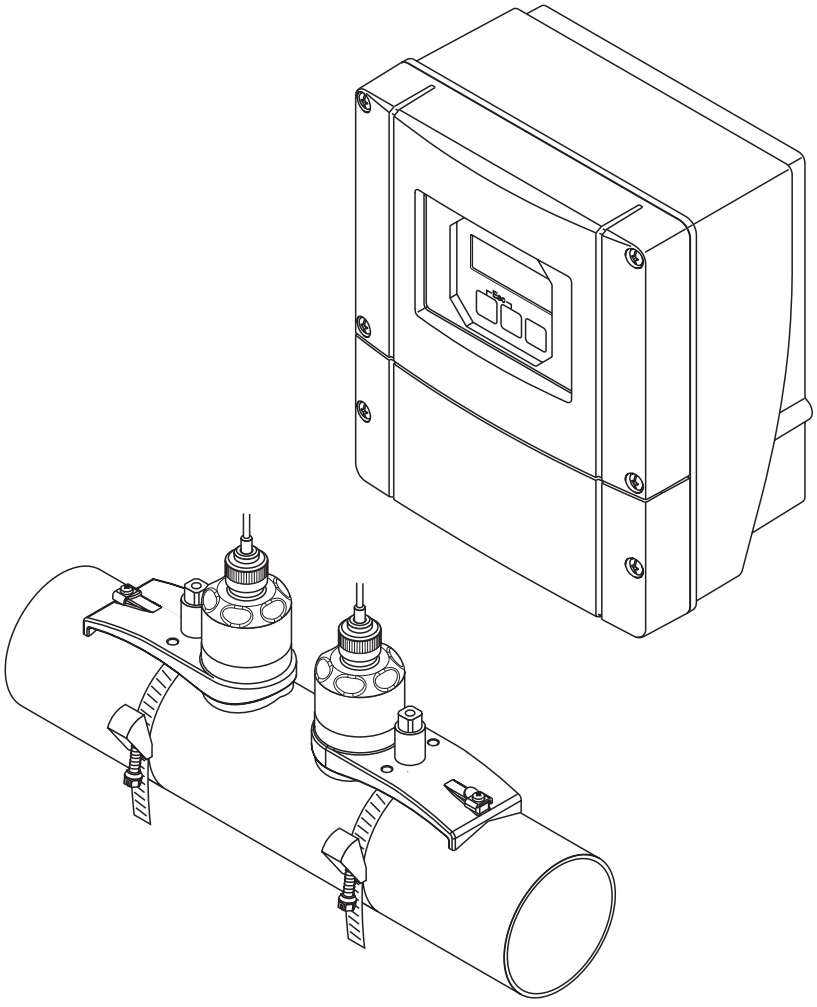
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Prosonic Flow 90

Ultrasonic Flow Measuring System

HART® FIELD COMMUNICATION PROTOCOL



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BA068D/06/en/11.04
50099981
Valid as of version:
V 2.00.XX (Device software)

Endress+Hauser

People for Process Automation

Brief operating instructions

These brief operating instructions explain how to configure your measuring device quickly and easily:

Safety instructions	Page 7
Please read the safety instructions through carefully.	 A0000893

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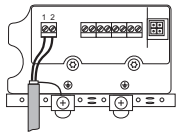
Connecting the transmitter	Page 37
Install the sensors using the transmitter software. Therefore connect the transmitter first to the power supply.	 A0001051

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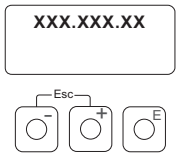
Display and operating elements	Page 44
A brief overview of the different display and operating elements to allow you to start quickly.	 A0001052

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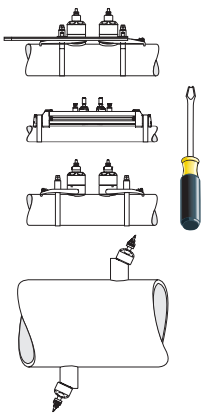
Installing the sensors	Page 18 ff.
Installing the flowrate measuring sensors Prosonic Flow P (clamp-on) Installing the flowrate measuring sensors Prosonic Flow W (clamp-on) Installing the flowrate measuring sensors Prosonic Flow U (clamp-on) Installing the flowrate measuring sensors Prosonic Flow W (Insertion)	 A0001053

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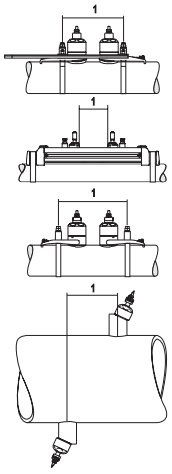
"SENSOR INSTALLATION" Quick Setup	Page 64, 67
*Measuring devices **with** a local display:* Use this "Quick Setup" (→ Page 64) to determine the data required for sensor installation such as sensor distance (1), wire length, pipe materials, sound velocity in liquids, etc. – The system provides you with the sensor distance for the W/P/U "clamp-on" versions as distance data. For the W and P sensors, you also receive the data in the form of a letter for sensor 1 and in the form of a number for sensor 2. You can thus easily position the sensors with the aid of the mounting rail. – With the butt-weld version, you receive the sensor distance as distance data. *Measuring devices **without** a local display:* No "Sensor Installation" Quick Setup is available for devices without a local display. The sensor installation procedure for such devices is explained on → Page 67. Connection of the sensor/transmitter connecting cable → Page 35	 A0001054

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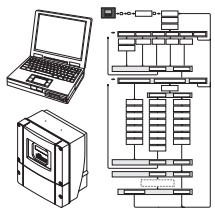
Commissioning via "QUICK SETUP" **Commissioning via "ToF Tool - Fieldtool Package"**	Page 65, 67
*Measuring devices **with** a local display:* You can commission your measuring device quickly and easily using the special "Quick Setup" menu → Page 65. This means that important basic functions can be configured directly via the local display, e.g. display language, measured variables, engineering units, etc. Where necessary, the following adjustments and configurations must be carried out separately: – Zero point adjustment – Bus address – Tag name – Configuration of the totalizers *Measuring devices **without** a local display:* – No "Commissioning" Quick Setup is available for devices without a local display. The commissioning procedure for such devices is explained on → Page 67	 A0001055

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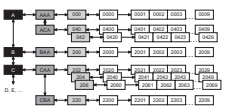
Customer-specific configuration	Page 45 ff.
Complex measurement tasks require the configuration of additional functions which you can individually select, set and adapt to your process conditions using the function matrix. There are two options: – Setting parameters via the configuration program "ToF Tool - Fieldtool Package" – Setting parameters via the local display (optional) All functions are described in detail, as is the function matrix itself, in the "Description of Device Functions" manual, which is a separate part of these Operating Instructions.	 A0001056

✎ Note!
Always start trouble-shooting with the checklist on Page 79, if faults occur after startup.

Table of Contents

1 Safety instructions

1.1 Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the flow of liquids in closed pipes, e.g.:
- Ultra clean water with low conductivity
- Water, wastewater, etc.

As well as measuring the volume flow, the measuring system also always measures the sound velocity of the fluid. The sound velocity can be used to distinguish different fluids or as a measure of fluid quality.

The manufacturer accepts no liability for damage resulting from incorrect use or other than designated use.

1.2 Installation, commissioning and operation

Note the following points:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the plant operator. Strict compliance with the instructions in the Operating Instructions is mandatory.
- Endress+Hauser will be happy to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning.
- If welding work is performed on the piping system, do not ground the welding appliance through the Prosonic flowmeter.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, unless the power supply is galvanically isolated.
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Note the following points:
- Measuring systems for use in hazardous environments are accompanied by separate “Ex documentation”, which is an *integral part* of these Operating Instructions. Strict compliance with the installation instructions and connection data as listed in the supplementary “Ex” documentation is mandatory. The symbol on the front of the Ex documentation indicates the approval and the certification body (Ex Europe, FM USA, CSA Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR Recommendation NE 21.
- 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.

1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always, enclose a fully completed "Declaration of contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.
- Remove all fluid residues. Pay special attention to the grooves for seals and crevices which could contain fluid residues. This is particularly important if the fluid is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

Note!
A *copy* of the "Declaration of contamination" can be found at the end of these Operating Instructions.

Warning!
- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (caustic burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements. They have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". They can, however, be a source of danger if used incorrectly or for other than the designated use.
Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following symbols:

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 Identification

2.1 Device designation

The “Prosonic Flow 90” flowmeter system consists of the following components:
- Transmitter Prosonic Flow 90
- Measuring sensors Prosonic Flow W, P and U

2.1.1 Nameplate of the Prosonic Flow 90 transmitter

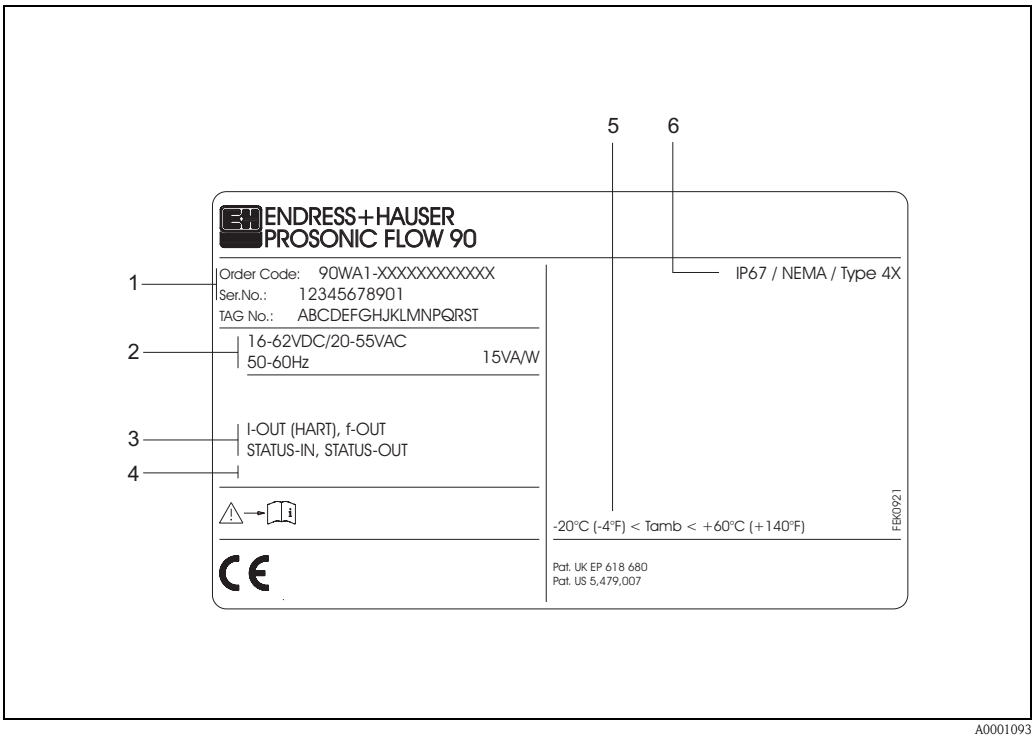


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Fig. 1: Nameplate specifications for the “Prosonic Flow 90” transmitter (example)

1 Ordering code / serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply / frequency: 16...62 V DC / 20...55 V AC / 50...60 Hz
Power consumption: 15 VA / W
3 Available inputs and outputs:
I-OUT (HART): with current output (HART)
f-OUT: with pulse/frequency output
STATUS-IN: with status input (auxiliary input)
STATUS-OUT: with status output
4 Reserved for information on special products
5 Ambient temperature range
6 Degree of protection

2.1.2 Nameplate of the Prosonic Flow W/P sensors

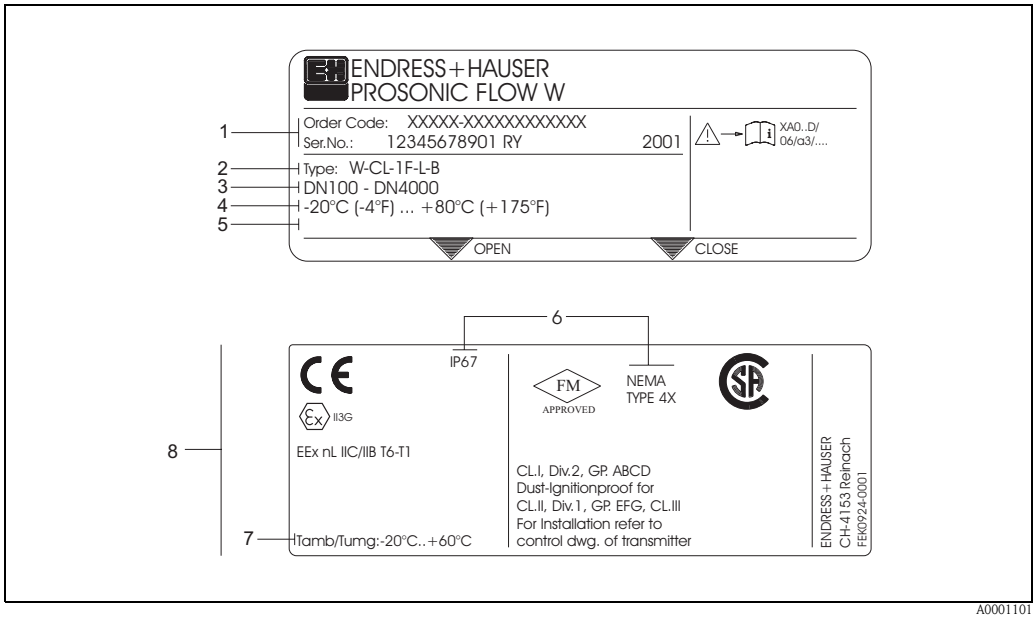

Fig. 2: Nameplate specifications for the "Prosonic Flow W" sensors (example)

1 *Ordering code / serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.*
2 *Sensor type*
3 *Range of nominal diameters: DN 100...4000*
4 *Max. fluid temperature range: –20 °C (–4 °F) ... +80 °C (+175 °F)*
5 *Reserved for information on special products*
6 *Degree of protection*
7 *Ambient temperature range*
8 *Data on explosion protection*
Refer to the specific additional Ex documentation for detailed information.
Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

2.1.3 Nameplate of the Prosonic Flow U sensors

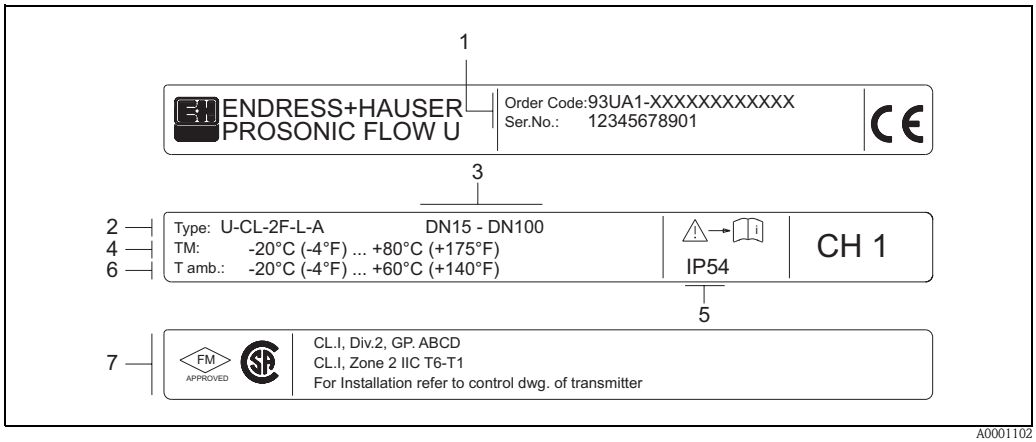

Fig. 3: Nameplate specifications for the "Prosonic Flow U" sensors (example)

1 *Ordering code / serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.*
2 *Sensor type*
3 *Range of nominal diameters: DN 15...100*
4 *Max. fluid temperature range: –20 °C (–4 °F) ... +80 °C (+175 °F)*
5 *Degree of protection*
6 *Ambient temperature range: –20 °C (–4 °F) ... v60 °C (+140 °F)*
7 *Data on explosion protection*
Refer to the specific additional Ex documentation for detailed information.
Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

2.1.4 Nameplate, connections

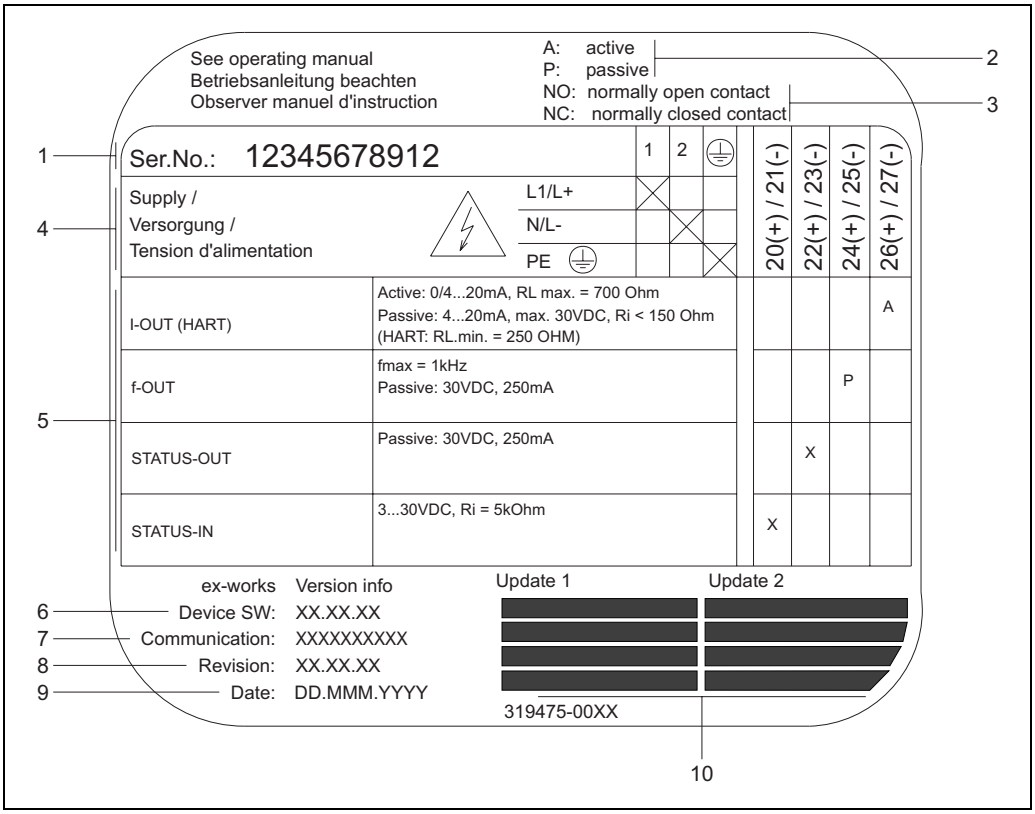

Fig. 4: Nameplate specifications for Proline transmitter (example)

1 Serial number
2 Possible configuration of current output
3 Possible configuration of relay contacts
4 Terminal assignment, cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L- for DC*
5 Signals present at inputs and outputs, possible configuration and terminal assignment (20...27), see also "Electrical values of inputs/outputs"
6 Version of device software currently installed
7 Installed communication type, e.g.: HART, PROFIBUS PA, etc.
8 Information on current communication software (Device Revision and Device Description), e.g.: Dev. 01 / DD 01 for HART
9 Date of installation
10 Current updates to data specified in points 6 to 9

2.2 CE mark, declaration of conformity

The devices are designed to meet state-of-the-art safety requirementsin accordance with sound engineering practice. They have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 “Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures” and with the EMC requirements of EN 61326/A1.
The measuring system described in these Operating Instructions is therefore in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms succesful testing of the device by affixing to it the CE mark.

2.3 Registered trademarks

HART®
is a registered trademark of the HART Communication Foundation, Austin, USA

SilGel®
is a registered trademark of Wacker-Chemie GmbH, Munich, D

F-CHIP®, ToF Tool - Fieldtool® Package, Fieldcheck®, Applicator®
are registered trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2 Transport

The devices must be transported in the container supplied when transporting them to the measuring point.

3.1.3 Storage

Note the following points:
- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The storage temperature corresponds to the ambient temperature range (Page 99) of the transmitter, the measuring sensors and the corresponding sensor cables.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 Installation conditions

3.2.1 Installation dimensions

The dimensions and the fitting lengths of the sensors and the transmitter are on Page 104 ff.

3.2.2 Installation location

Correct measuring is possible only if the pipe is full. **Avoid** the following installation locations:
- Do not install at the highest point in the run. Risk of air accumulating.
- Do not install directly upstream from an open pipe outlet in a down pipe.

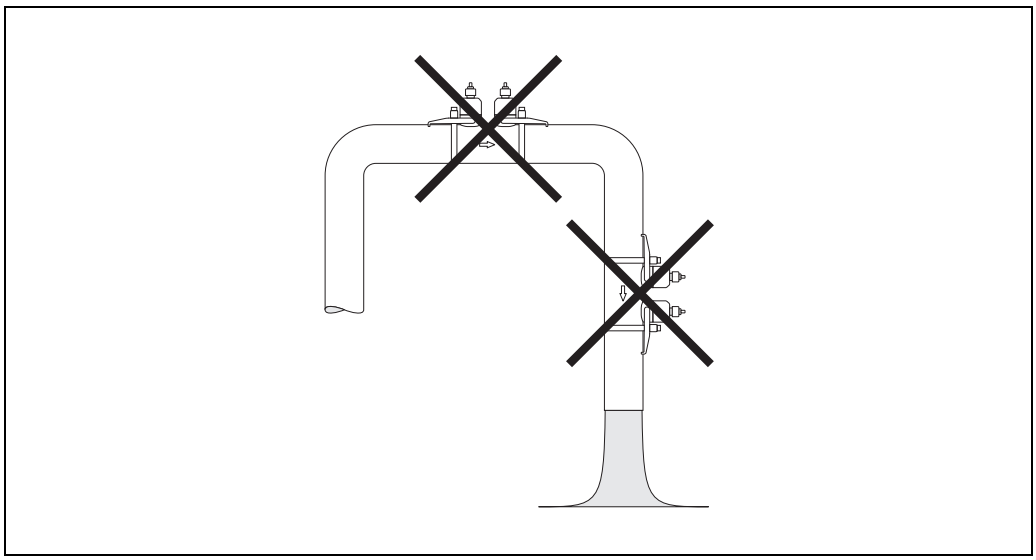

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Fig. 5: Installation location

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.

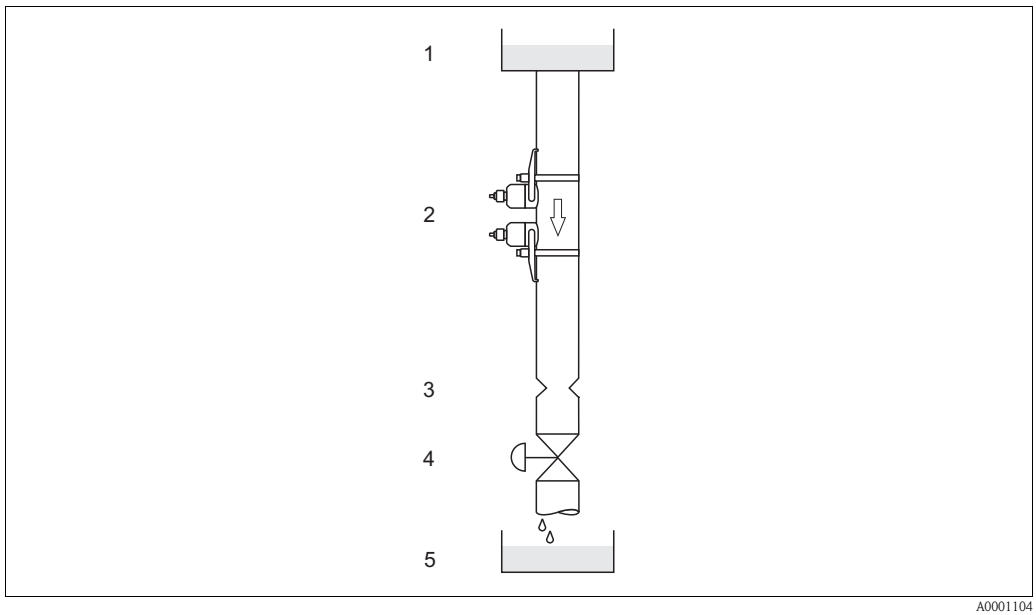

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Fig. 6: Installation in a down pipe
1 = Supply tank; 2 = Measuring sensors; 3 = Orifice plate, pipe restriction; 4 = Valve, 5 = Filling tank

3.2.3 Orientation

Vertical orientation
Recommended orientation with upward direction of flow (View A). Entrained solids sink down. Gases rise away from the measuring sensor when fluid is not flowing. The piping can be completely drained and protected against build-up.

Horizontal orientation
In the recommended installation range in a horizontal installation position (View B), gas and air accumulation at the pipe cover and problematic build-ups at the bottom of the pipe have a minor influence on the measurement.

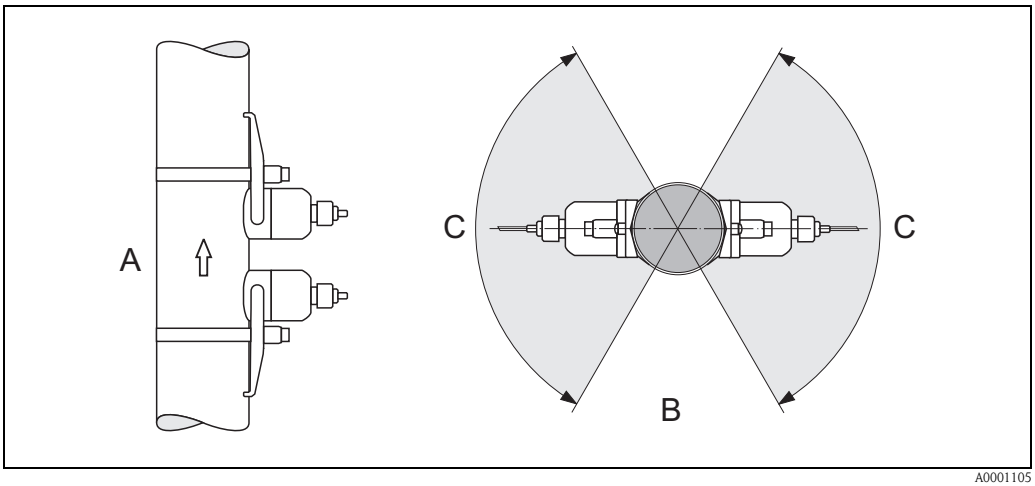


Fig. 7: Installation position (A = vertical, B = horizontal, C = recommended installation range max. 120°)

3.2.4 Inlet and outlet runs (clamp-on version)

If possible, install the sensor well clear of assemblies 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 requirements for the inlet and outlet runs is recommended to ensure measuring accuracy.

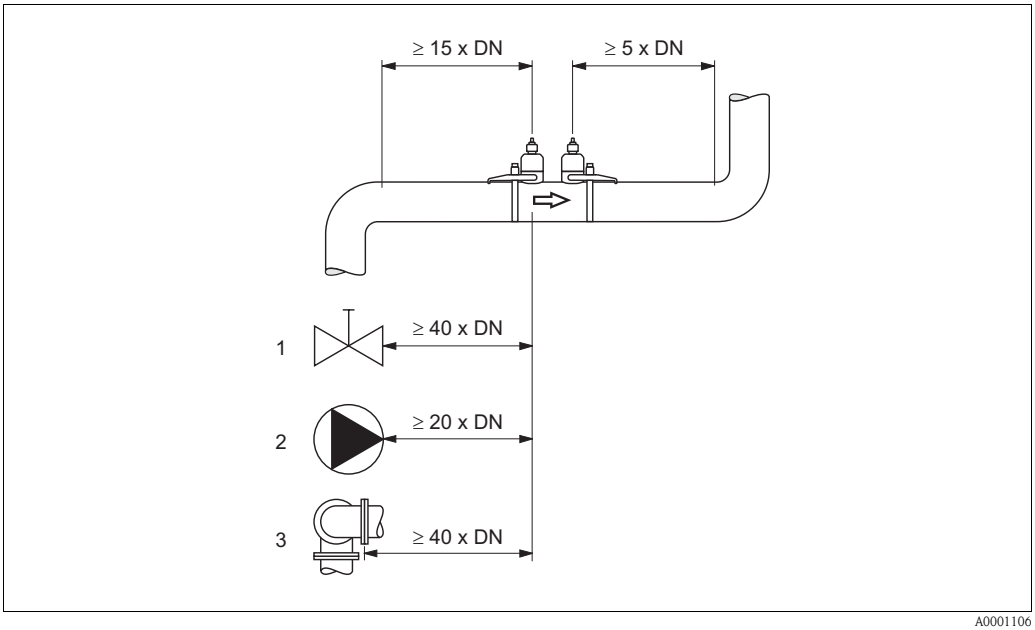


Fig. 8: Inlet and outlet runs (clamp-on version)
1 = Valve; 2 = Pump; 3 = Two pipe bends in different directions

3.2.5 Inlet and outlet runs (Insertion version)

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows, etc. The longest inlet or outlet run must always be taken into account if several flow obstructions are built in. Compliance with the following requirements for the inlet and outlet runs is recommended to ensure measuring accuracy.

