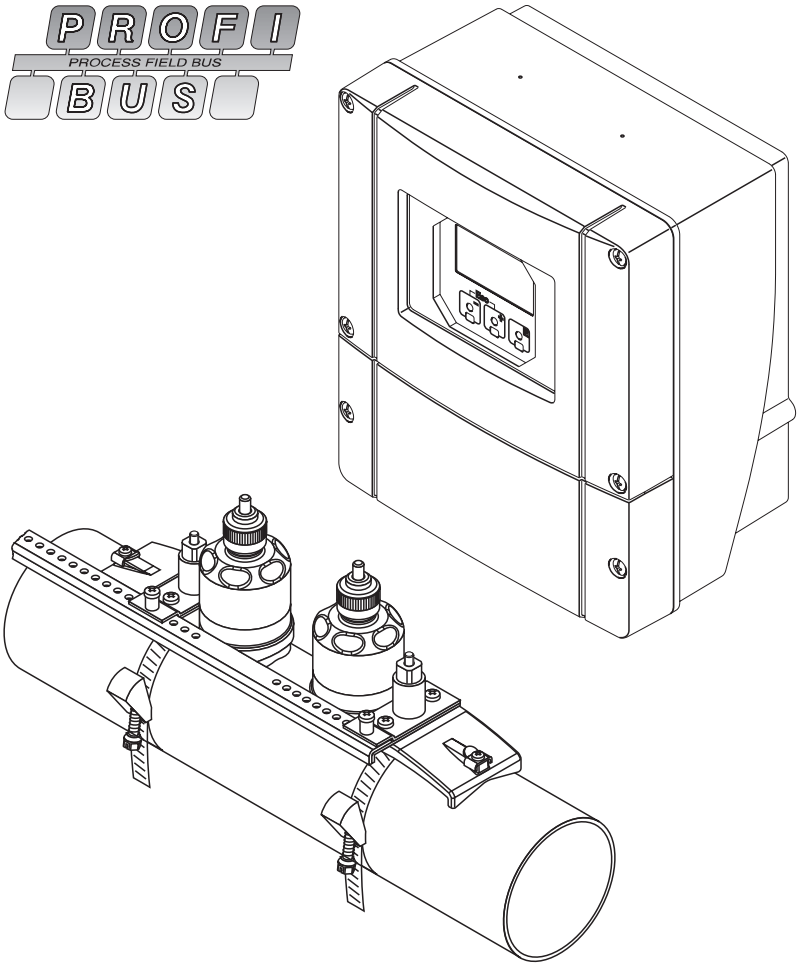
BA 076D/06/en/12.02
50102133

Valid as of software version:
V 1.05.XX (amplifier)
V 2.02.XX (communication)

PROline prosonic flow 93 PROFIBUS-DP/-PA
Ultrasonic Flow Measuring System

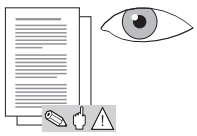
Operating Instructions



Endress+Hauser
The Power of Know How

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.	

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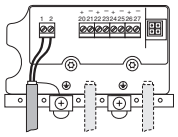
Connecting the transmitter	Page 48
Install the sensors using the transmitter software. Therefore connect the transmitter first to the power supply.	

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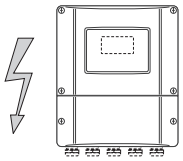
Switching on the measuring device	Page 81
Description of the startup sequence visible on the local display after switching on the transmitter.	

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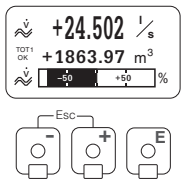
Display and operating elements	Page 56
A short overview of the different display and operating elements to allow you to start quickly.	

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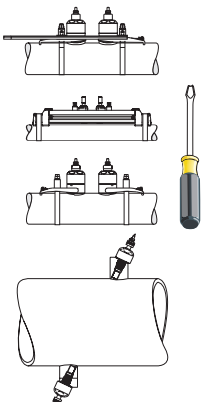
Installing the sensors	Page 17 ff.
Installing the flowrate measuring sensors Prosonic Flow P (Clamp On) Installing the flowrate measuring sensors Prosonic Flow W (Clamp On) Installing the flowrate measuring sensors Prosonic Flow U (Clamp On) Installing the flowrate measuring sensors Prosonic Flow W (Insertion) Installing the sound velocity measuring sensors DDU 18 Installing the wall thickness measuring sensor DDU 19	

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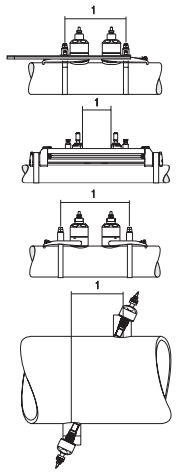
“SENSOR INSTALLATION” Quick Setup	Page 82, 86
*Measuring devices **with** a local display:* Use this “Quick Setup” (→ Page 78) to determine the data required for sensor installation such as sensor distance (1), wire length, pipe materials, sound velocity in liquids, etc. – The system provides you with 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 82. Connection of the sensor/transmitter connecting cable → Page 42	

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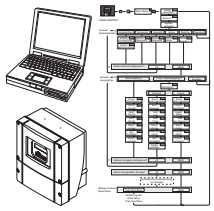
Commissioning via “QUICK SETUP” **Commissioning via PROFIBUS interface**	Page 84, 93
*Measuring devices **with** a local display:* You can commission your measuring device quickly and easily using the special “Quick Setup” menu → Page 80. This means that important basic functions can be configured directly 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 89	

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Basic configuration (device parameters, automation functions)	Page 93 ff.
Device-specific parameters are configured and the automation functions specified for the PROFIBUS interface by means of configuration programs from various manufacturers.	

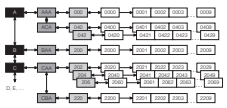
▼

System integration	Page 96 ff.
Cyclic data exchange, configuration examples	

▼

Application-specific commissioning	Page 113 ff.
Device functions, zero point adjustment	

▼

Customer-specific configuration	
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 open: – Setting parameters via the configuration program (e.g. Commuwin II) – 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.	

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Trouble-shooting	Page 123 ff.
Always start trouble-shooting with the checklist on Page 117 if faults occur after start-up or during operation. This routine takes you directly to the cause of the problem and the appropriate remedial measures.	

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.:
- Acids, alkalis, paints, oils
- Liquid gas
- Ultrapure water with low conductivity, water, wastewater

In addition to the volume flow, the system measures the sound velocity in 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 authorised 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 it contains.
- The device must be operated by persons authorised and trained by the facility's owner-operator. Strict compliance with the instructions in these 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. However the user is responsible for the choice of fluid-wetted materials as regards their in-process resistance to corrosion. The manufacturer refuses to accept liability.
- 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 ratings as stated in this supplementary 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 system 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 E+H 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 residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance 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 or injury (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, 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 icons:

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 93” flow measuring system consists of the following components:
- Prosonic Flow 93 transmitter
- Prosonic Flow W and U and Prosonic Flow P sensors

2.1.1 Nameplate of the transmitter

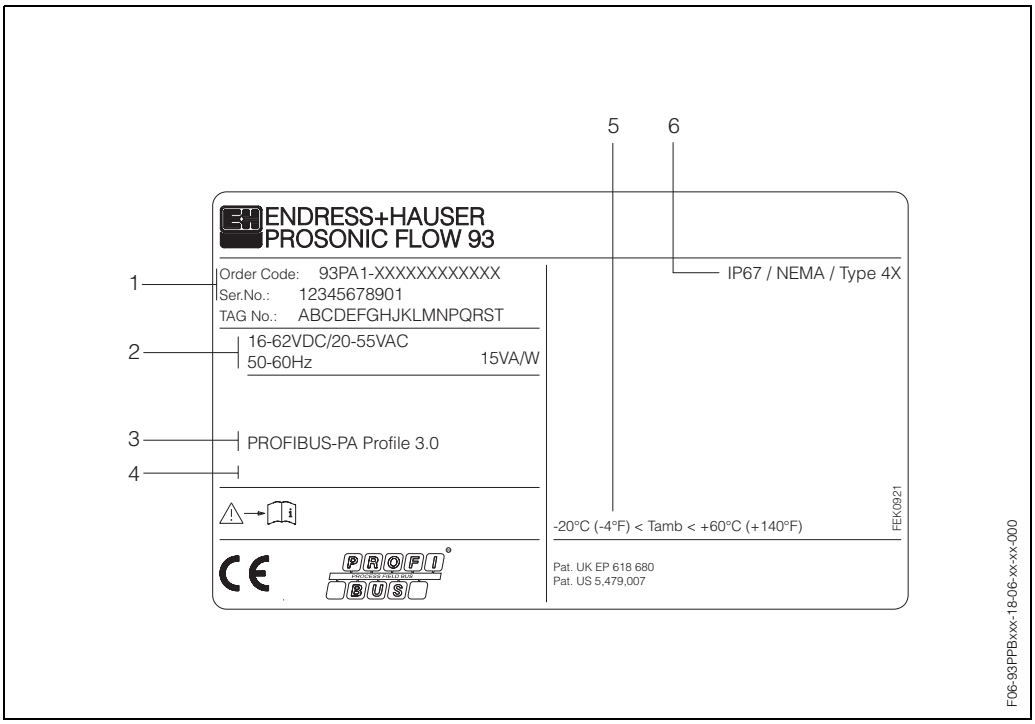


Fig. 1: Nameplate specifications for “Prosonic Flow 93 PROFIBUS-DP/-PA” transmitter (example)

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 / outputs: PROFIBUS-DP/-PA
4 Reserved for information on special products
5 Ambient temperature range
6 Degree of protection

2.1.2 Nameplate of the sensor

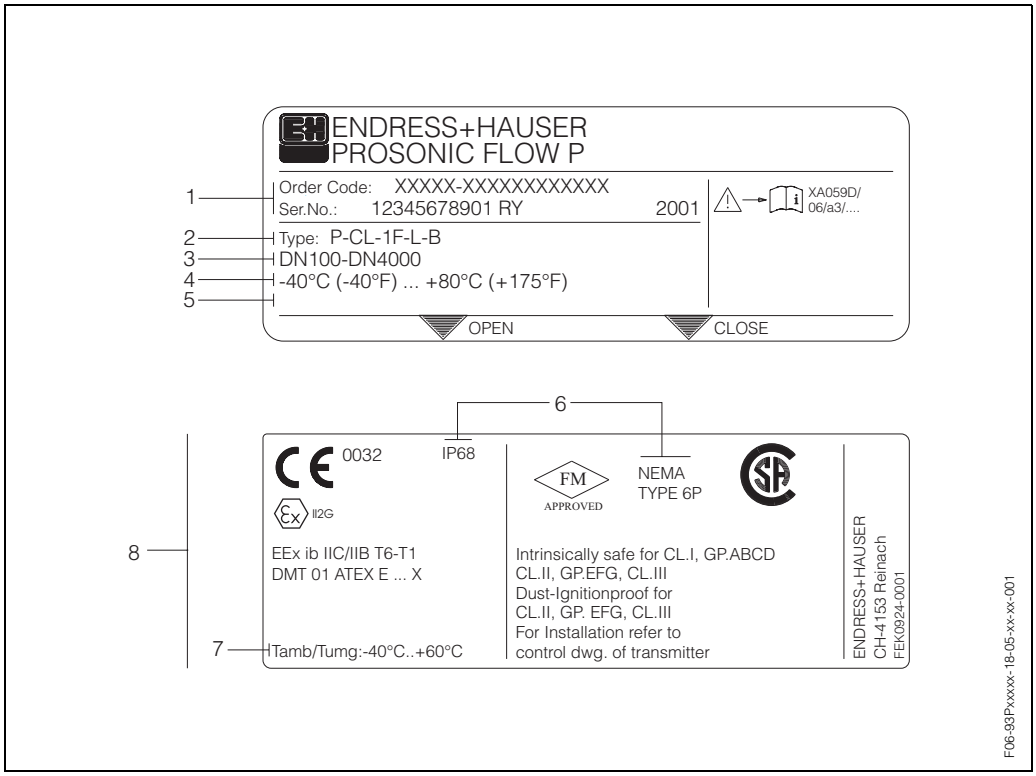


Fig. 2: Nameplate specifications for the "Prosonic Flow P" measuring sensor (example)

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 diameter: DN 100...4000*
4 *Max. fluid temperature range: –40°C (–40 °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 E+H sales office if you have any questions.*

2.1.3 Nameplate of the Prosonic Flow U sensors

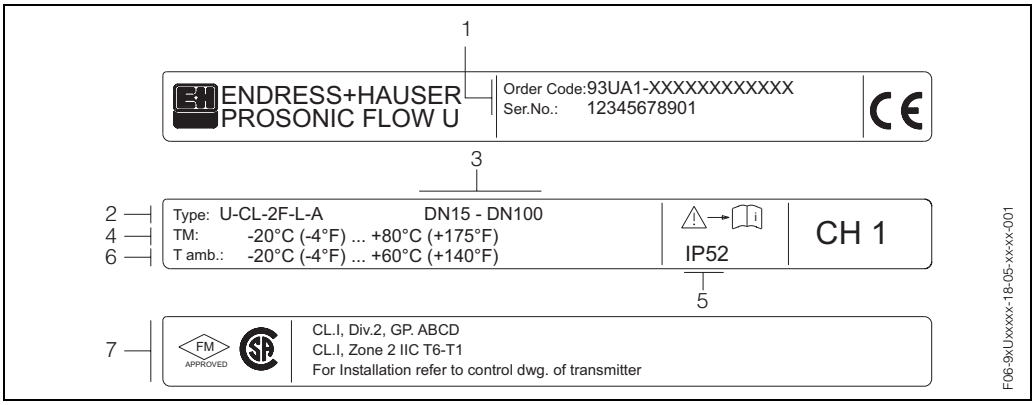


Fig. 3: Nameplate specifications for the "Prosonic Flow U" sensors (example)

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) ... +60 °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 E+H sales office if you have any questions.

2.2 CE mark, declaration of conformity

The devices are designed to meet state-of-the-art safety requirements, 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 thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing the CE mark.

2.3 Device certification PROFIBUS-DP/-PA

The Prosonic Flow 93 flowmeter has passed all the test procedures implemented and has been certified and registered by the PNO (PROFIBUS User Organisation). The flowmeter thus meets all the requirements of the specifications listed below:
- Certified for PROFIBUS Profile 3.0
  Device certification number: available upon request
- The instrument meets all of the PROFIBUS Profile 3.0 Specifications.
- The device may also be operated using certified devices from other manufacturers (interoperability).

2.4 Registered trademarks

SilGel ®
Registered trademark of Wacker-Chemie GmbH, Munich, D

PROFIBUS ®
Registered trademark of PROFIBUS Nutzerorganisation e.V., Karlsruhe, D

T-DAT™, F-CHIP™, FieldTool™, FieldCheck™, Applicator™
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

Note the following points:
- 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 147) of the transmitter, the measuring sensors and the corresponding sensor cables.

3.2 Installation conditions

3.2.1 Dimensions

The dimensions and the fitting lengths of the measuring sensors and the transmitter are on Page 152 ff.

3.2.2 Mounting location

Correct measuring is possible only if the pipe is full. **Avoid** the following mounting 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.

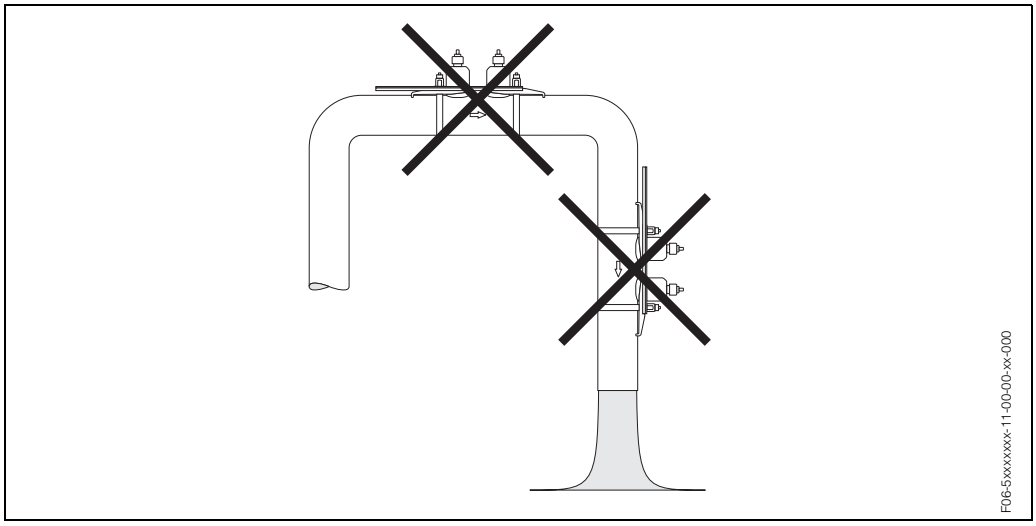


Fig. 4: Mounting location

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.

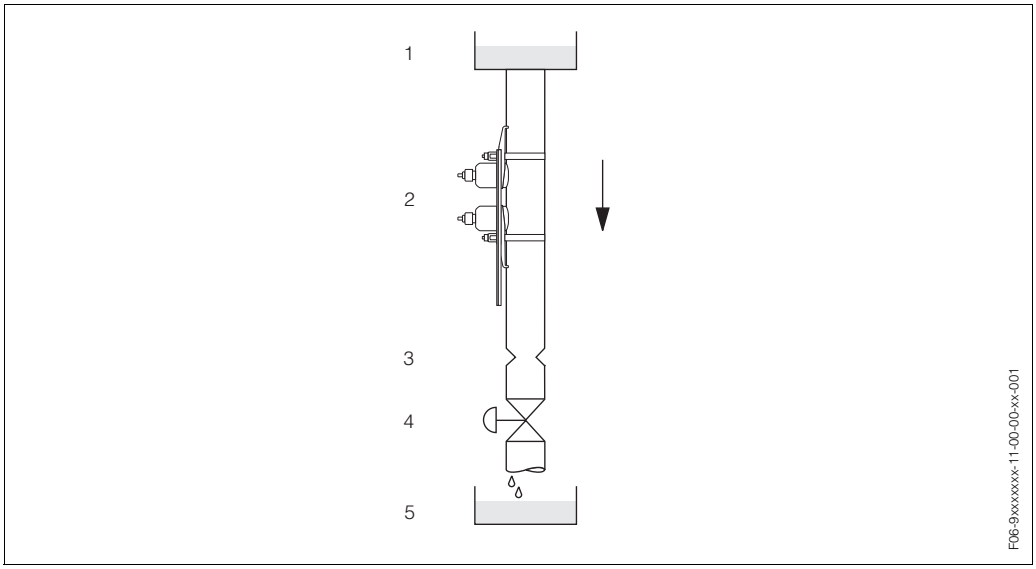


Fig. 5: Installation in a down pipe
1 = Supply tank, 2 = Measuring sensors, 3 = Orifice plate, pipe restriction, 4 = Valve, 5 = Filling tank

3.2.3 Orientation

Vertical orientation
Recommended orientation with upward direction of flow (View 1). 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 with a horizontal orientation (View 2), 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.

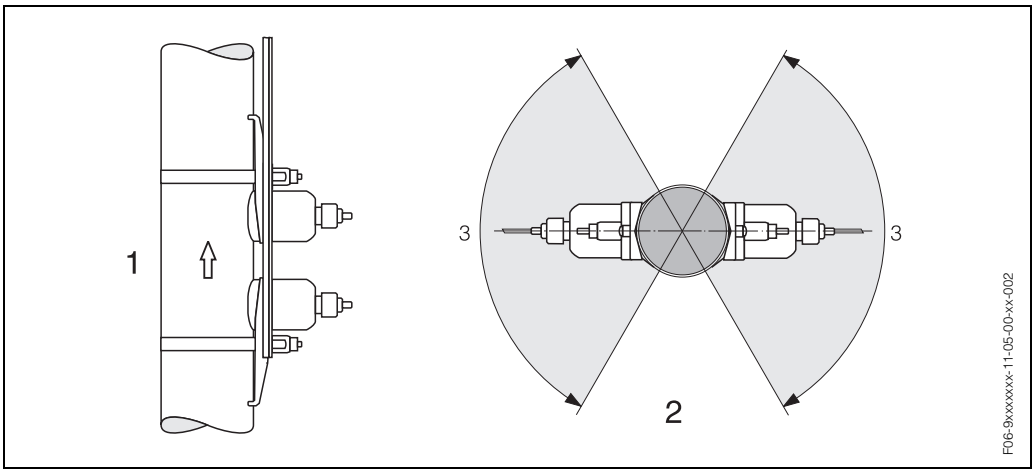


Fig. 6: Orientation (1 = Vertical, 2 = Horizontal, 3 = Recommended installation range max. 120°)

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:

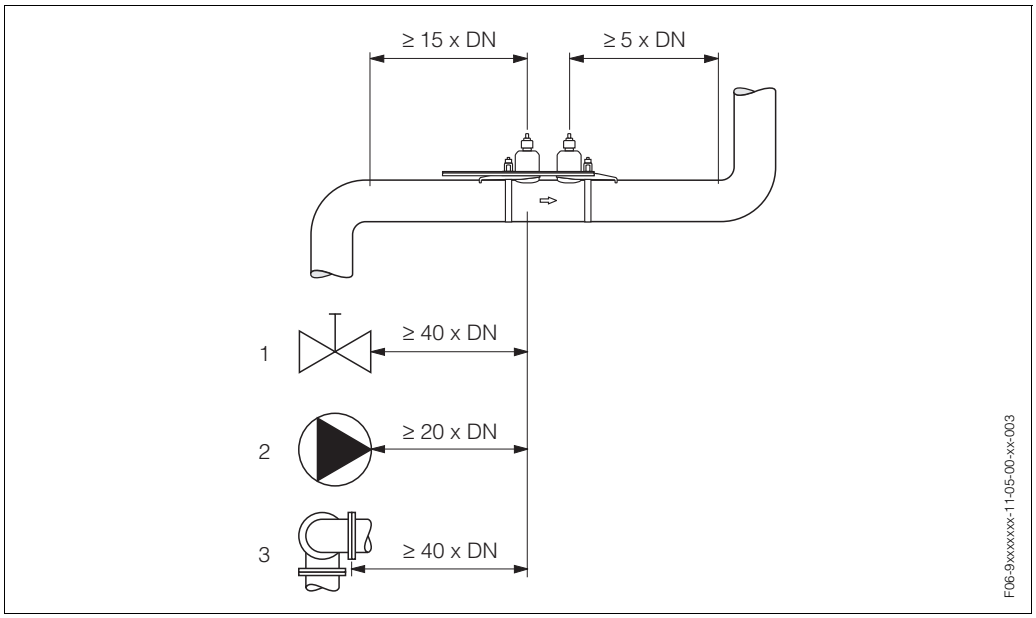


Fig. 7: Inlet and outlet runs (Clamp On version)
1 = Valve; 2 = Pump; 3 = Two pipe bends in different directions

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. 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:

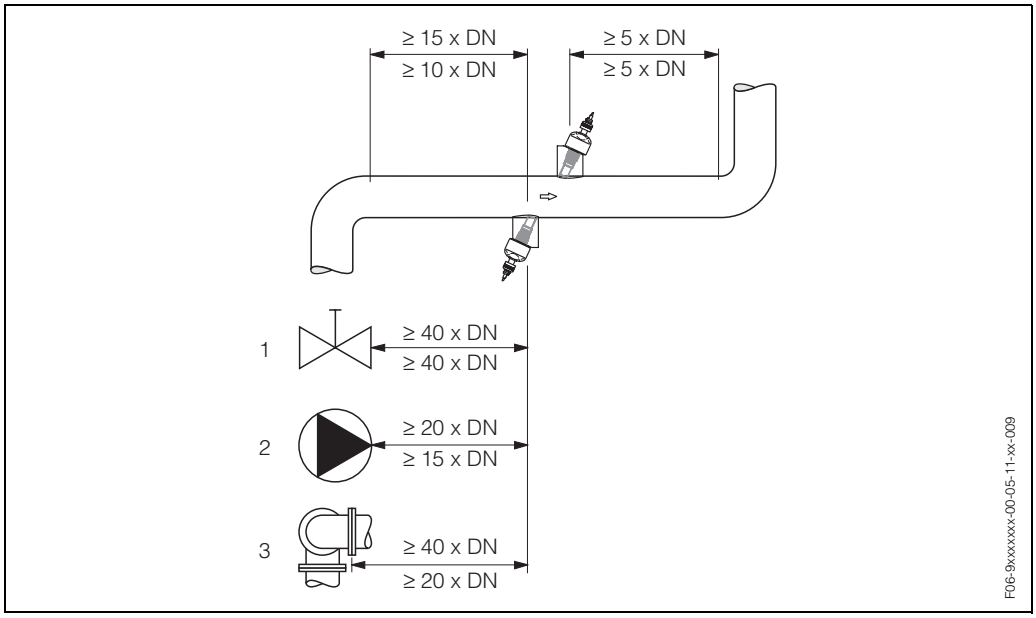


Fig. 8: Inlet and outlet runs (Insertion version)

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 Length of connecting cable

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.

