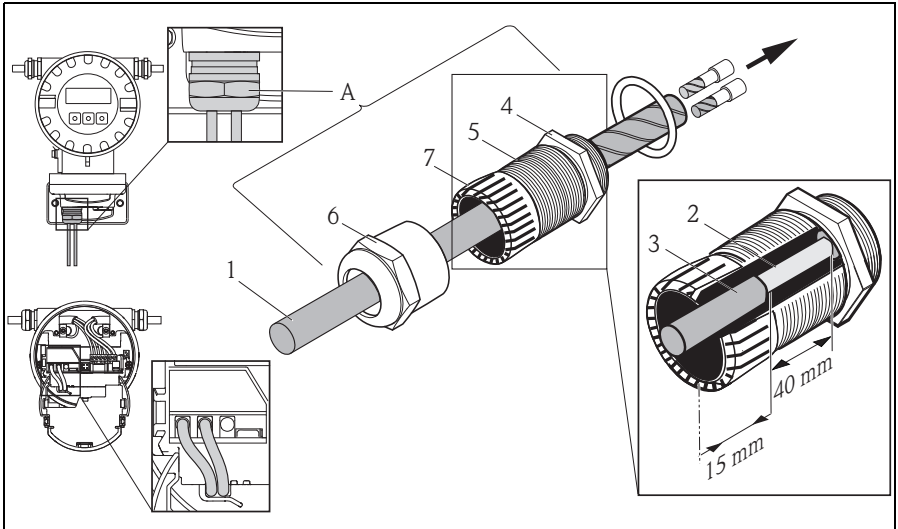


### 4.1.2 Connecting and Grounding Prosonic Flow W DN (1/2 to 2 1/2") Multicore cable



Note!

The Prosonic Flow W DN 15 to 65 (1/2 to 2 1/2") is grounded via the cable gland.




A0015587


Fig. 23: Connecting and grounding the measuring system (DN15 to 65)

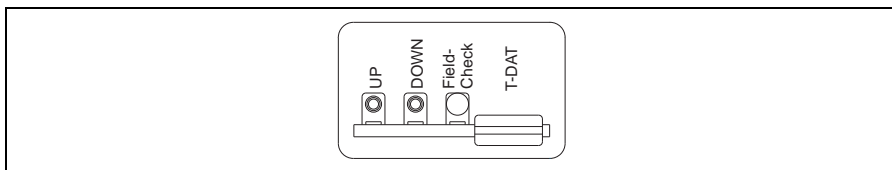
- 1 Cable sheath
- 2 Bared braided screen (pre-prepared)
- 3 Rubber grommet
- 4 Internal contact point for the grounding on this level (External inspection not possible)
- 5 Cable gland
- 6 Cable gland cover
- 7 Grounding mechanism

#### Procedure

1. Screw the cable gland (5) into the transmitter housing.
2. Guide the sensor connecting cables through the cable gland cover (6).
3. Thread the sensor connecting cables into the transmitter housing. Align the outer end of the rubber grommet (3) with the end of the cable gland (5) /grounding mechanism (7). This ensures that the cable entry will be a) tight and b) the cable is correctly grounded to the transmitter housing at the internal contact point (4) once tightened. An external inspection is not possible, so it is important to follow this instruction.
4. Tighten the cable gland cover (6) clockwise.

 **Note!**  
The red marked cable is sensor "up"; the blue marked cable is sensor "down".

 **Note!**  
The cable gland can be released from the cable by unscrewing and removing the cable gland cover. Then retract the grounding mechanism (7) with pair of pliers. The retraction of the mechanism does not require strong force (strong force might destroy the screen). It might be required to lift the internal hooks of the grounding mechanism out of a locked position by pressing the grounding mechanism further forward by turning the cable gland clockwise. Remove the cable gland cover again. Then retry to retract with the pair of pliers.



A0005875

Fig. 24: Connecting nameplate for sensor connecting cables (on circuit board (transmitter))

#### 4.1.3 Cable specification for connecting cable

Only use the connecting cables supplied by Endress+Hauser.

##### *Operation in areas with strong electrical interference*

The measuring system complies with the general safety requirements in accordance with EN 61010, the EMC requirements of IEC/EN 61326 "Emission as per Class A requirements" and NAMUR Recommendation NE 21.



## 4.2 Connecting the transmitter

Wire the unit using the terminal assignment diagram inside the cover.



### Warning!

- Risk of electric shock.  
Switch off the power supply before opening the device. **Do not** install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock.  
Connect the protective earth to the ground connection on the housing before the power supply is applied.
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.
- The transmitter must be included in the general circuit protection system.