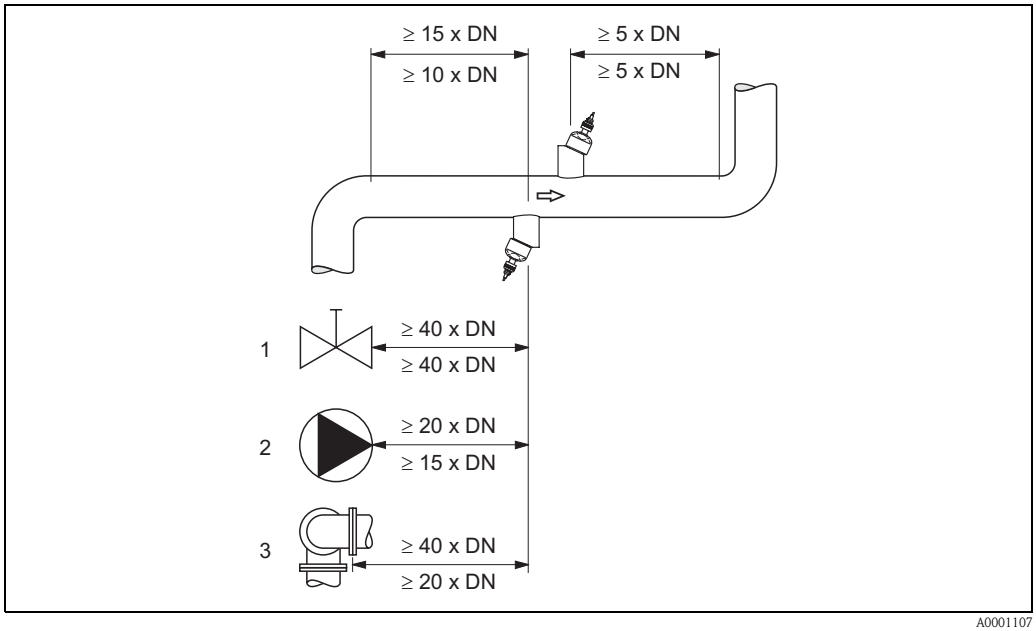


Fig. 9: Inlet and outlet runs (Insertion version)

1 = Valve; 2 = Pump; 3 = Two pipe bends in different directions
Data above the dimension line: apply to the single path version
Data below the dimension line: apply to the dual path version

3.2.6 Connecting cable length

Shielded cables are offered in the following lengths:
5 m, 10 m, 15 m and 30 m

Caution!
Route the cable well clear of electrical machines and switching elements.

3.2.7 Sensor arrangement (clamp-on)

The transmitter offers a number of options between 1 and 4 traverses for the type of installation. Please note that the signal strength is reduced with each additional reflection point in the pipe. (Example: 2 traverses = 1 reflection point)
To achieve the best signal quality possible, choose the least number of traverses required for a sufficient transit time difference.

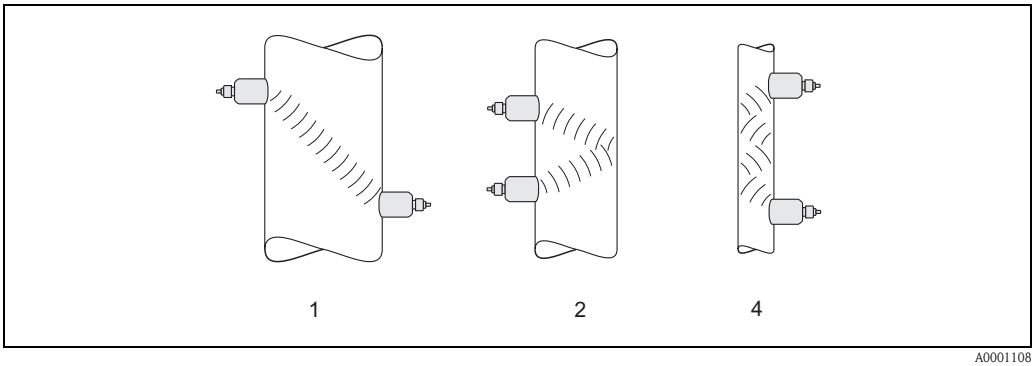


Fig. 10: Sensor arrangement (clamp-on)

1 = 1 traverse, 2 = 2 traverses, 4 = 4 traverses

Recommendations:
Due to their design and properties, the Prosonic Flow sensors are particularly suited to certain nominal diameter ranges and pipe wall thicknesses. For this reason, various sensor types W, P and U are offered for these different applications.
Recommendations for sensor installation can be found in the following table.

Sensor type	Nominal diameter	Type of mounting
Prosonic Flow U	DN 15...100	2 traverses
Prosonic Flow W Prosonic Flow P	DN 50...60 DN 80...600 DN 650...4000	2 (or 4) traverses* 2 traverses 1 traverse

** see note below*

Note!
- The installation of clamp-on sensors is principally recommended in the 2 traverse type of installation. This type of installation allows the easiest and most comfortable type of mounting and means that a system can also be mounted even if the pipe can only be accessed from one side.
- If the pipe nominal diameter is small (DN 60 and smaller), the sensor spacing with Prosonic Flow W/P can be too small for an installation with 2 traverses. In this case, the 4 traverse type of installation must be used. In all other instances, the 2 traverse configuration is the preferred method.
- The use of Prosonic Flow W/P sensors DN 100...4000 is principally recommended for pipes with a wall thickness >4 mm, pipes made of composites such as GRP, pipes with lining and for applications with media with high acoustic damping, even for nominal diameters < DN 100. For these applications, we principally recommend mounting the W/P sensors with 1 traverse configuration.
- In the DN 15...50 nominal diameter range, Prosonic Flow U is preferred for use on plastic pipes. Both the Prosonic Flow W/P and the Prosonic Flow U sensor types can be used in the DN 50...100 nominal diameter range. The use of Prosonic Flow W/P sensors is principally recommended for applications as of DN 60.
- If the measuring device displays an insufficient signal strength, reduce the number of the traverses.

3.3 Installation instructions

3.3.1 Installing tensioning bands (clamp-on)

For W/P sensors DN 50...200

1. Push one of the supplied threaded bolts on the tensioning band.
2. Run the tensioning band around the pipe without twisting it and push the end through the tensioning band lock (make sure that the screw is pushed up).
3. By hand, make the tensioning band as tight as possible.
4. Push the screw down and tighten the tensioning band with a screwdriver so that it cannot slip.
5. If so desired, shorten the tensioning band to the desired length.


Caution!
Risk of injury. When shortening the tensioning band, try to avoid sharp edges.

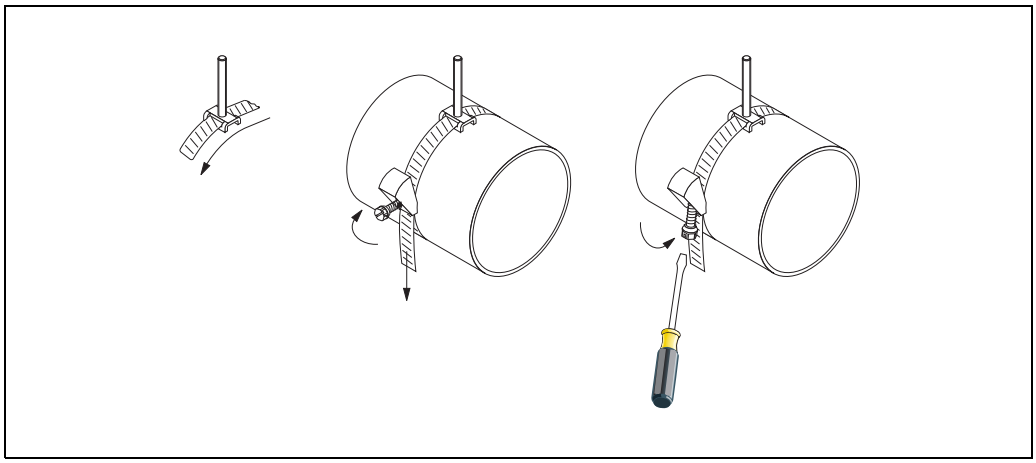


Fig. 11: Tensioning band installation for DN 50...200

For W/P sensors DN 250...4000
The following steps relate to Fig. 12 on Page 19.

1. Measure the pipe circumference.
   Shorten the tensioning band to the pipe circumference +10 cm.


Caution!
Risk of injury. When shortening the tensioning band, try to avoid sharp edges.

2. Loop the tensioning band through one of the centering plates supplied with the threaded bolt (1).
3. Insert both ends of the tensioning bands down into the openings in the tensioning band lock (2). Bend back the ends of the tensioning bands.
4. Interlock both halves of the lock (3). Make sure that there is sufficient space for the tensioning band to be tightened with the locking screw.
5. Tighten the tensioning band using a screwdriver (4).

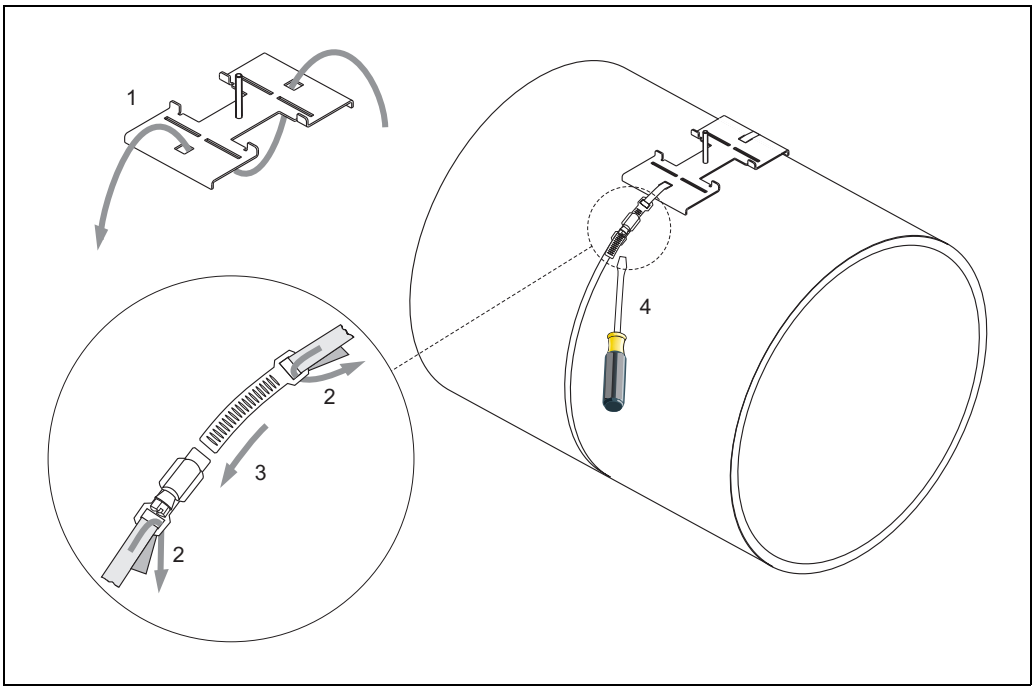


Fig. 12: Tensioning band installation for DN 250...4000

For U sensors - DN 15...100
The procedure for installing the tensioning bands for the U sensor is explained on Page 25 in the "Installing the sensor Prosonic Flow U" Section.

3.3.2 Use of weld bolts for W/P sensors

Weld studs can be used instead of tensioning bands for the following types of installation of the W/P clamp-on measuring sensors.

Note!
To determine the sensor distance (distance from the centre of the first stud to the centre of the second bolt) use:
- the "Sensor Installation" Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The sensor distance is displayed in the SENSOR DISTANCE function. The transmitter has to be installed and connected to the power supply to carry out the "Sensor Installation" Quick Setup.
- the procedure described on Page 67 ff. if the measuring device has no local operation.

For an exact description of the sensor installation process, please refer to the appropriate pages of the clamp-on versions. You must keep to same installation sequence.

If you want to use a non-metric M6 ISO thread, please note the following:
- You require a sensor holder with a removable locking nut.
  (Ordering code: 90WAx – xBxxxxxxxxxx)
- Remove the preinstalled locking nut on the sensor holder with a metric ISO thread.
- Use a nut which matches your threaded bolt.

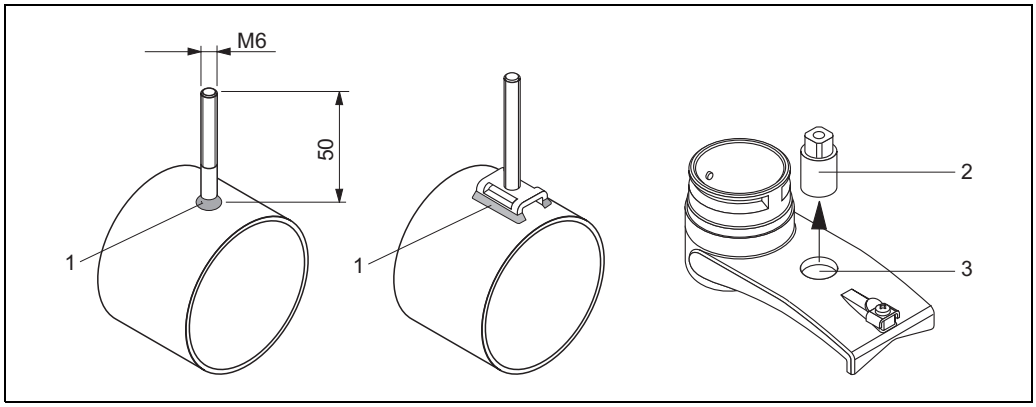


Fig. 13: Use of weld bolts

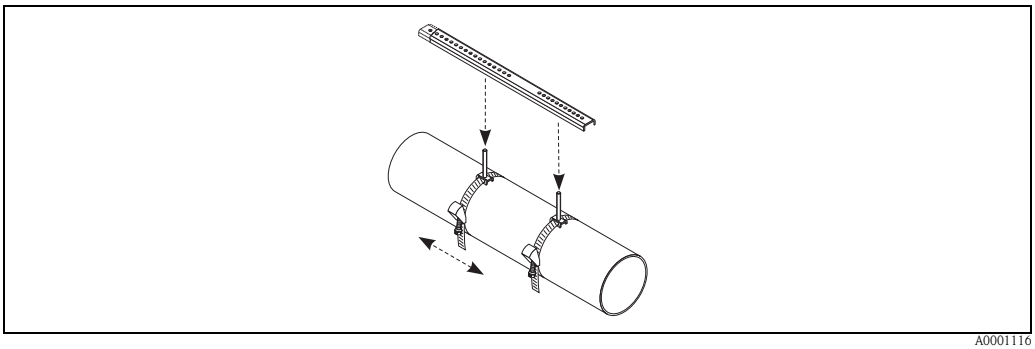
1 Welded joint
2 Locking nut
3 Hole diameter max. 8.7 mm

3.3.3 Installing the measuring sensors Prosonic Flow P

2 or 4 traverses version

1. Fix a tensioning band for small or large nominal diameters as described on Page 18. Install the second tensioning band (threaded stud on the opposite side). The second tensioning band must still be moveable.
2. Determine the sensor distance.

   ✎ Note!
   To determine the sensor distance use:
   – the “Sensor Installation” Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The sensor distance is shown in the POSITION SENSOR function (i.e. a letter on the mounting rail for sensor 1 and a number for sensor 2). The transmitter has to be installed and connected to the power supply to carry out the “Sensor Installation” Quick Setup.
   – the procedure described on Page 67 ff. if the measuring device has no local operation.
3. Arrange the tensioning bands to the sensor distance shown in the POSITION SENSOR function. Place the mounting rail on the threaded studs and then fasten the second tensioning band. Remove the mounting rail.



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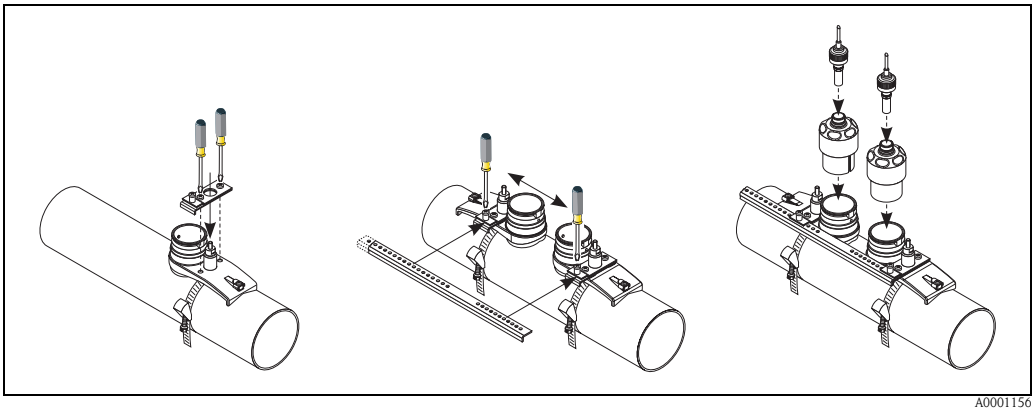
4. Fix the sensor holder to the pipe using the threaded studs. Tighten the locking nuts using a spanner (AF 13).
5. Fasten the mounting rail brackets to the sensor holders using a Philips screwdriver. Place the mounting rail on the threaded studs and then fasten the appropriate srews.
6. Coat the contact surface of the sensors with an even (approx. 1 mm thick) layer of coupling fluid (from the centre to the groove, see Page 73).
   Then carefully insert the sensor into the sensor holder. Press the sensor cover onto the sensor holder until you hear a click. Make sure that the arrows (▲ / ▼ “close”) on the sensor housing and sensor holder are pointing to each other. Then insert the sensor cable plug into the opening provided and manually tighten the plug to the stop.



A0001156

3.3.4 Installing the measuring sensors Prosonic Flow W/P (clamp-on)

1 traverse version

1. Fix a tensioning band for small or large nominal diameters as described on Page 18. Install the second tensioning band (threaded stud on the opposite side). The second tensioning band must still be moveable.
2. Determine the sensor distance and the wire length.

   ✎ Note!
   To determine the sensor distance and the wire length use:
   – the "Sensor Installation" Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The sensor distance is shown in the SENSOR DISTANCE function and the wire length is shown in the WIRE LENGTH function. The transmitter has to be installed and connected to the power supply to carry out the "Sensor Installation" Quick Setup.
   – the procedure described on Page 67 ff. if the measuring device has no local operation.
3. Enter the wire length on both halves of the wire.

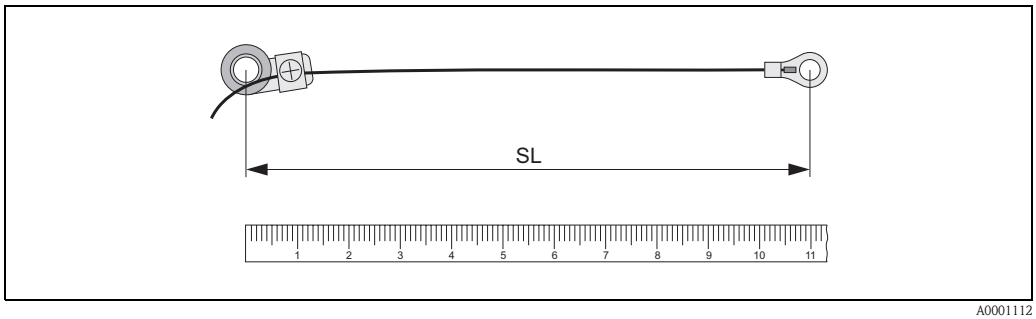


Fig. 14: Marking the determined wire length on the wire measurement equipment (SL = wire length)

4. Push the cable lug and the fixer over the first threaded stud. Lead each wire along one side of the pipe. Push the cable lug and the fixer over the second threaded stud. Pull in the threaded stud with the tensioning band until both wires are the same length.
5. Fix the tensioning band. Loosen the Phillips screws of the fixing parts. Remove the wires.

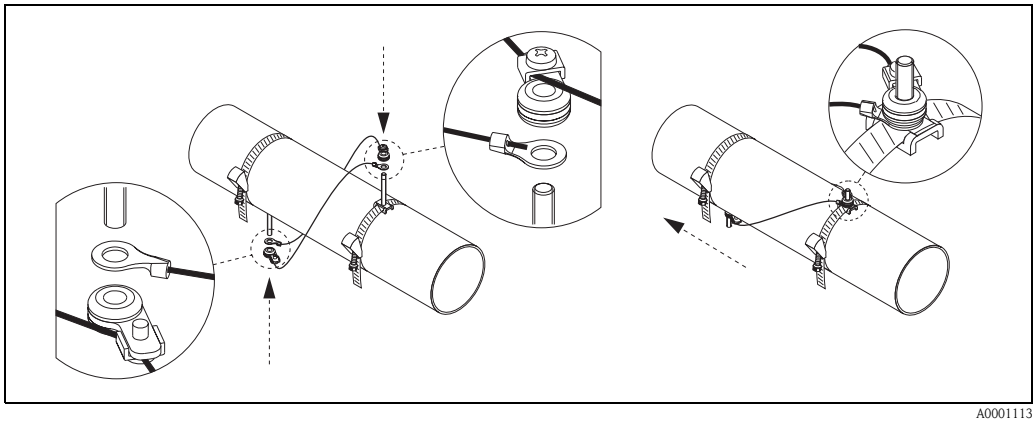
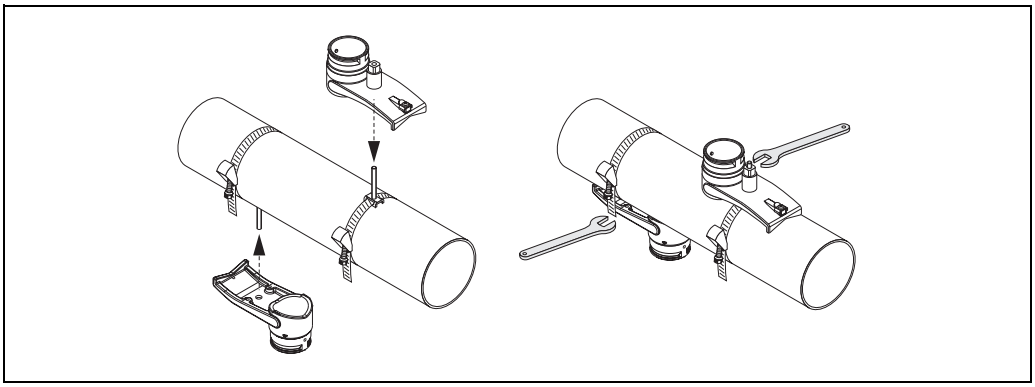


Fig. 15: Use of the wire measuring equipment for positioning of threaded studs

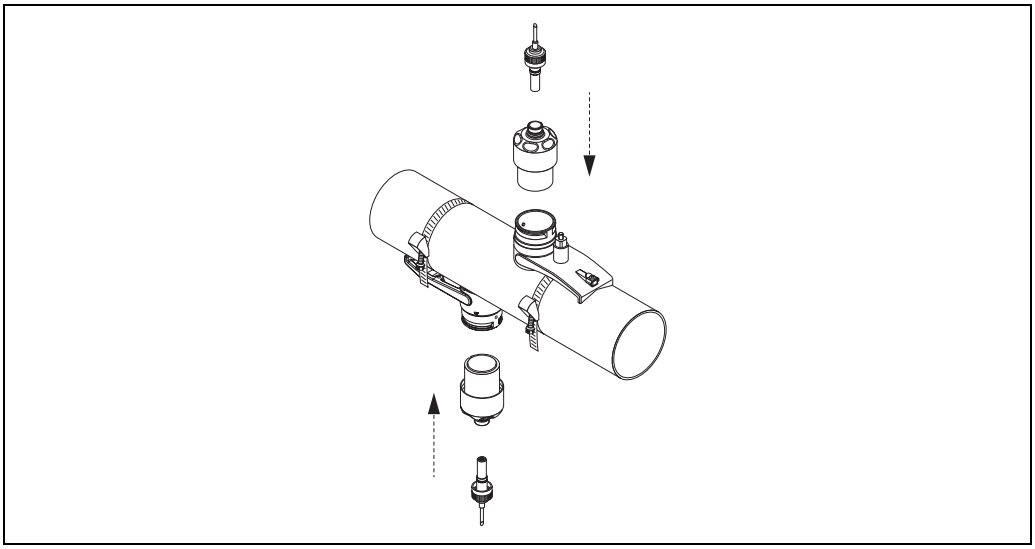
6. Push both of the sensor holders onto the pipe over the threaded studs and tighten the locking nuts using a spanner (AF 13).



A0001114

Fig. 16: Installing the sensor holders

7. Coat the contact surface of the sensors with an even (approx. 1 mm thick) layer of coupling fluid (from the centre to the groove, see Page 73).
Then carefully insert the sensors into the sensor holder. Press the sensor cover onto the sensor holder until you hear a click. Make sure that the arrows (▲ / ▼ "close") on the sensor housing and sensor holder are pointing to each other. Then insert the sensor cable plug into the opening provided and manually tighten the plug to the stop.



A0001115

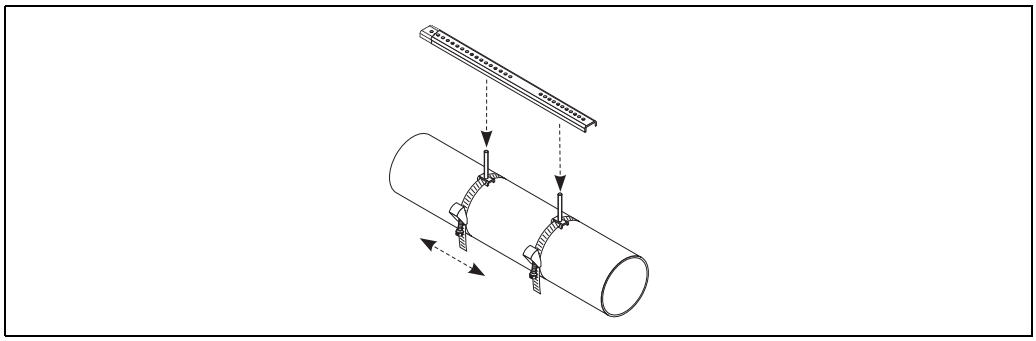
Fig. 17: Installing the sensors and the sensor connectors

3.3.5 Installing the measuring sensors Prosonic Flow W (clamp-on)

2 or 4 traverses version

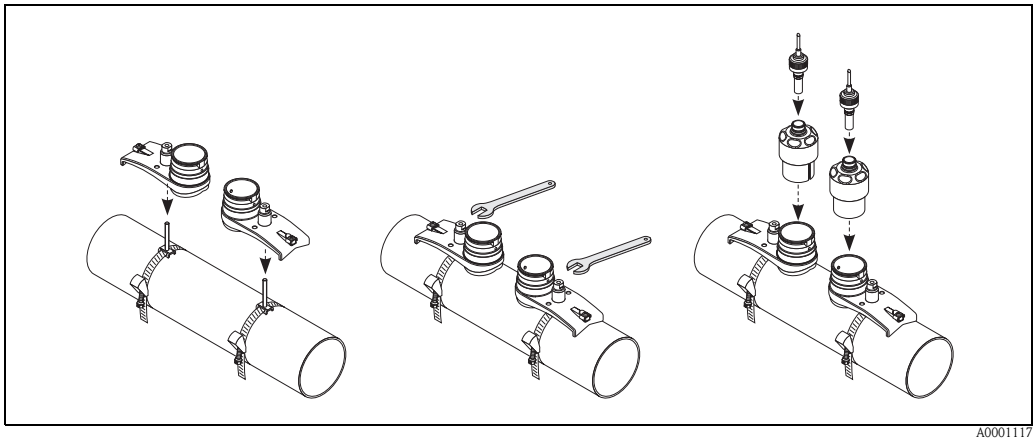
1. Fix a tensioning band for small or large nominal diameters as described on Page 18. Install the second tensioning band (threaded stud on the opposite side). The second tensioning band must still be moveable.
2. Determine the sensor distance.