3.3 Installation instructions

3.3.1 Installing tensioning bands (Clamp On)

For W / P sensors DN 50...200

1. Push one of the supplied threaded studs on the tensioning band (or both studs in the case of sound velocity measurement).
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.

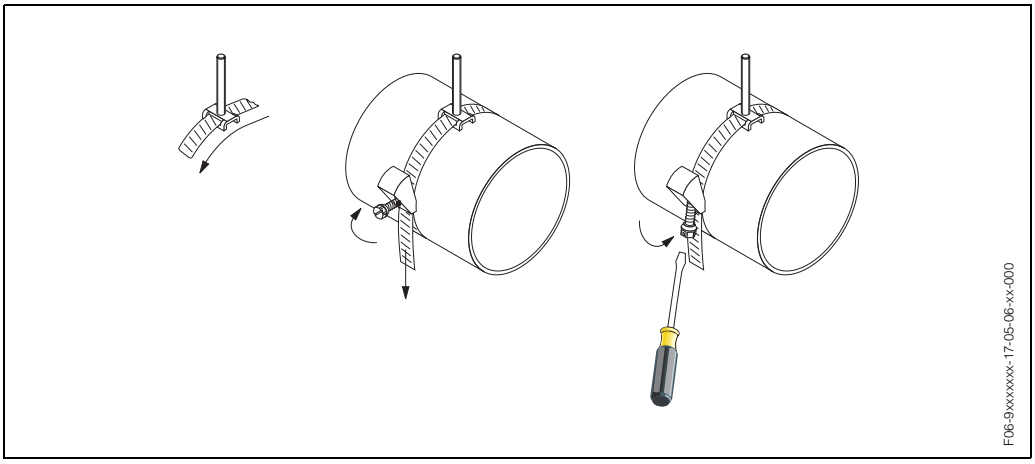


Fig. 9: Tensioning band installation for DN 50...200

For W / P sensors DN 250...4000
The following steps relate to Fig. 10, Page 18.

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 with the threaded stud (1) (or both centering plates in the case of sound velocity measurement).
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).

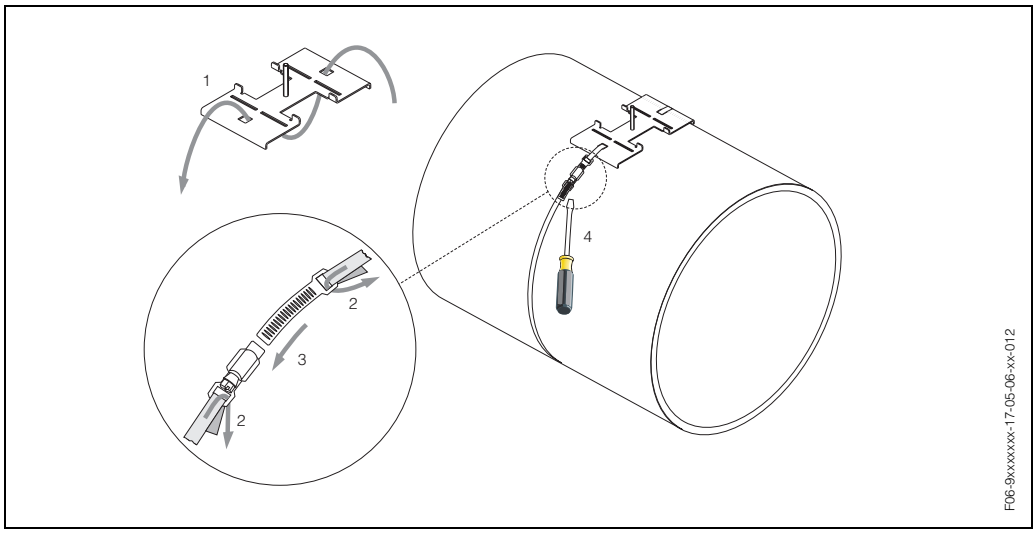


Fig. 10: Tensioning band installation for DN 250...4000

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 studs 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 82. The sensor distance is displayed in the SENSOR DISTANCE function (6886). 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 86 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: 93WAx – xBxxxxxxxxxx).
- Remove the preinstalled locking nuts on the sensor holder with a metric ISO thread.
- Use a nut which matches your threaded stud.

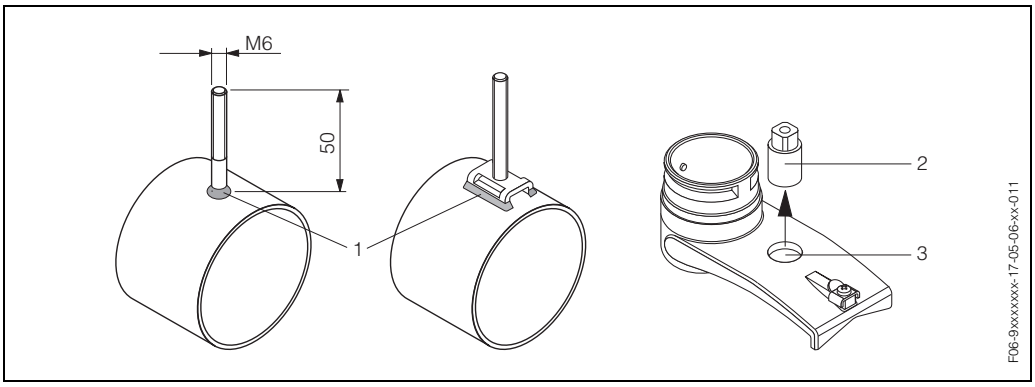


Fig. 11: Using weld studs
1 = Welding seam, 2 = Locking nut, 3 = Hole diameter: max. 8.7 mm

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 17.
2. Fix the sensor holder to the pipe using the threaded stud. Tighten the locking nut using a spanner (AF 13).
3. Fasten the mounting rail bracket to the sensor holder using a Philips screwdriver.

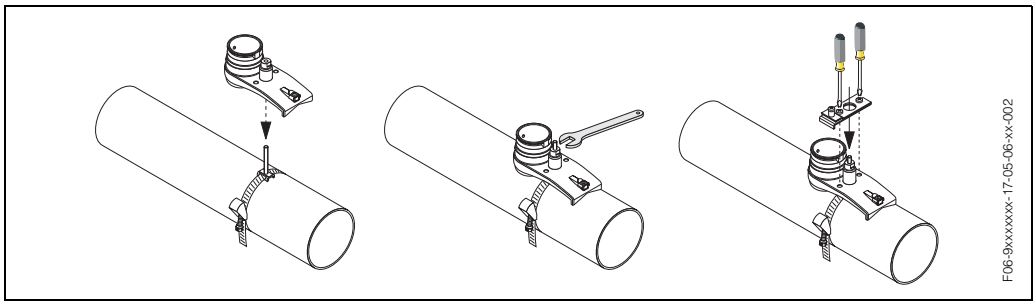


Fig. 12: Installation steps 1 to 3, measuring sensors Prosonic Flow P, 2 or 4 traverses version

Intermediate step:
Install the second sensor holder as per steps 1 to 3. Make sure that the tensioning band is not fastened. This means the sensor holder can still be moved along the pipe.

4. Determine the spacing between the distance holes (sensor distance).

   ✎ Note!
   To determine the spacing between the distance holes (sensor distance) use:
   – the “Sensor Installation” Quick Setup menu if the measuring device has a local operation. Run the Quick Setup as described on Page 82. The sensor distance is displayed in the POSITION SENSOR function (6884) (i.e. a letter between A...K for sensor 1 and a number between 10...76 for sensor 2). Insert the mounting rail as appropriate (for DN 50...200 or for DN 200...600) and tighten the relevant screws. Now fasten the second tensioning band. 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 86 ff. if the measuring device has no local operation.

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 117).
   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.

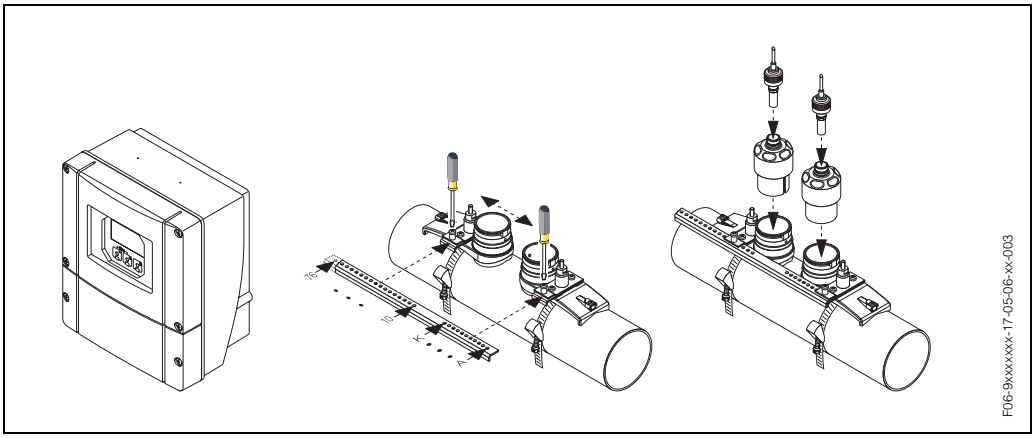


Fig. 13: Installation steps 4 to 5, measuring sensors Prosonic Flow P, 2 or 4 traverses version

3.3.4 Installing the measuring sensors Prosonic Flow P/W (Clamp On)

1 or 3 traverses version

1. Fix a tensioning band for small or large nominal diameters as described on Page 17.
   Install the second tensioning band (threaded stud on the opposite side). The second tensioning band must still be moveable.

Intermediate step:
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 82. The sensor distance is shown in the SENSOR DISTANCE function (6886) and the wire length is shown in the WIRE LENGTH function (6885). 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 86 ff. if the measuring device has no local operation.

2. Enter the wire length on both halves of the wire.

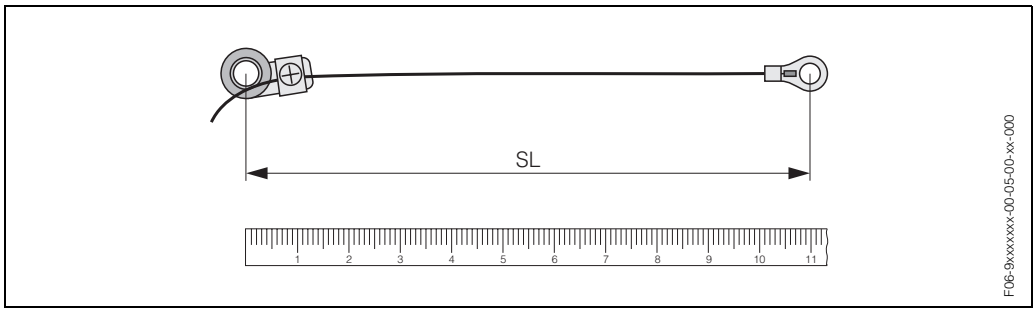


Fig. 14: Marking the determined wire length on the wire measurement equipment (SL = wire length)

3. 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. Fix the tensioning band. Loosen the Phillips screws of the fixing parts. Remove the wires.

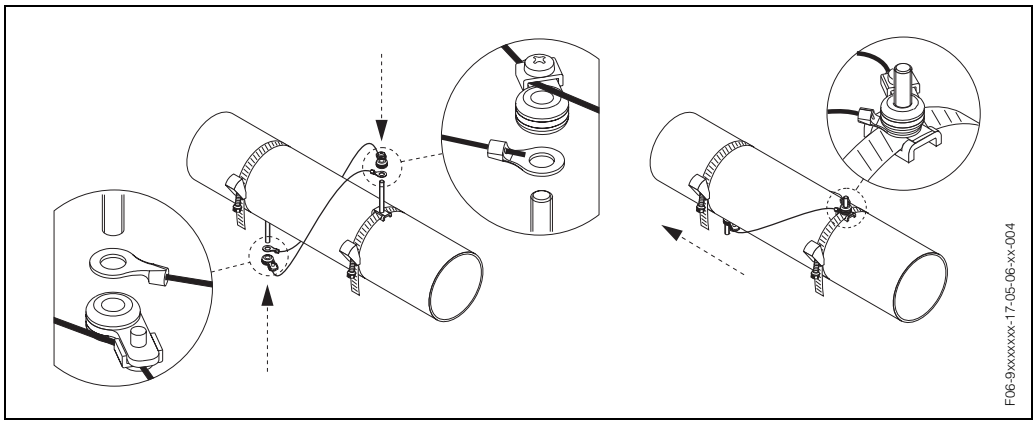


Fig. 15: Use of the wire measuring equipment for positioning of threaded studs

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

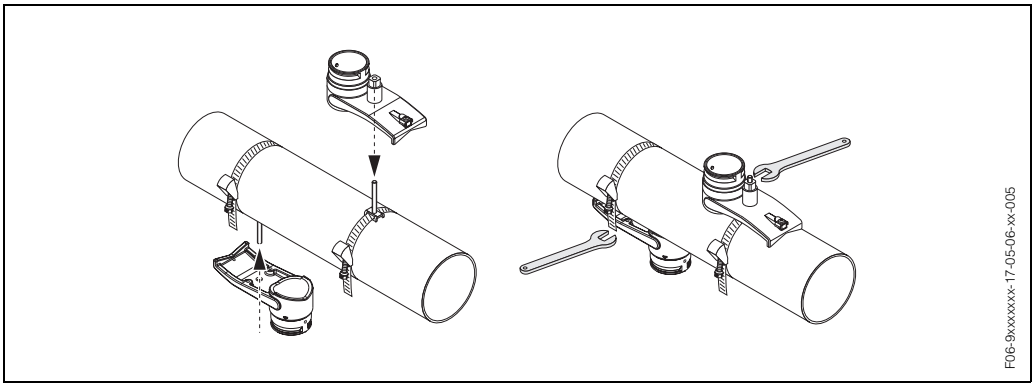


Fig. 16: Installing the sensor holders

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 117).
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.

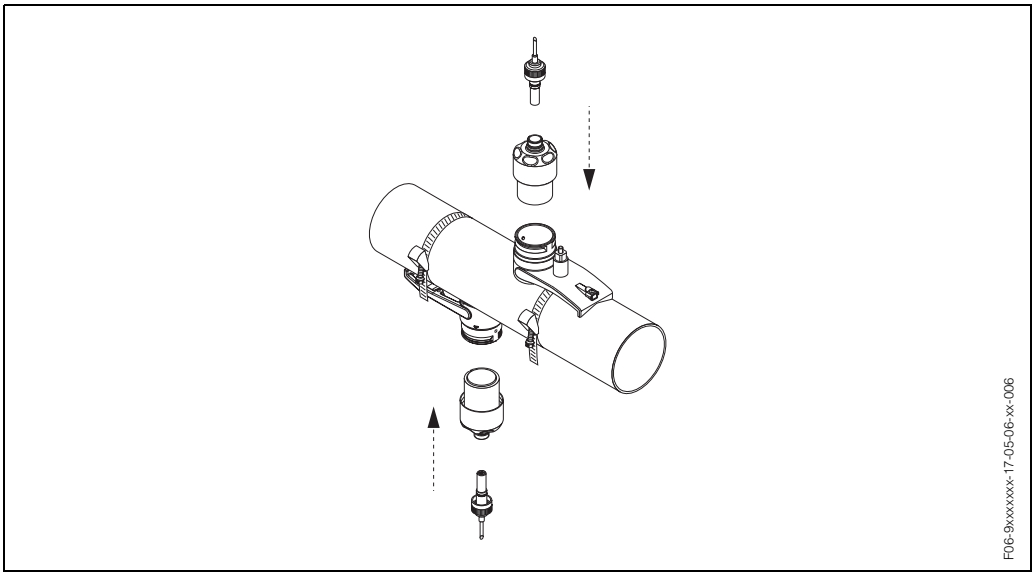


Fig. 17: Installing the sensors and the sensor connectors

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 17. Do not fasten the second tensioning band. You must still be able to move the second tensioning band along the pipe.
2. Determine the spacing between the distance holes (sensor distance).

   ✎ Note!
   To determine the spacing between the distance holes (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 82. The sensor distance is shown in the POSITION SENSOR function (6886), (i.e. a letter between A...K for sensor 1 and a number between 10...76 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 86 ff. if the measuring device has no local operation.

3. Place the mounting rail on the threaded studs and then fasten the second tensioning band. Remove the mounting rail.

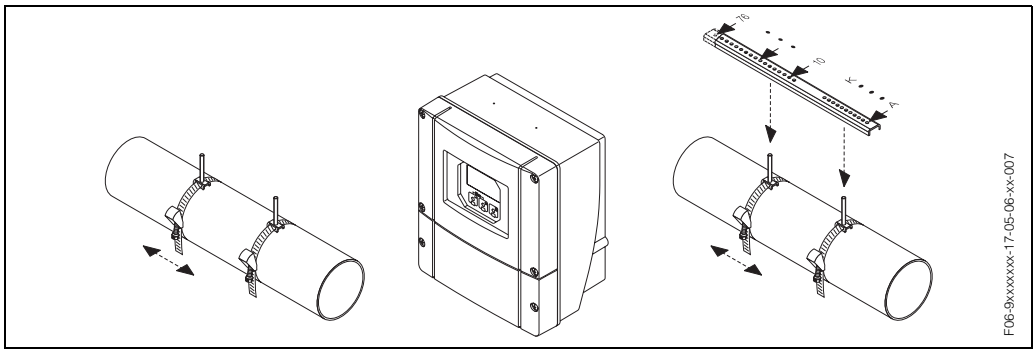


Fig. 18: Installation steps 1 to 3, measuring sensors Prosonic Flow W, 2 or 4 traverses version

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 117). 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.

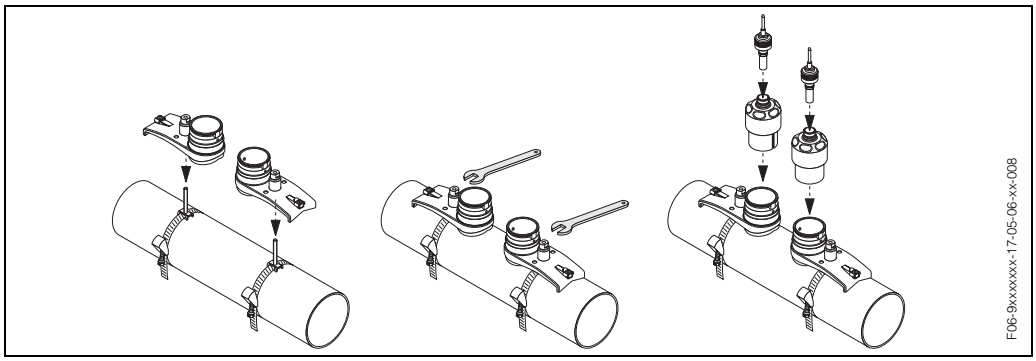


Fig. 19: Installation steps 4 to 5, measuring sensors Prosonic Flow W, 2 or 4 traverses version

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 119). 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).