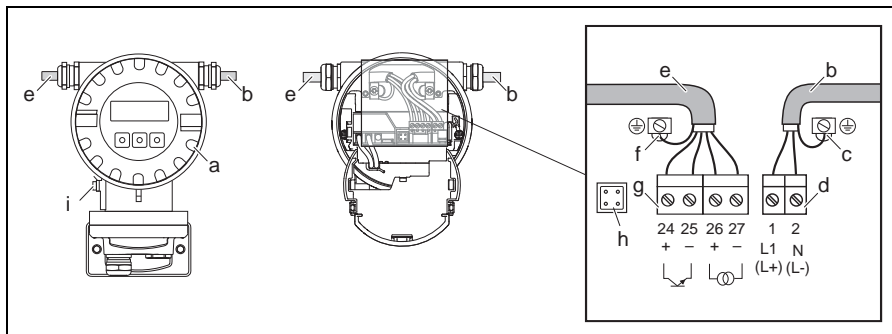
1. Unscrew cover of the electronics compartment from the transmitter housing.
2. Press the side latches and flip down the cover of the connection compartment.
3. Feed the cable for the power supply and the signal cable through the appropriate cable entries.
4. Remove the terminal connectors from the transmitter housing and connect the cable for the power supply and the signal cable:
  - Wiring diagram →  25
  - Terminal assignment →  28
5. Plug the terminal connectors back into the transmitter housing.



### Note!

The connectors are coded so you cannot mix them up.

6. Secure the ground cable to the ground terminal.
7. Flip up the cover of the connection compartment.
8. Screw the cover of the electronics compartment firmly onto the transmitter housing.



A0005836

Fig. 25: Connecting the transmitter (aluminum field housing). Cable cross-section: max. 2.5 mm<sup>2</sup> (AWG 14)

- a Electronics compartment cover
- b Cable for power supply: 85 to 250 V AC, 11 to 40 V DC, 20 to 28 V AC
- c Ground terminal for power supply cable
- d Terminal connector for power supply: **No. 1–2** → 28 (terminal assignment)
- e Signal cable
- f Ground terminal for signal cable
- g Terminal connector for signal cable: **No. 24–27** → 28 (terminal assignment)
- h Service connector
- i Ground terminal for potential equalization

#### 4.2.1 Terminal assignment

Terminal No. (wiring diagram → 25)					
24 (+)	25 (-)	26 (+)	27 (-)	1 (L1/L+)	2 (N/L-)
Pulse output		HART current output		Power supply	

### 4.3 Protective ground connection

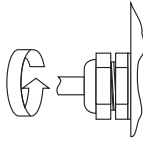
The sensor must be connected to the protective ground of the plant. The plant grounding guidelines must be taken into account.

## 4.4 Degree of protection

The devices meet all the requirements for IP 67.

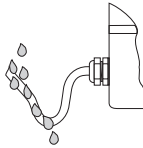
After mounting in the field or service work, the following points have to be observed to ensure that IP 67 protection is retained:

- Install the measuring device in such a way that the cable entries do not point upwards.
- Do not remove the seal from the cable entry.
- Remove all unused cable entries and plug them with suitable, certified drain plugs.
- When working at low temperatures (below  $-20\text{ }^{\circ}\text{C}$  /  $-4\text{ }^{\circ}\text{F}$ ), in particular, ensure the suitability of the cables, cable entries and plugs is certified for these temperatures.



Tighten the cable entries correctly.

A0007549



The cables must loop down before they enter the cable entries ("water trap").

A0007550

## 4.5 Post-connection check

- Are cables or the device damaged (visual inspection)?
- Does the supply voltage match the information on the nameplate?
- Do the cables comply with the specifications?
- Do the mounted cables have adequate strain relief and are they routed securely?
- Is the cable type route completely isolated? Without loops and crossovers?
- Are all screw terminals firmly tightened?
- Are all cable entries installed, firmly tightened and correctly sealed?
- Cable routed as a "water trap" in loops?
- Are all the housing covers installed and securely tightened?

### In addition, for measuring devices with fieldbus communication:

- Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?
- Has each fieldbus segment been terminated at both ends with a bus terminator?
- Has the max. length of the fieldbus cable been observed in accordance with the specifications?
- Has the max. length of the spurs been observed in accordance with the specifications?
- Is the fieldbus cable fully shielded and correctly grounded?

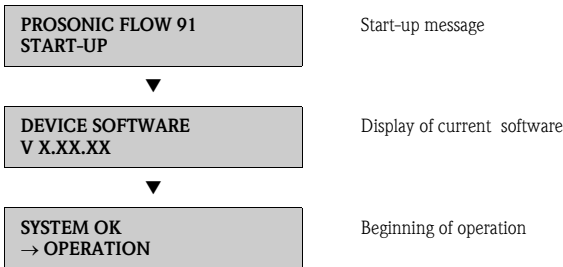
## 5 Commissioning

### 5.1 Switching on the measuring device

On completion of the installation (successful post-installation check), wiring (successful post-connection check) and after making the necessary hardware settings, where applicable, the permitted power supply (see nameplate) can be switched on for the measuring device.

After being switched on, the measuring system performs a number of internal test functions. As this procedure progresses the following sequence of messages appears on the onsite display:

Display examples:



The measuring device starts operating as soon as the startup procedure is complete. Various measured values and/or status variables appear on the display.



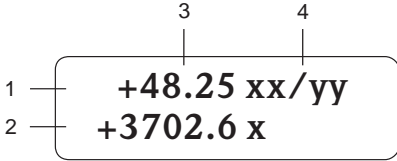
#### Note!