   ✎ Note!
   To determine the sensor distance use:
   – the "Sensor Installation" Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The sensor distance is shown in the POSITION SENSOR function (i.e. a letter on the mounting rail for sensor 1 and a number for sensor 2). The transmitter has to be installed and connected to the power supply to carry out the "Sensor Installation" Quick Setup.
   – the procedure described on Page 67 ff. if the measuring device has no local operation.
3. Arrange the tensioning bands to the sensor distance shown in the POSITION SENSOR function. Place the mounting rail on the threaded studs and then fasten the second tensioning band. Remove the mounting rail.



A0001116

4. Fix the sensor holder to the pipe using the threaded studs. Tighten the locking nuts using a spanner (AF 13).
5. Coat the contact surface of the sensors with an even (approx. 1 mm thick) layer of coupling fluid (from the centre to the groove, see Page 73).
   Then carefully insert the sensor into the sensor holder. Press the sensor cover onto the sensor holder until you hear a click. Make sure that the arrows (▲ / ▼ "close") on the sensor housing and sensor holder are pointing to each other. Then insert the sensor cable plug into the opening provided and manually tighten the plug to the stop.



A0001117

3.3.6 Installing the measuring sensors Prosonic Flow U (clamp-on)

1. In the case of pipes in the DN 15…32 nominal diameter range, use the retaining vee (a) supplied to reinforce the pipe. This retaining vee is only included in the DN 15….40 installation set (see Accessories on Page 75). Loop the tensioning bands (b) through the retaining vee as illustrated below. Pull the tensioning bands freely through the tensioning band locks to such an extent that the bands can later be guided over the ends of the sensor assembly (please note that the screw of the tensioning band lock must be opened).

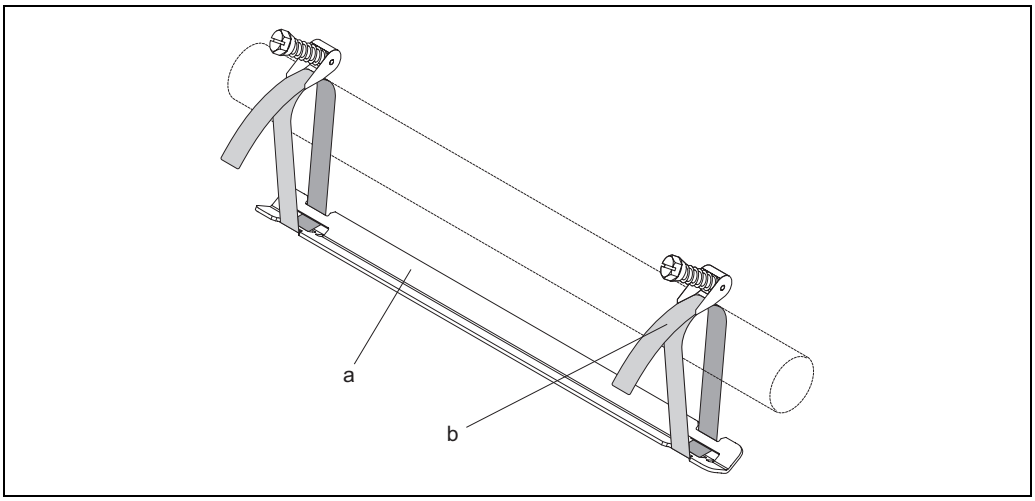


Fig. 18: Preparing sensor installation with retaining vee

a Retaining vee
b Tensioning band

2. Determine the sensor distance.

   ✎ Note!
   To determine the sensor distance use:
   – the “Sensor Installation” Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The sensor distance is shown in the SENSOR DISTANCE function. The transmitter has to be installed and connected to the power supply to carry out the “Sensor Installation” Quick Setup.
   – the procedure described on Page 67 ff. if the measuring device has no local operation.

   The U sensor is designed for 2 traverses only. Please ensure that “NO. TRAVERSE: 2” is selected for the number of traverses in the SENSOR CONFIGURATION function (see Page 64).

3. Set the sensor distance on the sensor assembly by moving the sensors (c) along the assembly frame and tightening the sensor fixing nuts (d). Preferably, the sensor position is set symmetrically to the rail centre.
   Turn the sensor adjustment screw counter-clockwise (e) so that the sensor moves upwards inside the assembly frame. Coat the sensors with coupling fluid as explained on Page 64.

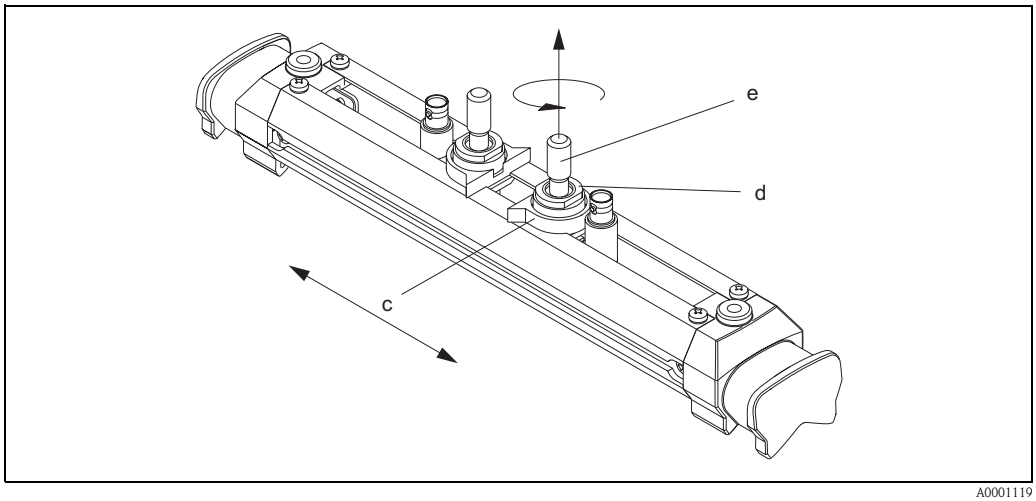


Fig. 19: Preparing the sensor assembly for the installation

c Sensor
d Sensor fixing nut
e Sensor adjustment screw

4. Then position the sensor assembly (f) on the pipe. Guide the tensioning bands over the ends of the sensor assembly (g) and pull the bands tight by hand (please note that).

   ✎ Note!
   The screw of the tensioning band lock must be opened.

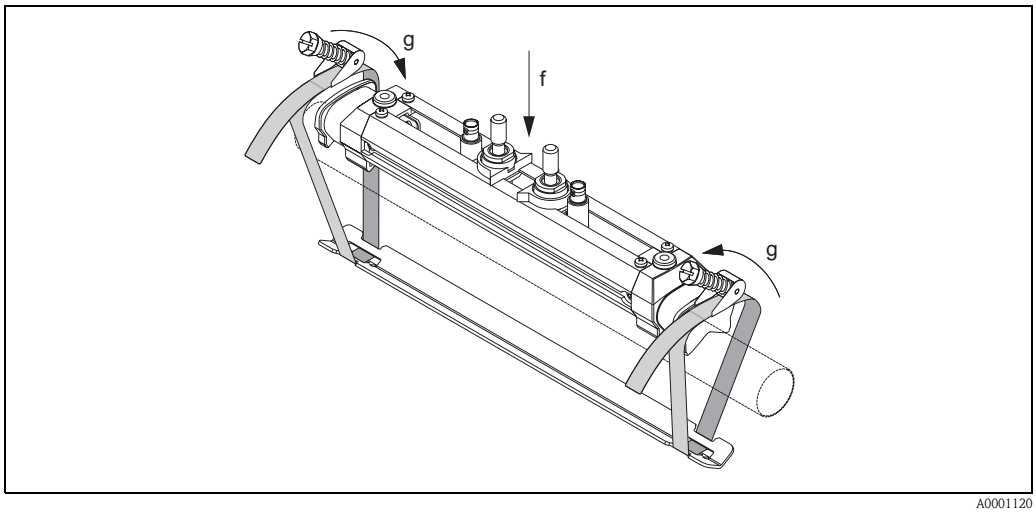


Fig. 20: Positioning the sensor and looping the tensioning bands

f Sensor assembly
g End of sensor assembly

5. Push down the screws (h) of tensioning band lock and tighten with a screwdriver so the bands cannot slip. If so desired, shorten the tensioning band then to the desired length.

   Caution!
   – Danger of injury! Avoid sharp edges when shortening the tensioning band.
   – If pulled too tightly, there is the risk of damaging the pipe (applies particularly to plastic pipes).

   Turn the sensor adjustment screws (i) clockwise until slight resistance is felt. The sensor is in the optimum position at this point.

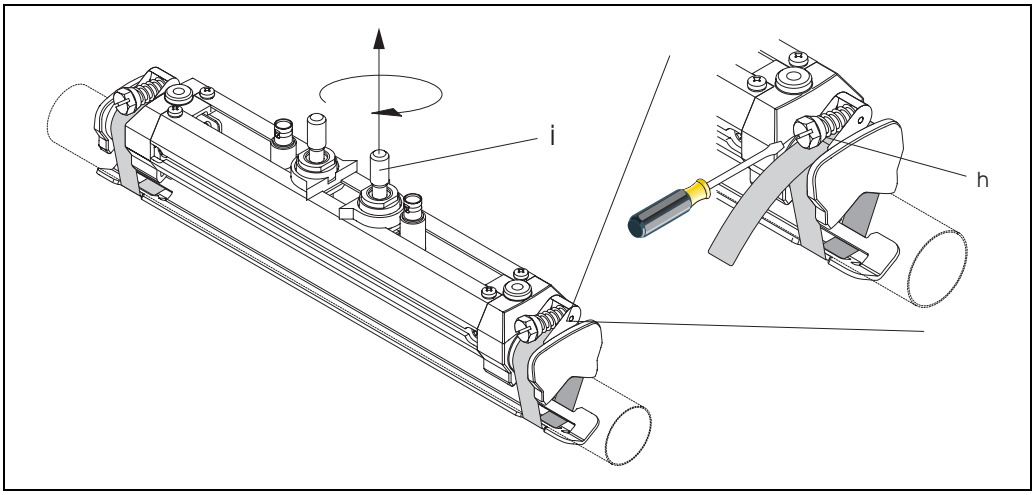


Fig. 21: Tightening the tensioning bands and the screw adjustment

h Screw of tensioning band lock
i Sensor adjustment screw

6. With the flat sides facing each other, fit the sensor protection cap (k) on the sensor adjustment screws and the sensor fixing nuts.
   Attach the BNC sensor cable connector (l) to the connections provided (upstream and downstream) and then screw the screw of the sensor cable grounding (m) into the thread provided. This ensures perfect grounding.

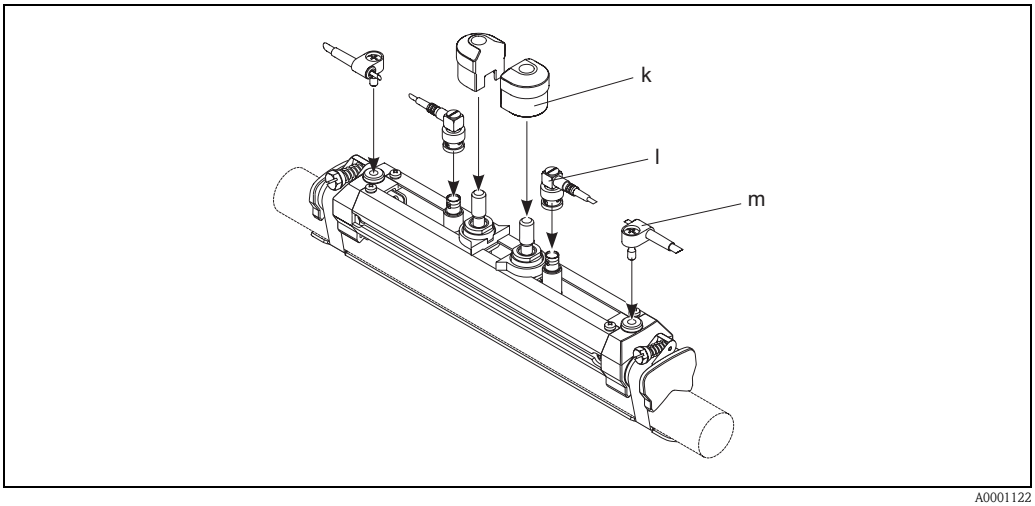
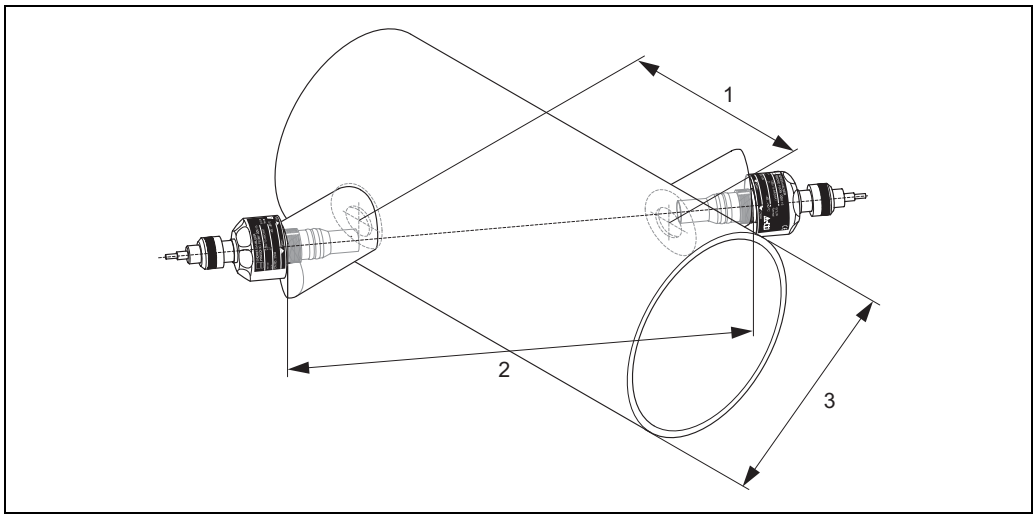


Fig. 22: Fitting the sensor protection cap, mounting the sensor cable connector and grounding

k Sensor protection cap
l BNC sensor cable connector
m Sensor cable grounding

3.3.7 Term explanations for Prosonic Flow W (Insertion version)

The graphic below provides you with an overview of the terms used when installing Prosonic Flow W (Insertion version).



A0001123

Fig. 23: Explanation of terms for single path version

1 = Sensor spacing
2 = Path length
3 = Pipe outer diameter (determined by application)

Arc length: $b = \frac{\Pi \cdot d \cdot \alpha}{360°}$

3.3.8 Installing the measuring sensors Prosonic Flow W (single path Insertion version)

1. Determine the installation area (e) on the pipe section:
   – Installation location: Page 14
   – Inlet/outlet runs: Page 16
   – Space required by the measuring point approx. 1x pipe diameter.
2. Mark the middle line on the pipe at the mounting location and mark the position of the first drillhole (drillhole diameter: 65 mm).

   ✎ Note!
   Make the middle line longer than the drillhole!

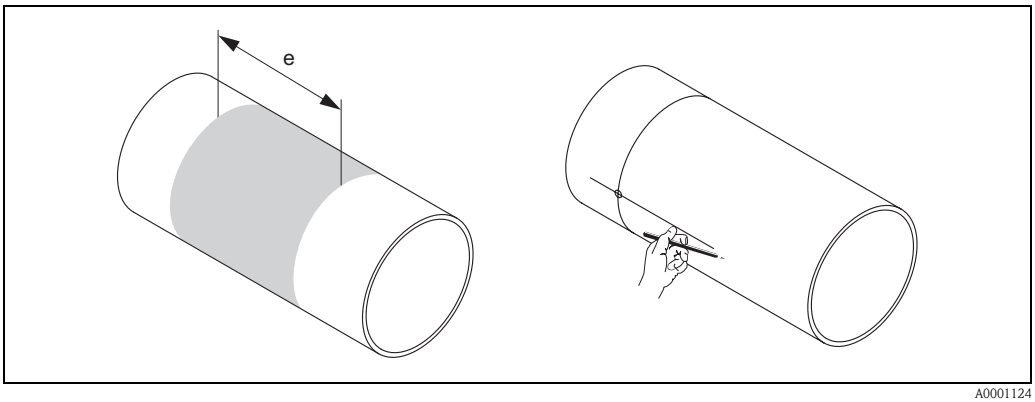


Fig. 24: Installing the measuring sensors, steps 1 and 2

3. Drill the first hole, e.g. with a plasma cutter. If the wall thickness of the pipe is unknown, measure it at this point.
4. Determine the sensor distance.

   ✎ Note!
   To determine the sensor distance use:
   – the “Sensor Installation” Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The sensor distance is shown in the SENSOR DISTANCE function. The transmitter has to be installed and connected to the power supply to carry out the “Sensor Installation” Quick Setup.
   – the procedure described on Page 67 ff. if the measuring device has no local operation.

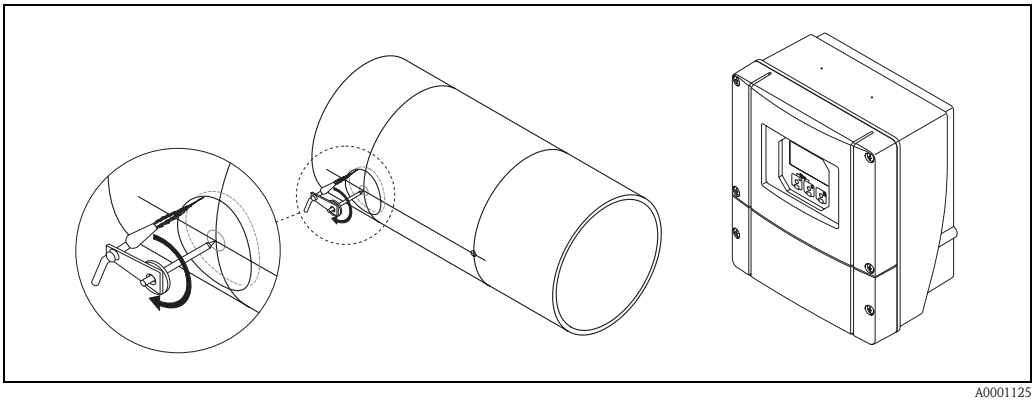
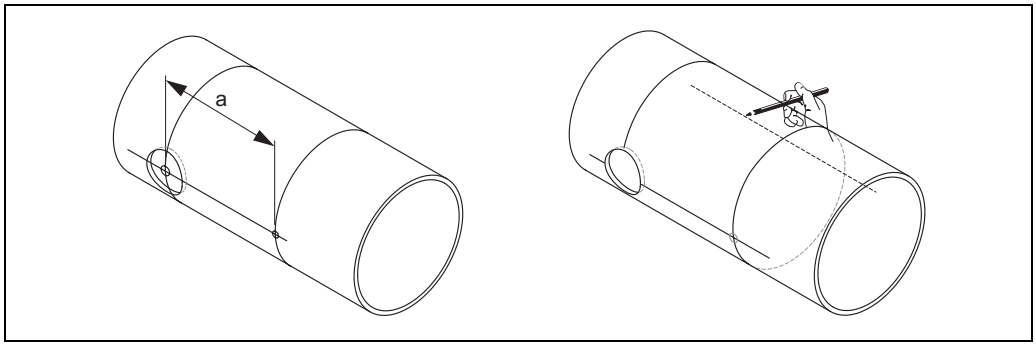


Fig. 25: Installing the measuring sensors, steps 3 and 4

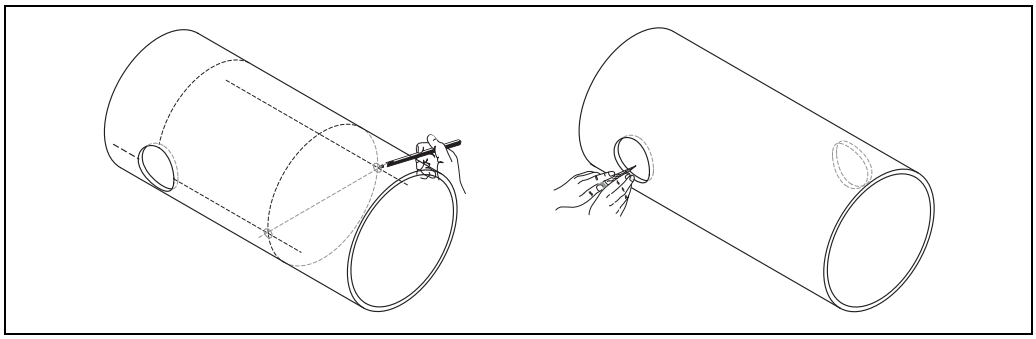
5. Mark the sensor distance (a) from the middle line starting from the first drillhole.
6. Project the middle line to the back of the pipe and draw it on.



A0001126

Fig. 26: Installing the measuring sensors, steps 5 and 6

7. Mark the drillhole on the middle line on the back of the pipe.
8. Cut out the second drillhole and prepare the holes for welding of the sensor holder (deburr, clean, etc.).

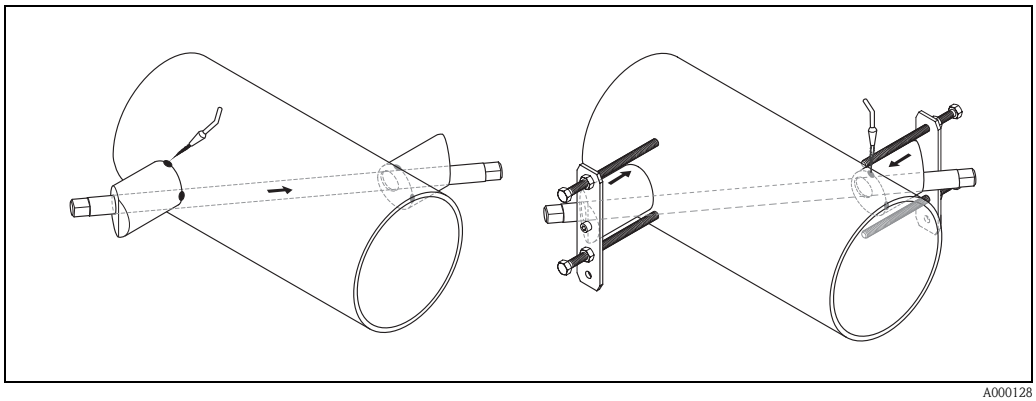


A0001127

Fig. 27: Installing the measuring sensors, steps 7 and 8

9. Insert the sensor holders into the two drill holes. To adjust the weld-in depth, both sensor holders can be fixed with the special tool for insertion depth regulation (optional) and then aligned using the tie rod. The sensor holder must be flush with the inner side of the pipe. Now pinpoint both sensor holders.

   ✎ Note!
   To align the tie rod, two bearing shells must be screwed onto the sensor holders.



A000128

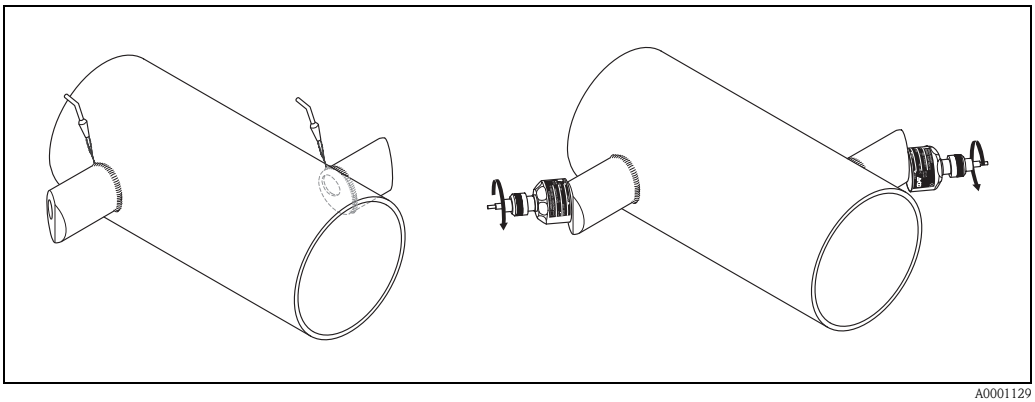
Fig. 28: Installing the measuring sensors, step 9

10. Weld in both sensor holders. After welding, check the distance between the drill holes once again and measure the path length.

    ✎ Note!
    To determine the path length use:
    – the “Sensor Installation” Quick Setup menu if the measuring device has a local operation. Use the Quick Setup as described on Page 64. The path length is shown in the PATH LENGTH function. The transmitter has to be installed and connected to the power supply to carry out the “Sensor Installation” Quick Setup.
    – the procedure described on Page 67 ff. if the measuring device has no local operation.

11. Then screw the sensors into the sensor holders by hand. If you use a tool, the maximum torque permissible is 30 Nm.

12. Then insert the sensor cable plug into the intended opening and manually tighten the plug to the stop.



A0001129

Fig. 29: Installing the measuring sensors, steps 10 to 12

3.3.9 Installing the wall-mount housing,

There are various ways of installing the wall-mount transmitter housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories → Page 75)
- Pipe mounting (with separate mounting kit, accessories → Page 75)

Caution!
- At the installation location, make sure that ambient temperature does not exceed the permissible range (–20 °...+60 °C). Install the device at a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Direct wall mounting

1. Drill the holes as illustrated in Fig. 30.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   – Securing screws (M6): max. Ø 6.5 mm
   – Screw head: max. Ø 10.5 mm
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

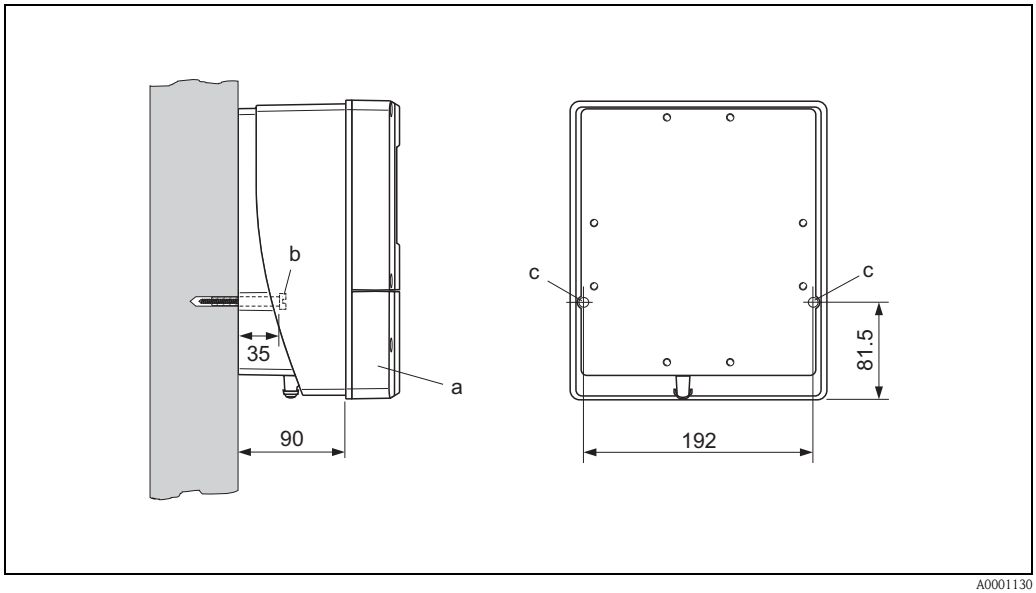


Fig. 30: Mounted directly on the wall

Panel mounting

1. Prepare the installation opening in the panel (Fig. 31).
2. Slide the housing through the front of the panel cutout.
3. Screw the fasteners to the wall-mount housing.
4. Screw the threaded rods into the brackets and tighten until the housing is firmly fixed to the panel wall. Tighten the counter nuts. No further support is necessary.