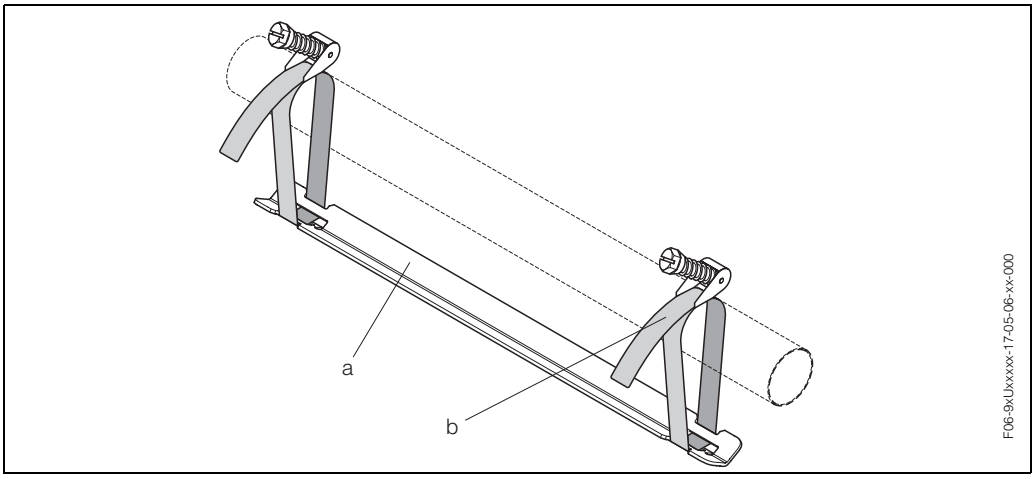


Abb. 20: Preparing sensor installation with retaining vee

Intermediate step:
The sensor distance is determined via the "Sensor Installation" Quick Setup. Run the Quick Setup as explained on Page 82. The sensor distance is then displayed in the "Sensor Distance" function.

Note!
- To run the “Sensor Installation” Quick Setup, the transmitter must have a local display and be installed and connected to the power supply.
- In the case of transmitters without a local display, the value can be determined as explained on Page 86 ff.
- 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 82).

2. 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 82.

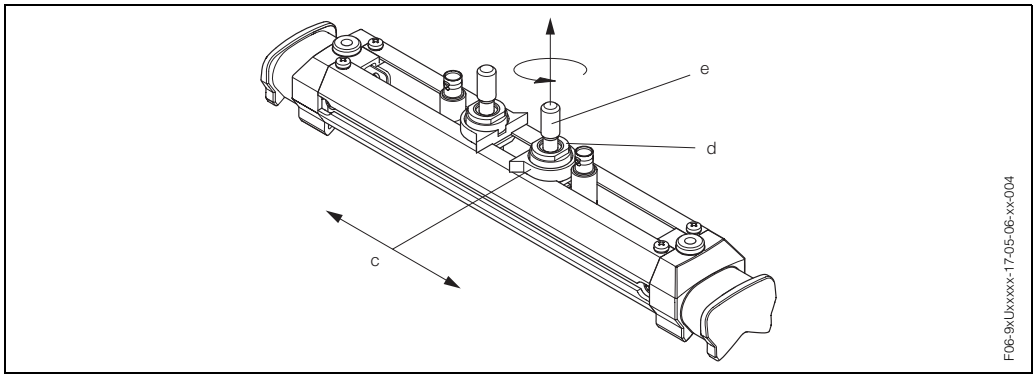


Abb. 21: Preparing the sensor assembly for the installation

3. 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 the screw of the tensioning band lock must be opened).

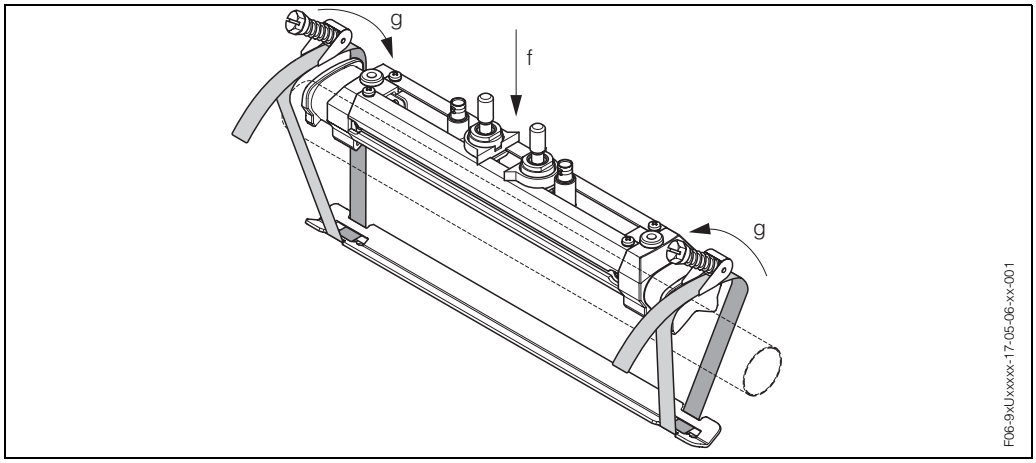


Abb. 22: Positioning the sensor and looping the tensioning bands

4. 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.

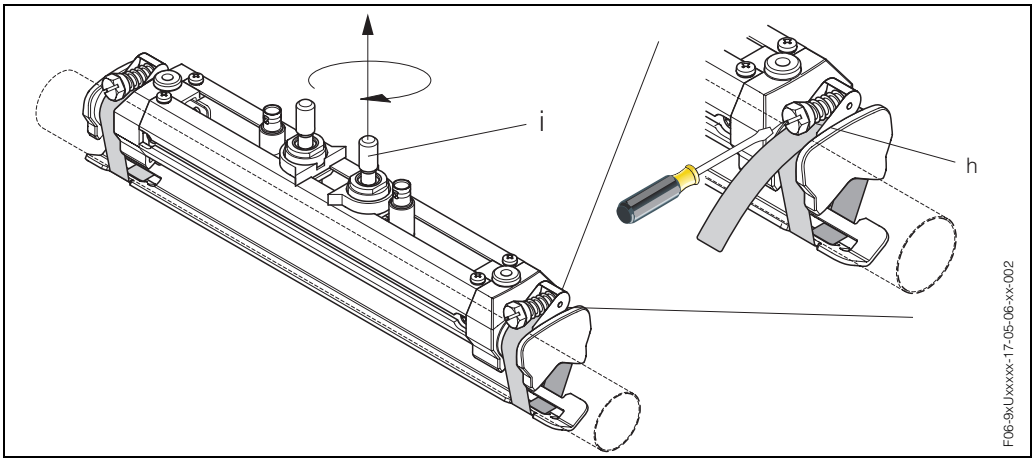


Abb. 23: Tightening the tensioning bands and the screw adjustment

5. 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.

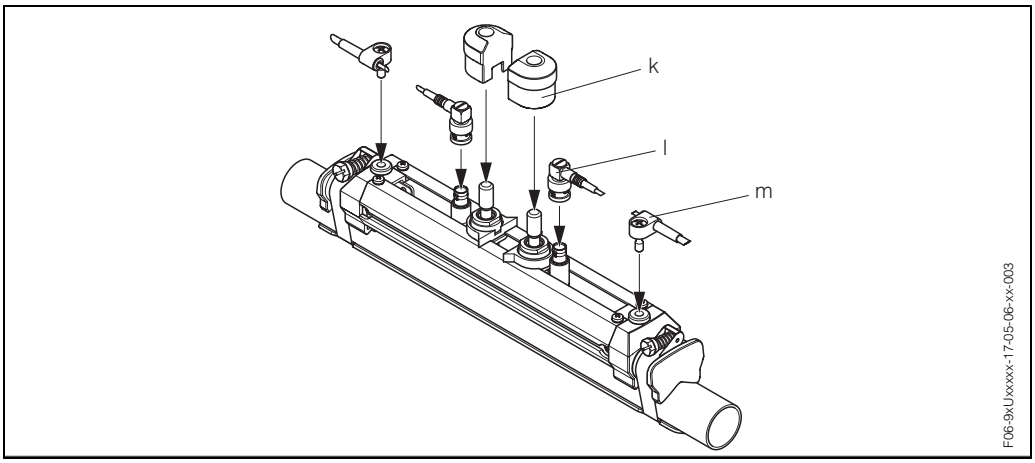


Abb. 24: Fitting the sensor protection cap, mounting the sensor cable connector and grounding

3.3.7 Explanation of terms 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).

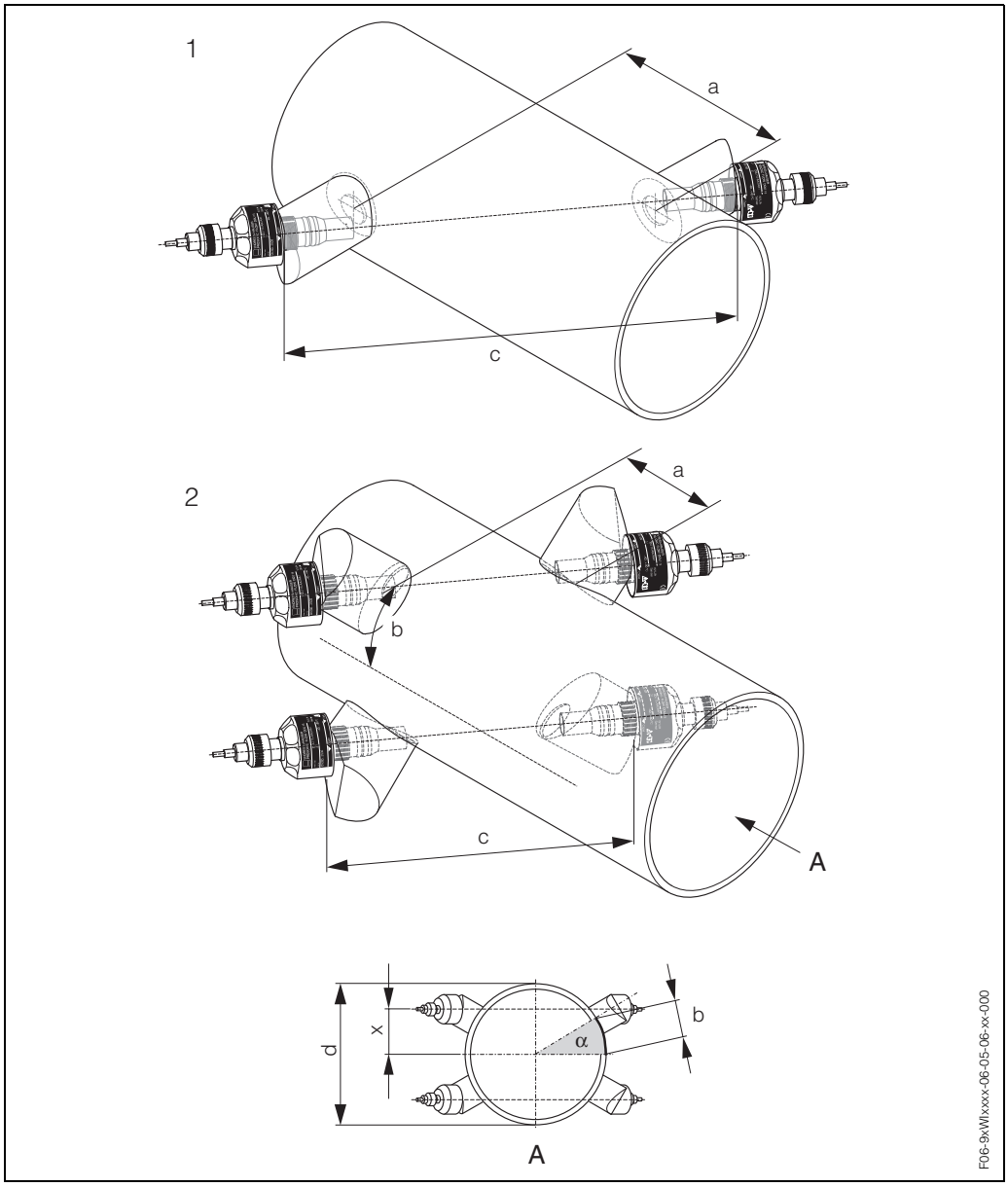


Fig. 25: Explanation of terms

1 = Single path version
2 = Dual path version

a = Sensor distance
b = Arc length
c = Path length
d = Pipe outer diameter (determined by application)
A = View A

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

Offset: $x = \frac{d \cdot \sin\alpha}{2}$

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 run: Page 16
   – Space required by the measuring point: approx. 1 x 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!

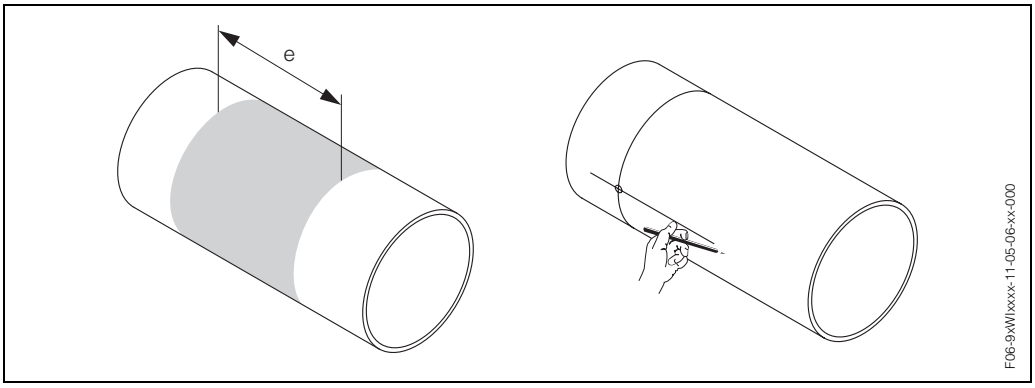


Fig. 26: Installing the measuring sensors, steps 1 and 2

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. Use the “Sensor installation” Quick Setup to determine the sensor distance (distance between the two drillholes). Run the Quick Setup as explained on Page 82. The sensor distance is displayed in the “Sensor distance” function (6886).

   ✎ Note!
   – To run the “Sensor Installation” Quick Setup, the transmitter must have a local display and be installed and connected to the power supply.
   – In the case of transmitters without a local display, the value can be determined as explained on Page 86 ff.

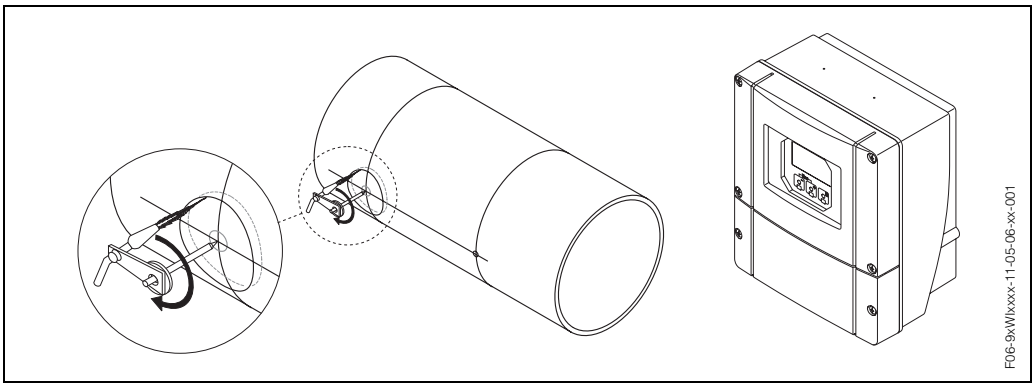


Fig. 27: Installing the measuring sensors, steps 3 and 4

5. Draw 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.

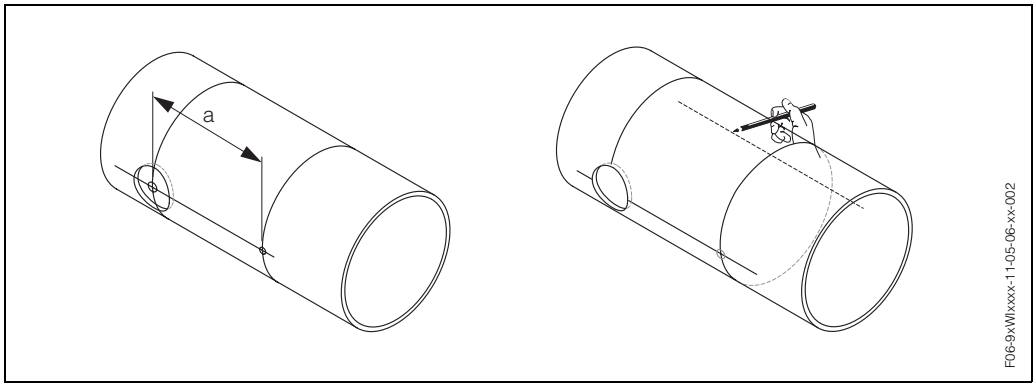


Fig. 28: Installing the measuring sensors, steps 5 and 6

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 the sensor holders (deburr, clean, etc.).

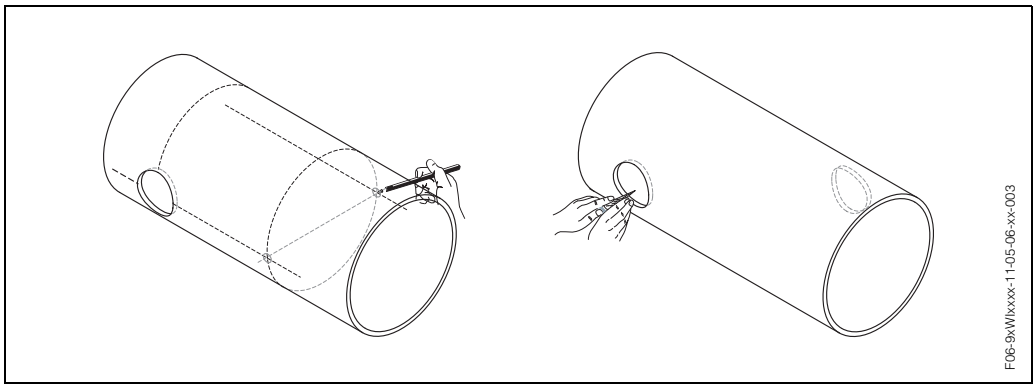


Fig. 29: Installing the measuring sensors, steps 7 and 8

9. Insert the sensor holders into the two drillholes. To adjust the weld-in depth, both sensor holders can be fixed with the special tool for insertion depth regulation 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.

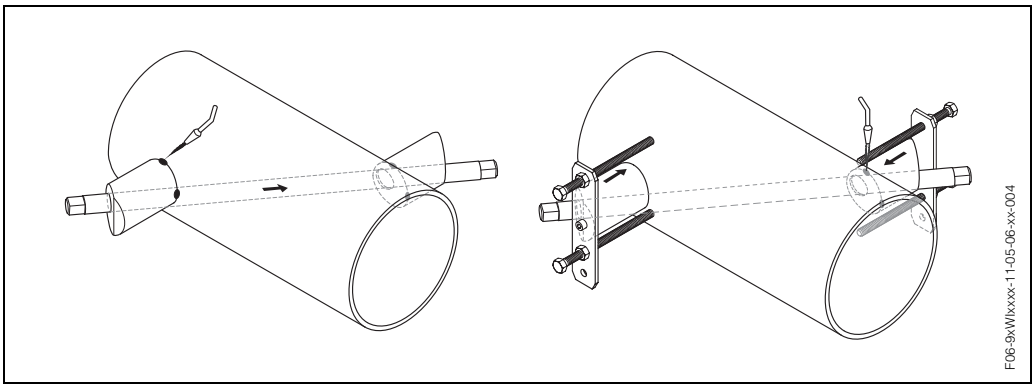


Fig. 30: Installing the measuring sensors, step 9

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

    ✎ Note!
    The path length is given as a measurement in the Quick Setup menu (“Path length” function, 6888). If you determine deviations to the path length actually measured, note these down and enter them as a correction factor when commissioning the measuring point.

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 opening provided and manually tighten the plug to the stop.

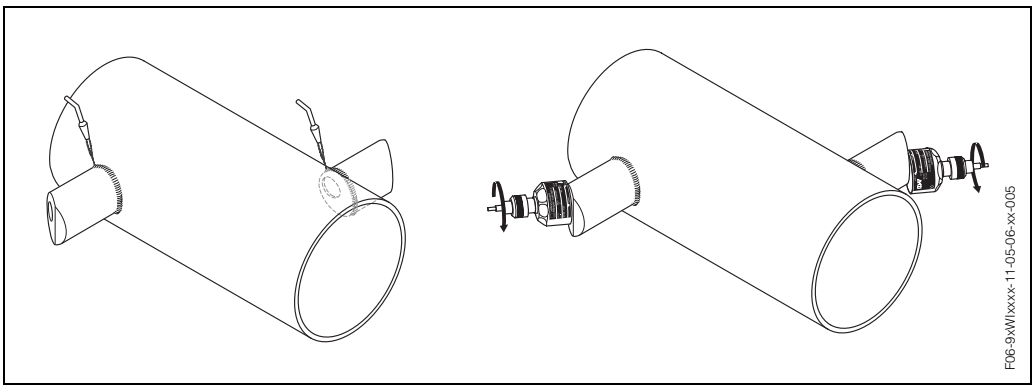


Fig. 31: Installing the measuring sensors, steps 10 to 12

3.3.9 Installing the measuring sensors Prosonic Flow W (dual path Insertion version)

1. Determine the installation area (e) on the pipe section:
   – Installation location: Page 14
   – Inlet/outlet run: Page 16
   – Space required by the measuring point: approx. 1 x pipe diameter.
2. Draw the middle line on the pipe at the mounting location.