If an error occurs during startup, this is indicated by an error message.

The error messages that occur most frequently when a measuring device is commissioned are described in the Troubleshooting section → [33](#).

## 5.2 Operation

### 5.2.1 Display elements

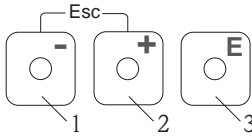


A0007557

Display lines/fields

1. Main line for primary measured values
2. Additional line for additional measured variables/status variables
3. Current measured values
4. Engineering units/time units

### 5.2.2 Operating elements



A0007559

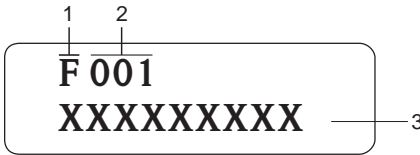
Operating keys

1. (-) Minus key for entering, selecting
2. (+) Plus key for entering, selecting
3. Enter key for calling the function matrix, saving

When the +/- keys are pressed simultaneously (Esc):

- Exit the function matrix step-by-step:
- > 3 sec. = cancel data input and return to the measured value display

### 5.2.3 Displaying error messages



A0012076

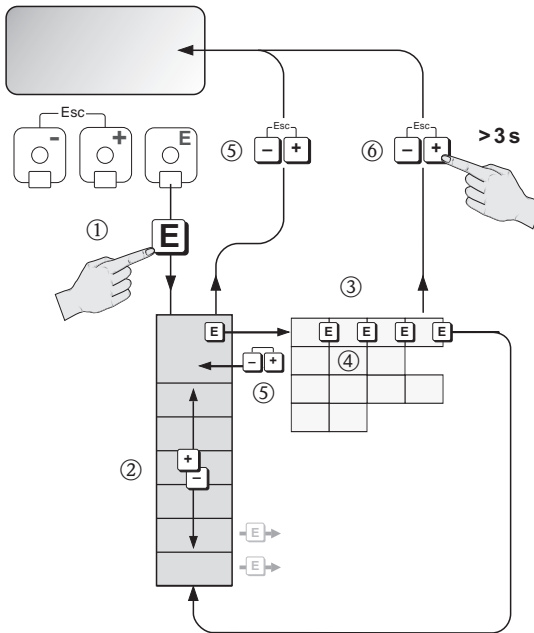
1. Type of error:  
F = Failure  
M = Maintenance needed  
C = Function check  
S = Outside specification
2. Error number
3. Diagnosis message



Note!

- The display alternates between the error number and diagnosis message and the last measured value.
- List of all error messages, see associated Operating Instructions on the CD-ROM

### 5.3 Navigating within the function matrix



A0007562

1. → Enter the function matrix (starting with measured value display)
2. → Select the group (e.g. OPERATION)  
 → Confirm selection
3. → Select function (e.g. LANGUAGE)
4. → Enter code **50** (only for the first time you access the function matrix)  
 → Confirm entry  
  
 → Change function/selection (e.g. ENGLISH)  
 → Confirm selection
5. → Return to measured value display step by step
6. > 3 s → Return immediately to measured value display



## 5.4 Group Sensor Setup

Picklist SENSOR SETUP:

- SETUP
- LIQUID
- PIPE DATA
- LINER
- CONFIG. CHANNEL
- POS. SENSOR
- QUIT

SETUP: LIQUID → TEMPERATURE → SOUND VEL. LIQUID →  
 PIPE MATERIAL → SOUND VEL. PIPE → CIRCUMFERENCE →  
 PIPE DIAMETER → WALL THICKNESS → LINER MATERIAL →  
 SOUND VEL. LINER → LINER THICKNESS → SENSOR TYPE →  
 SENSOR CONFIG. → CABLE LENGTH → POS.SENSOR/WIRE  
 LENGTH → SENSOR DISTANCE

LIQUID: LIQUID → TEMPERATURE → SOUND VEL. LIQUID

PIPE DATA: PIPE MATERIAL → SOUND VEL. PIPE → CIRCUMFERENCE →  
 PIPE DIAMETER → WALL THICKNESS

LINER: LINER MATERIAL → SOUND VEL. LINER → LINER THICKNESS

CONFIG. CHANNEL: SENSOR TYPE → SENSOR CONFIG. → CABLE LENGTH

POS.SENSOR: POS.SENSOR/WIRE LENGTH → SENSOR DISTANCE

The following information is required for a successful setup:

- Sound velocity of the liquid
- Operating temperature
- Pipe circumference or pipe outer diameter
- Sound velocity of the pipe material
- Wall thickness
- Sound velocity of the lining material (if present)
- Thickness of the lining (if present)
- Sensor type
- Sensor arrangement (direct or reflection mode)
- Length of the sensor cable

## 5.5 Troubleshooting

A complete description of all the error messages is provided in the Operating Instructions on the CD-ROM.



Note!

The output signals (e.g. pulse, frequency) of the measuring device must correspond to the higher-order controller.





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