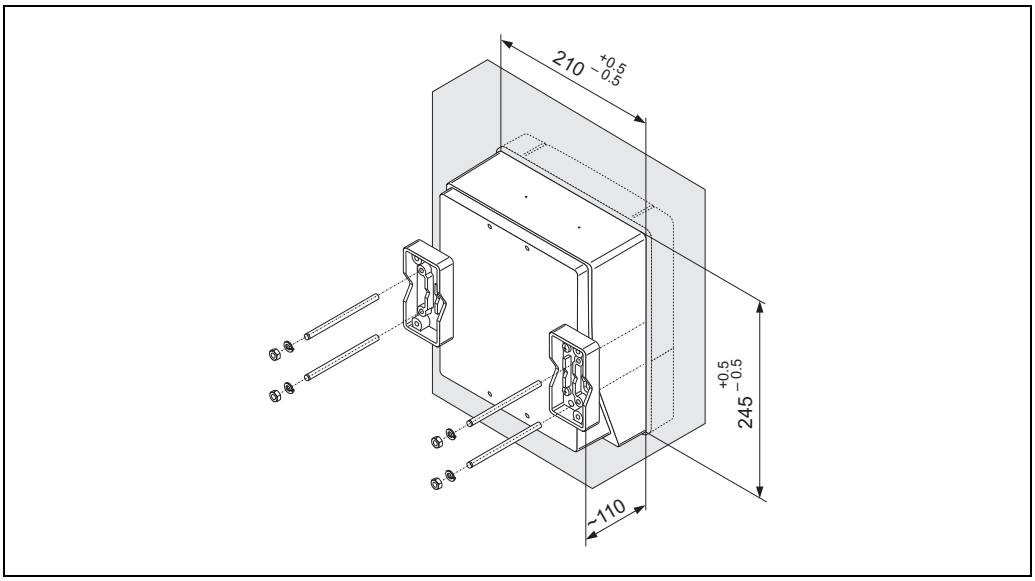


Fig. 31: Panel mounting (wall-mount housing)

Pipe mounting
Installation according to the instructions in Fig. 32.

Caution!
If a warm pipe is used for the installation, ensure that the housing temperature does not exceed the max. permitted value of +60 °C.

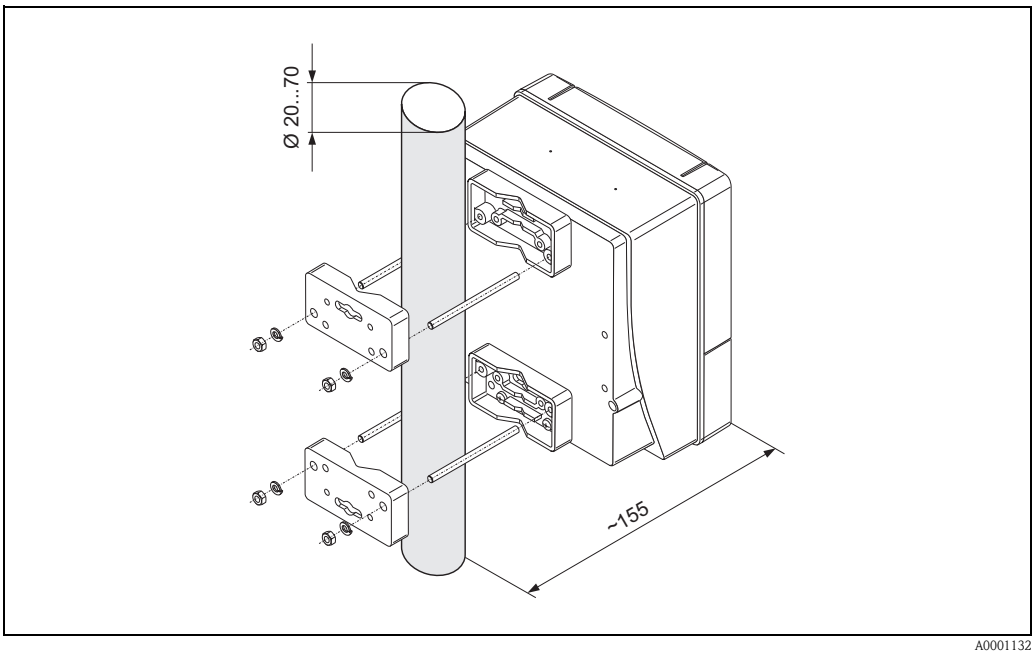


Fig. 32: Pipe mounting (wall-mount housing)

3.4 Installation check

Perform the following checks after installing the measuring device on the pipe:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	–
Does the device correspond to specifications at the measuring point, including process temperature, ambient temperature, measuring range, etc.?	see Page 95 ff.
Installation	Notes
Are the measuring point number and labeling correct (visual inspection)?	–
Process environment / process conditions	Notes
Are the inlet and outlet runs respected?	see Page 15, 16
Is the measuring device protected against moisture and direct sunlight?	–

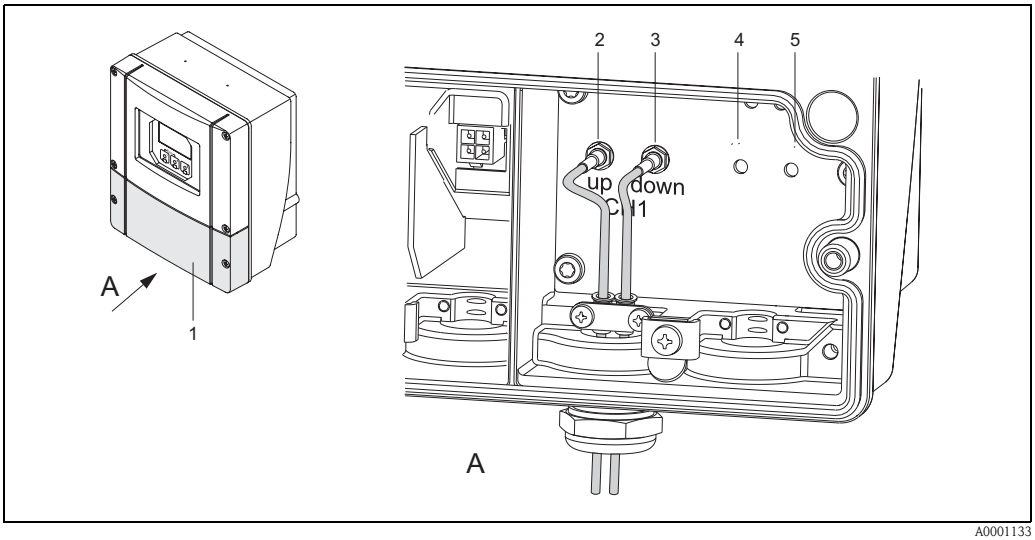
4 Wiring

Warning!
When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

4.1 Connection of the sensor connecting cable

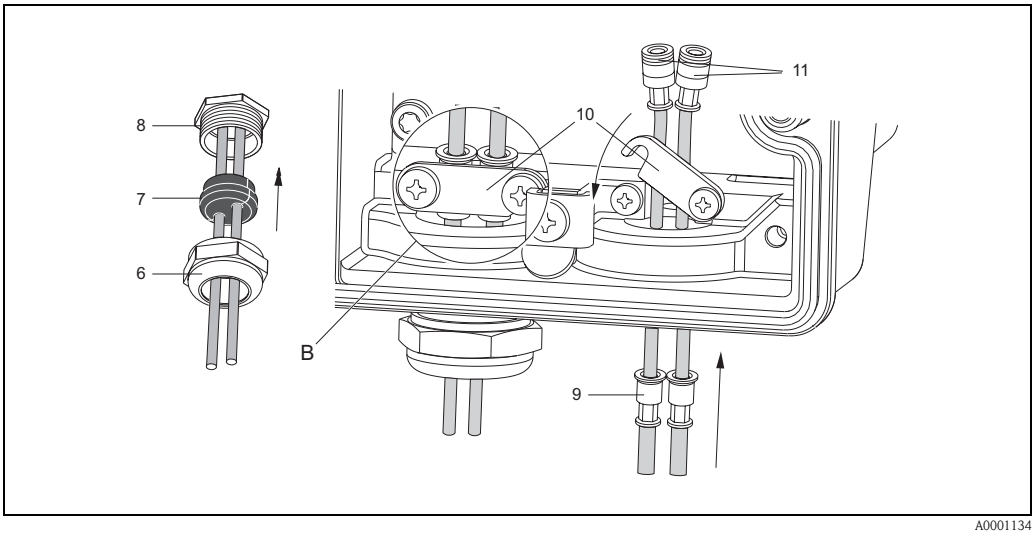
4.1.1 Connection of Prosonic Flow W/P/U

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.



A0001133

Fig. 33: Connecting the measuring system



A0001134

Fig. 34: Connection of the sensor connecting cable

See next page for graphic legend and installation instructions.

Legend:
A View A
B Detail B
1 Connection compartment cover
2 Sensor cable plug, upstream
3 Sensor cable plug, downstream
4 Cable entry (not required)
5 Cable entry (not required)
6 Cable gland cover
7 Rubber seal
8 Cable gland holder
9 Cable fixing sleeves
10 Earth contact terminals
11 Sensor cable plug

Procedure:

1. Transmitter: Loosen the screws and remove cover (item 3, Fig. 33) from the connection compartment.
2. Remove the blank cover for the cable entries.
3. Disassemble the special cable entry which is supplied with the sensors. Run both sensor connection cables through the cover (6) of the cable gland and into the connection compartment.
4. Position the cable fixing sleeves (9) of both sensor cables exactly next to each other (Detail B). Push in the earth contact terminals (10) and screw tight. This ensures perfect grounding.
5. Spread the rubber seal (7) along the side slit with a suitable tool (e.g. a large screwdriver) so that both sensor cables can be fixed into place. Push up the rubber seal in the cable gland (8). Close the cover of the cable gland (6) so that it is tight.
6. Plug in the sensor cable connectors (11) in the way shown in Fig. 33.
7. Transmitter: Secure cover (1) on the connection compartment.

4.1.2 Cable specifications

Sensor cable
- Use the ready-to-use cables supplied by Endress+Hauser with each sensor pair.
- The cables are available in lengths of 5 m, 10 m, 15 m and 30 m.
- You can choose between PTFE and PVC cable materials.

Operation in zones of severe electrical interference:
The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1 (IEC 1326) “Emmision to class A requirements”, and NAMUR Recommendation NE 21.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing.

4.2 Connecting the measuring unit

4.2.1 Connecting the transmitter

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 conductor to the ground terminal on the housing before the power supply is applied (not necessary if the power supply is galvanically isolated).
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

1. Remove the cover of the connection compartment (f) from the transmitter housing.
2. Feed the power supply cable (a) and signal cables (b) through the appropriate cable entries.
3. Wiring:
   – Connection plan (wall-mount housing) → Fig. 35
   – Terminal assignment → Page 38
4. Screw the cover of the connection compartment (f) firmly back onto the transmitter housing.

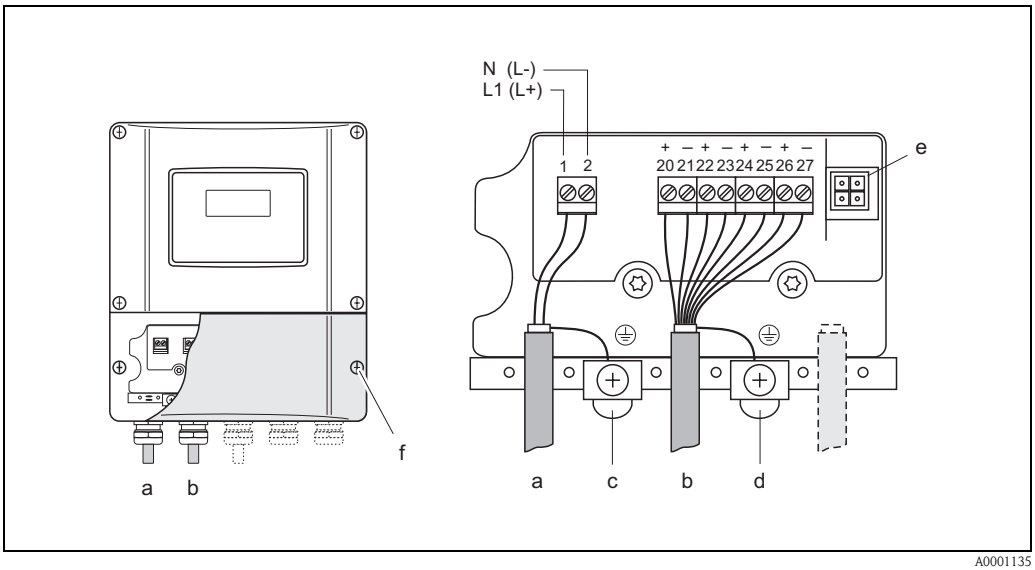


Fig. 35: Connecting the transmitter (wall-mount housing) Conductor cross-section: max. 2.5 mm²

a Power supply cables: 85...260 V AC, 20...55 V AC, 16...62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L– for DC*
*b Signal cable: terminals **No. 20–27** → Page 38*
c Ground terminal for protective earth (PE)
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA 193 (Fieldcheck, ToF Tool - Fieldtool Package)
f Cover of the connection compartment

4.2.2 Terminal assignment

Order variant	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 (+) / 27 (–)**
90***-**********W	–	–	–	Current output HART
90***-**********A	–	–	Frequency output	Current output HART
90***-**********D	Status input	Status output	Frequency output	Current output HART

Status input (auxiliary input)
galvanically isolated, 3...30 V DC, R_i = 5 kΩ

Status output
Open Collector, max. 30 V DC / 250 mA, galvanically isolated
configurable for: error messages, flow direction, limit values

Frequency output (passive)
Open Collector, galvanically isolated, 30 V DC, 250 mA
– Frequency output: end frequency 2...1000 Hz (f_{max} = 1250 Hz), on/off ration ~1:1, pulse width max. 2 s
– Pulse output: pulse value and pulse polarity selectable, pulse width adjustable (0.5...2000 ms)

Current output (active, passive)
galvanically isolated, active: 0/4...20 mA, R_L < 700 Ω (HART: R_L ≥ 250 Ω),
passive: 4...20 mA, max. 30 V DC, R_i ≤ 150 Ω,

Ground connection, power supply → Page 37

4.2.3 HART connection

Users have the following connection options at their disposal:
- Direct connection to transmitter by means of terminals 26 / 27
- Connection by means of the 4...20 mA circuit.

Note!
- The measuring loop's minimum load must be at least 250 Ω.
- After commissioning, make the following settings:
  – CURRENT SPAN function → "4...20 mA HART" or "4...20 mA (25 mA) HART"

Connecting the HART handheld communicator
For connecting, see also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".

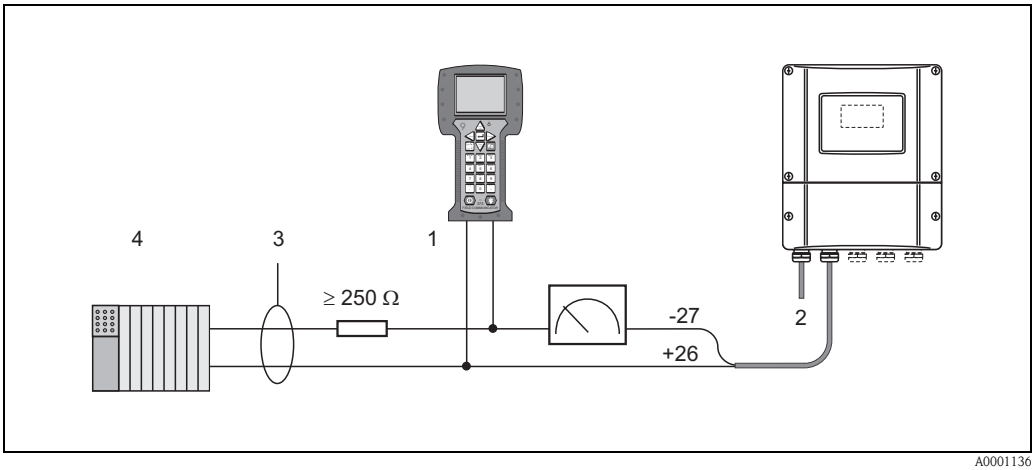


Fig. 36: Electrical connection of the HART handheld communicator:
1 = HART communicator, 2 = power supply, 3 = shield, 4 = other evaluation devices or PLC with passive input

Connecting a PC with operating software
A HART modem (e.g. Commubox FXA 191) is required for connection of a personal computer running operating software (e.g. "ToF Tool – Fieldtool Package").
See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary"
.

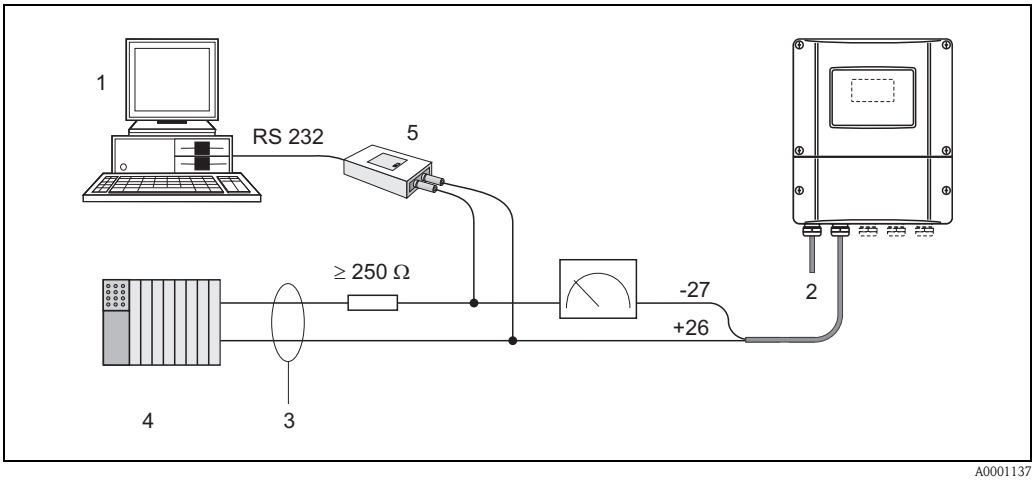


Fig. 37: Electrical connection of a PC with operating software
1 = PC with operating software, 2 = power supply, 3 = shield, 4 = other switching units or PLC with passive input, 5 = HART modem, e.g. Commubox FXA 191

4.3 Potential equalisation

For potential equalisation no special measures are necessary.

✎ Note!
For instruments for use in hazardous areas, observe the corresponding guidelines in the specific Ex documentation.

4.4 Degree of protection

Transmitter (wallmount housing)
The transmitter fulfills all the requirements for IP 67 degree of protection. Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter (see Page 97).
- Firmly tighten the cable entries (Fig. 38).
- Remove all unused cable entries and insert dummy plugs instead.
- Do not remove the grommet from the cable entry.

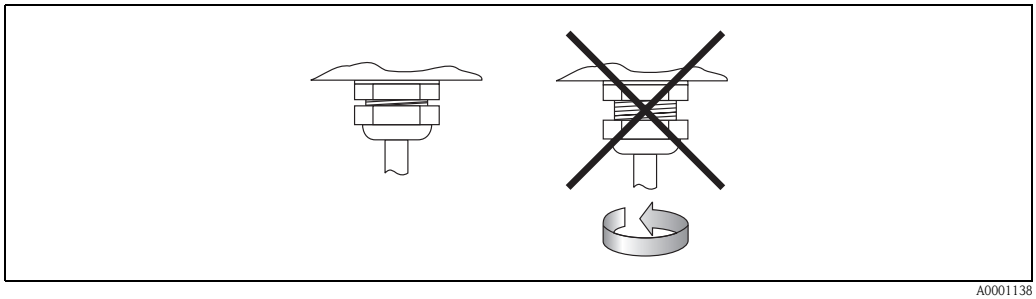


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Fig. 38: Installation instructions for cable entries on the transmitter housing

Flowrate measuring sensors W/P (clamp-on / Insertion)
The flowrate measuring sensors W/P, depending on the type, fulfill all the requirements for IP 67 or 68 degree of protection (please observe the informations on the nameplate of the sensor). Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67/68 protection is maintained:

- Only use cables supplied by Endress+Hauser with the corresponding sensor connectors.
- The cable connector seals (1) must be clean, dry and undamaged when inserted in the seal groove. Replace them if necessary.
- Insert the cable connectors, do not cant and then tighten them to the stop.

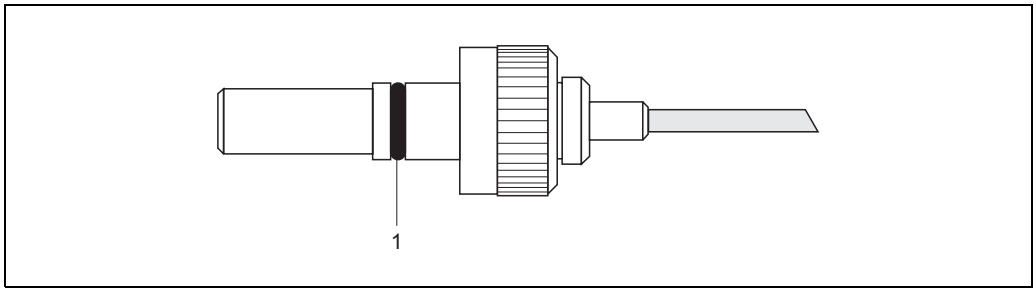

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Fig. 39: Installation instructions for IP 67/68 degree of protection for sensor connectors

Flowrate measuring sensors U (clamp-on)
The flowrate measuring sensors U fulfill all the requirements for IP 54 degree of protection. Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 54 protection is maintained:

- Only use cables supplied by Endress+Hauser with the corresponding sensor connectors.
- The BNC cable connectors (1) must be clean, dry and undamaged.
- Insert the BNC cable connectors (1), do not cant and then tighten them to the stop.

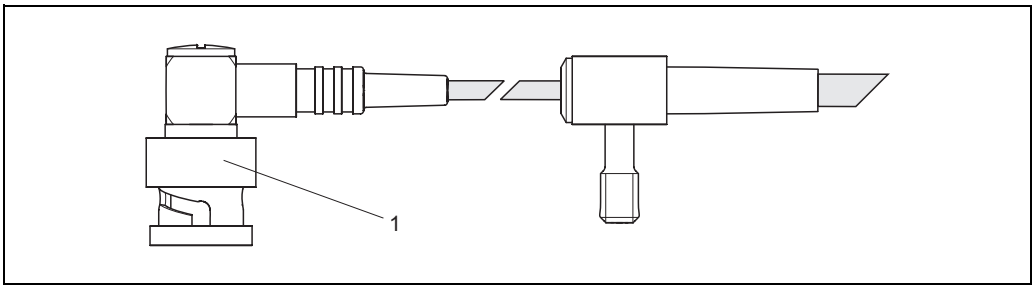


Fig. 40: Installation instructions for IP 54 degree of protection for BNC sensor connectors

4.5 Connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	Notes
Are cables or the device damaged (visual inspection)?	–
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?	85...260 V AC (45...65 Hz) 20...55 V AC (45...65 Hz) 16...62 V DC
Do the cables comply with the specifications?	see Page 36, 97
Do the cables have adequate strain relief?	–
Cables correctly segregated by type? Without loops and crossovers?	–
Are the power supply and sensor cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	–
Have the measures for grounding/potential equalisation been correctly implemented?	see Page 40 ff.
Are all cable entries installed, firmly tightened and correctly sealed?	see Page 40
Are all housing covers installed and firmly tightened?	–

5 Operation

5.1 Quick operation guide

You have a number of options for configuring and commissioning the device:

1. Local display (optional) → Page 44
   The local display enables you to read all of the important parameters directly at the measuring point, configure device-specific parameters in the field and commission the instrument.
2. Configuration programs → Page 67
   Measuring devices without local operation can be configured by means of the configuration program “ToF Tool – Fieldtool Package”.

5.2 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the "Quick Setup" or the function matrix.

The display consists of two lines; this is where measured values and/or status variables (direction of flow, bar graph, etc.) are displayed. You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the "Description of Device Functions" manual).

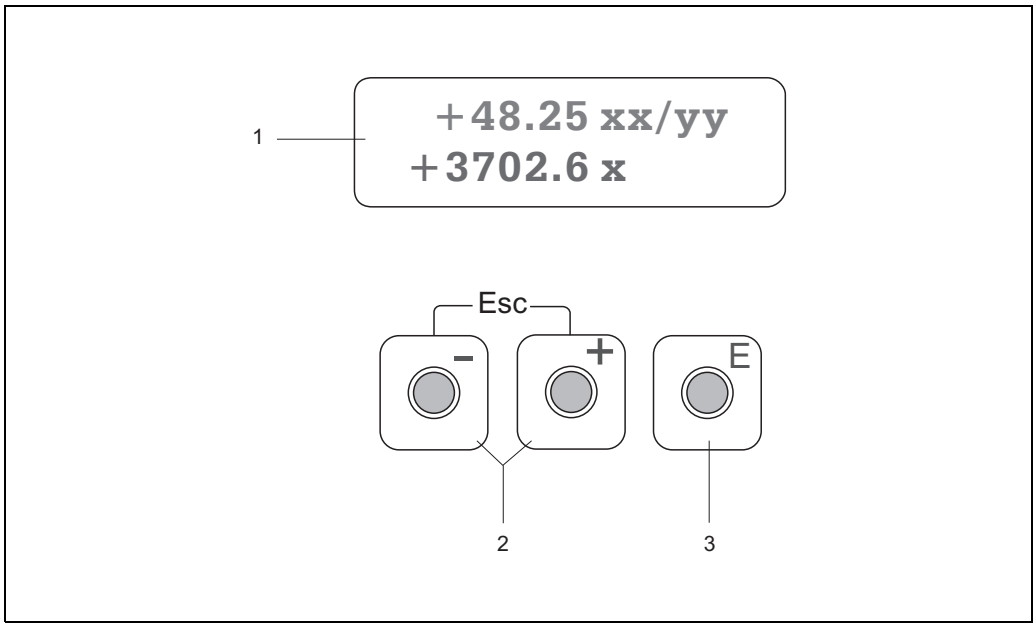


Fig. 41: Display and operating elements

Liquid crystal display (1)
The illuminated, two-line liquid crystal display shows measured values, dialog texts, fault messages and notice messages. The display as it appears during standard measuring mode is known as the HOME position (operating mode).