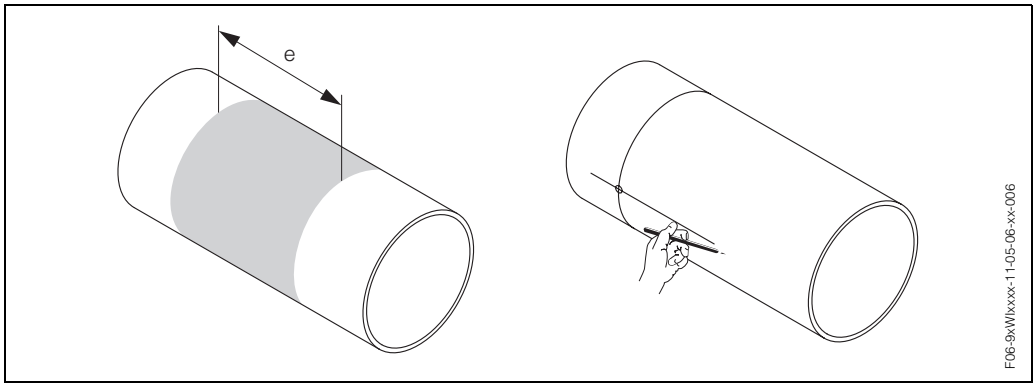


Fig. 32: Installing the dual path measuring sensors, steps 1 and 2

3. At the mounting location, pull the sensor holder to one side the length of arc (b) from the middle line. Usually, the arc length is taken as approx. 1/12 of the pipe circumference. Indicate the first drillhole (drillhole diameter approx. 81...82 mm).

   ✎ Note!
   Make the lines longer than the drillhole!

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

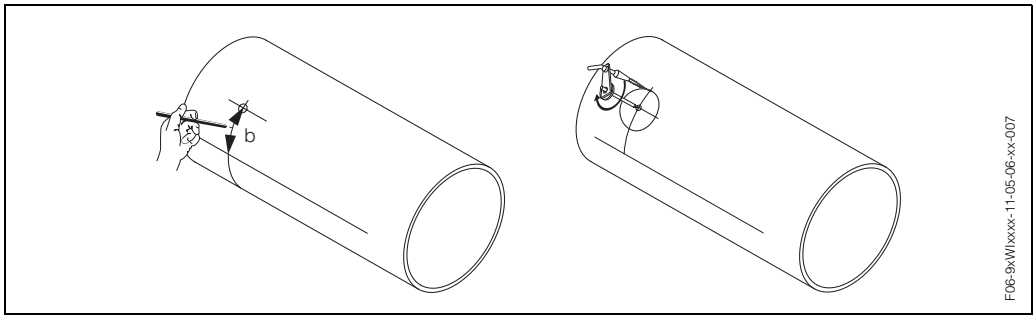


Fig. 33: Installing the dual path measuring sensors, steps 3 and 4

5. Use the “Sensor installation” Quick Setup to determine the sensor distance (distance between the two drillholes) and the arc length between the sensors of the measuring groups. Run the Quick Setup as explained on Page 82. The sensor distance is displayed in the “Sensor distance” function (6886) and the arc length in the “Arc length” function (6887).

   ✎ Note!
   – To run the “Sensor Installation” Quick Setup, the transmitter must have a local display and be installed and connected to the power supply.
   – In the case of transmitters without a local display, the value can be determined as explained on Page 86 ff.

6. You can correct the middle line with the arc length.

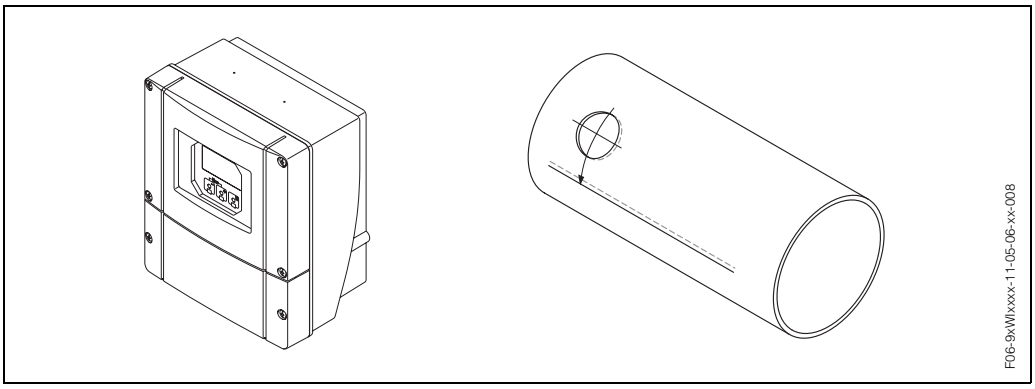


Fig. 34: Installing the dual path measuring sensors, steps 5 and 6

7. Project the corrected middle line onto the other side of the pipe and draw this on (half pipe circumference).

8. Indicate the sensor distance on the middle line and project it onto the middle line on the back.

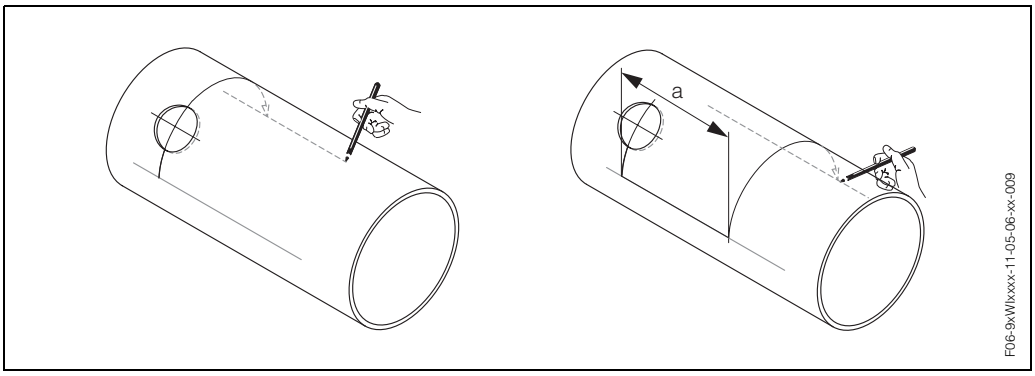


Fig. 35: Installing the dual path measuring sensors, steps 7 and 8

9. Extend the arc length to each side of the middle line and indicate the drillholes.

10. Create the drillholes and prepare the holes for welding of the sensor holder (deburr, clean, etc.).

✎ Note!
Drillholes for the sensor holders always come in pairs (CH 1 - CH 1 and CH 2 - CH 2).

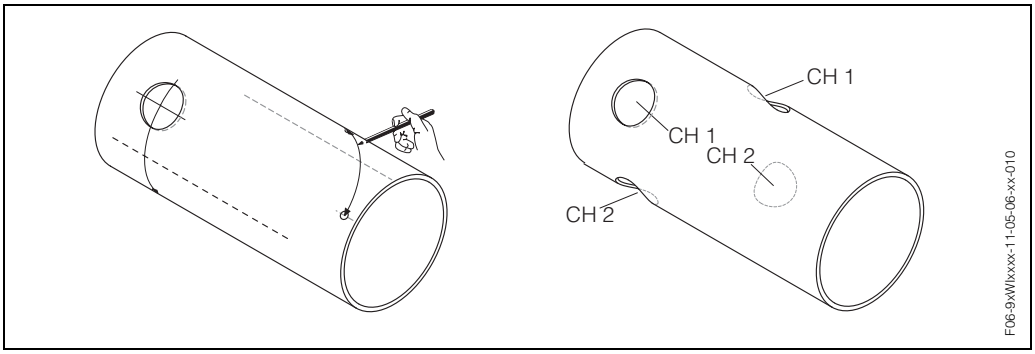


Fig. 36: Installing the dual path measuring sensors, steps 9 and 10

11. Insert the sensor holders into the first two drillholes. 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.

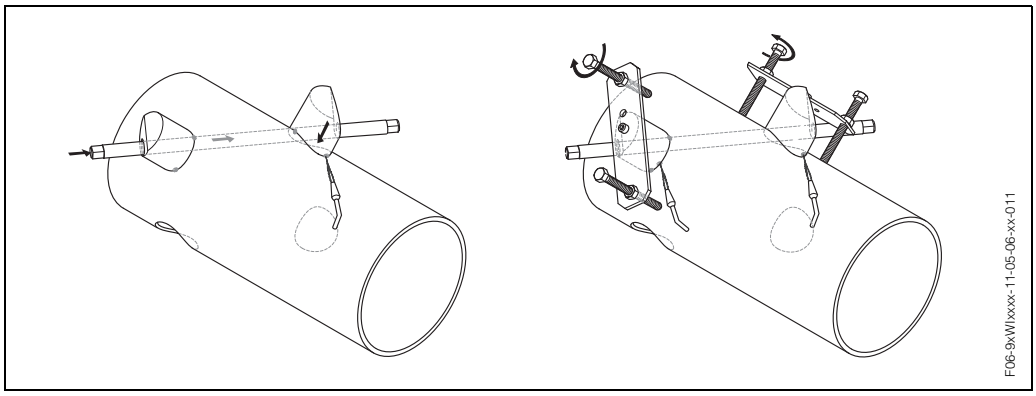


Fig. 37: Installing the dual path measuring sensors, step 11

12. Weld in both sensor holders. After welding-in, check the sensor distances, path lengths and arc lengths once again.

    ✎ Note!
    These distances are given as a measurement in Quick Setup. If you determine deviations, note these down and enter them as correction factors when commissioning the measuring point.

13. Insert the second pair of sensor holders into the two remaining drillholes, as described in step 11 and 12.

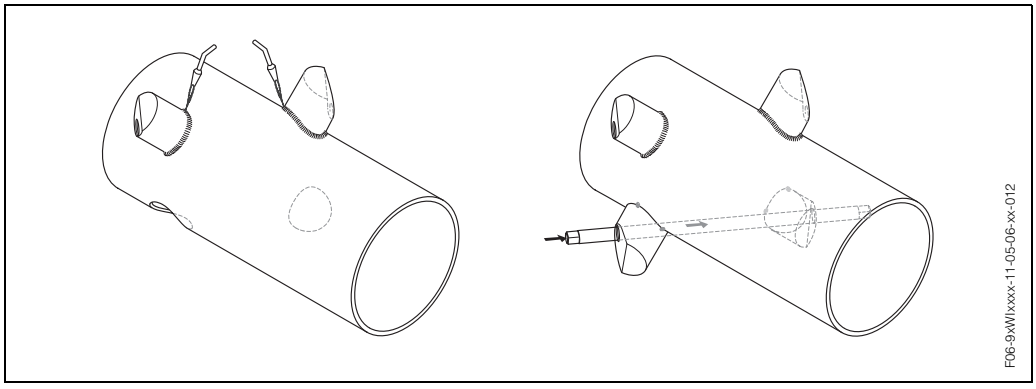


Fig. 38: Installing the dual path measuring sensors, steps 12 and 13

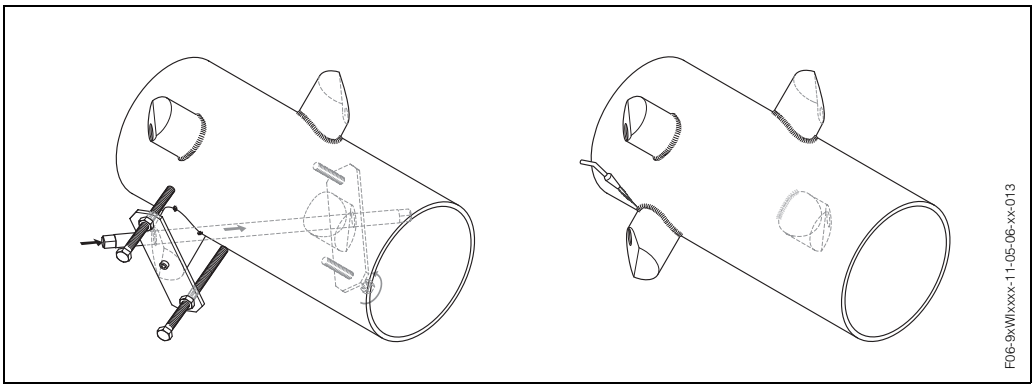


Fig. 39: Installing the dual path measuring sensors, step 13

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

15. Insert the sensor cable plug into the opening provided and manually tighten the plug to the stop.

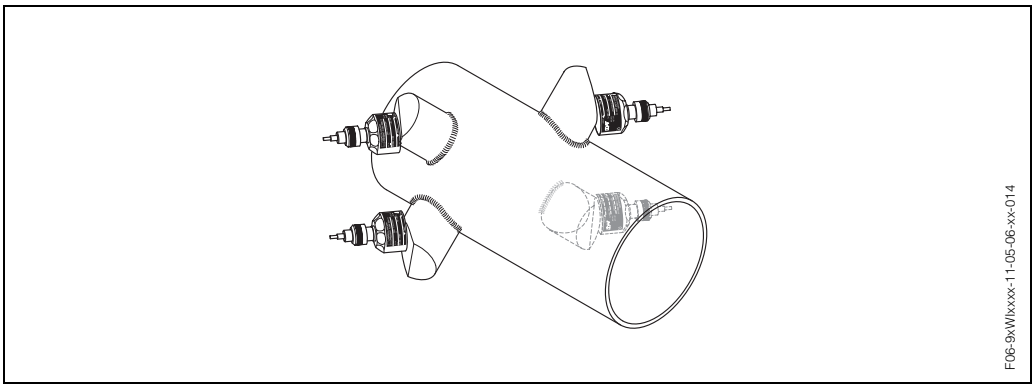


Fig. 40: Installing the dual path measuring sensors, step 14 and 15

3.3.10 Installing the sound velocity measuring sensors DDU 18 (accessories)

1. Fix a tensioning band for small or large nominal diameters as described on Page 17. The two threaded studs must be positioned opposite each other on either side of the pipe.

2. Push the sensor holder onto the pipe over the threaded studs and tighten the locking nut using a spanner (AF 13).

3. Coat the contact surfaces of the sensors with an even (approx. 1 mm thick) layer of coupling fluid starting from the groove, through the centre and to the opposite side (see Page 117). Then carefully insert the sensors into the sensor holders. 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.

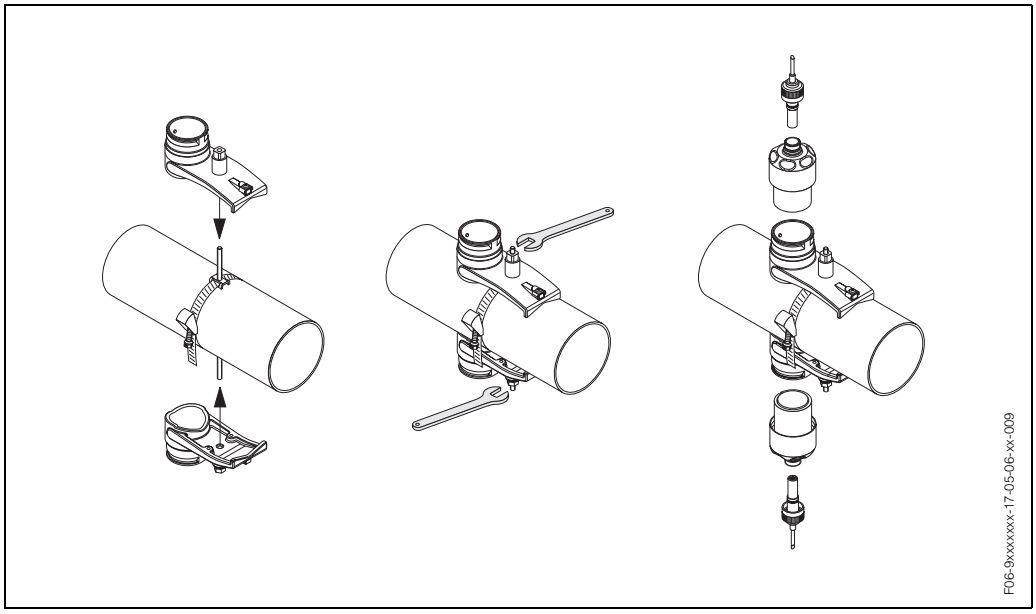


Fig. 41: Steps 1 to 3, installing the sound velocity measuring sensors

3.3.11 Installing the wall thickness measuring sensors DDU 19 (accessories)

Variant 1

1. Fix a tensioning band for small or large nominal diameters as described on Page 17.

2. Coat the contact surface of the sensor with an even (approx. 1 mm thick) layer of coupling fluid (starting from the groove, through the centre and to the opposite side). Then carefully insert the sensor into the sensor holders. 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.

3. After determining the pipe wall thickness, replace the wall thickness measuring sensor DD 19 with the appropriate flowmeter measuring sensor.

✎ Note!
Do not forget to clean the coupling point carefully before you insert the flowrate measuring sensor coated with the coupling fluid.

Variant 2
This is only suitable for as long as the transmitter Prosonic Flow 93 is within arm's length of the measuring point. Coat the sensor surface from the centre to the groove with an even (approx. 1 mm thick) layer of coupling fluid (see Page 117). Then hold the sensor vertically on the pipe for measurement. Operate the local operation with your other hand.

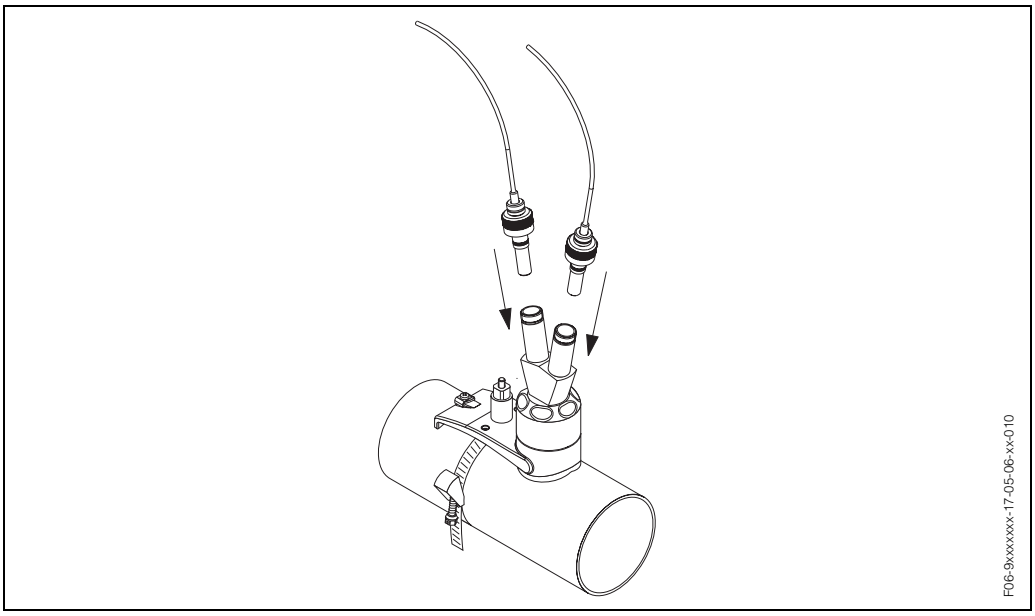


Fig. 42: Installing the wall thickness measuring sensor

3.3.12 Installing the wall-mount transmitter housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting set, accessories → Page 119)
- Pipe mounting (with separate mounting set, accessories → Page 119)

Caution!
- Make sure that ambient temperature does not exceed the permissible range (–20...+60 °C). Install the device in 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. 43.
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.

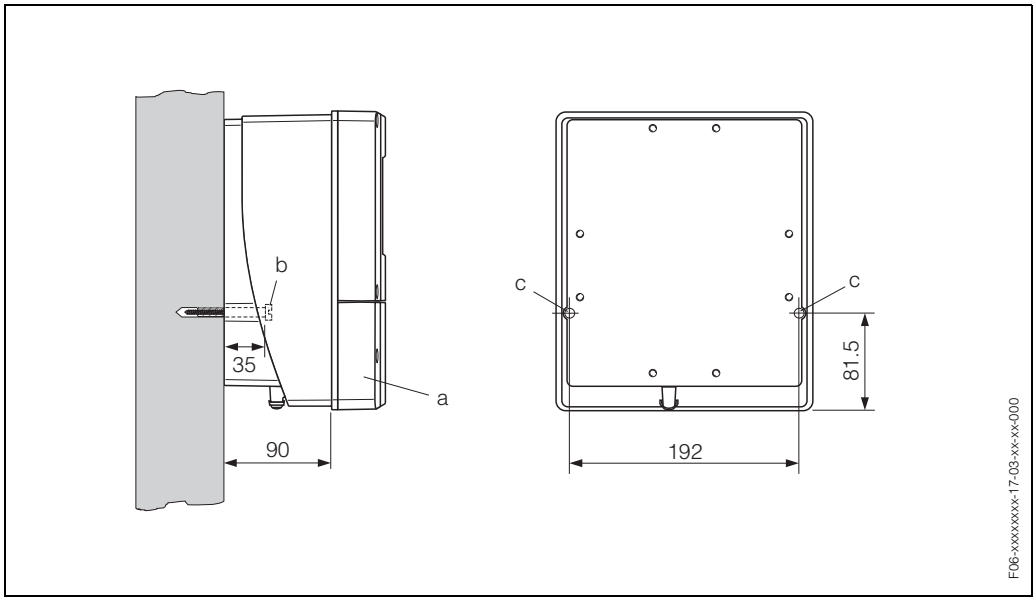


Fig. 43: Direct wall mounting

Panel mounting

1. Prepare the opening in the panel (Fig. 44).
2. Slide the housing into the panel cutout from the front.
3. Screw the fasteners onto 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.

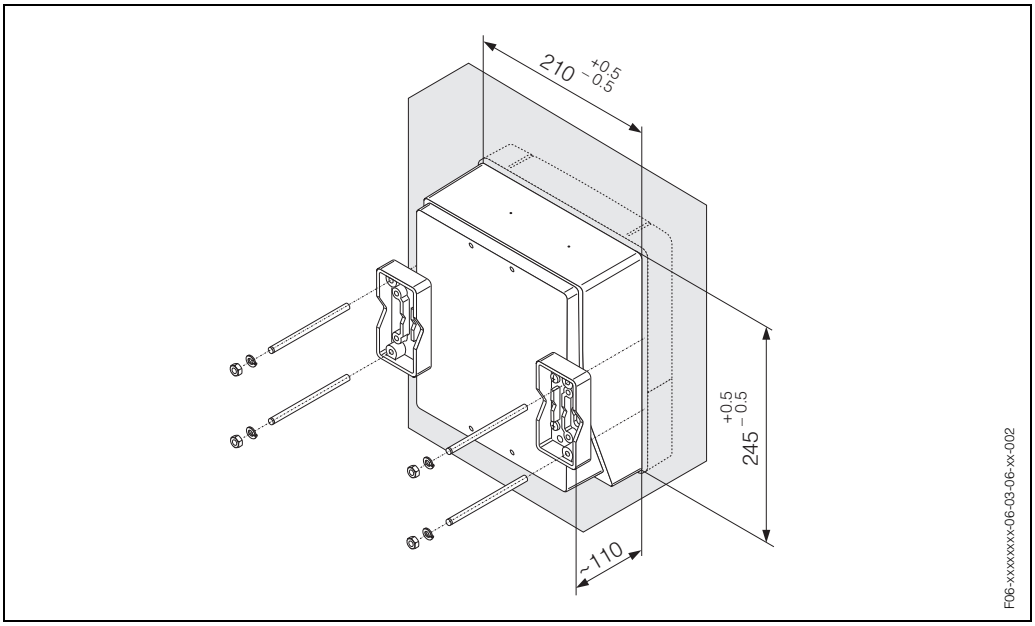


Fig. 44: Panel mounting (wall-mount housing)

Pipe mounting
Installation according to the instructions in Fig. 45.