Top line: Shows main measured values, e.g. volume flow in [ml/min] or in [%].
Bottom line: Shows additional measured variables and status variables, e.g. totalizer reading in [m^3], bar graph representation, tag name

Plus/minus keys (2)
- *Enter numerical values, select parameters*
- *Select different function groups within the function matrix*

Press the [+] [–] keys simultaneously to trigger the following functions:
- *Exit of the function matrix step by step → HOME position*
- *Press and hold down the [+] [–] keys for more than 3 seconds → Return directly to HOME position*
- *Cancel data entry*

Enter key (3)
- *HOME position → Entry to the function matrix*
- *Save the numerical values you input or settings you change*

5.3 Brief operating instructions to the function matrix

Note!
- Please refer to the general notes on Page 46.
- Function descriptions → see the "Description of Device Functions" manual

1. HOME position → E → Entry to the function matrix
2. Select a function group (e.g. CURRENT OUTPUT 1)
3. Select a function (e.g. TIME CONSTANT)

   Change parameter / enter numeric values:
   ± → Select or enter the release code, parameters, numerical values
   E → Save the entries

4. Exit the function matrix:
   – Press and hold down Esc key (Esc) for more than 3 seconds → HOME position
   – Repeatedly press Esc key (Esc) → return step by step to HOME position

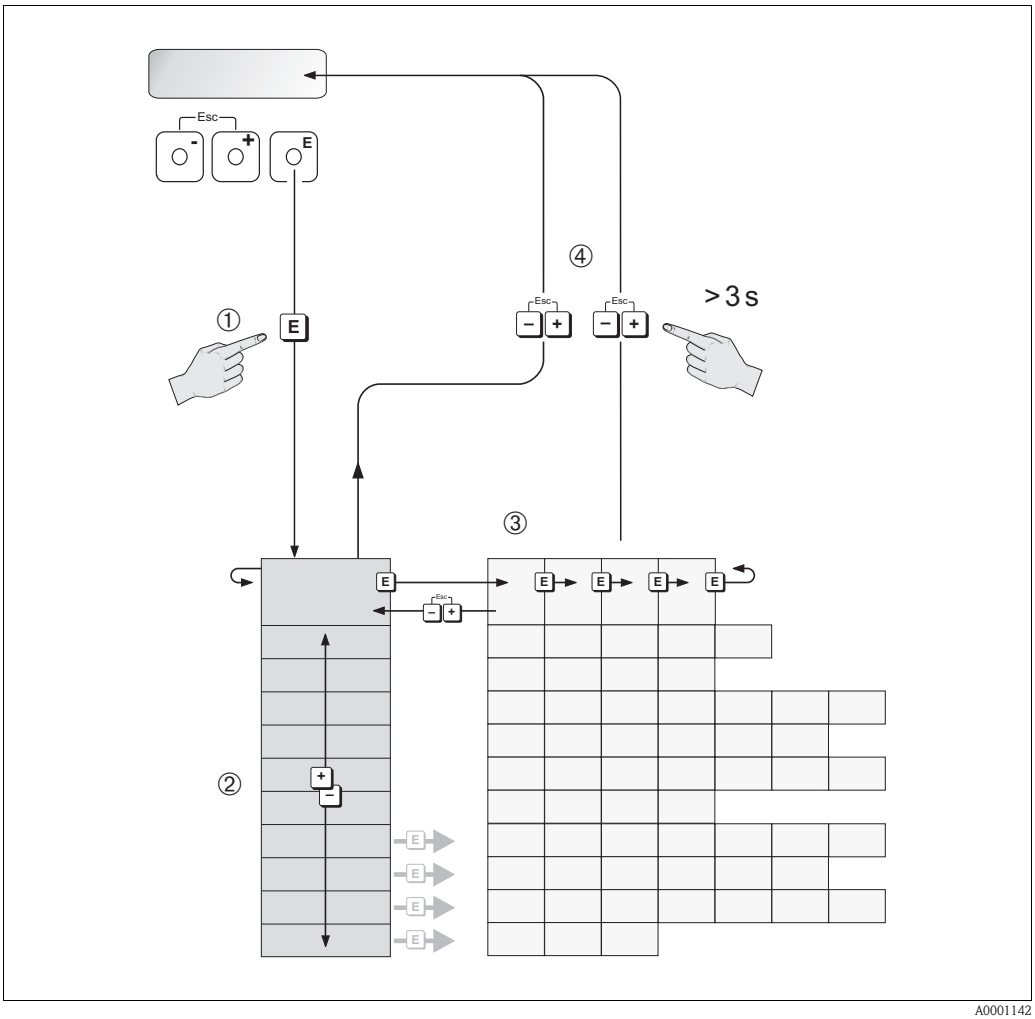


Fig. 42: Selecting functions and configuring parameters (function matrix)

5.3.1 General notes

The Quick Setup menu (see Page 65) is adequate for commissioning with the necessary standard settings. Complex measurement tasks on the other hand necessitate additional functions that you can configure as necessary and customize to suit your process condition. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged in a number of function groups.

Comply with the following instructions when configuring functions:
- You select functions as described on Page 45.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press ⊞ to select "SURE [YES]" and press ⓔ again to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.

Note!
- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the power supply fails all preset and parameterised values remain safely stored in the EEPROM.

Caution!
All functions are described in detail , including the function matrix itself, in the **"Description of Device Functions"** manual, which is a separate part of these Operating Instructions.

5.3.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 90) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ see the "Description of Device Functions" manual).
Comply with the following instructions when entering codes:
- If programming is disabled and the ⊞ keys are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is entered as the customer's code, programming is always enabled.
- The Endress+Hauser service organisation can be of assistance if you mislay your personal code.

Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring device, particularly measuring accuracy.
There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organisation. Please contact Endress+Hauser if you have any questions.

5.3.3 Disabling the programming mode

Programming mode is disabled if you do not press an operating element within 60 seconds after you return to the HOME position.
You can also disable programming in the "ACCESS CODE" function by entering any number (other than the customer's code).

5.4 Error messages

Type of error
Errors that occur during commissioning or measuring operation are displayed immediately. If two or more system or process errors occur, the error with the highest priority is always the one shown on the display.

The measuring system distinguishes between two types of error:
- *System errors:* this group includes all device errors, for example communication errors, hardware errors, etc. → see Page 80
- *Process error:* this group comprises all application errors, e.g. measuring range exceeded → see Page 84

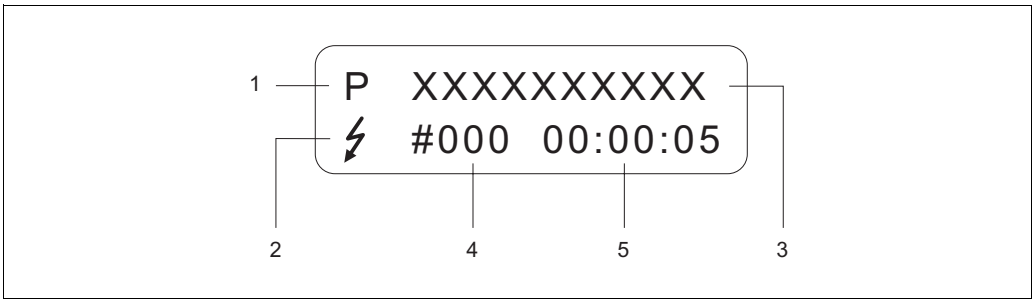


Fig. 43: Error messages on the display (example)

1 Error type: P = process error, S = system error
2 Error message type: ϟ = fault message, ! = notice message
3 Error designation: e.g. S.VELOC RANGE = sound velocity outside the measuring range
4 Error number: e.g. #491
5 Duration of most recent error occurrence (in hours, minutes and seconds)

Error message type
Users have the option of weighting system and process errors differently, by defining them as **"Fault messages"** or **"Notice messages"**. You can define messages in this way with the aid of the function matrix (see the "Description of Device Functions" manual). Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)
- Displayed as → Exclamation mark (!), Error type (S: system error, P: process error).
- The error in question has no effect on the outputs of the measuring device.

Fault message (ϟ)
- Displayed as → Lightning flash (ϟ), Error type (S: system error, P: process error)
- The error in question has a direct effect on the outputs.
  The response of the outputs (failsafe mode) can be defined by means of functions in the function matrix (see Page 86).

✎ Note!
- Error status can be output via the status output.
- If there is an error message present a higher or lower signal on alarm level can be output via the current output in accordance with NAMUR Recommendation NE 43.

5.5 Communication (HART)

In addition to local operation, the measuring device can also be configured and measured values obtained by means of the HART protocol. Digital communication takes place using the 4...20 mA current output HART (see Page 39).

The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes. The HART master, such as a handheld terminal or PC-based operating programs (such as "ToF Tool – Fieldtool Package"), require device description (DD) files. They are used to access all the information in a HART device. Information is exclusively transferred using so-called "commands". There are three different command groups:

Universal commands:
All HART device support and use universal commands. The following functionalities are linked to them:
- Recognizing HART devices
- Reading digital measured values (volume flow, totalizer, etc.)

Common practice commands:
Common practice commands offer functions which are supported and can be executed by most but not all field devices.

Device-specific commands:
These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, amongst other things, such as empty/full pipe calibration values, low flow cut off settings etc.

Note!
The measuring device has access to all three command classes. On Page 52, you will find a list with all the supported "Universal Commands" and "Common Practice Commands".

5.5.1 Operating options

For the complete operation of the measuring device, including device-specific commands, there are DD files available to the user to provide the following operating aids and programs:

Note!
In the CURRENT RANGE function (current output 1), the HART protocol demands the setting "4...20 mA HART" or "4-20 mA (25 mA) HART".
- HART write protection can be disabled or enabled by means of a jumper on the I/O board.

HART handheld terminal DXR 375
Selecting device functions with a HART Communicator is a process involving a number of menu levels and a special HART function matrix.
The HART manual in the carrying case of the HART Communicator contains more detailed information on the device.

Operating program "ToF Tool - Fieldtool Package"
Modular software package consisting of the service program "ToF Tool" for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and evolution of pressure measuring instruments as well as the "ToF Tool - Fieldtool Package" service program for the configuration and diagnosis of Proline flowmeters. The Proline flowmeters are accessed via a service interface or via the service interface FXA 193 or the HART protocol.

Contents of the "ToF Tool - Fieldtool Package":
- Commissioning, maintenance analysis
- Configuring flowmeters
- Service functions
- Visualisation of process data
- Trouble-shooting
- Controlling the "Fieldcheck" tester/simulator

Fieldcare
FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA 193.

Operating program "SIMATIC PDM" (Siemens)
SIMATIC PDM is a standardised, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

Operating program "AMS" (Emerson Process Management)
AMS (Asset Management Solutions): program for operating and configuring devices

5.5.2 Current device description files

The following table illustrates the suitable device description file for the operating tool in question and then indicates where these can be obtained.

HART protocol:

Valid for software:	2.00.XX	→ Function "Device software" (8100)
Device data HART Manufacturer ID: Device ID:	 11_{hex} (ENDRESS+HAUSER) 58_{hex}	 → Function "Manufacturer ID" (6040) → Function "Device ID" (6041)
HART version data:	Device Revision 6/ DD Revision 1	
Software release:	11.2004	

Operating program:	**Sources for obtaining device descriptions:**
Handheld terminal DXR 375	■ Use update function of handheld terminal
ToF Tool - Fieldtool Package	■ www.tof-fieldtool.endress.com (→ Download → Software → Device driver) ■ CD-ROM (Endress+Hauser order number 50097200)
Fieldcare / DTM	■ www.endress.com (→ Download → Software → Device driver) ■ CD-ROM (Endress+Hauser order number 50097200)
AMS	■ www.endress.com (→ Download → Software → Device driver) ■ CD-ROM (Endress+Hauser order number 50097200)
SIMATIC PDM	■ www.endress.com (→ Download → Software → Device driver) ■ CD-ROM (Endress+Hauser order number 50097200)

Operation via the service protocol

Valid for device software:	2.00.XX	→ Function "Device software" (8100)
Software release:	11.2004	

Operating program:	**Sources for obtaining device descriptions:**
ToF Tool - Fieldtool Package	■ www.tof-fieldtool.endress.com (→ Download → Software → Device driver) ■ CD-ROM (Endress+Hauser order number 50097200)

Tester/simulator:	**Sources for obtaining device descriptions:**
Fieldcheck	■ Update by means of ToF Tool - Fieldtool Package via Fieldflash module

5.5.3 Device variables and process variables

Device variables:
The following device variables are available using the HART protocol:

ID (decimal)	Device variable
0	OFF (not assigned)
30	Volume flow
40	Sound velocity
49	Flow velocity
250	Totalizer 1

Process variables:
At the factory, the process variables are assigned to the following device variables:

- Primary process variable (PV) → Volume flow
- Second process variable (SV) → Totalizer
- Third process variable (TV) → Sound velocity
- Fourth process variable (FV) → Flow velocity

Note!
You can set or change the assignment of device variables to process variables using Command 51 (see Page 56).

5.5.4 Universal / common practice HART commands

The following table contains all the universal and common practice commands supported by Prosonic Flow 90.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
Universal Commands			
0	Read unique device identifier Access type = read	none	Device identification provides information on the device and manufacturer and cannot be changed. The response consists of a 12 byte device ID: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 88 = Prosonic Flow 90 – Byte 3: Number of preambles – Byte 4: Rev. no. universal commands – Byte 5: Rev. no. device-specific commands – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Byte 9–11: Device identification
1	Read primary process variable Access type = read	none	– Byte 0: HART unit code of the primary process variable – Byte 1–4: Primary process variable *Factory setting:* Primary process variable = Volume flow ✎ Note! ■ You can set or change the assignment of device variables to process variables using Command 51. ■ Manufacturer-specific units are represented using the HART unit code “240”.
2	Read the primary process variable as current in mA and percentage of the set measuring range Access type = read	none	– Byte 0–3: Present current of the primary process variable in mA – Byte 4–7: Percentage of the set measuring range *Factory setting:* Primary process variable = Volume flow ✎ Note! You can set or change the assignment of device variables to process variables using Command 51.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
3	Read the primary process variable as current in mA and four (preset using Command 51) dynamic process variables Access type = read	none	24 bytes are sent as a response: – Byte 0–3: Primary process variable current in mA – Byte 4: HART unit code of the primary process variable – Byte 5–8: Primary process variable – Byte 9: HART unit code of the secondary process variable – Byte 10–13: Second process variable – Byte 14: HART unit code of the third process variable – Byte 15–18: Third process variable – Byte 19: HART unit code of the fourth process variable – Byte 20–23: Fourth process variable *Factory setting:* ■ Primary process variable = Volume flow ■ Second process variable = Totalizer ■ Third process variable = Sound velocity ■ Fourth process variable = Flow velocity ✎ Note! ■ You can set the assignment of device variables to process variables using Command 51. ■ Manufacturer-specific units are represented using the HART unit code “240”.
6	Set HART shortform address Access type = write	Byte 0: Desired address (0...15) *Factory setting:* 0 ✎ Note! With an address >0 (multidrop mode), the current output of the primary process variable is set to 4 mA.	Byte 0: Active address
11	Read unique device identification using the TAG (measuring point designation) Access type = Read	Byte 0–5: Measuring point designation (TAG)	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID if the given TAG agrees with the one saved in the device: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 88 = Prosonic Flow 90 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Byte 9–11: Device identification
12	Read user message Access type = read	none	Byte 0–24: User message ✎ Note! You can write the user message using Command 17.
13	Read TAG, TAG descriptor and date Access type = read	none	– Byte 0–5: TAG name – Byte 6–17: TAG description – Byte 18–20: Date ✎ Note! You can write the TAG, TAG descriptor and date using Command 18.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
14	Read sensor information on primary process variable	none	– Byte 0–2: Sensor serial number – Byte 3: HART unit code of the sensor limits and measuring range of the primary process variable – Byte 4–7: Upper sensor limit – Byte 8–11: Lower sensor limit – Byte 12–15: Minimum span ✎ Note! ■ The data relate to the primary process variable (= volume flow). ■ Manufacturer-specific units are represented using the HART unit code “240”.
15	Read output information of primary process variable Access type = read	none	– Byte 0: Alarm selection code – Byte 1: Transfer function code – Byte 2: HART unit code for the set measuring range of the primary process variable – Byte 3–6: End of measuring range, value for 20 mA – Byte 7–10: Start of measuring range, value for 4 mA – Byte 11–14: Attenuation constants in [s] – Byte 15: Write protection code – Byte 16: OEM dealer code, 17 = E+H *Factory setting:* Primary process variable = Volume flow ✎ Note! ■ You can set the assignment of device variables to process variables using Command 51. ■ Manufacturer-specific units are represented using the HART unit ID “240”.
16	Read the device production number Access type = read	none	Byte 0–2: Production number
17	Write user message Access = write	You can save any 32-character long text in the device under this parameter: Byte 0–23: Desired user message	Displays the current user message in the device: Byte 0–23: Current user message in the device
18	Write TAG, TAG descriptor and date Access = write	With this parameter, you can store an 8 character TAG, a 16 character TAG description and a date: – Byte 0–5: TAG name – Byte 6–17: TAG description – Byte 18–20: Date	Displays the current information in the device: – Byte 0–5: TAG name – Byte 6–17: TAG description – Byte 18–20: Date
Common Practice Commands			
34	Write damping value for primary process variable Access = write	Byte 0–3: Damping value of the primary process variable in seconds *Factory setting:* Primary process variable = Volume flow	Displays the current attenuation constant in the device: Byte 0–3: Damping constants in seconds

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
35	Write measuring range of primary process variable Access = write	Write the desired measuring range: – Byte 0: HART unit code for the primary process variable – Byte 1–4: Upper range, value for 20 mA – Byte 5–8: Lower range, value for 4mA *Factory setting:* Primary process variable = Volume flow ✎ Note! ■ You can set or change the assignment of device variables to process variables using Command 51. ■ If the HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.	The currently set measuring range is shown as the response: – Byte 0: HART unit code for the set measuring range of the primary process variable – Byte 1–4: Upper range, value for 20 mA – Byte 5–8: Lower range, value for 4mA ✎ Note! Manufacturer-specific units are represented using the HART unit code “240”.
38	Device status reset “Configuration changed” Access = write	none	none
40	Simulate output current of primary process variable Access = write	Simulation of the desired output current of the primary process variable. An entry value of 0 exits the simulation mode: Byte 0–3: Output current in mA *Factory setting:* Primary process variable = Volume flow ✎ Note! You can set the assignment of device variables to process variables using Command 51.	The momentary output current of the primary process variable is displayed as a response: Byte 0–3: Output current in mA
42	Perform device reset Access = write	none	none
44	Write unit of primary process variable Access = write	Set unit of primary process variable Only unit which are suitable for the process variable are transferred to the device: Byte 0: HART unit code *Factory setting:* Primary process variable = Volume flow ✎ Note! ■ If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit. ■ If you change the unit of the primary process variable, this has no impact on the system units.	The current unit code of the primary process variable is displayed as a response: Byte 0: HART unit code ✎ Note! Manufacturer-specific units are represented using the HART unit code “240”.
48	Read additional device status Access = read	none	The device status is displayed in extended form as the response: Coding: see table on Page 57

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
50	Read assignment of the device variables to the four process variables Access = read	none	Display of the current variable assignment of the process variables: – Byte 0: Device variable code for the primary process variable – Byte 1: Device variable code for the second process variable – Byte 2: Device variable code for the third process variable – Byte 3: Device variable code for the fourth process variable *Factory setting:* ■ Primary process variable: code 30 for volume flow ■ Secondary process variable: code 250 for totalizer ■ Third process variable: code 40 for sound velocity ■ Fourth process variable: code 49 for flow velocity ✎ Note! You can set or change the assignment of device variables to process variables using Command 51.
51	Write assignments of the device variables to the four process variables Access = write	Setting of the device variables to the four process variables: – Byte 0: Device variable code for the primary process variable – Byte 1: Device variable code for the second process variable – Byte 2: Device variable code for the third process variable – Byte 3: Device variable code for the fourth process variable *Code of the support device variables:* See data on Page 51 *Factory setting:* ■ Primary proc. variable = Volume flow ■ Secondary process variable = Totalizer ■ Third process variable = Sound velocity ■ Fourth process variable = Flow velocity	The variable assignment of the process variables is displayed as a response: – Byte 0: Device variable code for the primary process variable – Byte 1: Device variable code for the second process variable – Byte 2: Device variable code for the third process variable – Byte 3: Device variable code for the fourth process variable
53	Write device variable unit Access = write	This command set the unit of the given device variables. Only those units which suit the device variable are transferred: – Byte 0: Device variable code – Byte 1: HART unit code *Code of the supported device variables:* See data on Page 51 ✎ Note! ■ If the written unit is not the correct one for the device variable, the device will continue with the last valid unit. ■ If you change the unit of the device variable, this has no impact on the system units.	The current unit of the device variables is displayed in the device as a response: – Byte 0: Device variable code – Byte 1: HART unit code ✎ Note! Manufacturer-specific units are represented using the HART unit code “240”.
59	Set number of preambles in message responses Access = write	This parameter sets the number of preambles which are inserts in the message responses: Byte 0: Number of preambles (2...20)	As a response, the current number of the preambles is displayed in the response message: Byte 0: Number of preambles

5.5.5 Device status / Error messages

You can read the extended device status, in this case, current error messages, via Command “48”. The command delivers information which are partly coded in bits (see table below).

✎ Note!
You can find a detailed explanation of the device status and error messages and their elimination on Page 80 ff.!

Byte	Bit	Error no.	Short error description (→ Page 80 ff.)
0	0	001	Serious device error
	1	011	Measuring amplifier has faulty EEPROM
	2	012	Error when accessing data of the measuring amplifier EEPROM
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
1	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
2	0	not assigned	–
	1	081	Connection (downwards) sensor/transmitter interrupted
	2	not assigned	–
	3	not assigned	–
	4	084	Connection (upwards) sensor/transmitter interrupted
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
3	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	111	Totalizer checksum error
	4	121	The I/O- and the amplifier board are not compatible.
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–

Byte	Bit	Error no.	Short error description (→ Page 80 ff.)
4	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	261	No data transfer between amplifier and I/O board
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
5	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	339	Current buffer: The temporarily buffered flow portions (measuring mode for pul-sating flow) could not be cleared or output within 60 seconds.
6	0	340	
	1	341	
	2	342	
	3	343	Frequency buffer: The temporarily buffered flow portions (measuring mode for pul-sating flow) could not be cleared or output within 60 seconds.
	4	344	
	5	345	
	6	346	
	7	347	Pulse buffer: The temporarily buffered flow portions (measuring mode for pul-sating flow) could not be cleared or output within 60 seconds.
7	0	348	
	1	349	
	2	350	
	3	351	Current output: flow is out of range.
	4	352	
	5	353	
	6	354	
	7	355	Frequency output: flow is out of range.
8	0	356	
	1	357	
	2	358	
	3	359	Pulse output: the pulse output frequency is out of range.
	4	360	
	5	361	
	6	362	
	7	not assigned	–

Byte	Bit	Error no.	Short error description (→ Page 80 ff.)
9	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
10	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	391	Attenuation of acoustic measurement section too high.
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
11	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
12	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	491	Sound velocity is outside the measuring range
	5	not assigned	–
	6	not assigned	–
	7	501	New measuring amplifier software version is loaded. No other commands possible at this point.
13	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–

Byte	Bit	Error no.	Short error description (→ Page 80 ff.)
14	0	592	Initialization is running. All outputs set to “0”.
	1	not assigned	–
	2	not assigned	–
	3	601	Positive zero return active
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	611	Simulation current output active
15	0	612	
	1	613	
	2	614	
	3	621	Simulation frequency output active
	4	622	
	5	623	
	6	624	
	7	631	Simulation pulse output active
16	0	632	
	1	633	
	2	634	
	3	641	Simulation status output active
	4	642	
	5	643	
	6	644	
	7	not assigned	–
17	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	671	Simulation status input active
18	0	672	
	1	673	
	2	674	
	3	691	Simulation of response to error (outputs) active
	4	692	Simulation of volume flow active
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–

Byte	Bit	Error no.	Short error description (→ Page 80 ff.)
19	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
20	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	731	Zero adjustment not possible or interrupted.
	6	not assigned	–
	7	not assigned	–
21	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–

6 Commissioning

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- "Installation check" checklist → Page 34
- "Connection check" checklist → Page 41

Switching on the measuring device
Once the connection checks (see Page 41) have been successfully completed, it is time to switch on the power supply. The device is now operational.
The measuring device performs a number of self-tests after power-on. As this procedure progresses the following sequence of messages appears on the local display:

PROSONIC FLOW 90 **START UP. . .**	Start-up message
▼	
SW AMPLIFIER **V X.XX.XX**	Current software is displayed (example)
▼	
SYSTEM OK **→ OPERATION**	Beginning of standard measuring mode
▼	

Standard measuring mode commences as soon as power-on is completed. Various measured value and/or status variables appear on the display (HOME position).

✎ Note!
If start-up fails, an error message indicating the cause is displayed.

6.2 Commissioning via local display

6.2.1 "Sensor installation" Quick Setup menu

If the measuring device is equipped with a local operation, the sensor distance can be ascertained using the "Sensor" Quick Setup menu (Fig. 44).
If a measuring device does not have a local operation, the individual parameters and functions must be configured via the configuration program "ToF Tool – Fieldtool Package" (see Page 67).

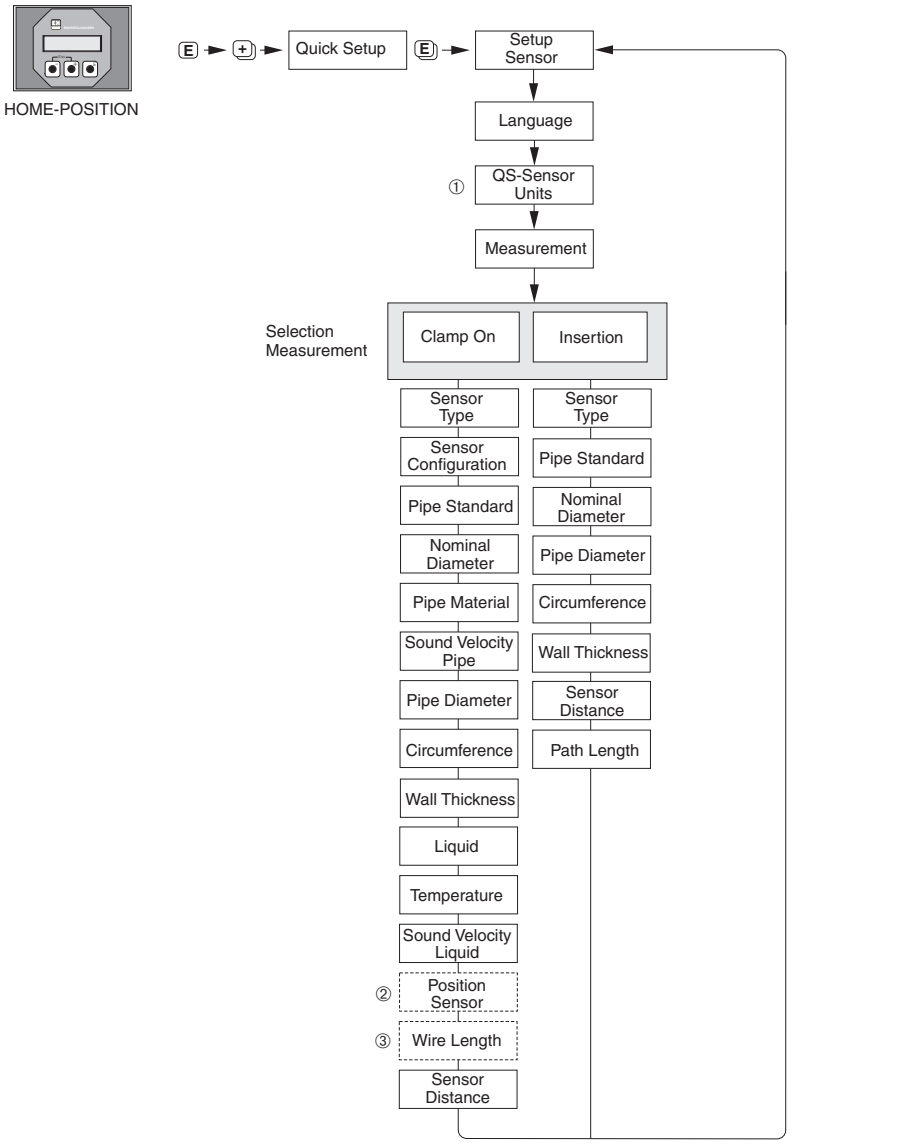


Fig. 44: "Quick Setup" menu for sensor installation

Note!
The display returns to the QUICK SETUP COMMISSIONING function cell if you press the ESC key (− + ESC) during parameter interrogation.

① Selection of the system units only influences the functions UNIT TEMPERATURE, UNIT LENGTH and UNIT VELOCITY.

② The POSITION SENSOR function only appears when the CLAMP ON option is set in the MEASUREMENT function and the number of traverses is 2 or 4 in the SENSOR CONFIGURATION function.

③ The WIRE LENGTH function only appears when the CLAMP ON option is set in the MEASUREMENT function and the number of traverses is 1 or 3 in the SENSOR CONFIGURATION function.