Caution!
If the device is mounted to a warm pipe, make certain that the housing temperature does not exceed +60 °C, which is the maximum permissible temperature.

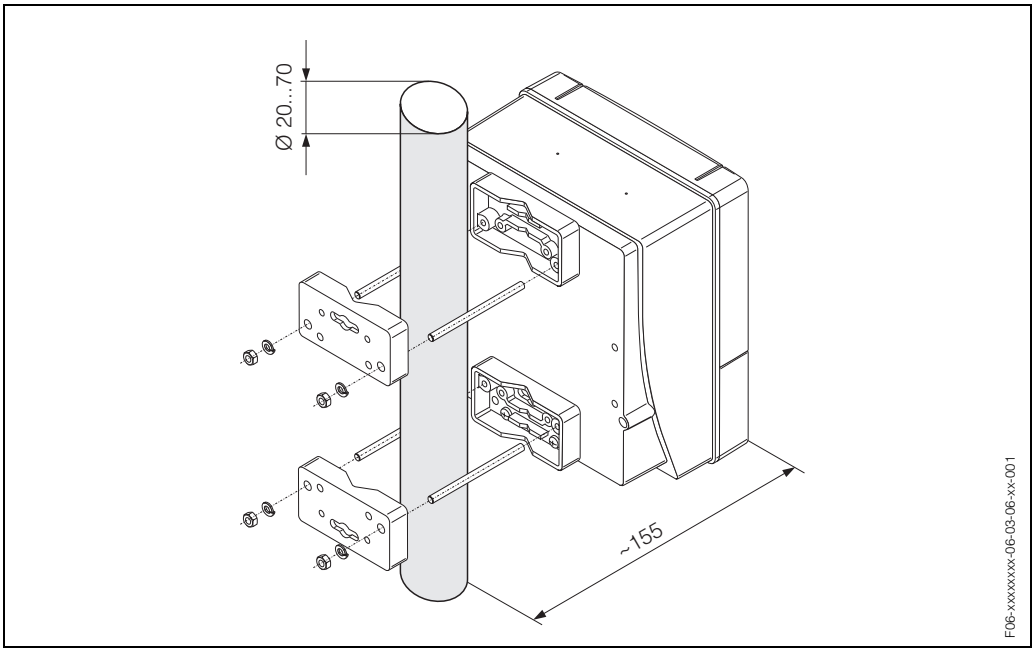


Fig. 45: Pipe mounting (wall-mount housing)

3.4 Post-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 143 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, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions. Please do not hesitate to contact your E+H sales office if you have any questions.

4.1 Cable specifications for PROFIBUS

4.1.1 PROFIBUS-DP cable specifications

Two types of cable are specified for the bus line in the EN 50 170 standard. Cable type A can be used for all transmission rates up to 12 Mbit/s. The cable parameters can be taken from the following table:

Cable type A	
Characteristic impedance	135... 165 Ω at a measurement frequency of 3...20 MHz
Cable capacitance	<30 pF/m
Wire size	>0.34 mm^2, equals AWG 22
Cable type	Twisted pairs, 1 x 2, 2 x 2 or 1 x 4 conductors
Loop resistance	110 Ω/km
Signal attenuation	Max. 9 dB over the entire length of the line segment
Shielding	Copper braided shield or braided shield and foil screen

When setting up the bus, observe the following points:
- The maximum line length (segment length) of a PROFIBUS-DP system depends on the transmission rate. With PROFIBUS-RS 485 cable type A, this value is:

Transmission rate [kBit/s]	9,6...93,75	187,5	500	1500	300...12000
Cable length [m]	1200	1000	400	200	100

- A maximum of 32 stations are permitted per segment.
- Each segment is terminated at both ends with a terminating resistor.
- The bus length or number of users can be increased by installing a repeater.
- The first and last segments can support a max. of 31 devices. The segment between repeaters can support a max. of 30 stations.
- The maximum distance achievable between two bus users is calculated as:
  (NUM_REP + 1) x segment length
  NUM_REP = maximum number of repeaters, which can be placed in series, depending on the respective repeater.

  Example:
  According to the manufacturer's information, a maximum of 9 repeaters may be placed in series on a standard segment.
  The maximum distance between two bus users at a transmission rate of 1.5 MBit/s is calculated as: (9 + 1) x 200 m = 2000 m

Spurs (PROFIBUS-DP)
Note the following points:
- Length of spurs < 6.6 m (at a max. of 1.5 MBit/s)
- At transmission rates >1.5 MBit/s, spurs should not be used.
  The line between the cable connector and the bus driver in the field device is called a spur. Our experience with the systems, indicates that you should be quite careful with the length of the spurs when planning your project. Therefore, we recommend that you do not attempt to utilise the full theoretical maximum total combined length of 6.6 m for all spurs at 1.5 MBit/s. The order of the respective field devices makes more of a difference in this case. We recommend that you avoid using spurs at transmission rates >1,5 MBit/s.
- If you must use spurs, do not install terminating resistors on them.

Shielding and grounding (PROFIBUS-DP/-PA)
When planning the shielding and grounding for a fieldbus system, there are three important points to consider:
- Electromagnetic compatibility (EMC)
- Explosion protection
- Safety of the personnel

To ensure the optimum electromagnetic compatibility of systems, it is important that the system components and above all the cables, which connect the components, are shielded and that no portion of the system is unshielded.
Ideally, the cable shields will be connected to the field devices' housings, which are usually metal. Since these housings are generally connected to the protective earth, the shield of the bus cable will thus be grounded many times.
This approach, which provides the best electromagnetic compatibility and personnel safety, can be used without restriction in systems with good potential equalisation.
In the case of systems without potential equalisation, a mains frequency (50 Hz) equalising current can flow between two grounding points which, in unfavorable cases, e.g. when it exceeds the permissible shield current, may destroy the cable.
To suppress the low frequency equalising currents on systems without potential equalisation, it is therefore recommended to connect the cable shield directly to the building ground (or protective earth) at one end only and to use capacitive coupling to connect it to all other grounding points.

Setting the terminating resistors
Since mismatches in the impedance result in signal reflections on the line and can thus lead to communication errors, it is important to terminate the lines properly.

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 terminator switches are located on the I/O board (see Fig. 46).

1. Remove the screws and open the housing cover (1).
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. Unplug ribbon cable connector (3) of the display module.
4. Remove the cover (4) from the electronics compartment by loosening the screws.
5. Removing the I/O board:
   Insert a thin pin into the opening provided (5) and pull the board out of the holder.

6. Use a pointed object to adjust the positions of the miniature switches on the I/O board.
7. Installation is the reverse of the removal procedure.

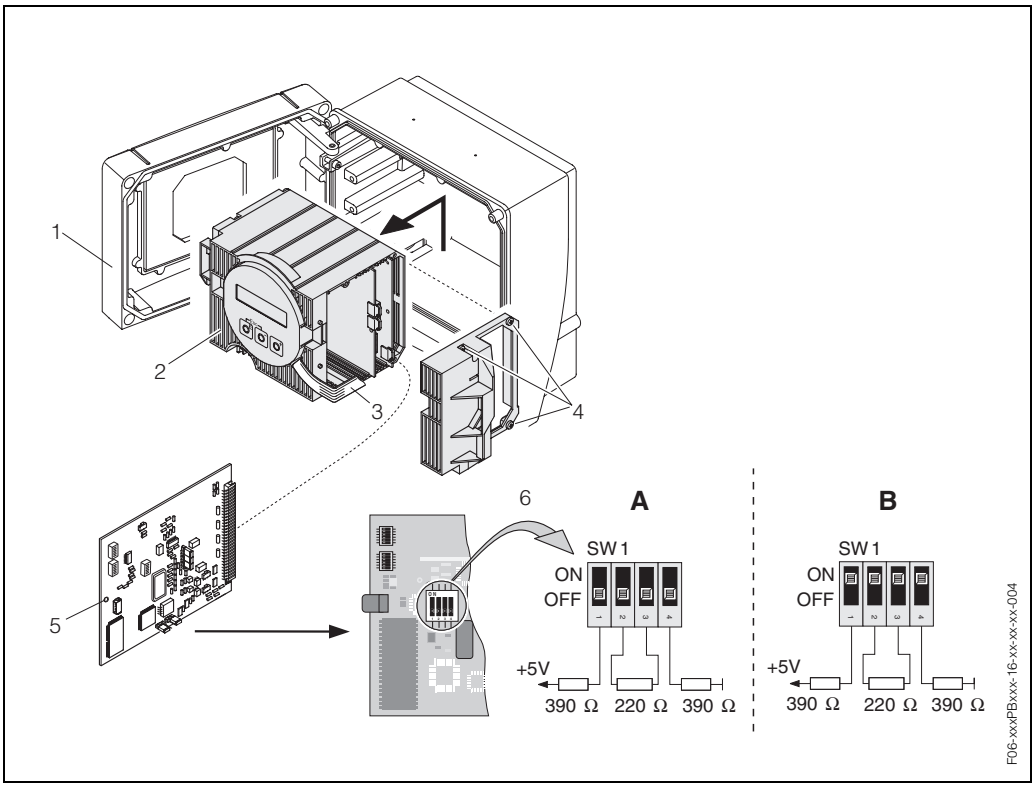


Fig. 46: Setting the terminating resistors (PROFIBUS-DP)

A = Factory setting
B = Setting on the last transmitter

In addition, pay attention to the following points:
- For baud rates of up to 1.5 MBaud, terminate the last transmitter on the bus by setting the terminator switches SW 1 to: ON – ON – ON – ON.
- If the device is to be operated at over 1.5 MBaud, you can tap the power supply for an external terminator from terminals 24 (GND) and 25 (+5 V), see Page 49.
- If the device is to be operated at a baud rate >1.5 MBaud, an external terminator is necessary, e.g. with a 9-pin Sub D cable connector combination, with an integrated series inductance to compensate for the station's capacitive load and minimise the resulting line reflections.

Note!
As a rule, we recommend that an external terminator be used, since a defect in an internally terminated device can disrupt the entire segment.

4.1.2 PROFIBUS-PA cable specifications

Cable type
Twin-core cables are required for connecting the device to the fieldbus. In analogy with IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the fieldbus, only two of which (cable types A and B) are shielded.

- Cable types A or B are particularly preferable for new installations. Only these types have cable shielding that guarantees adequate protection from electromagnetic interference and thus the most reliable data transfer. On multi-pair cables (type B) it is permissible to operate multiple fieldbuses (with the same degree of protection) on one cable. No other circuits are permissible in the same cable.
- Practical experience has shown that cable types C and D should not be used due to the lack of shielding, since the freedom from interference generally does not meet the requirements described in the standard.

The electrical data of the fieldbus cable have not been specified but determine important characteristics of the design of the fieldbus, such as distances bridged, number of users, electromagnetic compatibility, etc.

	Cable type A	**Cable type B**
Cable structure	Twisted pair, shielded	One or more twisted pairs, fully shielded
Wire size	0.8 mm^2 (AWG 18)	0.32 mm^2 (AWG 22)
Loop resistance (DC)	44 Ω/km	112 Ω/km
Impedance at 31.25 kHz	100 Ω ± 20%	100 Ω ± 30%
Attenuation at 39 kHz	3 dB/km	5 dB/km
Capacitive asymmetry	2 nF/km	2 nF/km
Envelope delay distortion (7.9...39 kHz)	1.7 µs/km	*
Shield coverage	90%	*
Max. cable length (inc. spurs >1 m)	1900 m	1200 m
* not specified		

Suitable fieldbus cables from various manufacturers for non-hazardous areas are listed below:

- Siemens: 6XV1 830-5BH10
- Belden: 3076F
- Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Maximum overall cable length
The maximum network expansion depends on the type of explosion protection and the cable specifications. The overall cable length is made up of the length of the main cable and the length of all spurs (>1 m). Note the following points:
- The maximum permissible overall cable length depends on the cable type used.

Type A	1900 m
Type B	1200 m

- If repeaters are used the maximum permissible cable length is doubled.
  A maximum of four repeaters are permitted between master and station.

Maximum spur length
The line between distribution box and field device is described as a spur.
In the case of non-Ex applications the max. length of a spur depends on the number of spurs (>1 m):

Number of spurs	1...12	13...14	15...18	19...24	25...32
Max. length per spur	120 m	90 m	60 m	30 m	1 m

Number of field devices
In systems that meet FISCO in the EEx ia type of protection, the line length is limited to max. 1000 m.
A maximum of 32 users per segment in non-Ex areas or a maximum of approximately 10 stations in an Ex-area (EEx ia IIC) are possible. The actual number of stations must be determined during the project planning.

Bus termination
The start and end of each fieldbus segment are always to be terminated with a bus terminator. With various junction boxes (non-Ex) the bus termination can be activated via a switch. If this is not the case a separate bus terminator must be installed. Note the following points in addition:
- In the case of a branched bus segment, the device furthest from the segment coupler represents the end of the bus.
- If the fieldbus is extended with a repeater then the extension must also be terminated at both ends.

Shielding and grounding
See PROFIBUS-DP cable specifications on → Page 42

Further information
General information and further notes regarding the wiring can be found in the Operating Instructions BA 198F/00/en: “Field Communication - PROFIBUS-DP/-PA: Guidelines for project planning and commissioning”.

4.2 Connecting the sensor connecting cable

4.2.1 Connecting Prosonic Flow P / W / U / DDU 18 / DDU 19

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 terminal on the housing before the power supply is applied.

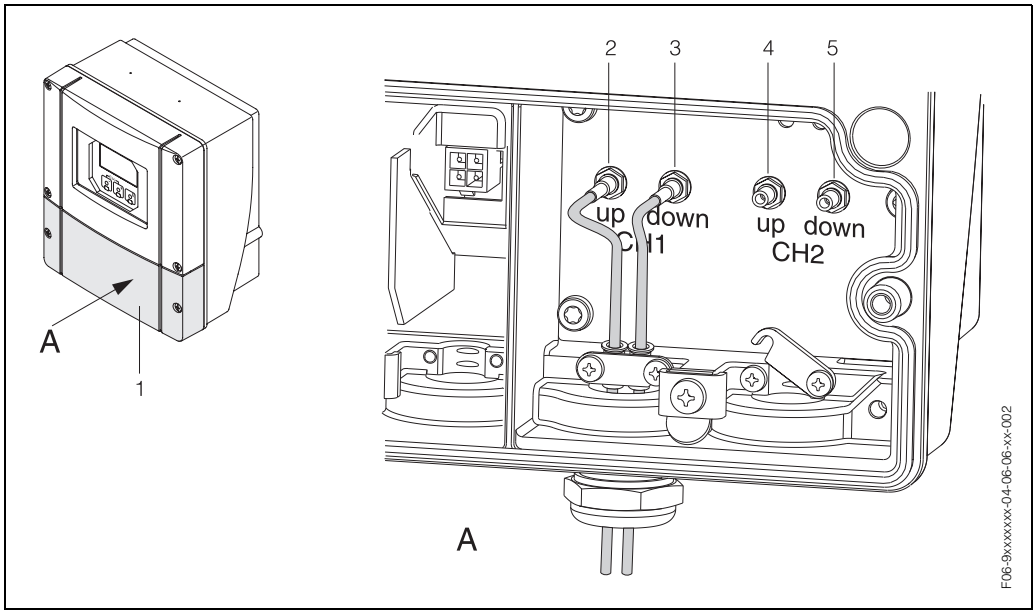


Fig. 47: Connecting the measuring system

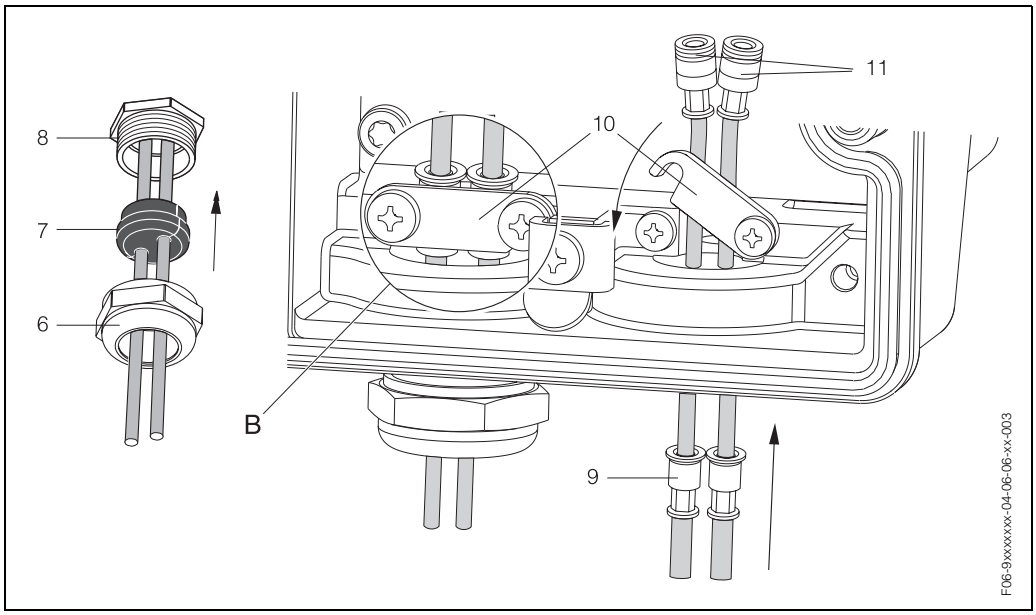


Fig. 48: Connecting the sensor connecting cable

See next page for graphic legend and installation instructions.

Legend:
A View A
B Detail B
1 Connection compartment cover
2 Sensor cable plug, channel 1, upstream
3 Sensor cable plug, channel 1, downstream
4 Sensor cable plug, channel 2, upstream
5 Sensor cable plug, channel 2, downstream
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 1, Fig. 47) from the connection compartment.
2. Remove the blank cover for the cable entries for channel 1 (CH1) and channel 2 (CH2).
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 in the way shown in Fig. 47.
7. Transmitter: Secure cover (1) on the connection compartment.

4.2.2 Cable specifications

Sensor cable:
- Use the ready-to-use cables supplied by E+H 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 system 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.

4.3 Connecting the measuring unit

4.3.1 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 earth 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.

Procedure (Fig. 49):

1. Remove the cover of the connection compartment (f) from the transmitter housing.
2. Feed the power supply cable (a) and PROFIBUS cable (b) through the appropriate cable entries.

   ✎ Note!
   Prosonic Flow 93 can also be supplied with the option of a ready-mounted fieldbus connector. More information on this can be found on Page 50.

3. Wiring:
   Wiring diagram (wall-mount housing) → Page 49

   ☝ Caution!
   – The PROFIBUS cable can be damaged!
     If the shielding of the cable is grounded at more than one point in systems without additional potential equalisation, a mains frequency equalising current can occur that damages the cable or the shielding.
     In such cases the shielding of the cable is to be grounded on only one side, i.e. it must not be connected to the ground terminal of the housing. The shield that is not connected should be insulated!
   – We recommend that the PROFIBUS not be looped using conventional cable glands. If you later replace even just one measuring device, the bus communication will have to be interrupted.

   ✎ Note!
   – The terminals for the PROFIBUS-PA connection (26/27) have an integral reverse polarity protection. This ensures correct signal transmission via the fieldbus even if lines are confused.
   – Conductor cross-section: max. 2.5 mm^2
   – Observe the grounding concept of the plant.

4. Screw the cover of the connection compartment (f) firmly back onto the transmitter housing.

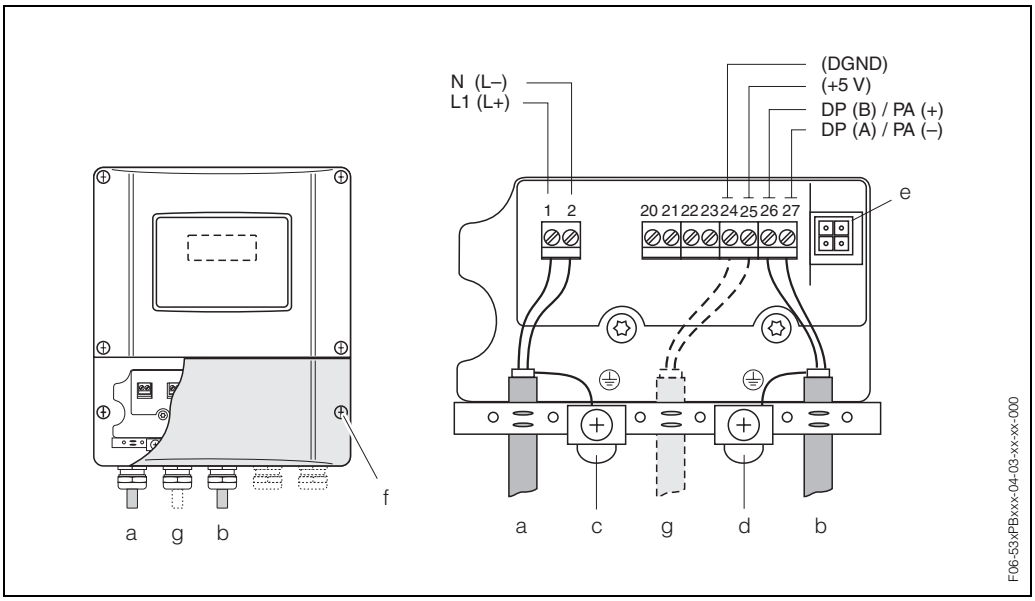


Fig. 49: Connecting the transmitter (wall-mount housing), cable cross-section: max. 2.5 mm²

a Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DCs*
*Terminal **No. 2**: N for AC, L– for DC*
b PROFIBUS-DP/-PA line:
*Terminals **No. 26: DP(B) / PA+***
*Terminal **No. 27: DP(A) / PA –***
DP(A) = RxD/TxD-N, DP(B) = RxD/TxD-P
c Ground terminal for protective earth
d Ground terminal for signal-cable screen
e Service adapter for connecting service interface FXA 193 (FieldCheck, FieldTool)
f Cover of the connection compartment
g Cable for external termination:
*Terminal **No. 24**: DGND*
*Terminal **No. 25**: +5V*

4.3.2 Terminal assignment

Order variant	**Terminals No. (outputs/inputs)** 26: DP(B) / PA+ 27: DP(A) / PA–
93***-**********F	PROFIBUS-PA (Ex i)
93***-**********H	PROFIBUS-PA (non-Ex)
93***-**********J	PROFIBUS-DP
Connected values PROFIBUS-DP/-PA	
PROFIBUS-PA: V_i = 30 V AC, I_i = 500 mA, P_i = 5.5 W, L_i = 10.0 µH, C_i = 5.0 nF *PROFIBUS-DP:* To connect to devices with V_{max} = 260 V and I_{max} = 500 mA	

4.3.3 Fieldbus connector

Note!
This connector can only be used for a PROFIBUS-PA device.