6.2.2 "Commissioning" Quick Setup menu

If the measuring device is equipped with a local operation, all the device parameters important for standard measuring mode can be configured easily and quickly using the "Commissioning" Quick Setup menu (Fig. 45).
If a measuring device does not have a local operation, the individual parameters and functions must be configured via the configuration program "ToF Tool – Fieldtool Package" (see Page 67).

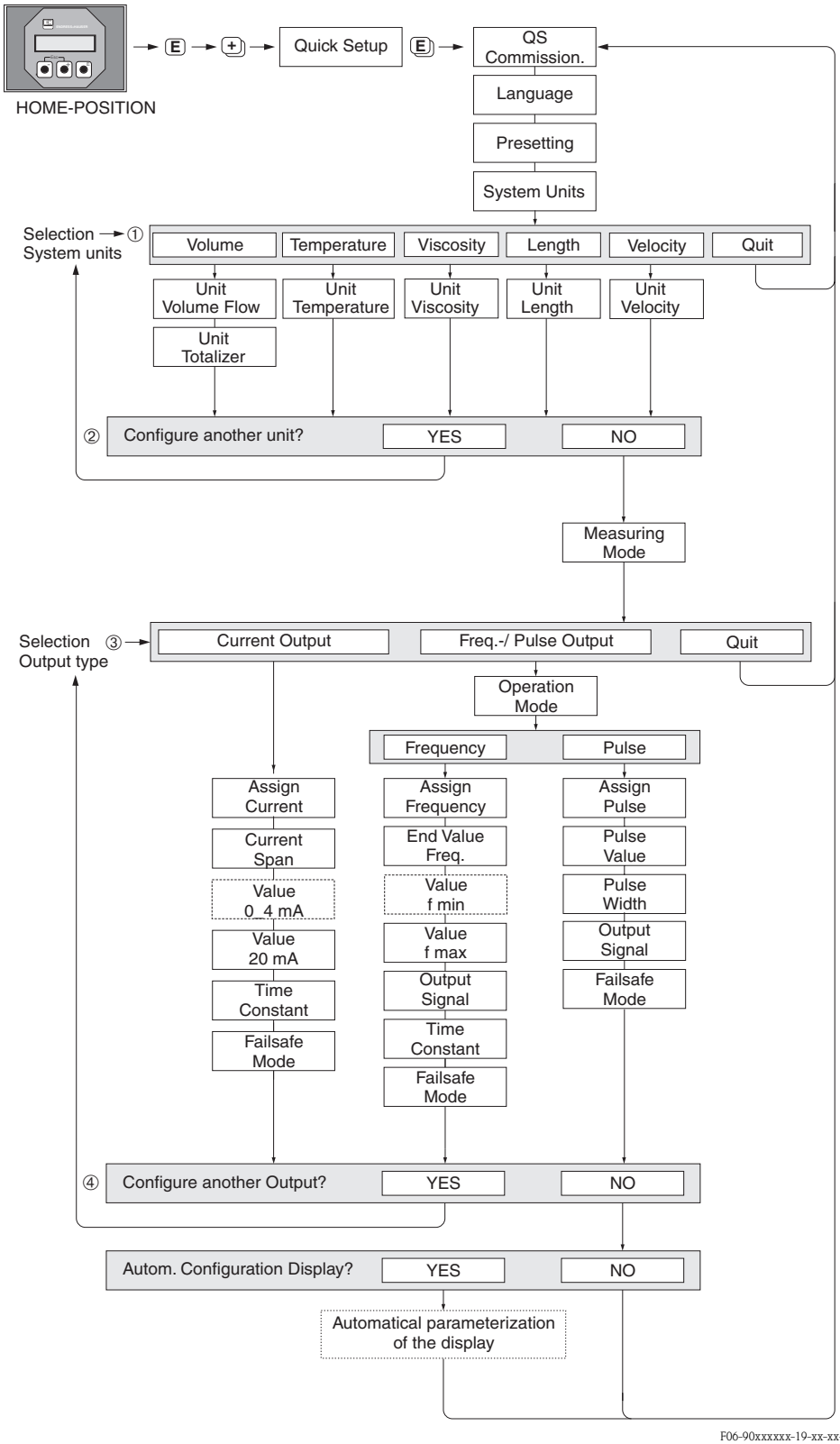


Fig. 45: "Commissioning" Quick Setup for rapid configuration of important device functions
For an explanation of points ①–④: see next page

Note!
The display returns to the function cell QUICK SETUP COMMISSIONING if you press the ESC key (ESC) during interrogation.

①
Only the units not yet configured in the current Quick Setup are offered for selection in each cycle. The unit for volume is derived from the volume flow unit.

②
The “YES” option remains visible until all the units have been parameterized.
“NO” is the only option displayed when no further units are available.

③
Only the outputs not yet configured in the current Quick Setup are offered for selection in each cycle.

④
The “YES” option remains visible until all the outputs have been parameterized.
“NO” is the only option displayed when no further outputs are available.

6.3 Commissioning via a configuration program

6.3.1 Sensor installation

For sensor installation with the configuration program "ToF Tool - Fieldtool Package" any "Quick Setup" menus which correspond to the local operation exist.
Other methods (see table) are available for determining the relevant values for sensor distance, wire length, etc. The procedure is illustrated in detail on → Page 68.

Sensor type	Required values for the sensor mounting procedure	Local display [1]	ToF Tool - Fieldtool Package [2]	Applicator [3]
clamp-on version	Sensor position	x	x	x
	Wire length	x	x	x
	Sensor distance	x	x	x
Insertion version	Sensor distance	x	x	x
	Arc length	x	x	x
	Path length	x	x	x

1) Conditions that must be met before determining the values via the local display using the "Sensor" Quick Setup (see Page 64):
- Transmitter installed (see Page 32)
- Transmitter connected to power supply (see Page 37)

2) ToF Tool - Fieldtool Package is a configuration and service software for flowmeters in the field. Conditions that must be met before determining the values via the "ToF Tool - Fieldtool Package":
- Transmitter installed (see Page 32)
- Transmitter connected to power supply (see Page 37)
- ToF Tool - Fieldtool Package configuration and service software installed on a notebook/PC
- Connection made between notebook/PC and device via the FXA 193 service interface (see Page 37)

3) Applicator is a software for selecting and configuring flowmeters. The values required can be determined without having to connect the transmitter beforehand.
The "Applicator" can be downloaded from the Internet (→ *www.applicator.com*) or ordered on CD-ROM for installation on a local PC.

Procedure (determining data for sensor installation)
You can use the following tables to select and configure, in the correct order, the functions required to install the sensor:

- "clamp-on" sensor installation → Page 68
- "Insertion" sensor installation → Page 69

Note!
You must enter a valid release code before device parameters can be changed or activated.
The code (factory setting = 90) is entered by means of the corresponding matrix cell.

"Clamp-on" sensor installation		
Procedure Selection – Input – display	**Local display (Quick Setup)** ▼	**ToF Tool - Fieldtool Package** ▼
▼	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.
Type of measurement	MEASUREMENT	MEASUREMENT
Sensor type	SENSOR TYPE	SENSOR TYPE
Sensor configuration	SENSOR CONFIGURATION	SENSOR CONFIGURATION
▼	→ BASIC FUNCTION → PROCESS PARAM. → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. → PIPE DATA
Standard pipe selection	PIPE STANDARD	PIPE STANDARD
Nominal diameter pipe	NOMINAL DIAMETER	NOMINAL DIAMETER
Pipe material	PIPE MATERIAL	PIPE MATERIAL
Pipe sound velocity	SOUND VELOCITY PIPE	SOUND VELOCITY PIPE
Pipe circumference	CIRCUMFERENCE	CIRCUMFERENCE
Pipe diameter	PIPE DIAMETER	PIPE DIAMETER
Wall thickness	WALL THICKNESS	WALL THICKNESS
Liner material	LINER MATERIAL	LINER MATERIAL
Liner sound velocity	SOUND VELOCITY LINER	SOUND VELOCITY LINER
Liner thickness	LINER THICKNESS	LINER THICKNESS
▼	→ BASIC FUNCTION → PROCESS PARAM. → LIQUID DATA	→ BASIC FUNCTION → PROCESS PARAM. → LIQUID DATA
Liquid in the pipe	LIQUID	LIQUID
Liquid temperature	TEMPERATURE	TEMPERATURE
Liquid sound velocity	SOUND VELOCITY LIQUID	SOUND VELOCITY LIQUID
▼	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.
Didsplay sensorposition (for sensor installation)	POSITION SENSOR	POSITION SENSOR

Didsplay wire length (for sensor installation)	WIRE LENGTH	CABLE LENGTH
Didsplay sensor distance (for sensor installation)	SENSOR DISTANCE	SENSOR DISTANCE

✎ Note!
- All functions are described in detail in the "**Description of Device Functions**" manual, which is a separate part of this Operating Instruction!
- The procedure for running through the "Sensor Installation" Quick Setup using the local display is explained on Page 64.

"Insertion" sensor installation

Procedure Selection – Input – display	**Local display (Quick Setup)** ▼	**ToF Tool – Fieldtool Package** ▼
▼	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.
Type of measurement	MEASUREMENT	MEASUREMENT
Sensor type	SENSOR TYPE	SENSOR TYPE
Sensor configuration	SENSOR CONFIGURATION	SENSOR CONFIGURATION
▼	→ BASIC FUNCTION → PROCESS PARAM. → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. → PIPE DATA
Standard pipe selection	PIPE STANDARD	PIPE STANDARD
Nominal diameter pipe	NOMINAL DIAMETER	NOMINAL DIAMETER
Pipe circumference	CIRCUMFERENCE	CIRCUMFERENCE
Pipe diameter	PIPE DIAMETER	PIPE DIAMETER
Wall thickness	WALL THICKNESS	WALL THICKNESS
▼	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA → SENSOR PARAM.
Didsplay sensor distance (for sensor installation)	SENSOR DISTANCE	SENSOR DISTANCE
Didsplay arc length (for sensor installation)	ARC LENGTH	ARC LENGTH
Didsplay path length (for sensor installation)	PATH LENGTH	PATH LENGTH

✎ Note!
- All functions are described in detail in the "**Description of Device Functions**" manual, which is a separate part of this Operating Instruction!
- The procedure for running through the "Sensor Installation" Quick Setup using the local display is explained on Page 64.

6.3.2 Commissioning

Additionally to the settings for the sensor installation (Chapter 6.3.1) the following functions have to be configured for the standard application:

- System parameters
- Outputs

6.4 Application specific commissioning

6.4.1 Zero point adjustment

Consequently, zero point adjustment is generally **not** necessary.

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high viscosity fluids).

Preconditions for a zero point adjustment
Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that contain no gas or solid contents.
- Zero point adjustment is performed with the pipe completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shut-off valves upstream and/or downstream of the measuring range or by using existing valves and gates (Fig. 46).
  – Standard operation → valves 1 and 2 open
  – Zero point adjustment *with* pump pressure → valve 1 open / valve 2 closed
  – Zero point adjustment *without* pump pressure → valve 1 closed / valve 2 open

Caution!
- If the fluid is very difficult to measure (e.g. containing entrained solids or gas) it may prove impossible to obtain a stable zero point despite repeated zero point adjustments. In instances of this nature, please contact your Endress+Hauser service center.
- You can view the currently valid zero point value using the "ZERO POINT" function (see the "Description of Device Functions" manual).

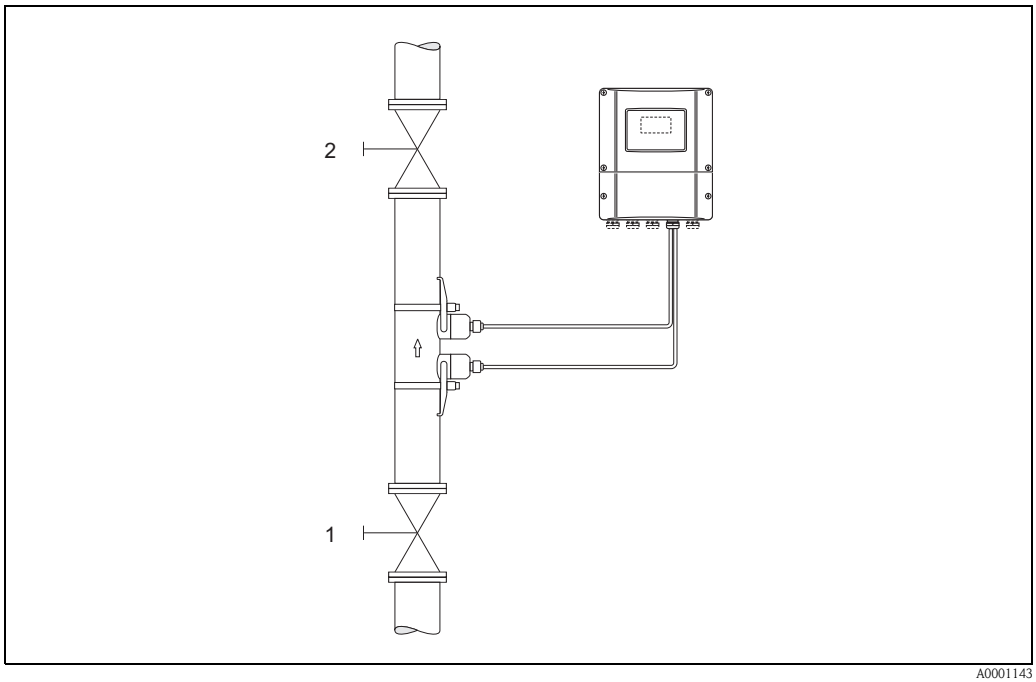


Fig. 46: Zero point adjustment and shut-off valves

Performing a zero point adjustment

1. Operate the system until normal operating conditions resume.
2. Stop the flow (v = 0 m/s).
3. Check the shut-off valves for leaks.
4. Check that operating pressure is correct.
5. Using the local display, select the "ZERO POINT ADJUSTMENT" function in the function matrix:

   HOME → E → ± → PROCESS PARAMETER
   PROCESS PARAMETER → E → ± → ZERO POINT ADJ.
6. When you press ± you are automatically prompted to enter the code if the function matrix is still disabled. Enter the code.
7. Use ± to select START and press E to confirm.
   Select YES at the prompt and press E again to confirm. Zero point adjustment now starts.
   – The message "ZEROPOINT ADJUST RUNNING" appears on the display for 30...60 seconds while adjustment is in progress.
   – If the fluid velocity in the pipe exceeds 0.1 m/s, the following error message appears on the display: ZERO ADJUST NOT POSSIBLE.
   – When the zero point adjustment is completed, the "ZERO ADJUST." function reappears on the display.
8. Back to the HOME position
   – Press and hold down the Esc key (Esc) for longer than three seconds.
   – Repeatedly press and release the Esc key (Esc).

6.5 Hardware configuration

6.5.1 Current output: active/passive

The current output can be configured as “active” or “passive” by means of various jumpers on the I/O board.

⚠ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → Page 89
3. Set the jumpers in accordance with Fig. 47.

   ☝ Caution!
   Risk of destroying the measuring device. Make sure that the jumper positions are exactly those shown in Fig. 47. Incorrectly set jumpers can cause
   overcurrents that would destroy either the measuring device or external devices connected to it.

4. Installing the I/O board is the reverse of the removal procedure.

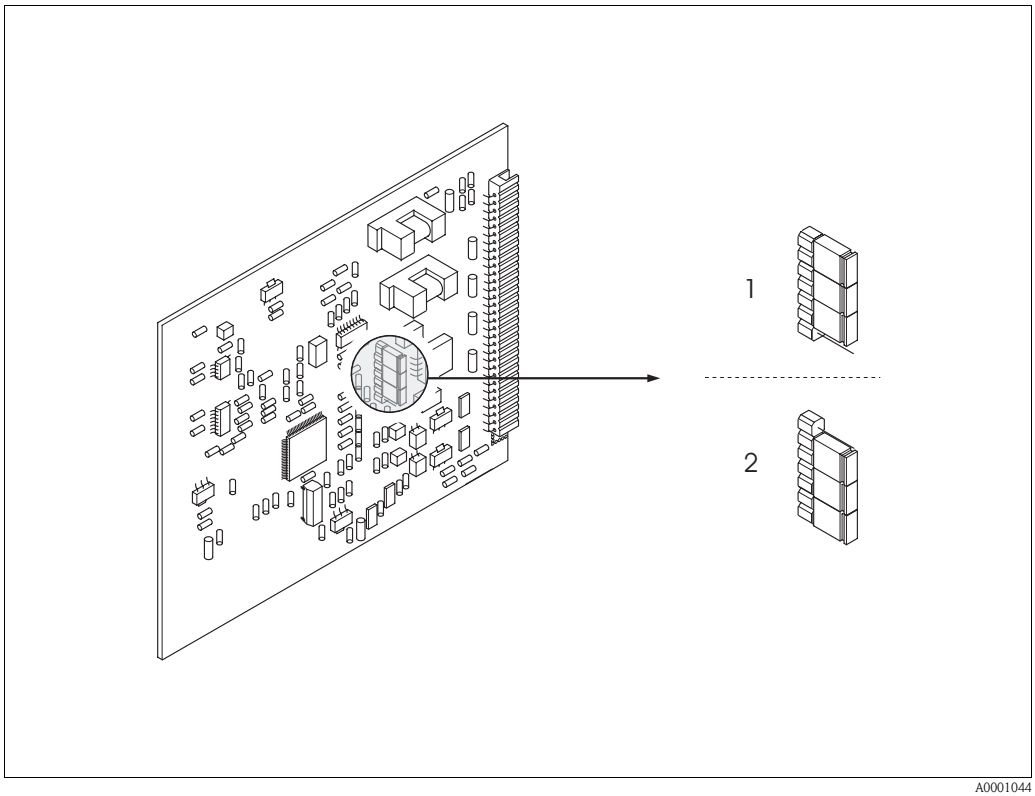


Fig. 47: Current output configuration (I/O board)

1 Active current output (default)
2 Passive current output

7 Maintenance

The Prosonic Flow 90 flow measuring system requires no special maintenance.

Exterior cleaning
When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

Coupling fluid
A coupling fluid is required to ensure the acoustic link between the sensor and the piping. This is applied to the sensor surface during commissioning. Periodic replacement of the coupling fluid is usually not required.

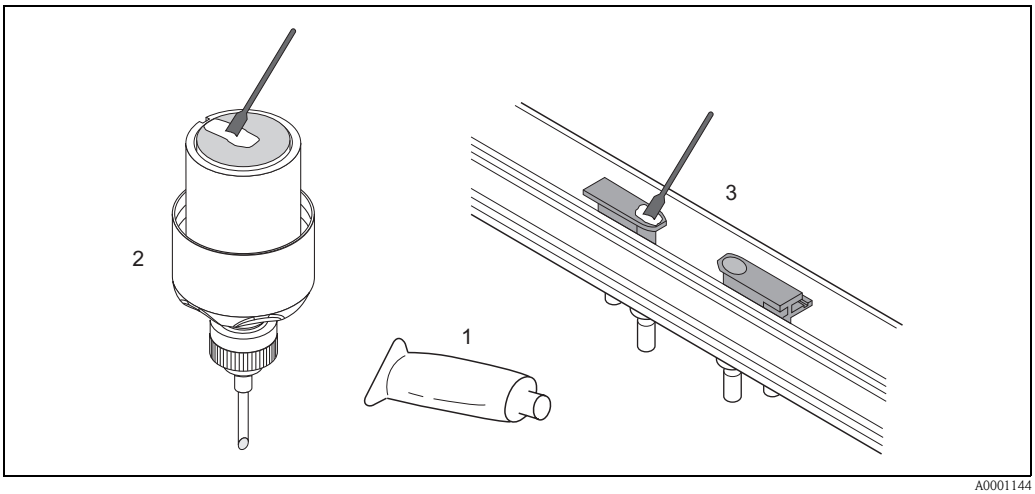


Fig. 48: Application of the coupling fluid

1 Coupling fluid
2 Sensor surface Prosonic Flow W/P
3 Sensor surface Prosonic Flow U

8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. The Endress+Hauser service organisation can provide detailed information on the order codes of your choice.

Accessory	Description	Order Code
Transmitter wall-mount housing Prosonic Flow 90	Transmitter for replacement or for stock. Use the order code to define the following specifications: – Approvals – Degree of protection / version – Cable entries – Display / power supply / operation – Software – Outputs / inputs	90XXX–XXXXX ********
Mounting set for transmitter	Mounting set for wall-mount housing. Suitable for: – Wall mounting – Pipe mounting – Panel mounting Mounting set for alum. field housing Suitable for pipe mounting (3/4"...3")	DK9WM – A DK9WM – B
Flowmeter sensor W	Clamp-on Sensor: –20...+80 °C; DN 100...4000; IP67 –20...+80 °C; DN 50...300; IP67 –20...+80 °C; DN 100...4000; IP68 –20...+80 °C; DN 50...300; IP68 Installation sensor –40...+80 °C; DN 200...4000; IP68	 DK9WS – A* DK9WS – B* DK9WS – M* DK9WS – N* DK9WF – K*
Flowmeter sensor P	Clamp-on Sensor: –40...+80 °C; DN 100...4000 –40...+80 °C; DN 50...300 Clamp-on Sensor: 0...+170 °C; DN 100...4000 0...+170 °C; DN 50...300	 DK9PS – A* DK9PS – B* DK9PS – E* DK9PS – F*
Flowmeter sensor U	Clamp-on Sensor: –20...+80 °C; DN 15...100	 DK9UF – A
Sensor holder set for Prosonic Flow W/P sensors	– Sensor holder, fixed retaining nut, clamp-on version – Sensor holder, removable retaining nut, clamp-on version – Sensor holder, welding type, DN 200...300, Insertion version, single channel – Sensor holder, welding type, DN 300...400, Insertion version, single channel – Sensor holder, welding type, DN 400...4000, Insertion version, single channel – Sensor holder, welding type, DN 400...4000, Insertion version, two channel	 DK9SH – A DK9SH – B DK9SH – C DK9SH – D DK9SH – E DK9SH – F

Accessory	Description	Order Code
Installation set clamp-on sensor fastening for Prosonic Flow W/P	– Without sensor fastening – Tensioning bands DN 50...200 – Tensioning bands DN 200...600 – Tensioning bands DN 600...2000 – Tensioning bands DN 2000...4000	DK9IC – A* DK9IC – B* DK9IC – C* DK9IC – D* DK9IC – E*
Installation set clamp-on Installation aids for Prosonic Flow W/P	– Without installation aids – Spacing ruler DN 50...200 – Spacing ruler DN 200...600 – Mounting rail DN 50...200 – Mounting rail DN 200...600	DK9IC – *1 DK9IC – *2 DK9IC – *3 DK9IC – *4 DK9IC – *5
Installation set clamp-on sensor fastening for Prosonic Flow U	– Installation set DN 15...40 – Tensioning bands DN 32...65 – Tensioning bands DN 50...100	DK9IS – A DK9IS – B DK9IS – C
Installation set Insertion	– Installation set DN 200...1800, Insertion – Installation set DN 1800...4000, Insertion	DK9II – A DK9II – B
Sensor cable set for Prosonic Flow W/P sensors	– 5 m sensor cable, PVC, –20...+70 °C – 10 m sensor cable, PVC, –20...+70 °C – 15 m sensor cable, PVC, –20...+70 °C – 30 m sensor cable, PVC, –20...+70 °C – 5 m sensor cable, PTFE, –40...+170 °C – 10 m sensor cable, PTFE, –40...+170 °C – 15 m sensor cable, PTFE, –40...+170 °C – 30 m sensor cable, PTFE, –40...+170 °C	DK9SC – A DK9SC – B DK9SC – C DK9SC – D DK9SC – E DK9SC – F DK9SC – G DK9SC – H
Sensor cable set for Prosonic Flow U sensors	– 5 m sensor cable, PVC, –20...+70 °C – 10 m sensor cable, PVC, –20...+70 °C – 15 m sensor cable, PVC, –20...+70 °C – 30 m sensor cable, PVC, –20...+70 °C – 5 m sensor cable, PTFE, –40...+170 °C – 10 m sensor cable, PTFE, –40...+170 °C – 15 m sensor cable, PTFE, –40...+170 °C – 30 m sensor cable, PTFE, –40...+170 °C	DK9SK – A DK9SK – B DK9SK – C DK9SK – D DK9SK – E DK9SK – F DK9SK – G DK9SK – H
Sensor cable conduit adapter for Prosonic Flow W/P	– Sensor cable conduit adapter incl. sensor cable entries M20x1.5 – Sensor cable conduit adapter incl. sensor cable entries ½" NPT – Sensor cable conduit adapter incl. sensor cable entries G½"	DK9CA – 1 DK9CA – 2 DK9CA – 3
Acoustic coupling medium	– Wacker P –40...+80 °C – Coupling medium 0...+170 °C, standard – Adhesive coupling medium –40...+80 °C – Water-soluble coupling medium –20...+80 °C – SilGel –40...+130 °C – Coupling medium DDU 19 –20...+60 °C – Coupling medium –40...+80 °C, standard, Typ MBG2000	DK9CM – 1 DK9CM – 2 DK9CM – 3 DK9CM – 4 DK9CM – 5 DK9CM – 6 DK9CM – 7
HART Communicator DXR 375 handheld terminal	Handheld terminal for remote parameterisation and for obtaining measured values via the current output HART (4...20 mA). Contact your Endress+Hauser representative for more information.	DXR375 – ****
Applicator	Software for selecting and configuring flowmeters. Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.	DKA80 – *

Accessory	Description	Order Code
ToF Tool - Fieldtool Package	Configuration and service software for flowmeters in the field: – Commissioning, maintenance analysis – Configuring measuring devices – Service functions – Visualization of process data – Trouble-shooting – Controlling the "Fieldcheck" tester/simulator Contact your Endress+Hauser representative for more information.	DXS10 – *****
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "ToF Tool - Field-tool Package" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information	DXC10 – **

9 Trouble-shooting

9.1 Trouble-shooting instructions

Always start trouble-shooting with the checklist below, if faults occur after start-up or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

Check the display	
No display visible and no output signals present.	1. Check supply voltage → Terminal 1, 2 2. Check device fuse → Page 92 85...260 V AC: 0.8 A slow-blow / 250 V 20...55 V AC and 16...62 V DC: 2 A slow-blow / 250 V 3. Electronics defective → Order spare part → Page 88
No display visible, but output signals are present.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → Page 90 2. Display module defective → Order spare part → Page 88 3. Electronics defective → Order spare part → Page 88
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the ± keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
Measured value indicated, but no signal at the current or pulse output	Electronics PCB defective → Order spare part → Page 88

▼

Error messages on display	
Errors that occur during commissioning or measuring are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows: – Error type: **S** = system error, **P** = process error – Error message type: ↯ = fault message, **!** = notice message – **S.VELOC RANGE** = error designation (e.g. sound velocity outside measuring range) – **03:00:05** = duration of error occurrence (in hours / minutes /seconds) – **# 491** = error number Caution! ■ See the information on Page 47 ff.! ■ The measuring system interprets simulations and measured-value suppression as system errors, but displays them as information messages only.	
Error number: No. 001 – 399 No. 501 – 799	System error (device error) has occurred → Page 80
Error number: No. 401 – 499	Process error (application error) has occurred → Page 84

▼

Other error (without error message)	
Some other error has occurred.	Diagnosis and remedial measures → Page 85

9.2 System error messages

Serious system errors are **always** recognized by the instrument as "Fault message", and are shown as a lightning flash (ϟ) on the display. Fault messages immediately affect the outputs. Simulations and measured-value suppression, on the other hand, are classed and displayed as information messages.

Caution!
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. The procedures on Page 8 must be carried out before you return a flowmeter to Endress+Hauser. Always enclose a fully completed "Declaration of contamination" form. You will find a preprinted form at the back of this manual.

Note!
The error types listed in the following correspond to the factory settings.
Also observe the information on Page 47 ff. and 86.