The connection technology of PROFIBUS-PA allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, junction boxes, etc. This connection technology using prefabricated distribution modules and plug-in connectors offers substantial advantages over conventional wiring:
- Field devices can be removed, replaced or added at any time during normal operation. The communications will not be interrupted.
- This simplifies installation and maintenance significantly.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel junction boxes.

Prosonic Flow 93 can therefore be supplied with the option of a ready-mounted fieldbus connector. Fieldbus connectors for retrofitting can be ordered from E+H as a spare part (see Page 119).

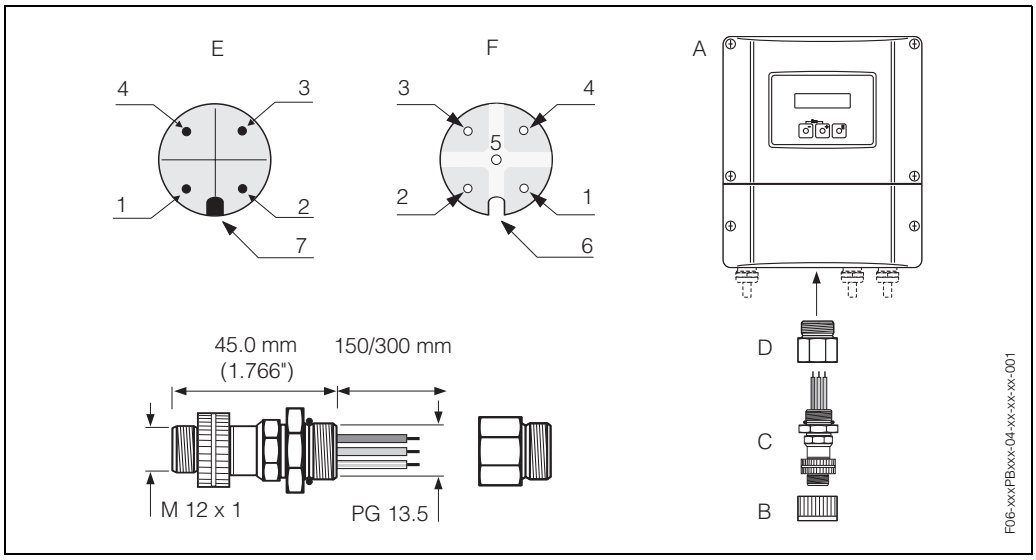


Fig. 50: Connectors for connecting to the PROFIBUS-PA

A = Wall-mount housing
B = Protection cap for connector
C = Fieldbus conector
D = Adapter PG 13.5 / M 20.5
E = Connector on housing (male)
F = Connector (female)

Pin assignment / colour codes:
1 = Brown wire: PA+ (terminal 26)
2 = Not connected
3 = Blue wire: PA – (terminal 27)
4 = Black wire: ground (notes on connection → Page 49)
5 = Female connector in centre not assigned
6 = Positioning groove
7 = Positioning key

Technical data (fieldbus connector):

Connection cross section	0.75 mm^2
Connector thread	PG 13.5
Degree of protection	IP 67 in accordance with DIN 40 050 IEC 529
Contact surface	CuZnAu
Housing material	Cu Zn, surface Ni
Flammability	V - 2 in accordance with UL - 94
Operating temperature	–40...+85 °C
Ambient temperature	–40...+150 °C
Nominal current per contact	3 A
Nominal voltage	125...150 V DC in accordance with the VDE standard 01 10/ISO Group 10
Resistance to tracking	KC 600
Volume resistance	≤8 mΩ in accordance with IEC 512 Part 2
Insulation resistance	≤10^{12} Ω in accordance with IEC 512 Part 2

4.4 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.

4.5 Degree of protection

Transmitter (wallmount housing)
The transmitter fulfill all the requirements for IP 67. 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 145).
- Firmly tighten the cable entries (Fig. 51).
- Remove all unused cable entries and insert dummy plugs instead.
- Do not remove the grommet from the cable entry.

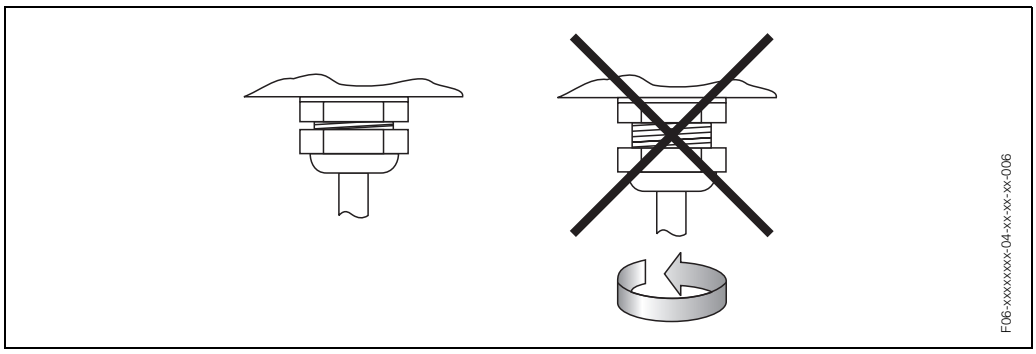


Fig. 51: Installation instructions for cable entries on the transmitter housing

Flowrate measuring sensors P and W (Clamp on / insertion)
The flowrate measuring sensors P and W and the sound velocity measuring sensors DDU 18 fulfill all the requirements for IP 67 or IP 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 degree of protection is maintained:

- Only use cables supplied by E+H 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.

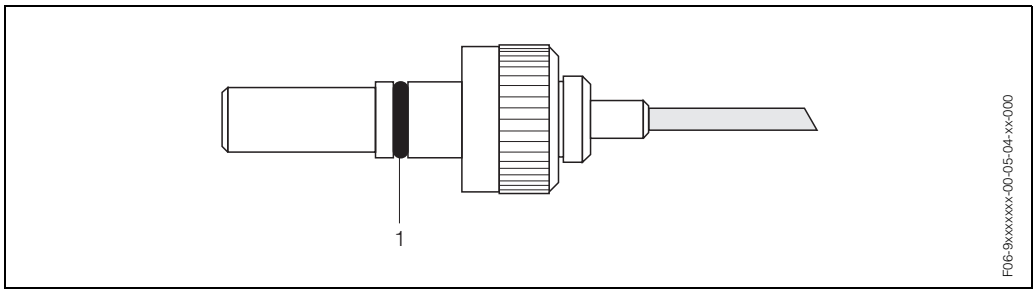


Fig. 52: Installation instructions for IP 67/68 degree of protection for sensor connectors

Flowrate measuring sensors U (Clamp on)
The flowrate measuring sensors U fulfill all the requirements for IP 52 degree of protection. Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 52 protection is maintained:

- Only use cables supplied by E+H 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.

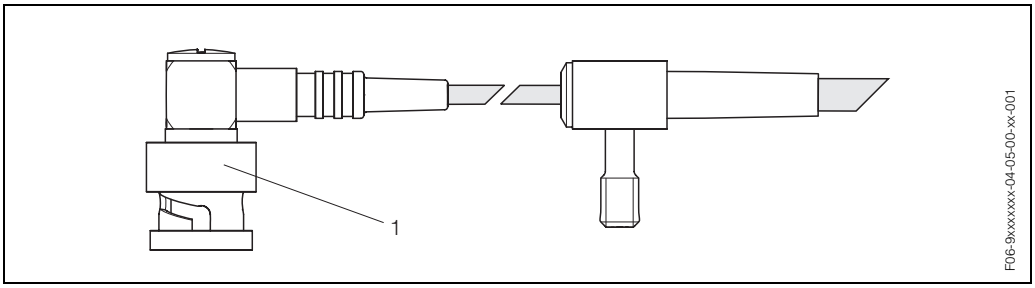


Abb. 53: Installation instructions for IP 52 degree of protection for BNC sensor connectors

4.6 Post-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?	PROFIBUS-DP → Page 41 PROFIBUS-PA → Page 44 Sensor cables → Page 47, 145
Do the cables have adequate strain relief?	–
Are the 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 51 ff.
Are all cable entries installed, firmly tightened and correctly sealed?	see Page 52
Are all the housing covers installed and tightened?	–
Electrical connection PROFIBUS-DP/-PA	Notes
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	–
Has each fieldbus segment been terminated at both ends with a bus terminator?	–
Has the max. length of the fieldbus cable been observed in accordance with the PROFIBUS specifications?	PROFIBUS-DP → Page 41 ff. PROFIBUS-PA → Page 45
Has the max. length of the spurs been observed in accordance with the PROFIBUS specifications?	PROFIBUS-DP → Page 42 PROFIBUS-PA → Page 45
Is the fieldbus cable fully shielded and correctly grounded?	see Page 42

5 Operation

5.1 Quick operation guide

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

1. Local display (optional) → Page 56
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
The configuration of profile and device-specific parameters is primarily done via the PROFIBUS-DP/-PA interface. You can obtain special configuration and operating programs from the various manufacturers for these purposes.

3. Jumpers and miniature switches for hardware settings → Page 78
You can make the following hardware settings for the PROFIBUS-DP/-PA using jumpers or miniature switches on the I/O board:
- Set the device bus address
- Switch the hardware write protection on/off

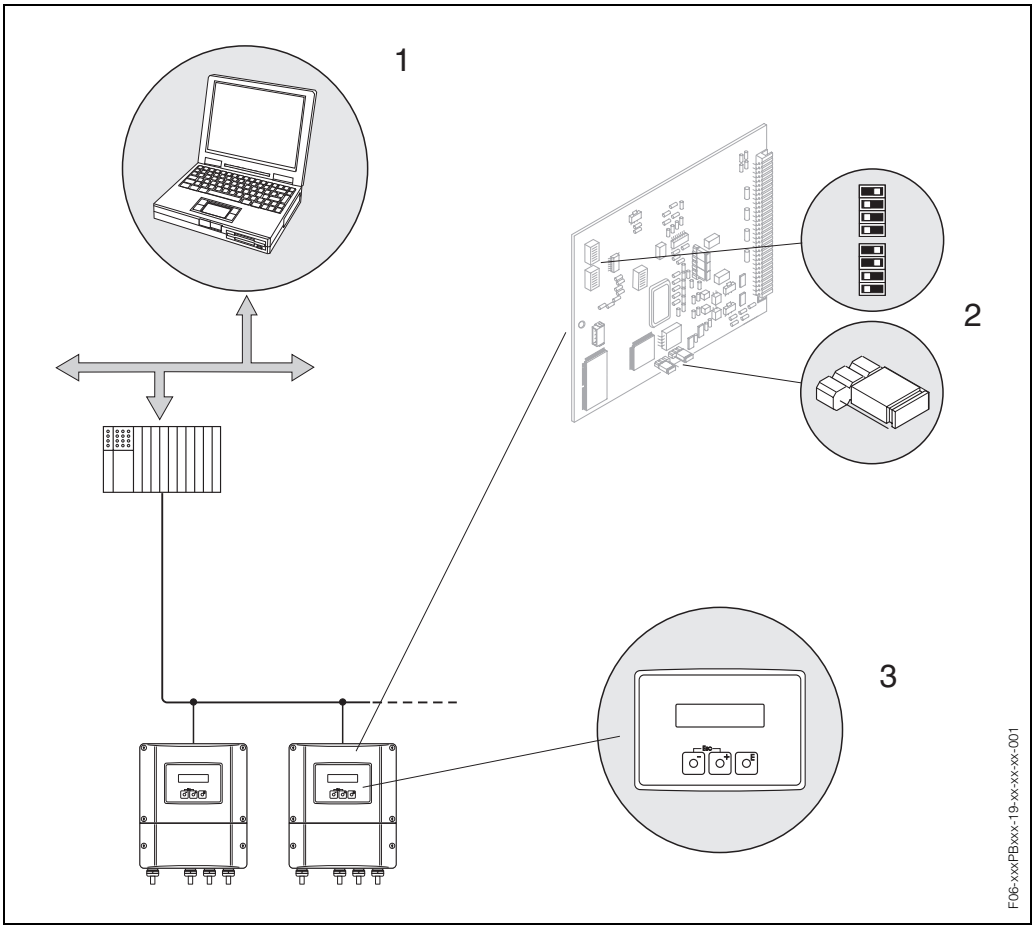


Fig. 54: Options for operating Prosonic Flow 93 PROFIBUS-DP/-PA

1 Configuration / operation programs for operating the device via the PROFIBUS-DP/-PA
2 Jumpers or miniature switch for hardware settings (write protection, device address)
3 Local display for the operation of the device in the field (optional)

5.2 Operation via the local display

5.2.1 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 four 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).

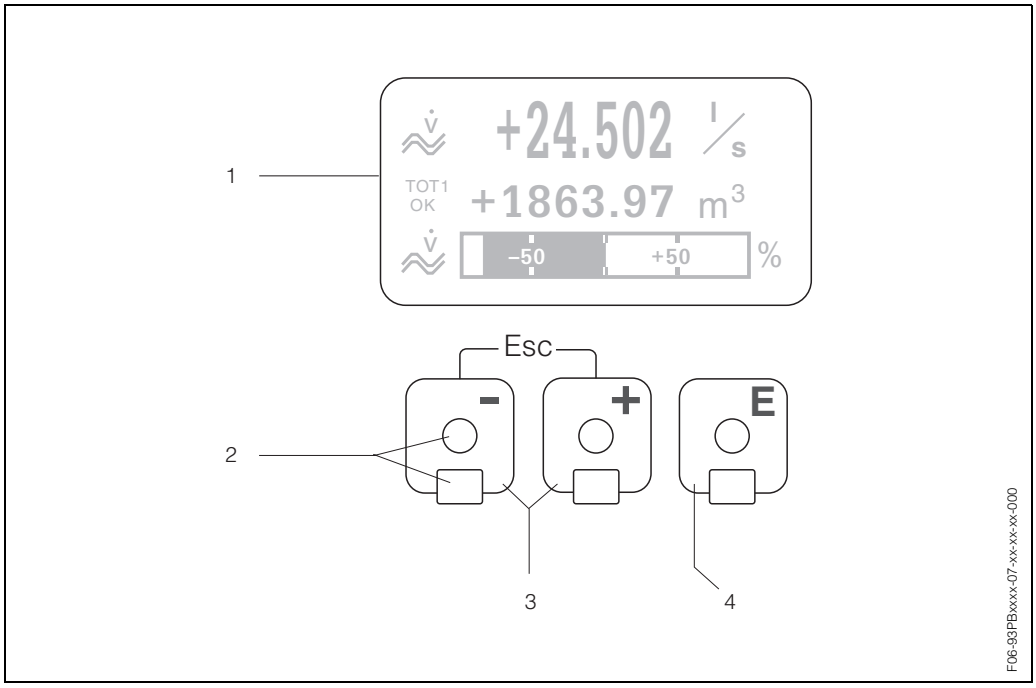


Fig. 55: Display and operating elements

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

Optical sensors for Touch Control (2)

Plus/minus keys (3)
– HOME position → Direct access to totalizer values and actual values of inputs/outputs
– Enter numerical values, select parameters
– Select different blocks, groups or function groups within the function matrix

Press the +/– keys simultaneously to trigger the following functions:
– Exit 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 (4)
– HOME position → Enter the function matrix
– Save the numerical values you input or settings you change

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

Multiplex mode:
A maximum of two different display variables can be assigned to each line. Variables multiplexed in this way alternate every 10 seconds on the display.

Error messages:
The modes of presentation for system and process error messages are described in detail on Page 58.

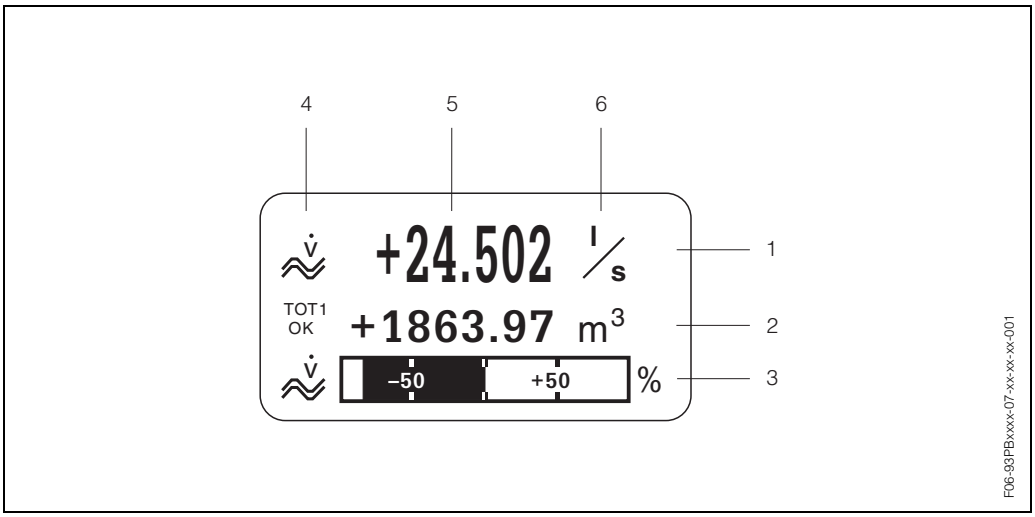


Fig. 56: Typical display for standard operating mode (HOME position)

1 Main line: shows primary measured values, e.g. volume flow in [l/s].
2 Additional line: shows supplementary measured variables and status variables, e.g. totalizer No. 3 in [m^3].
3 Information line: shows additional information on the measured variables and status variables, e.g. bar graph of the full scale value achieved by the volume flow.
4 "Info icons" display field: icons representing additional information on the measured values displayed are shown in this field. For a full list of the icons and their meanings, see Page 58.
5 "Measured values" field: the current measured values appear in this field.
6 "Unit of measure" field: the units of measure and time defined for the current measured values appear in this field.

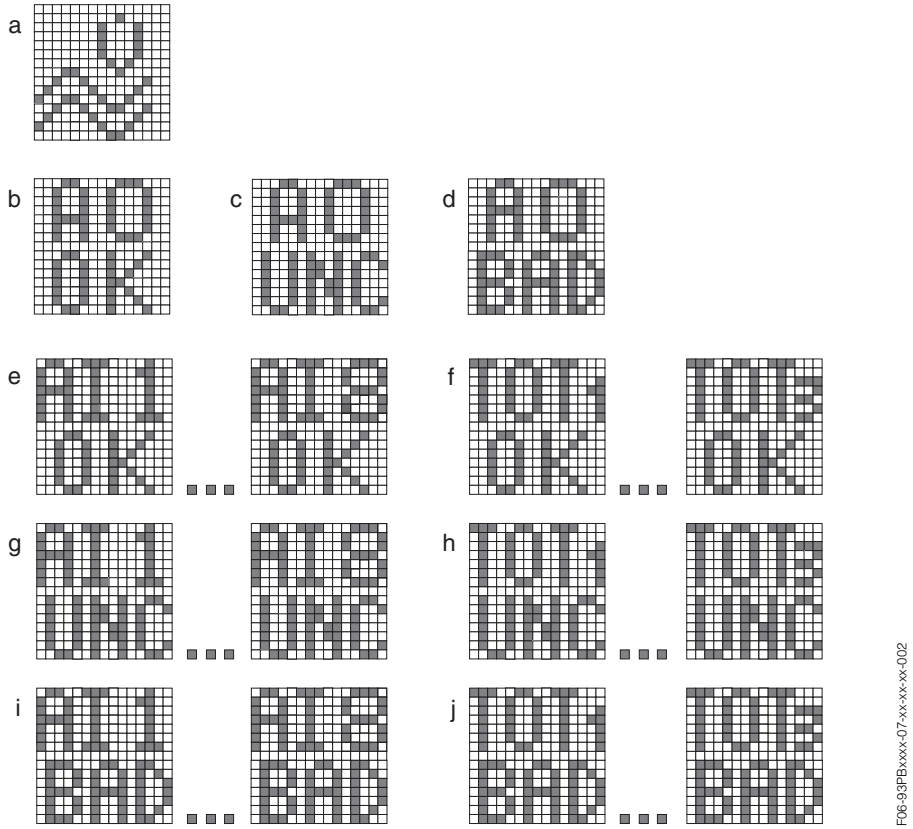
Note!
From HOME position, use the +/- keys to open an "Info Menu" containing the following information:
- Totalizers (including overflow)
- Actual values or states of the configured inputs/outputs
- TAG name of the device (user-definable)

[+][−] key → key to request individual values in the list
Esc key ([Esc] [−] [+]) → Return to HOME position

Icons

The icons which appear in the field on the left make it easier to read and recognise measured variables, device status, and error messages.

Icon	Meaning
S	System error
P	Process errors
ϟ	Fault message (with effect on outputs)
!	Notice message (without effect on outputs)
Other icons	



a Icon for volume flow
b Status of Analog Output 1 (display value) with status OK
c Status of Analog Output 1 (display value) with status UNC = uncertain
d Status of Analog Output 1 (display value) with status BAD
e Status of Analog Input 1...8 with status OK
f Status of Totalizer 1...3 with status OK
g Status of Analog Input 1...8 with status UNC = uncertain
h Status of Totalizer 1...3 with status UNC = uncertain
i Status of Analog Input 1...8 with status BAD
j Status of Totalizer 1...3 with status BAD

5.2.2 Brief guide to the function matrix

Note!
- See the general notes on Page 60.
- Function descriptions → “Description of Device Functions” manual.

1. HOME position → E → Enter the function matrix
2. Select a block (e.g. USER INTERFACE)
3. Select a group (e.g. CONTROL)
4. Select a function group (e.g. BASIC CONFIGURATION)
5. Select a function (e.g. LANGUAGE)

   Change parameter / enter numerical values:
   +/− → Select or enter: release code, parameters, numerical values
   E → Save your entries

6. Exit the function matrix:
   – Press and hold down Esc key (Esc −/+) for longer than 3 seconds → HOME position
   – Repeatedly press Esc key (Esc −/+) → Return step by step to HOME position

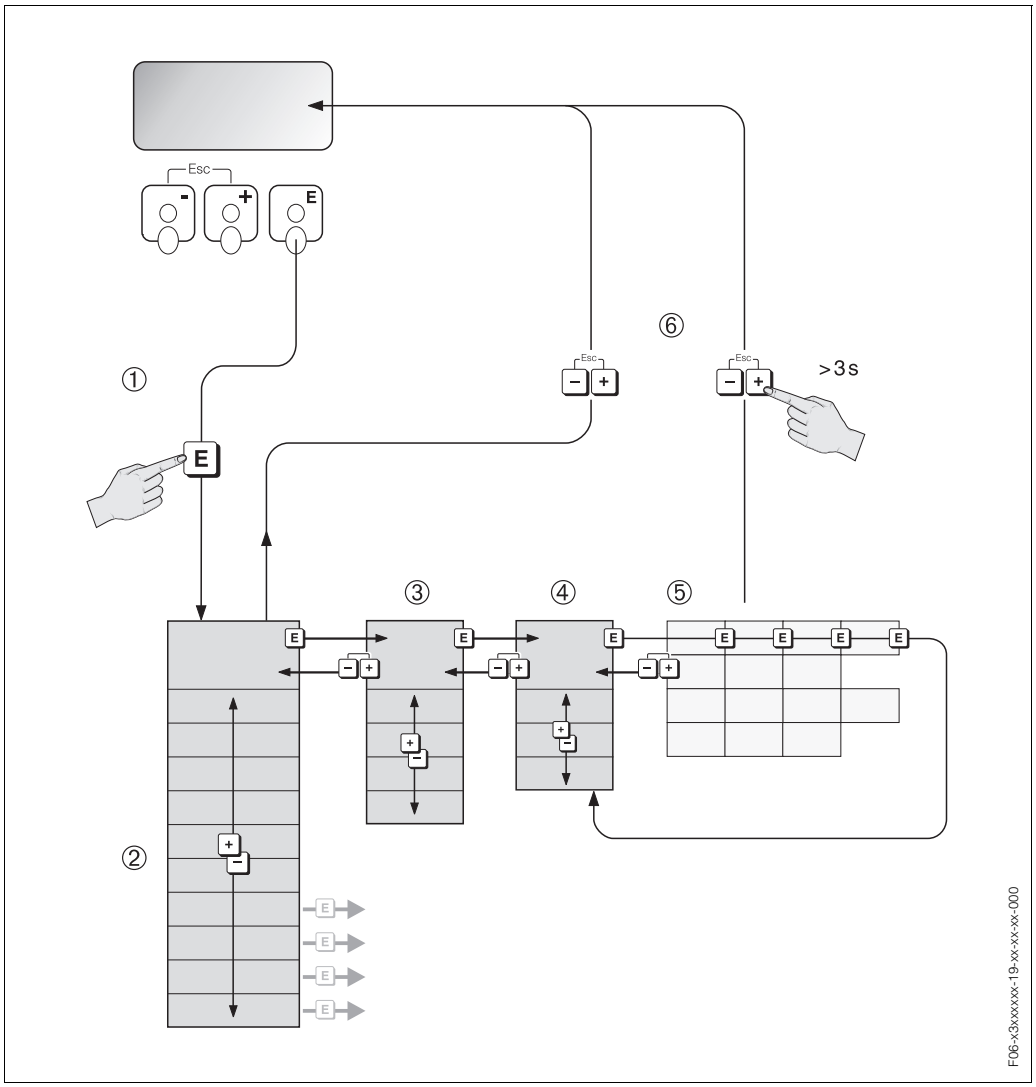


Fig. 57: Selecting functions and configuring parameters (function matrix)

General notes
The Quick Setup menu (see Page 84) is adequate for commissioning with the necessary standard settings. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customise to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged on a number of menu levels (blocks, groups, and function groups).

Comply with the following instructions when configuring functions:
- You select functions as described on Page 59. Each cell in the function matrix is identified by a numerical or letter code on the display.
- 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 E 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, as is the function matrix itself, in the **"Description of Device Functions"** manual, which is a separate part of these Operating Instructions.

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 = 93) has to be entered before settings can be changed.
If you use a code of your choice, you exclude the possibility of unauthorised persons accessing data (→ see "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 private code, programming is always enabled.
- The E+H 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 system, 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 E+H service organisation. Please contact Endress+Hauser if you have any questions.

Disabling the programming mode
Programming mode is disabled if you do not press a key within 60 seconds following automatic 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).

5.2.3 Error messages

Type of error
Errors that occur during commissioning or measuring 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 error:* this group includes all device errors, for example communication errors, hardware errors, etc.
- *Process error:* this group includes all application errors, e.g. fluid not homogeneous, etc.

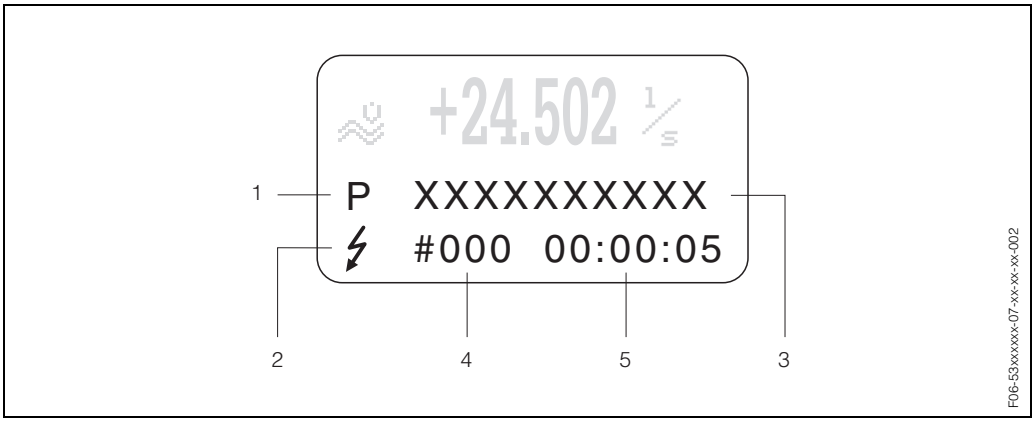


Fig. 58: Error messages on the display (example)

1 Type of error: P = Process error, S = System error
2 Error message type: ϟ = Fault message, ! = Notice message (definition: see Page 61)
3 Error designation: e.g. S.V. RANGE CH1 = Channel 1 sound velocity outside the measuring range
4 Error number: e.g. #492
5 Duration of most recent error occurrence (in hours, minutes and seconds)

Error message types
The measuring device always assigns system and process errors which occur to two types of error messages (fault and notice messages) resulting in different weightings → Page 125 ff.
Serious system errors, e.g. module defects, are always identified and classed as “fault messages” by the measuring device.

Notice message (!)
- The error in question has no effect on measurement currently in progress.
- Displayed as → Exclamation mark (!), error type (S: system error, P: process error).
- PROFIBUS → Notice messages are relayed to downstream function blocks or higher-level process control systems with the status “UNCERTAIN” of the corresponding process variable.

Fault message (ϟ)
- The error in question interrupts or stops measurement currently in progress.
- Displayed as → Lightning flash *(ϟ)*, error type (S: system error, P: process error)
- PROFIBUS → Fault messages are relayed to downstream function blocks or higher-level process control systems with the status “BAD” of the corresponding process variable.

5.3 Communications: PROFIBUS-DP/-PA

5.3.1 PROFIBUS-DP/-PA technology

PROFIBUS (Process Fieldbus) is a standardised bus system based on the European standard EN 50170, Volume 2, which has been successfully used for many years in production and process automation (chemical industry and process engineering). The PROFIBUS is a multi-master bus system with high performance, which is particularly suitable for medium to large plants.

PROFIBUS-DP
PROFIBUS-DP is a MASTER/SLAVE bus system. The master function is handled by an automation system (Class 1 master) or by one or more personal computers (Class 2 master). Using cyclic data telegrams, the automation system has full access to all of the bus stations assigned to it. With a personal computer (Class 2 master) you can, if needed, use acyclic data telegrams to exchange data with all of the connected field devices.
In accordance with the standard, up to 126 stations can be connected to a PROFIBUS-DP network. The PROFIBUS-DP can operate at a transmission rate of 9.6 kBit/s...12 MBit/s and, at a transmission rate of 1.5 MBit/s, can support network expansions of up to 2000 m with copper cables or 21.730 m using optical link modules.

PROFIBUS-PA
PROFIBUS-PA expands the PROFIBUS-DP by using an optimised transmission technology for field devices while retaining the communication functions of the PROFIBUS-DP. With the selected transmission technology, field devices can be connected via the PROFIBUS-PA to the automation system over great distances, even in hazardous areas. PROFIBUS-PA is the communications compatible extension of PROFIBUS-DP.

PROFIBUS-PA = PROFIBUS-DP + optimised transmission technology for field devices

5.3.2 PROFIBUS-DP system architecture

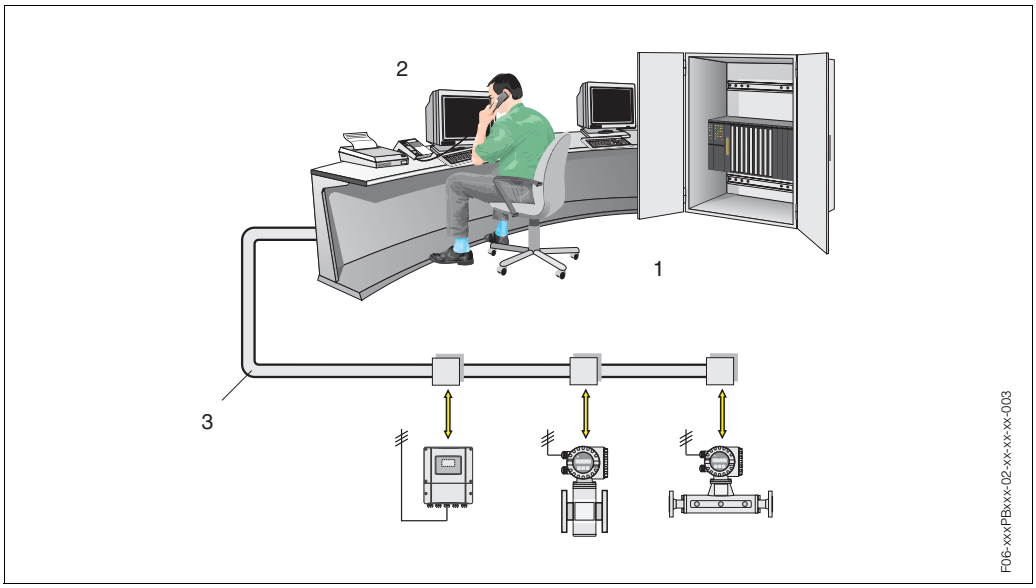


Fig. 59: PROFIBUS-DP system architecture
1 = Automation system, 2 = Commuwin II operating program,
3 = PROFIBUS-DP RS 485 (max. 12 MBaud)

General information
Prosonic Flow 93 can be equipped with a PROFIBUS-DP interface (decentral periphery) in accordance with the fieldbus standard PROFIBUS-DP (EN 50170 Volume 2) which utilises the RS485 transmission technology.
As a consequence, Prosonic Flow 93 can exchange data with automation systems which satisfy this standard. The integration in a control system must be in accordance with the PROFIBUS-PA Profile 3.0 Specifications.

Data transmission rate
Prosonic Flow 93's maximum PROFIBUS-DP data transmission rate is 12 MBaud.

Note!
- The device is able to automatically determine the data transmission rate. We recommend that, before you load a new data transmission rate, you reset the device:
  – Via the function: SUPERVISION → SYSTEM → OPERATION → SYSTEM RESET
  – By switching the supply voltage off and back on again
- Information about bus terminators (terminating resistors) can be found on Page 42.

Communications partner
In a control system, Prosonic Flow 93 always serves as a slave and can thus, depending on the type of application, exchange data with one or more masters.
The master can be a process control system, a PLC or a PC with a PROFIBUS-DP communications adapter card.

Note!
For additional project planning information on the PROFIBUS-DP fieldbus, see the Operating Instructions BA 198F/00/en “Field Communication - PROFIBUS-DP/-PA: Guidelines for project planning and commissioning”.

Function blocks
The PROFIBUS uses predefined function blocks to describe the function blocks of a device and to specify uniform data access.
The function blocks implemented in the fieldbus devices provide information on the tasks which a device can perform as part of the whole automation strategy.

The following blocks can be implemented in field devices in accordance with Profile 3.0:
- Physical Block:
  The Physical Block contains all device-specific characteristics.
- Transducer Block (transmission block):
  One or more Transducer Blocks contain all the device's measurement-related and device-specific parameters. In the Transducer Blocks, the measurement principles (e.g. flow rate and temperature) are mapped in accordance with the PROFIBUS Profile 3.0.
- Function block:
  One or more function blocks contain the device's automation functions.
  We distinguish between different function blocks, e.g. Analog Input Block, Analog Output Block, Totalizer Block, etc. Each of these function blocks is used to process different applications.

5.3.3 PROFIBUS-PA system architecture

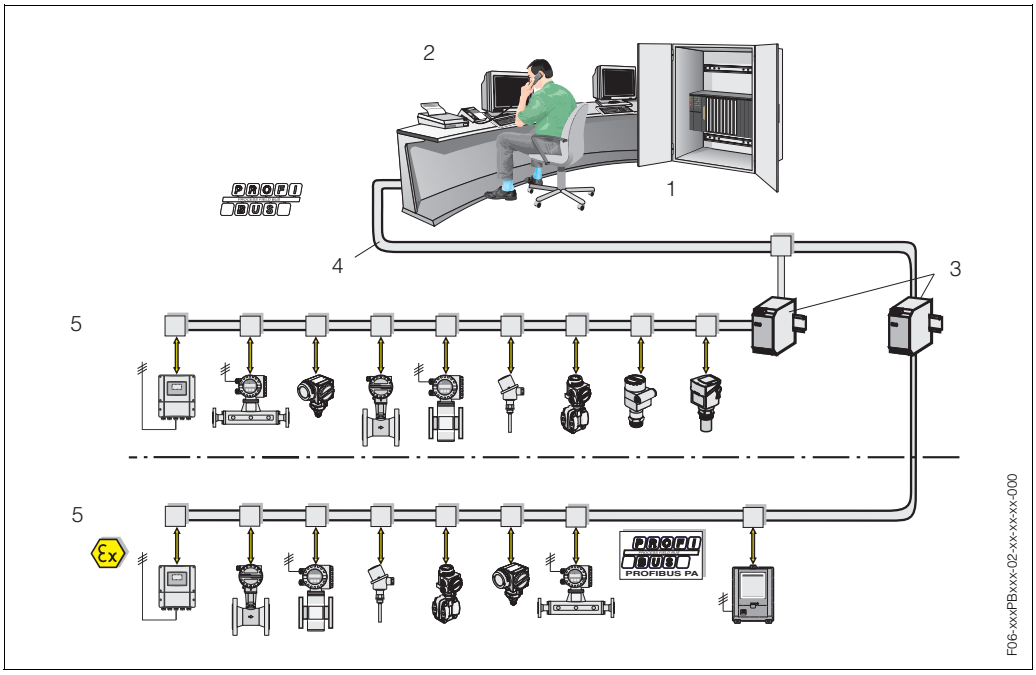


Fig. 60: PROFIBUS-PA system architecture
1 = Automation system, 2 = Commuwin II operating program, 3 = Segment coupler,
4 = PROFIBUS-DP RS 485 (max. 12 MBit/s), 5 = PROFIBUS-PA IEC 61158-2 (MBP) (max. 31.25 kbit/s)

General information
Prosonic Flow 93 can be equipped with a PROFIBUS-PA interface in accordance with the fieldbus standard PROFIBUS-DP (EN 50170 Volume 2).
As a consequence, Prosonic Flow 93 can exchange data with process control systems which satisfy this standard. The integration in a control system must be in accordance with the PROFIBUS-PA Profile 3.0 Specifications.
The selection of the international IEC 61158-2 (MBP) (International Electrotechnical Commission) transmission standard ensures a future-proof field installation with PROFIBUS-PA.

Communications partner
In a control system, Prosonic Flow 93 always serves as a slave and can thus, depending on the type of application, exchange data with one or more masters.
The master can be a process control system, a PLC or a PC with a PROFIBUS-DP communications adapter card.

Note!
During project planning, please remember that Prosonic Flow 93 consumes 11 mA.

Caution!
To prevent severe device failures (e.g. short-circuits) from having effect on the PROFIBUS-PA segment, the IEC 61158-2 (MBP) interface is equipped with a fuse. If the fuse blows, the device is permanently disconnected from the bus. In this case, the I/O module must be replaced (see Page 140).

Project planning
For additional project planning information on the PROFIBUS-DP fieldbus, see the Operating Instructions BA 198F/00/en “Field Communication - PROFIBUS-DP/-PA: Guidelines for project planning and commissioning”.

Function blocks
The PROFIBUS uses predefined function blocks to describe the function blocks of a device and to specify uniform data access.
The function blocks implemented in the fieldbus devices provide information on the tasks which a device can perform as part of the whole automation strategy.

The following blocks can be implemented in field devices in accordance with Profile 3.0:
- Physical Block:
  The Physical Block contains all device-specific characteristics.
- Transducer Block (transmission block):
  One or more Transducer Blocks contain all the device's measurement-related and device-specific parameters. The measurement principles (e.g. flow rate and temperature) are mapped in the Transducer Blocks in accordance with the PROFIBUS specification.
- Function block:
  One or more function blocks contain the device's automation functions.
  We distinguish between different function blocks, e.g. Analog Input Block, Analog Output Block, Totalizer Block, etc. Each of these function blocks is used to process different applications.

More information is provided in the “Description of Device Functions” manual.

5.3.4 Acyclic data exchange

The acyclic data transmission is used to transmit parameters during the commissioning, during maintenance or to display other measured variables that are not contained in the cyclic data traffic.

Generally, a distinction is made between Class 1 and Class 2 master connections. Depending on the implementation of the field device, it is possible to simultaneously establish several Class 2 connections.

- Theoretically, a maximum of 49 Class 2 connections can be established to the same field device.
- Two Class 2 masters are permitted with Prosonic Flow 93. This means that two Class 2 masters can access Prosonic Flow 93 at the same time. However, you must make certain that they do not both attempt to write the same data, since otherwise the data consistency cannot be guaranteed.
- When a Class 2 master reads parameters, it will send an interrogation telegram to the field device specifying the field device address, the slot/index and the expected data record length. The field device will answer with the requested data record, if the record exists and is the correct length (byte).
- When a Class 2 master writes parameters, it will send the address of the field device, the slot/index, record length (byte) and the record. The field device will acknowledge this write job after completion.

A Class 2 master can access the blocks that are shown in the illustration below.
The parameters which can be operated by the Endress+Hauser operating program (Commuwin II) are shown on Page 68 ff. in the form of a matrix.

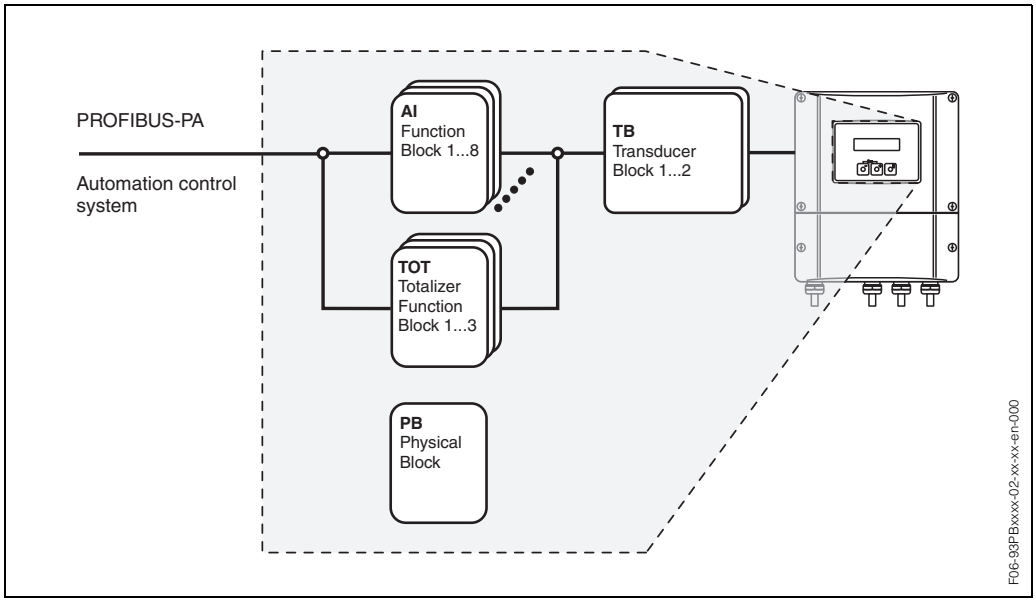


Fig. 61: Function block model for Prosonic Flow 93 PROFIBUS-DP/-PA

5.4 Operation via PROFIBUS configuration programs

The user can obtain special configuration and operating programs offered by different manufacturers for use in configuration. These can be used for configuring both the PROFIBUS-DP/-PA parameters and all of the device-specific parameters. The predefined function blocks allow uniform access to all the network and device data.