Type	Error message / No.	Cause	Remedy / spare part
S = System error ϟ = Fault message (*with* an effect on the outputs) ! = Notice message (*without* an effect on the outputs)			
No. # 0xx → Hardware error			
S ϟ	CRITICAL FAIL. **# 001**	Serious device error	Replace the amplifier board. Spare parts → Page 88
S ϟ	AMP HW-EEPROM **# 011**	Amplifier: Defective EEPROM	Replace the amplifier board. Spare parts → Page 88
S ϟ	AMP SW-EEPROM **# 012**	Amplifier: Error accessing EEPROM data	The EEPROM data blocks in which an error has occurred are displayed in the "TROUBLESHOOTING" function. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the errored parameter values. Note! The measuring device has to be restarted if an error has occurred in a totalizer block (see error No. 111 / CHECKSUM TOTAL.).
S ϟ	A / C COMPATIB. **# 051**	The I/O board and the amplifier board are not compatible.	Use only compatible modules and boards. Check the compatibility of the modules used. Check the: – Spare part set number – Hardware revision code
S ϟ	SENSOR DOWN **# 081**	Connection between sensor and transmitter interrupted	– Check the cable connection between the sensor and the transmitter. – Check that the sensor connector is fully screwed in. – The sensor may be defective. – Incorrect sensor connected – A wrong sensor was selected in the function SENSOR TYPE .

Type	Error message / No.	Cause	Remedy / spare part
S ϟ	SENSOR UP **# 084**	Connection between sensor and transmitter interrupted	– Check the cable connection between the sensor and the transmitter. – Check that the sensor connector is fully screwed in. – The sensor may be defective. – Incorrect sensor connected – A wrong sensor was selected in the function SENSOR TYPE .
No. # 1xx → Software error			
S ϟ	CHECKSUM TOT. **# 111**	Totalizer checksum error	1. Restart the measuring device 2. Replace the amplifier board if necessary. Spare parts → Page 88
S ϟ	A / C COMPATIB. **# 121**	Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). ✎ Note! – The indication on the display as notice message appears only for 30 seconds (with listing in "Previous system condition" function). – This condition can occur if only one electronics board has been exchanged; the extended software functionality is not available. The previously existing software functionality is still working and the measurement possible.	Module with lower software version has either to be actualizied by ToF Tool - Fieldtool Package with the required software version or the module has to be replaced. Spare parts → Page 88
No. # 3xx → System range limits exceeded			
S ϟ	STACK CUR.OUT n **# 339...342**	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable. Recommendations in the event of fault category = FAULT MESSAGE (ϟ): – Configure the fault response of the output to "ACTUAL VALUE" (see Page 86), so that the temporary buffer can be cleared. – Clear the temporary buffer by the measures described under Item 1.
S ϟ	STACK FRQ.OUT n **# 343...346**		
S ϟ	STACK PULSE n **# 347...350**	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Increase the setting for pulse weighting 2. Increase the max. pulse frequency, if the totalizer can handle a higher number of pulses. 3. Increase or reduce flow. Recommendations in the event of fault category = FAULT MESSAGE (ϟ): – Configure the fault response of the output to "ACTUAL VALUE" (see Page 86), so that the temporary buffer can be cleared. – Clear the temporary buffer by the measures described under Item 1.

Type	Error message / No.	Cause	Remedy / spare part
S !	RANGE CUR.OUT n **# 351...354**	Current output: Flow is out of range.	– Change the upper or lower range values, as applicable. – Increase or reduce flow, as applicable.
S !	RANGE FRQ.OUT n **# 355...358**	Frequency output: Flow is out of range.	– Change the upper or lower range values, as applicable. – Increase or reduce flow, as applicable.
S !	RANGE PULSE n **# 359...362**	Pulse output: Pulse output frequency is out of range.	1. Increase the setting for pulse weighting 2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.). *Determine the pulse width:* – Variant 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration. – Variant 2: Enter the maximum (pulse) frequency as the half "reciprocal value" that a pulse must be present at the connected counter to ensure its registration. Example: The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is: $\frac{1}{2 \cdot 10\ \text{Hz}} = 50\ \text{ms}$ 3. Reduce flow.
S ↯	SIGNAL TOO LOW **# 391**	Attenuation of acoustic measurement section too high.	– Check to see if the coupling fluid must be renewed. – It is possible that the fluid indicates too much attenuation. – It is possible that the pipe indicates too much attenuation. – Check the sensor spacing (Installation dimensions). – Reduce the number of traverses if possible.
No. # 5xx → Application error			
S !	SW.-UPDATE ACT. **# 501**	New amplifier or communication (I/O module) software version is loaded. Currently no other functions are possible.	Wait until the procedure is finished. The device will restart automatically.
S !	UP-/DOWNLOAD ACT **# 502**	Up- or downloading the device data via configuration program. Currently no other functions are possible.	Wait until the procedure is finished.
S ↯	INITIAL. RUN **# 591**	Initialisation is running. All outputs are set to 0.	Wait until the procedure is complete.

Type	Error message / No.	Cause	Remedy / spare part
No. # 6xx → Simulation operation active			
S !	POS. ZERO-RET. **# 601**	Positive zero return active. Caution! This is the highest priority notice message.	Switch off positive zero return
S !	SIM. CURR. OUT. n **# 611...614**	Simulation current output active	Switch off simulation
S !	SIM. FREQ. OUT. n **# 621...624**	Simulation frequency output active	Switch off simulation
S !	SIM. PULSE n **# 631...634**	Simulation pulse output active	Switch off simulation
S !	SIM. STAT. OUT n **# 641...644**	Simulation status output active	Switch off simulation
S !	SIM.STATUS IN n **# 671...674**	Simulation status input active	Switch off simulation
S !	SIM. FAILSAFE **# 691**	Simulation of response to error (outputs) active	Switch off simulation
S !	SIM. MEASURAND **# 692**	Simulation of volume flow active	Switch off simulation
S !	DEV. TEST ACT. **# 698**	The measuring device is being checked on site via the test and simulation device.	–
No. # 7xx → Calibration or action errors			
S !	ADJ.ZERO FAIL. **# 731**	Static zero point adjustment is not possible or was cancelled.	Check that the flow velocity is = 0 m/s.

9.3 Process error messages

Process errors can be defined as either “Fault” or “Notice” messages and can thereby be weighted differently. Determination of this is done via the function matrix
(→ see the “Description of Device Functions” manual).

✎ Note!
The error types listed in the following correspond to the factory settings.
Also observe the information on Page 47 ff. and 86.

Type	Error message / No.	Cause	Remedy
P = Process error ↯ = Fault message (*with* an effect on the inputs and outputs) ! = Notice message (*without* an effect on the inputs and outputs)			
P ↯	PIPE DATA **# 468**	The inner diameter is negative.	In the function group PIPE DATA check the values of the functions CIRCUMFERENCE and WALL THICKNESS resp. LINER THICKNESS.
P ↯	S.VELOC. RANGE **# 491**	The sound velocity is outside the search range of the transmitter.	– Check the installation dimensions. – If possible, check the sound velocity of the fluid or check the specialist literature. If the actual sound velocity is outside the defined search range, the corresponding parameters must be changed in the LIQUID DATA function group. Detailed information on this topic is provided in the Description of Device Functions Prosonic Flow 90 (BA069D/06/en) manual under the SOUND VELOCITY LIQUID function.
P !	INTERFERENCE **# 494**	The pipe transmitted wave may superpose the signal. We recommend you alter the sensor configuration in the event of this error message. ☝ Caution! A change of the sensor configuration is required if the measuring device indicates zero or low flow.	– In the SENSOR CONFIGURATION function, change the number of traverses from 2 or 4 to 1 or 3 and mount the sensors accordingly.

9.4 Process errors without messages

Symptoms	Remedial measures
Note: You may have to change or correct certain settings in functions in the matrix in order to rectify faults. The functions outlined below, such as DISPLAY DAMPING, for example, are described in detail in the "Description of Device Functions" manual.	
Flow values are negative, even though the fluid is flowing forwards through the pipe.	1. Check wiring → Page 35. If necessary, reverse the connections at terminals "up" and "down". 2. Change the setting in the "INSTALLATION DIRECTION, SENSOR" function accordingly
Measured value reading fluctuates even though flow is steady.	1. Check the fluid for presence of gas bubbles. 2. "TIME CONSTANT" function (current output) → Increase value 3. "DISPLAY DAMPING" function → Increase value
There are differences between the flowmeter's internal totalizer and the external metering device.	This symptom is due primarily to backflow in the piping, because the pulse output cannot subtract in the "STANDARD or SYMMETRY" measuring modes. The following solution is possible: Allow for flow in both directions.
Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	1. Check the fluid for presence of gas bubbles. 2. Activate the "LOW FLOW" function, i.e. enter or increase the value for the switching point.
The current output signal is always 4 mA, irrespective of the flow signal at any given time.	1. Select the "BUS ADDRESS" function and change the setting to "0". 2. Low flow cut off too high. Reduce the corresponding value in the "LOW FLOW CUTOFF" functions (ON-/OFF-VALUE).
The fault cannot be rectified or some other fault not described above has occurred. In these instances, please contact your Endress+Hauser service organisation.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service organisation to have a service technician sent out, please be ready with the following information: – Brief description of the fault – Nameplate specifications (Page 9 ff.): Ordering code and serial number **Returning devices to Endress+Hauser** The procedures on Page 8 must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. In all cases, enclose a fully completed "Declaration of contamination" form with the flowmeter. You will find a preprinted form at the end of these Operating Instructions. **Replace transmitter electronics** Components in the measuring electronics defective → Order spare part → Page 88

9.5 Response of outputs to errors

Note!
The failsafe mode of totalizers, current, pulse and frequency outputs can be customized by means of various functions in the function matrix. You will find detailed information on these procedures in the "Description of Device Functions" manual.

Positive zero return and failsafe mode:
You can use positive zero return to set the signals of the current, pulse and frequency outputs to their fallback value, for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions; Simulations, for example, are suppressed.

Failsafe mode of outputs and totalizers

	Process/system error is present	Positive zero return is activated
Caution! System or process errors defined as "Notice messages" have no effect whatsoever on the outputs. See the information on Page 47 ff.		
Current output	*MINIMUM CURRENT* The current output will be set to the lower value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the "Description of Device Functions" manual). *MAXIMUM CURRENT* The current output will be set to the higher value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the "Description of Device Functions" manual). *HOLD VALUE* Measured value display on the basis of the last saved value preceding occurrence of the fault. *ACTUAL VALUE* Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow"
Pulse output	*FALLBACK VALUE* Signal output → no pulses *HOLD VALUE* Last valid value (preceding occurrence of the fault) is output. *ACTUAL VALUE* Fault is ignored, i.e. standard measured value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"
Frequency output	*FALLBACK VALUE* Signal output → 0 Hz *FAILSAFE LEVEL* Output of the frequency specified in the FAILSAFE VALUE function. *HOLD VALUE* Last valid value (preceding occurrence of the fault) is output. *ACTUAL VALUE* Fault is ignored, i.e. standard measured value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"

Failsafe mode of outputs and totalizers		
	Process/system error is present	Positive zero return is activated
Totalizer	*STOP* The totalizer is paused until the fault is rectified. *ACTUAL VALUE* The fault is ignored. The totalizers continue to count in accordance with the current flow value. *HOLD VALUE* The totalizers continue to count the flow in accordance with the last valid flow value (before the error occurred).	Totalizer stops
Status output	In the event of a fault or power supply failure: Status output → not conductive A detailed description of the response of the status output with different configurations, such as fault message, flow direction, limit value, etc., is provided in the "Description of Device Functions" manual.	No effect on status output

9.6 Spare parts

Chap. 9.1 contains a detailed trouble-shooting guide. The measuring device, more over, provides additional support in the form of continuous self-diagnosis and error messages.
Trouble-shooting can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your Endress+Hauser service organisation by providing the serial number printed on the nameplates (see Page 9).

Spare parts are shipped as sets comprising the following parts:
- Spare part
- Additional parts, small items (threaded fasteners, etc.)
- Mounting instructions
- Packaging

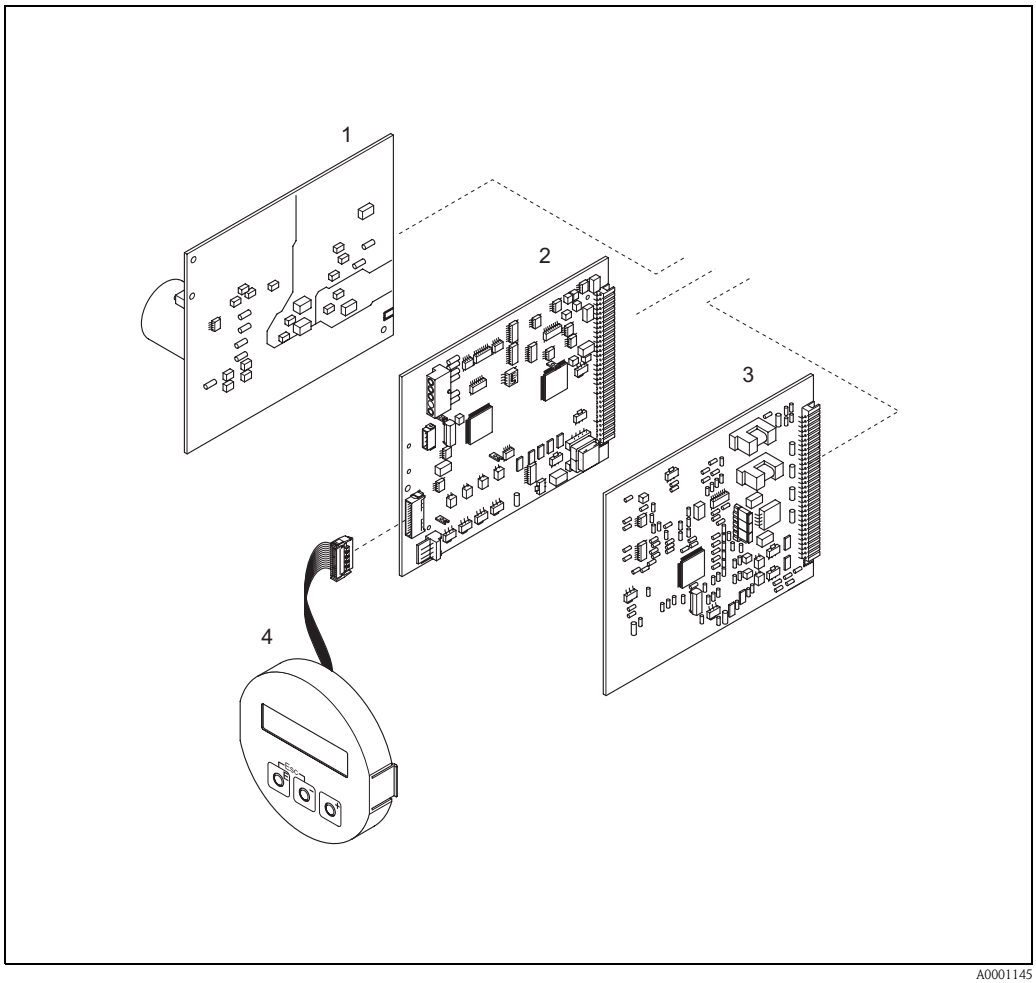


Fig. 49: Spare parts for Prosonic Flow 90 transmitter (wall-mount housing)

1 Power unit board (85...260 V AC, 20...55 V AC, 16...62 V DC)
2 Amplifier board
3 I/O board (COM module)
4 Display module

9.7 Removing and installing printed circuit boards

Warning!
- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface, purpose-built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.

Procedure (Fig. 50):

1. Remove the screws and open the hinged cover (1) of the housing.
2. Remove the screws securing the electronics module (2). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Disconnect the following cable plugs from amplifier board (7):
   – Unplug sensor signal cable (7.1)
   – Unplug ribbon cable (3) of the display module
4. Remove the cover (4) from the electronics compartment by loosening the screws.
5. Removal of boards (6, 7, 8):
   Insert a thin pin into the opening (5) and pull the board out of the holder.
6. Installation is the reverse of the removal procedure.

Caution!
Use only original Endress+Hauser replacement parts.

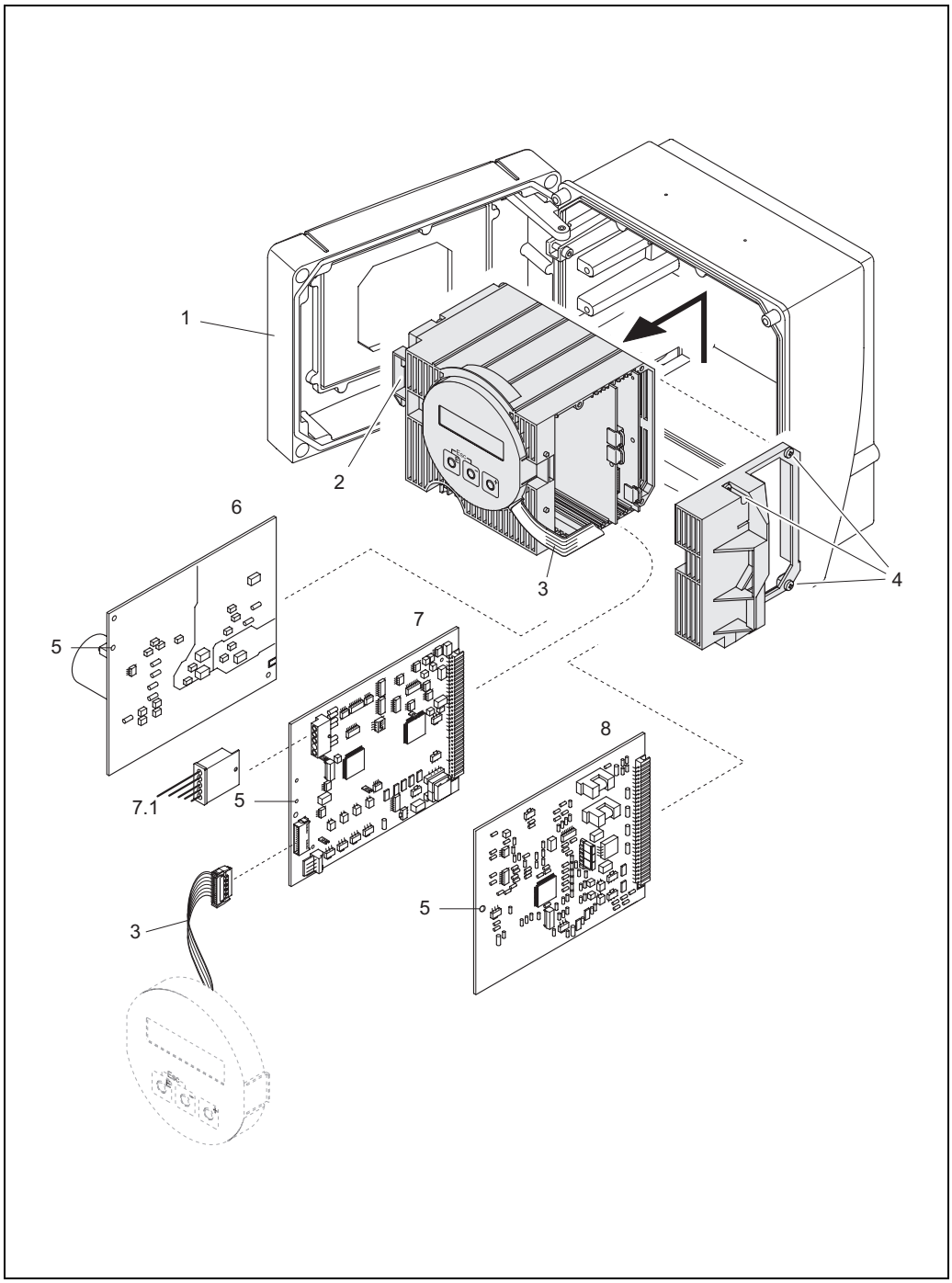


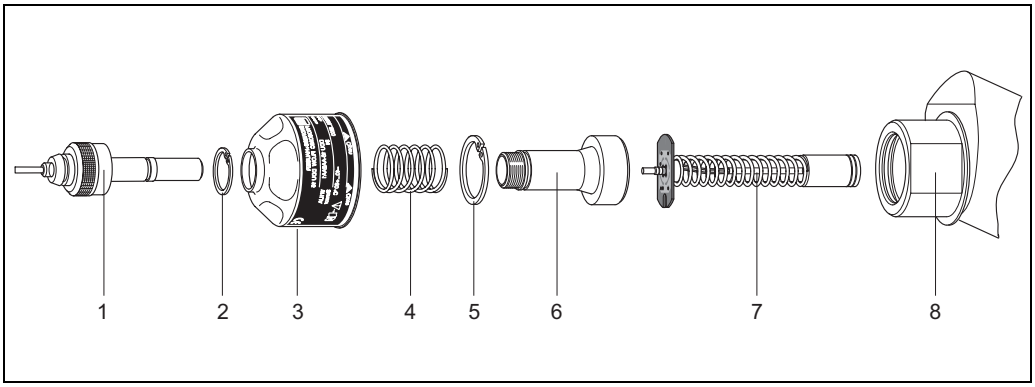
Fig. 50: Wall-mount housing: removing and installing printed circuit boards

1 Housing cover
2 Electronics module
3 Ribbon cable (display module)
4 Screws of electronics compartment cover
5 Aperture for installing/removing boards
6 Power unit board
7 Amplifier board
7.1 Sensor signal cable
8 I/O board

9.8 Installation/removal of flowmeter sensors W "Insertion"

The active part of the flowmeter sensor W "Insertion" can be replaced without interrupting the process.

1. Pull the sensor connector (1) out of the sensor cover (3).
2. Remove the small retainer ring (2). This is located on the top of the sensor neck and keeps the sensor cover in place.
3. Remove the sensor cover (3) and spring (4).
4. Remove the large retainer ring (5). This keeps the sensor neck (6) in place.
5. The sensor neck can now be pulled out. Note that you must reckon with a certain amount of resistance.
6. Pull the sensor element (7) out of the sensor holder (8) and replace it with a new one.
7. Installation is the reverse of the removal procedure.



A0001147

Fig. 51: Installation/removal of flowmeter sensor W "Insertion"

1 Sensor connector
2 Small retainer ring
3 Sensor cover
4 Spring
5 Large retainer ring
6 Sensor neck
7 Sensor element
8 Sensor holder

9.9 Replacing the device fuse

⚠ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is located on the power unit board (Fig. 52).
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove power unit board → Page 89
3. Remove protective cap (1) and replace the device fuse (2).
   Use only fuses of the following type:
   – Power supply 20...55 V AC / 16...62 V DC → 2.0 A slow-blow / 250 V; 5.2 x 20 mm
   – Power supply 85...260 V AC → 0.8 A slow-blow; 5.2 x 20 mm
   – Ex-systems → see appropriate Ex documentation
4. Assembly is the reverse of the disassembly procedure.

☝ Caution!
Use only original Endress+Hauser replacement parts.

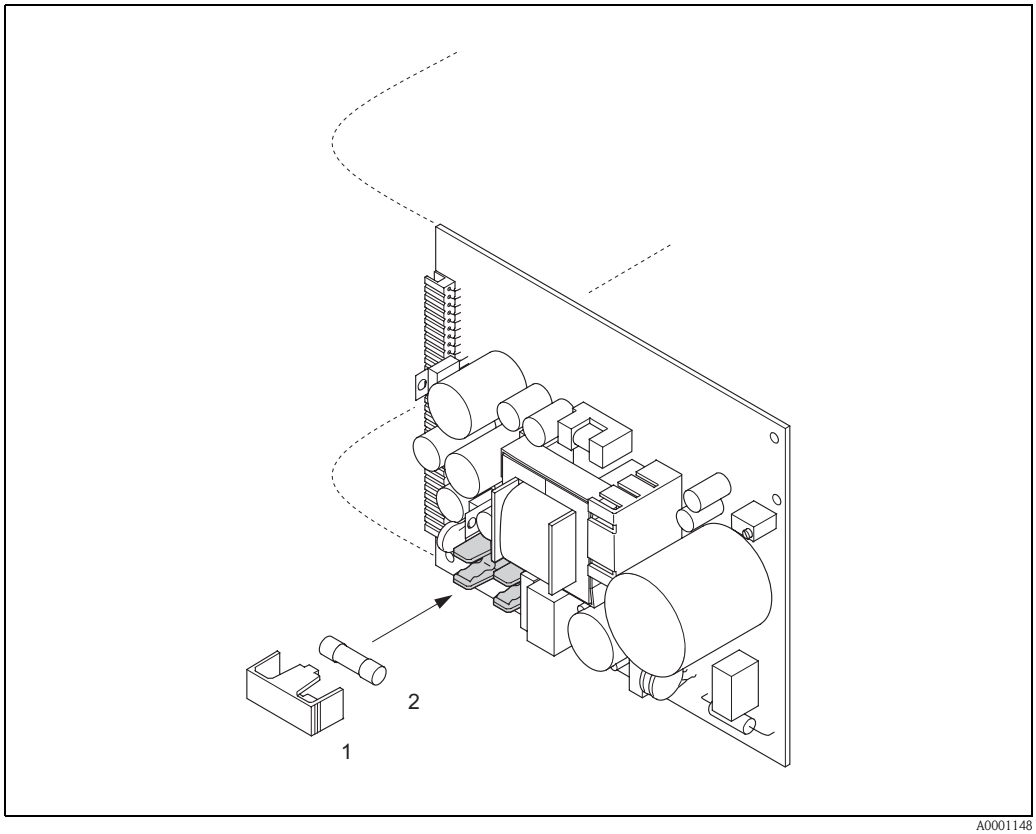


Fig. 52: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse

9.10 Software history

Date	Software version	Changes to software	Operating Instructions
11.2004	2.00.XX	Software expansion: – Prosonic Flow P sensor – Language group (contains the language Chinese and English) New functionalities: – DEVICE SOFTWARE → Device software displayed (NAMUR-recommendation 53) – REMOVE SW OPTION → Remove F-CHIP options	50099981/11.04
10.2003	Amplifier: 1.06.XX Communication module: 1.03.XX	Software expansion: – Language groups – Flow direction pulse output selectable New functionalities: – Operation hours counter – Adjustable backlight – Simulation function for pulse output – Access code counter – Reset function fault history – Up-/download with Fieldtool in preparation	50099981/10.03
12.2002	Amplifier: 1.05.00	Software expansion: – Prosonic Flow P sensor	50099981/12.02
07.2002	Amplifier: 1.04.00 Communication module: 1.02.01	Software expansion: – Device functions: New definition of search range “sound velocity liquid” – New error messages: PIPE DATA INTERFERENCE – Minimum sensor dicstance 180 mm for W sensor – Function CURRENT SPAN: additional options	50099981/07.02
06.2001	Amplifier: 1.00.00 Communication module: 1.02.00	Original software. Compatible with: – Fieldtool – HART communicator DXR 275 (OS 4.6) and higher) with rev. 1, DD 1	50099981/06.01

Note!
Usually, an upload or download between the different software versions is only possible with a special service software.

10 Technical data

10.1 Technical data at a glance

10.1.1 Application

- Measuring the flow rate of fluids in closed piping systems.
- Applications in measuring, control and regulation technology for monitoring processes.

10.1.2 Function and system design

Measuring principle	Prosonic Flow operates on the principle of transit time difference.
Measuring system	The measuring system consists of a transmitter and sensors. The following version is available: ■ Version for installing in safe area *Transmitter:* ■ Prosonic Flow 90 *Measuring sensors:* ■ Prosonic Flow P clamp-on version (for chemical and process applications) for nominal diameters DN 50...4000 ■ Prosonic Flow W clamp-on version (water/wastewater applications) for nominal diameters DN 50...4000 ■ Prosonic Flow U clamp-on version (water/ultra pure water applications) for nominal diameters DN 15...100 dedicated for plastic pipes ■ Prosonic Flow W Insertion version (water/wastewater applications) for nominal diameters DN 200...4000

10.1.3 Input

Measured variable	Flow velocity (transit time difference proportional to flow velocity)
Measuring range	Typically v = 0...15 m/s with the specified measuring accuracy for Prosonic Flow W/P Typically v = 0...10 m/s with the specified measuring accuracy for Prosonic Flow U
Operable flow range	Over 150 : 1
Input signals	Status input (auxiliary input): U = 3...30 V DC, R_i = 5 kΩ, galvanically isolated. Configurable for: totalizer reset, measured value suppression, error message reset.

10.1.4 Output

Output signal	Current output: Active/passive selectable, galvanically isolated, time constant selectable (0.05...100 s), full scale value selectable, temperature coefficient: typically 0.005% o.r./°C, resolution: 0.5 µA. ■ active: 0/4...20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$) ■ passive: 4...20 mA, operating voltage 18...30 V DC, $R_L < 700\ \Omega$ Pulse/frequency output: Passive, open collector, 30 V DC, 250 mA, galvanically isolated. ■ Frequency output: full-scale frequency 2...1000 Hz (f_{max} = 1250 Hz), on/off ratio 1:1, pulse width max. 10 s ■ Pulse output: pulse value and pulse polarity selectable, max. pulse width adjustable (0.05...2000 ms), above a frequency of 1 / (2x pulse width) the on/off ratio is 1:1.
Signal on alarm	■ Current output → failsafe mode selectable (e.g. in accordance with NAMUR Recommendation NE 43) ■ Pulse/frequency output → failsafe mode selectable ■ Status output → "not conductive" in the event of fault or power supply failure Detailed data → Page 86
Load	see "Output signal"
Switching output	Status output: Open collector, max. 30 V DC / 250 mA, galvanically isolated Configurable for: error messages, flow direction, limit values
Low flow cutoff	Switch points for low flow cutoff are selectable
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

10.1.5 Power supply

Electrical connections	see Page 35 ff.
Potential equalisation	see Page 40
Cable entries	Power supply and signal cables (inputs/outputs): ■ Cable entry M20 x 1.5 or ■ Cable gland for cables with Ø 6...12 mm ■ Threaded adapter 1/2" NPT, G 1/2" Sensor cable connection (see Fig. 34 on Page 35): A special cable gland allows you to insert both sensor cables into the connection compartment simultaneously. ■ Cable gland M20 x 1.5 for 2 x Ø 4 mm or ■ Threaded adapter 1/2" NPT, G 1/2"
Cable specifications	see Page 36
Supply voltage	Transmitter: ■ 85...260 V AC, 45...65 Hz ■ 20...55 V AC, 45...65 Hz ■ 16...62 V DC Measuring sensors: powered by the transmitter
Power consumption	AC: <18 VA (incl. sensors) DC: <10 W (incl. sensors) Switch-on current: ■ max. 13.5 A (< 50 ms) at 24 V DC ■ max. 3 A (< 5 ms) at 260 V AC
Power supply failure	Lasting min. 1 power cycle: EEPROM saves measuring system data if power supply fails.

10.1.6 Performance characteristics

Reference operating conditions

- Fluid temperature: +28 °C ± 2 K
- Ambient temperature: +22 °C ± 2 K
- Warm-up period: 30 minutes

Installation:
- Inlet run >10 x DN
- Outlet run > 5 x DN
- Sensor and transmitter grounded.

Maximum measured error

For flow velocities of > 0.3 m/s and a Reynolds number of >10000, the system accuracy is:
- Pipe diameter DN < 50: ± 0.5 % o.r. ± 0.1 % o.f.s. *
- Pipe diameter 50 < DN < 200: ± 0.5 % o.r. ± 0.05 % o.f.s.
- Pipe diameter DN > 200: ± 0.5 % o.r. ± 0.02 % o.f.s.

o.r. = of reading
o.f.s. = of full scale value
* plastic pipes only

As standard, the system is dry-calibrated. The dry calibration procedure results in an additional uncertainty of measurement. This measuring uncertainty is better than 1.5% typically. During dry calibration, the characteristics of the pipe and the fluid are derived to calculate the calibration factor.

As verification of the accuracy, an accuracy report is offered as an option.
Accuracy is verified using a stainless steel pipe.

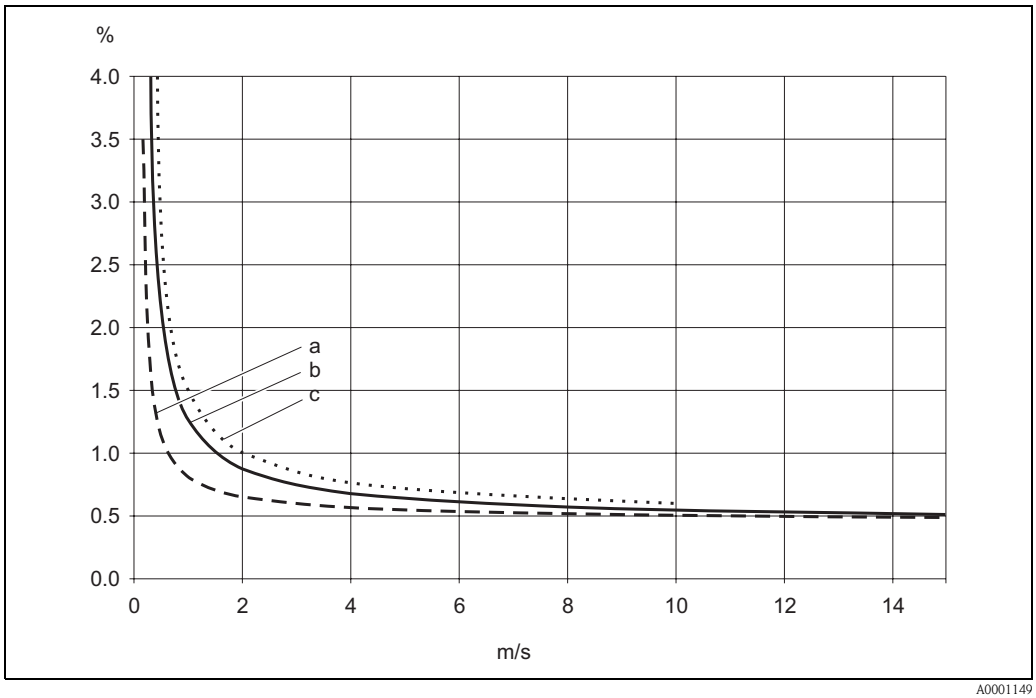


Fig. 53: Max. measured error (wet calibration) in % of reading

a = pipe diameter DN > 200
b = pipe diameter 50 < DN < 200
c = pipe diameter DN < 50

Repeatability

max. ± 0.3% for flow velocities > 0.3 m/s

10.1.7 Operating conditions

Installation

Installation instructions	Any orientation (vertical, horizontal) Restrictions and additional installation instructions → Page 14 ff.
Inlet and outlet runs	Clamp-on version → Page 15 Insertion version → Page 16
Connecting cable length	Shielded cables are offered in the following lengths: 5 m, 10 m, 15 m and 30 m Route the cable well clear of electrical machines and switching elements.

Environment

Ambient temperature	■ Transmitter Prosonic Flow 90: –20...+60 °C optionally: –40...+60°C ✎ Note! At ambient temperatures below –20°C the readability of the display may be impaired. ■ Flowrate measuring sensors Prosonic Flow P (clamp-on): –40...+80 °C / 0...+170 °C ■ Flowrate measuring sensors Prosonic Flow W (clamp-on): –20...+80 °C ■ Flowrate measuring sensors Prosonic Flow U (clamp-on): –20...+60 °C ■ Flowrate measuring sensors Prosonic Flow W (Insertion): –40...+80 °C ■ Sensor cable PTFE: –40...+170 °C; Sensor cable PVC: –20...+70 °C ■ In heated piping or piping conveying cold fluids, it is always permissible to insulate the piping completely with the mounted ultrasonic sensors. ■ Install the transmitter at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
Storage temperature	The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors and the corresponding sensor cable (see above).
Degree of protection	■ Transmitter Prosonic Flow 90: IP 67 (NEMA 4X) ■ Flowrate measuring sensors Prosonic Flow P (clamp-on): IP 68 (NEMA 6P) ■ Flowrate measuring sensors Prosonic Flow W (clamp-on): IP 67 (NEMA 4X) ■ Flowrate measuring sensors Prosonic Flow U (clamp-on): IP 54 ■ Flowrate measuring sensors Prosonic Flow W (Insertion): IP 68 (NEMA 6P)

Shock and vibration resistance	according to IEC 68-2-6
Electromagnetic compatibility (EMC)	To EN 61326/A1 (IEC 1326) “Emission to class A requirements” and NAMUR Recommendations NE 21/43.
	Process conditions
Medium temperature range	■ Flowrate measuring sensors Prosonic Flow P (clamp-on): –40...+80 °C / 0...+170 °C ■ Flowrate measuring sensors Prosonic Flow W (clamp-on): –20...+80 °C ■ Flowrate measuring sensors Prosonic Flow U (clamp-on): –20...+80 °C ■ Flowrate measuring sensors Prosonic Flow W (Insertion): –40...+80 °C
Medium pressure range (nominal pressure)	Perfect measurement requires that the static fluid pressure is higher than vapor pressure. Max. nominal pressure for the W sensors (Insertion): PN 16 (PSI 232)
Pressure loss	There is no pressure loss.

10.1.8 Mechanical construction

Design / dimensions

see Page 104 ff.

Weight

Transmitter housing:
- Wall-mount housing: 6.0 kg

Measuring sensors:
- Flowrate measuring sensors P (clamp-on) incl. mounting rail and tensioning bands: 2.8 kg
- Flowrate measuring sensors W (clamp-on) incl. mounting rail and tensioning bands: 2.8 kg
- Flowrate measuring sensors U (clamp-on): 1 kg
- Flowrate measuring sensors W (Insertion): 4.5 kg

Materials

Transmitter housing 90 (wall-mount housing):
powder-coated die-cast aluminum

Standard designations of the materials (measuring sensors W/P/U)

	DIN 17660	**UNS**
Standard sensor cable – Cable connector (nickled brass) – Cable sheath	 2.0401 PVC	 C38500 PVC
	DIN 17440	**AISI**
Sensor housing W/P (clamp-on)	1.4301	304
Sensor holder W/P (clamp-on)	1.4308	CF-8
Sensor housing U (clamp-on)	Plastic	
Frame end-piece for U sensor – Cast steel	 1.4308	 CF-8
Welding parts for W sensors (Insertion version)	1.4301	304
Sensor contact surface	Chemical resistant plastic	
Tensioning bands	1.4301	304
High temperature sensor cable – Cable connector (stainless steel) – Cable sheath	 1.4301 PTFE	 304 PTFE
	DIN EN 573-3	**ASTM B3221**
U sensor fixation bar – Cast aluminum	 EN AW-6063	 AA 6063

10.1.9 Human interface

Display elements	■ Liquid crystal display: illuminated, two lines with 16 characters per line ■ Custom configurations for presenting different measured value and status variables ■ 1 totalizer
Operating elements	■ Local operation with three keys (–, +, E) ■ "Quick Setup" for quick and easy commissioning
Remote operation	Operation via HART protocol
Language group	Language groups available for operation in different countries: ■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese ■ Eastern Europe and Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech ■ South and east Asia (SEA): English, Japanese, Indonesian ■ China (CIN): English, Chinese You can change the language group via the operating program "ToF Tool – Fieldtool Package."

10.1.10 Certificates and approvals

Ex approval	The transmitter housing (wall-mount housing) is suitable for use in ATEX II3G (hazardous Zone 2). Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your Endress+Hauser Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.
CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Other standards and guidelines	EN 60529: Degrees of protection by housing (IP code) EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. EN 61326/A1 (IEC 1326) "Emission to class A requirements" Electromagnetic compatibility (EMC requirements) NAMUR NE 21 Electromagnetic compatibility (EMC) of imdustrial process and laboratory control equipment. NAMUR NE 43 Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.

10.1.11 Ordering information

The Endress+Hauser service organisation can provide detailed ordering information and information on the order codes on request.

10.1.12 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor (see Page 75). The Endress+Hauser service organisation can provide detailed information on the order codes of your choice.

10.1.13 Supplementary documentation

- System Information Prosonic Flow 90/93 (SI 034D/06/en)
- Technical Information Prosonic Flow 90/93 W/U/C (TI 057D/06/en)
- Description of Device Functions Prosonic Flow 90 (BA 069D/06/en)
- Operating Instructions Prosonic Flow 93 (BA 070D/06/en and BA 071D/06/en)
- Supplementary Ex documentation: ATEX, FM, CSA, etc.

10.2 Dimensions of wall-mount housing

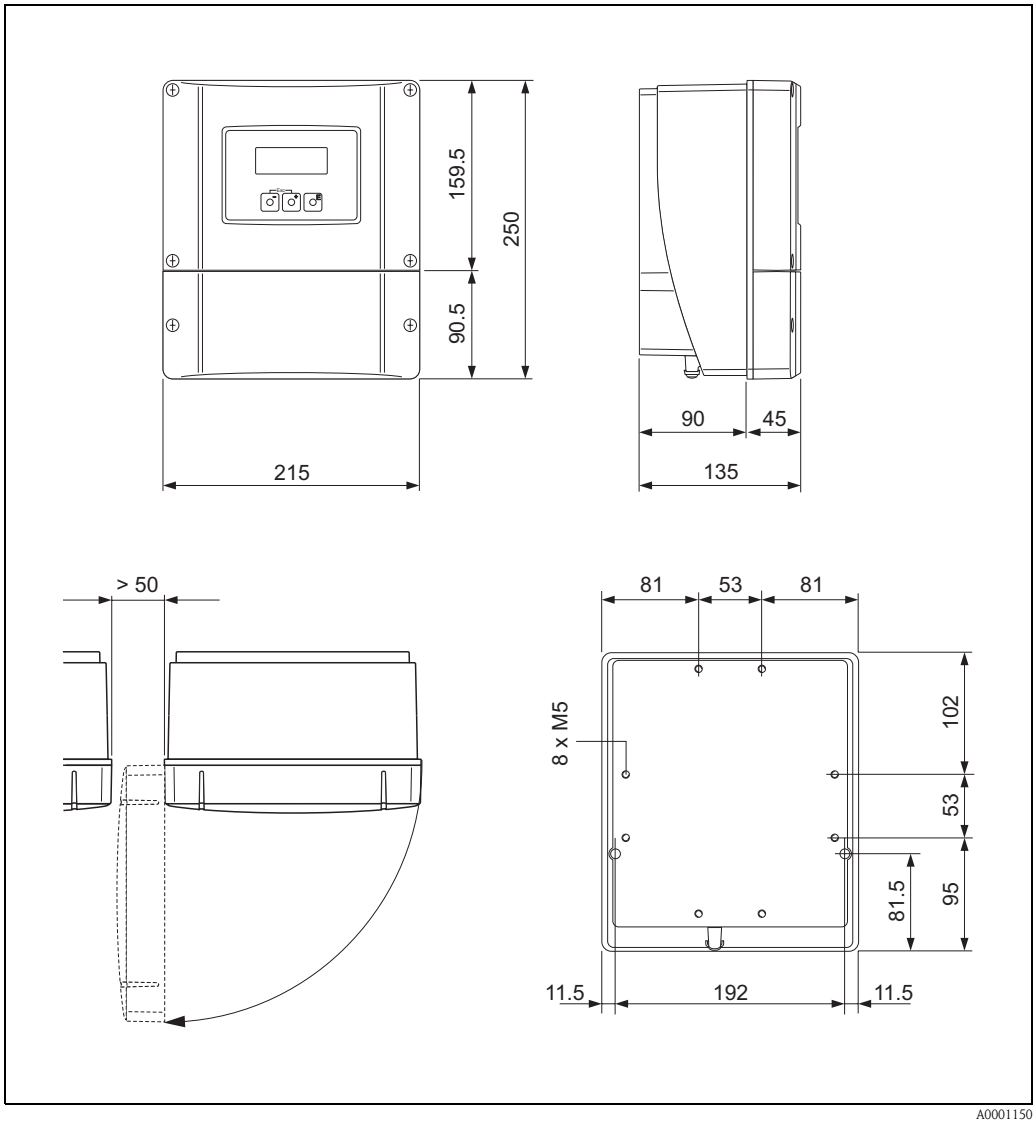


Fig. 54: Dimensions of wall-mount housing (panel mounting and pipe installation → Page 33)

10.3 Dimensions of P sensors (clamp-on)

2 or 4 traverses version

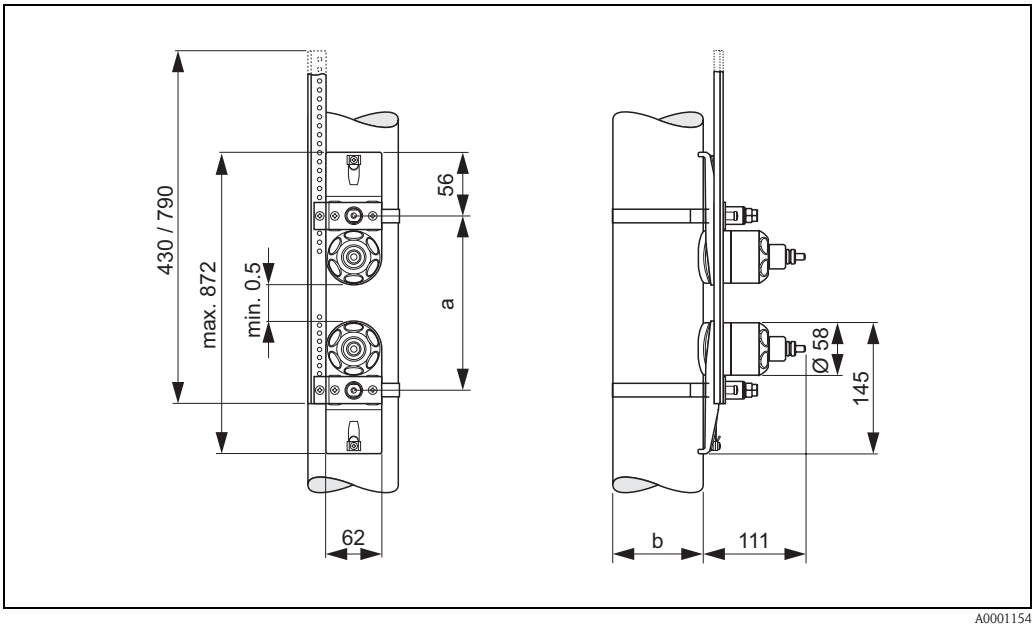


Fig. 55: Dimensions of P sensor (clamp-on) / (version: 2 or 4 traverses)

a = Sensor spacing can be determined using Quick Setup
b = Pipe outer diameter (defined by the application)

1 traverse version

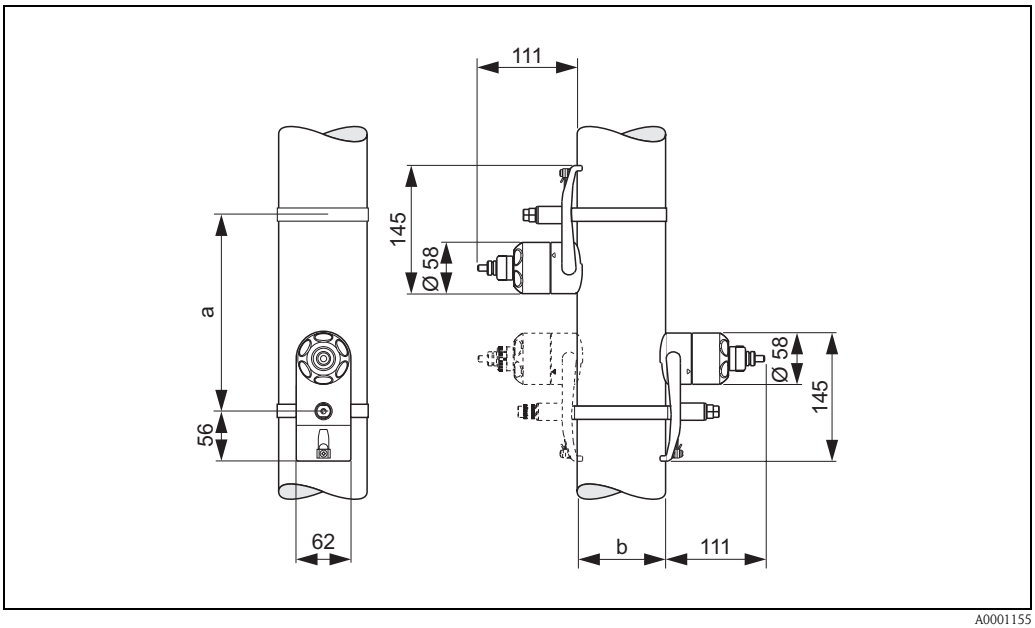


Fig. 56: Dimensions of P sensor (clamp-on) / (version: 1 traverse)

a = Sensor spacing can be determined using Quick Setup
b = Pipe outer diameter (defined by the application)

10.4 Dimensions of W sensors (clamp-on)

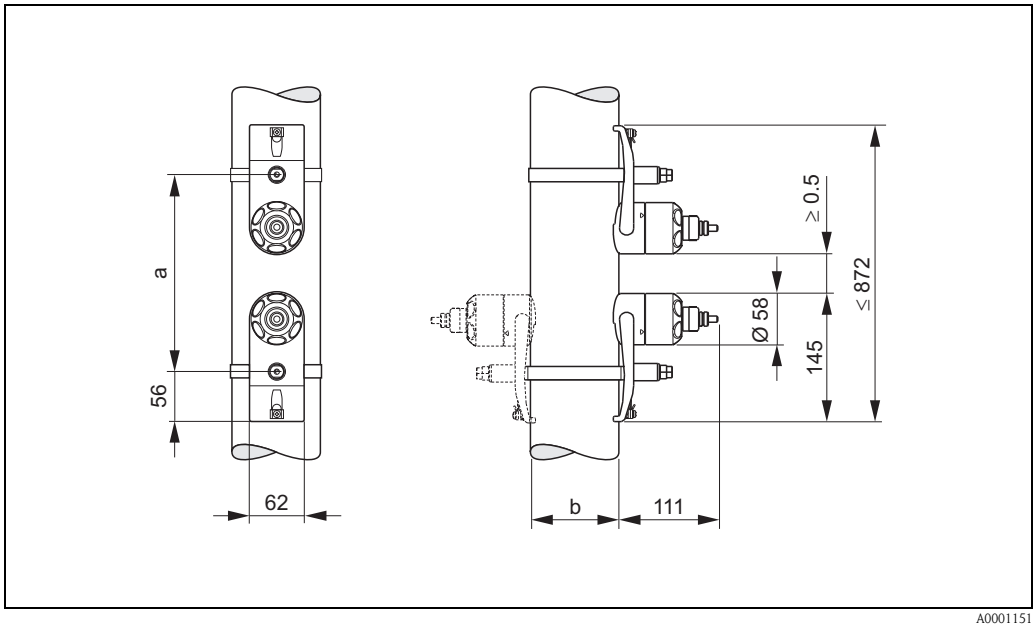


Fig. 57: Dimensions of W sensor (clamp-on)

a = Sensor spacing can be determined using Quick Setup
b = Pipe outer diameter (defined by the application)

10.5 Dimensions of U sensors (clamp-on)

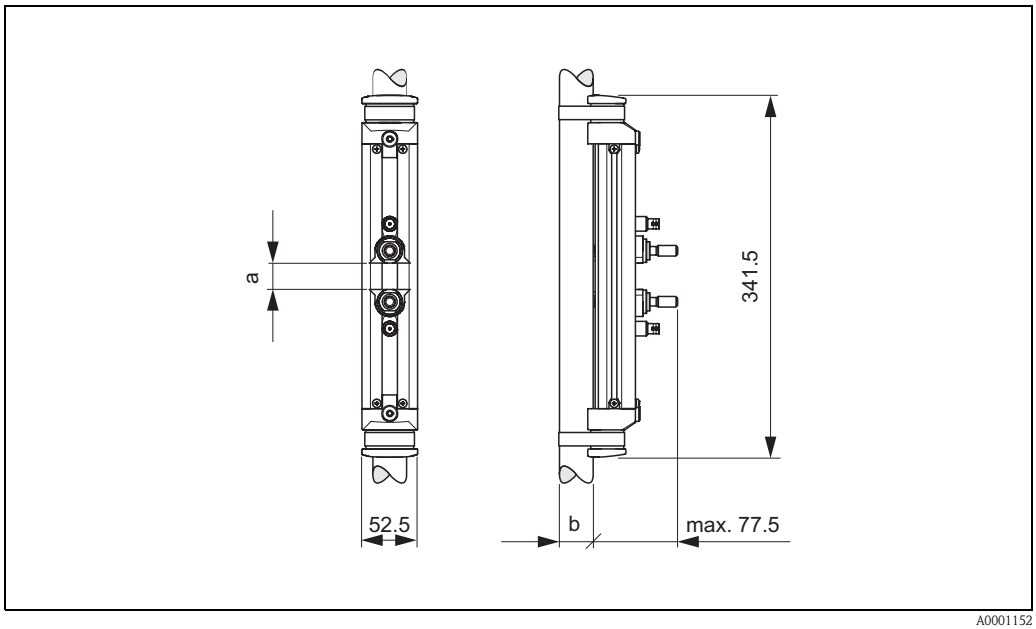


Fig. 58: Dimensions of U sensor (clamp-on)

a = Sensor spacing can be determined using Quick Setup
b = Pipe outer diameter (defined by the application)

10.6 Dimensions of W sensors (Insertion version)

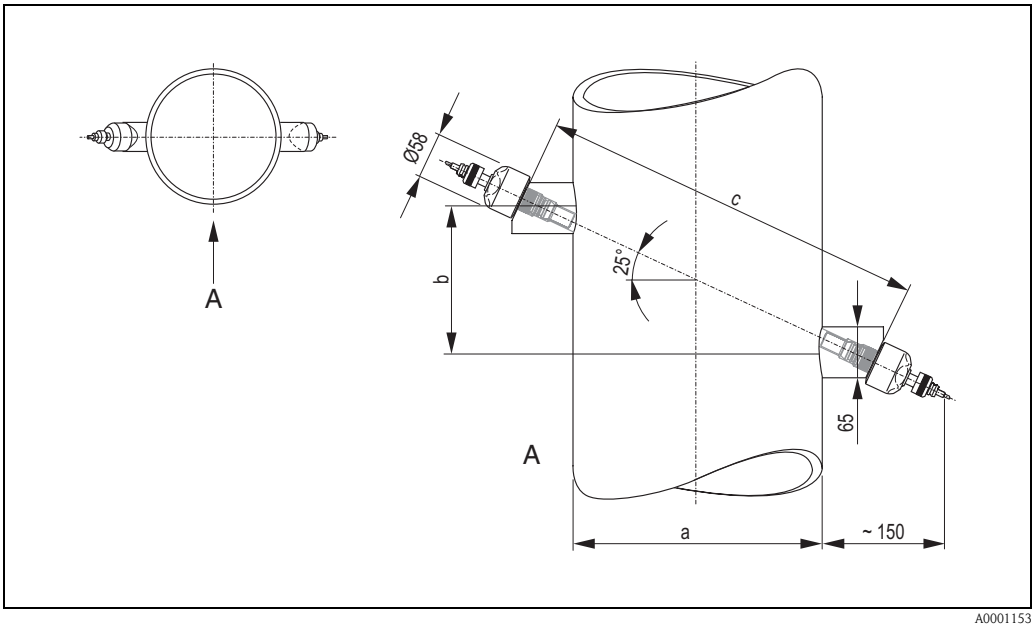


Fig. 59: Dimensions of W sensors (Insertion version)

A = View A
a = Pipe outer diameter (defined by the application)
b = Sensor spacing determinable using Quick Setup
c = Path length determinable using Quick Setup

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Declaration of contamination

Dear customer,
Because of legal determinations and for the safety of our employees and operating equipment, we need this "Declaration of contamination" with your signature before your order can be handled. Please, include the completely filled in declaration with the device and the shipping documents in any case. Add also safety sheets and / or specific handling instructions if necessary.

Type of device / sensor:		Serial no.:			
Medium / concentration:		Temperature:		Pressure:	
Cleaned with:		Conductivity:		Viscosity:	

Warning hints for medium used (mark the appropriate hints)

☐	☐	☐	☐	☐	☐	☐	☐
radioactive	explosive	caustic	poisonous	harmful to health	biologically hazardous	inflammable	safe

Reason for return

Company data

Company:		Contact person:	
		Department:	
Address:		Phone:	
		Fax / e-mail:	
		Your order no.:	

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

(Place, date)

(Company stamp and legally binding signature)

More information about services and repairs:
www.services.endress.com

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