✎ Note!
A step-by-step description of the procedure for commissioning the PROFIBUS interface is given on Page 93 together with information about the configuration of device-specific parameters.

5.4.1 FieldTool operating program

FieldTool is a universal service and configuration software package designed for the PROline measuring devices. Connection is by means of the PROline service interface (service adapter).

The functionality of FieldTool includes the following:
- Configuration of device functions
- Visualisation of measuring values (including data logging)
- Data backup of device parameters
- Extended device diagnosis
- Measuring point documentation

✎ Note!
You can find more information on FieldTool in the following E+H documentation:
- System Information: SI 031D/06/en “FieldTool”

5.4.2 Commuwin II operating program

Commuwin II is a program for remote operation of field and control-room equipment. Commuwin II can be used irrespective of the device type and the mode of communication (HART or PROFIBUS standard).

Note!
You can find more information on Commuwin II in the following E+H documentation:
- System information: SI 018F/00/en “Commuwin II”
- Operating Instructions: BA 124F/00/en “Commuwin II” operating program
- An exact description of the data types can be found in the slot/index lists in the “Description of Device Functions” manual.

All of Prosonic Flow 93's device functions are clearly arranged in a matrix for programming via Commuwin II. Using the “MATRIX SELECTION” (VAH5) function, you can call up various parts of the matrix.

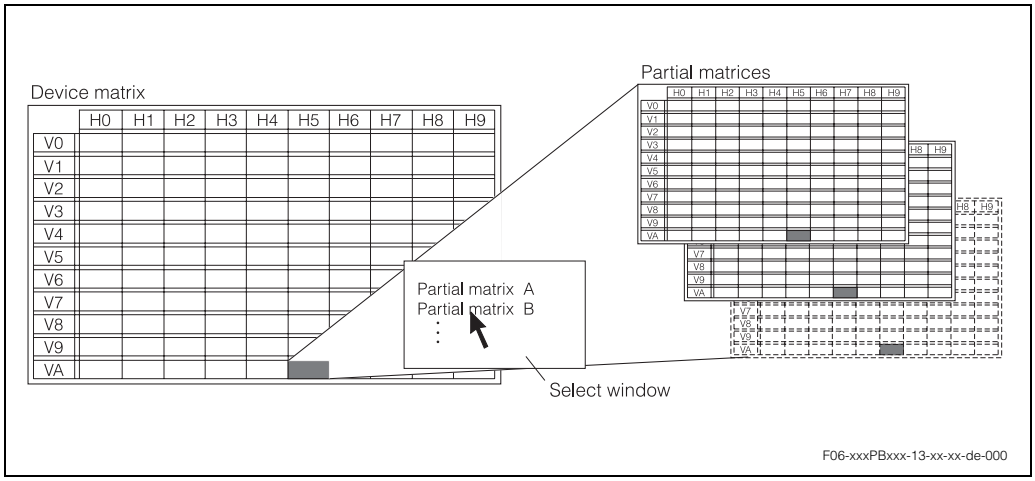


Fig. 62: Graphical user interface with Commuwin II software

Device matrix channel 1 (partial matrix)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURING VALUES	VOLUME FLOW CH1 (Display)	SOUND VELOC. CH1 (Display)	FLOW VELOC. CH1 (Display)	SIGNAL STRENGTH CH1 (Display)	VOLUME FLOW AVG. (Display)	VOLUME FLOW SUM (Display)	VOLUME FLOW DIFF. (Display)	SOUND VELOC.AVG. (Display)	FLOW VELOC. AVG. (Display)	
V1 SYSTEM UNITS	UNIT VOLUME FLOW (Options)	UNIT VELOCITY (Options)			UNIT VISCOSITY (Options)	UNIT TEMPERATURE (Options)	UNIT LENGTH (Options)			
V2 USER INTERFACE	ACCESS CODE (Input)	DEF. PRIVATE CODE (Input)	STATUS ACCESS (Display)							
V3 PROCESS PARAM	ASSIGN LF-CUTOFF (Options)	ON VAL. LF-CUTOFF (Input)	OFF VAL. LF-CUTOFF (Input)	PRESS SHOCK. SUP (Input)						
V4 PIPE DATA	PIPE STANDARD (Options)	NOMINAL DIAMETER (Options)	PIPE MATERIAL (Options)	REVERENCE VALUE (Input)	SOUND VELOC. PIPE (Input)	CIRCUMFERENCE (Input)	PIPE DIAMETER (Input)	WALL THICKNESS (Input)	LINER MATERIAL (Options)	
V5 ADJUSTMENT / PIPE	ZEROPOINT ADJUST (Options)	SOUND VEL. LINER (Input)	LINER THICKNESS (Input)		SOUND VEL. LONGI (Display)	STORE ? (Options)	SOUND VEL. LONGI (Input)	WALL THICKNESS (Display)	STORE ? (Options)	
V6 PROFIBUS-DP/PA	WRITE PROTECT (Display)	SELECTION GSD (Options)	SET UNIT TO BUS (Input)	BLOCK SELECTION (Options)	OUT VALUE (Display)	OUT STATUS (Display)	DISPLAY VALUE (Display)	DISP.VAL. STATUS (Display)		
V7 PROFIBUS INFO	FIELDBUS ADDRESS (Display)	PROFILE VERSION (Display)	ACTUAL BAUDRATE (Display)	DEVICE ID (Display)	CHECK CONFIG. (Display)					
V8 SYSTEM PARAMETER	MEASURING MODE (Options)	INSTL. DIR. SENSOR (Options)	FLOW DAMPING (Input)	POS. ZERO RETURN (Input)						
V9 LIQUID DATA	LIQUID (Options)	TEMPERATURE (Input)	SOUND VELOCITY (Input)	VISCOSITY (Input)	S.VELOC. NEG. (Input)	S.VELOC. POS. (Input)				
VA MEASURING POINT	TAG NAME (Input)					MATRIX SELECTION (Options)	DEVICE NAME (Display)			

Device matrix channel 2 (partial matrix)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURING VALUES	VOLUME FLOW CH2 (Display)	SOUND VELOC. CH2 (Display)	FLOW VELOC. CH2 (Display)	SIGNAL STRENGTH CH2 (Display)	VOLUME FLOW AVG. (Display)	VOLUME FLOW SUM (Display)	VOLUME FLOW DIFF. (Display)	SOUND VELOC.AVG. (Display)	FLOW VELOC. AVG. (Display)	
V1 SYSTEM UNITS	UNIT VOLUME FLOW (Options)	UNIT VELOCITY (Options)			UNIT VISCOSITY (Options)	UNIT TEMPERATURE (Options)	UNIT LENGTH (Options)			
V2 USER INTERFACE	ACCESS CODE (Input)	DEF. PRIVATE CODE (Input)	STATUS ACCESS (Display)							
V3 PROCESS PARAM	ASSIGN LF-CUTOFF (Options)	ON VAL. LF-CUTOFF (Input)	OFF VAL. LF-CUTOFF (Input)	PRESS SHOCK. SUP (Input)						
V4 PIPE DATA	PIPE STANDARD (Options)	NOMINAL DIAMETER (Options)	PIPE MATERIAL (Options)	REVERENCE VALUE (Input)	SOUND VELOC. PIPE (Input)	CIRCUMFERENCE (Input)	PIPE DIAMETER (Input)	WALL THICKNESS (Input)	LINER MATERIAL (Options)	
V5 ADJUSTMENT / PIPE	ZEROPOINT ADJUST (Options)	SOUND VEL. LINER (Input)	LINER THICKNESS (Input)		SOUND VEL. LONGI (Display)	STORE ? (Options)	SOUND VEL. LONGI (Input)	WALL THICKNESS (Display)	STORE ? (Options)	
V6 PROFIBUS-DP/PA	WRITE PROTECT (Display)	SELECTION GSD (Options)	SET UNIT TO BUS (Input)	BLOCK SELECTION (Options)	OUT VALUE (Display)	OUT STATUS (Display)	DISPLAY VALUE (Display)	DISP.VAL. STATUS (Display)		
V7 PROFIBUS INFO	FIELDBUS ADDRESS (Display)	PROFILE VERSION (Display)	ACTUAL BAUDRATE (Display)	DEVICE ID (Display)	CHECK CONFIG. (Display)					
V8 SYSTEM PARAMETER	MEASURING MODE (Options)	INSTL. DIR. SENSOR (Options)	FLOW DAMPING (Input)	POS. ZERO RETURN (Input)						
V9 LIQUID DATA	LIQUID (Options)	TEMPERATURE (Input)	SOUND VELOCITY (Input)	VISCOSITY (Input)	S.VELOC. NEG. (Input)	S.VELOC. POS. (Input)				
VA MEASURING POINT	TAG NAME (Input)					MATRIX SELECTION (Options)	DEVICE NAME (Display)			

Sensor data channel 1+2 (partial matrix)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0										
V1										
V2 USER INTERFACE	ACCESS CODE (Input)	DEF. PRIVATE CODE (Input)	STATUS ACCESS (Display)							
V3 SENSOR PARAM. CH1	MEASUREMENT (Options)	SENSOR TYPE (Options)	SENSOR CONFIG. (Options)	CABLE LENGTH (Options)	SENSOR POSITION (Display)	WIRE LENGTH (Display)	SENSOR DISTANCE (Display)	ARC LENGTH (Display)	PATH LENGTH (Display)	
V4 CALIBR. DATA CH1	CALIB. FACTOR (Input)	ZEROPOINT (Input)		CORR. FACTOR (Input)	DEV. SENSOR DIST. (Input)	DEV. ARC LENGTH (Input)	DEV. PATH LENGTH (Input)			
V5										
V3 SENSOR PARAM. CH2	MEASUREMENT (Options)	SENSOR TYPE (Options)	SENSOR CONFIG. (Options)	CABLE LENGTH (Options)	SENSOR POSITION (Display)	WIRE LENGTH (Display)	SENSOR DISTANCE (Display)	ARC LENGTH (Display)	PATH LENGTH (Display)	
V4 CALIBR. DATA CH2	CALIB. FACTOR (Input)	ZERO POINT (Input)		CORRECTION FACTOR (Input)	DEV. SENSOR DIST. (Input)	DEV. ARC LENGTH (Input)	DEV. PATH LENGTH (Input)			
V8										
V9										
VA MEASURING POINT	TAG NAME (Input)					MATRIX SELECTION (Options)	DEVICE NAME (Display)			

Display functions (partial matrix)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0										
V1										
V2 USER INTERFACE	ACCESS CODE (Input)	DEF. PRIVATE CODE (Input)	STATUS ACCESS (Display)							
V3 DISPLAY FUNCTION	LANGUAGE (Options)	DISPLAY DAMPING (Input)	CONTRAST LCD (Input)	X-LINE CALC. MAIN VAL. (Options)						
V4 MAIN LINE	ASSIGN LINE 1 (Options)	100% VALUE (Input)	FORMAT (Options)							
V5 MULTIPLEX	ASSIGN LINE 1 (Options)	100% VALUE (Input)	FORMAT (Options)							
V6 ADDITIONAL LINE	ASSIGN LINE 2 (Options)	100% VALUE (Input)	FORMAT (Options)	DISPLAY MODE (Options)						
V7 MULTIPLEX	ASSIGN LINE 2 (Options)	100% VALUE (Input)	FORMAT (Options)	DISPLAY MODE (Options)						
V8 INFORMATION LINE	ASSIGN LINE 3 (Options)	100% VALUE (Input)	FORMAT (Options)	DISPLAY MODE (Options)						
V9 MULTIPLEX	ASSIGN LINE 3 (Options)	100% VALUE (Input)	FORMAT (Options)	DISPLAY MODE (Options)						
VA MEASURING POINT	TAG NAME (Input)					MATRIX SELECTION (Options)	DEVICE NAME (Display)			

Diagnosis / Alarm / Simulation / Version info / Channel 1+2 (partial matrix)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 DIAGNOSIS/ALARM	ACTUAL SYS. COND (Display)	PREVIOUS. SYS. CON (Display)	SYSTEM RESET (Options)	ALARM DELAY (Input)	TROUBLESHOOTING (Options)					
V1										
V2 USER INTERFACE	ACCESS CODE (Input)	DEF. PRIVATE CODE (Input)	STATUS ACCESS (Display)							
V3										
V4 SIMULATION	SIM. MEASURAND (Options)	VALUE SIM. MEAS. (Input)	SIM. FAILSAFEMODE (Options)							
V5 SIMULATION CH2	SIM. MEASURAND (Options)	VALUE SIM. MEAS. (Input)								
V6 SENSOR/ F-CHIP	SERIAL NUMBER (Display)									
V7 AMPLIFIER INFO			SW-REV. AMP. (Display)			SW REV. T-DAT (Display)				
V8 I/O MODULE INFO	I/O TYPE (Display)			SW REV. I/O (Display)						
V9										
VA MEASURING POINT	TAG NAME (Input)					MATRIX SELECTION (Options)	DEVICE NAME (Display)			

Physical Block (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 DEVICE DATA	DEVICE ID (Display)	SERIAL NUMBER (Display)	SOFTWARE VERSION (Display)	HARDWARE VERSION (Display)	MANUFACTURER ID (Display)					
V1 DESCRIPTION	DESCRIPTOR (Input)	INSTALLATION DATE (Display)	MESSAGE (Entry)	DEVICE CERTIFICAT (Display)						
V2 SOFTWRE RESET	SOFTWARE RESET (Input)									
V3 SECURITY LOCKING	WRITE LOCKING (Input)	HW WRITE PROTEC (Options)	LOCAL OPERATION (Input)							
V4 DEVICE DATA	IDENT NUMBER (Options)									
V5 DIAGNOSIS MASK	MASK (Display)	MASK 1 (Display)	MASK 2 (Display)	DIAG MASK EXTENS (Display)						
V6 DIAGNOSIS	DIAGNOSIS (Display)	DIAGNOSIS 1 (Display)	DIAGNOSIS 2 (Display)	DIAGNOSIS EXTENS (Display)						
V7										
V8 BLOCK MODE	TARGET MODE (Input)	ACTUAL (Display)	NORMAL (Display)	PERMITTED (Display)						
V9 ALARM CONFIG	CURRENT (Display)	DISABLE (Display)				ST REVISION (Display)				
VA BLOCK PARAMETER	TAG (Input)	STRATEGY (Input)	ALERT KEY (Entry)	PROFILE VERSION (Display)						

Transducer Block Flow / channel 1+2 (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 VOLUME FLOW	VOLUME FLOW (Display)	STATUS (Display)	UNIT (Options)	LOWER RANGE VALUE (Input)	UPPER RANGE VALUE (Input)					
V1										
V2										
V3										
V4 ULTRASONIC	SOUND VELOCITY (Display)	STATUS (Display)	UNIT (Options)	LOWER RANGE VALUE (Input)	UPPER RANGE VALUE (Input)					
V5										
V6										
V7 SYSTEM PARAMETER	MEASURING MODE (Options)	FLOW DIRECTION (Options)	LOW FLOW CUTOFF (Input)	ZERO POINT (Input)	ZERO POINT ADJUST (Input)	UNIT (Options)	CALIB. FACTOR (Input)	NOMINAL SIZE (Input)	UNIT (Input)	
V8 BLOCK MODE	TARGET MODE (Input)	ACTUAL (Display)	NORMAL (Display)	PERMITTED (Display)				UNIT MODE (Options)		
V9 ALARM CONFIG	CURRENT (Display)	DISABLE (Display)				ST REVISION (Display)				
VA BLOCK PARAMETER	TAG (Input)	STRATEGY (Input)	ALERT KEY (Entry)	PROFILE VERSION (Display)						

Analog Input Block (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 OUT	OUT VALUE (Display)	OUT STATUS (Display)	OUT STATUS (Display)	OUT SUB STATUS (Display)	OUT LIMIT (Display)		FAILSAFE ACTION (Options)	FAILSAFE VALUE (Input)		
V1 SCALING	PV SCALE MIN (Input)	PV SCALE MAX (Input)	TYPE OF LIN (Options)	OUT SCALE MIN (Input)	OUT SCALE MAX (Input)	OUT UNIT (Input)	USER UNIT (Input)	DEC POINT OUT (Input)	RISING TIME (Input)	
V2 ALARM LIMITS	ALARM HYSTERESIS (Input)									
V3 HI HI ALARM	HI HI LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V4 HI ALARM	HI LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V5 LO ALARM	LO LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V6 LO LO ALARM	LO LO LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V7 SIMULATION	SIMULATION VALUE (Input)	SIMULATION STATUS (Options)	SIMULATION MODE (Options)							
V8 BLOCK MODE	TARGET MODE (Input)	ACTUAL (Display)	NORMAL (Display)	PERMITTED (Display)		CHANNEL (Options)		UNIT MODE (Options)		
V9 ALARM CONFIG	CURRENT (Display)	DISABLE (Display)				ST REVISION (Display)				
VA BLOCK PARAMETE	TAG (Input)	STRATEGY (Input)	ALERT KEY (Entry)	PROFILE VERSION (Display)	BATCH ID (Input)	BATCH RUP (Input)	BATCH PHASE (Input)	BATCH OPERATION (Options)		

Totalizer Block (operation via profile)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 TOTALIZER	TOTAL. VALUE (Display)	TOTAL. STATUS (Display)	TOTAL. STATUS (Display)	TOTAL. SUB STATUS (Display)	TOTAL. LIMIT (Display)		FAILSAFE MODE (Input)			
V1 CONFIGURATION	TOTAL. UNIT (Display)	SET TOTALIZER (Options)	PRESET TOTALIZER (Input)	TOTALIZER MODE (Options)						
V2 ALARM LIMITS	ALARM_HYSTERESIS (Input)									
V3 HI HI ALARM	HI HI LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V4 HI ALARM	HI LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V5 LO ALARM	LO LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V6 LO LO ALARM	LO LO LIM (Input)	VALUE (Display)	ALARM STATE (Display)	SWITCH-ON POINT (Input)	SWITCH-OFF POINT (Input)					
V7										
V8 BLOCK MODE	TARGET MODE (Input)	ACTUAL (Display)	NORMAL (Display)	PERMITTED (Display)		CHANNEL (Input)		UNIT MODE (Options)		
V9 ALARM CONFIG	CURRENT (Display)	DISABLE (Display)				ST REVISION (Display)				
VA BLOCK PARAMETER	TAG (Input)	STRATEGY (Input)	ALERT KEY (Entry)	PRFILE VERSION (Display)	BATCH ID (Input)	BATCH RUP (Input)	BATCH PHASE (Input)	BATCH OPERATION (Options)		

5.5 Hardware configuration

5.5.1 Configuration of write protection

A jumper on the I/O board provides the means of activating or deactivating hardware write protection.

⚠ 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 137 ff.
3. Configure hardware write protection appropriately using the jumpers (Fig. 63).
4. Installation of the I/O board is the reverse of the removal procedure.

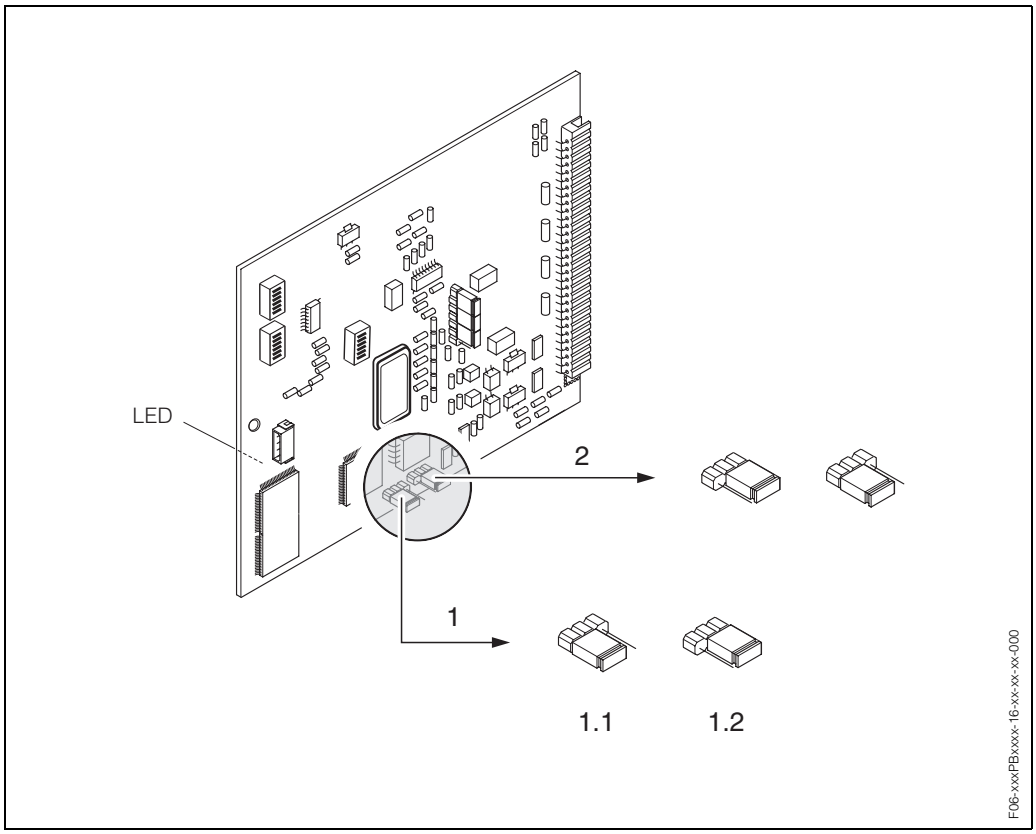


Fig. 63: Hardware configuration (I/O board)

1 Jumper for hardware write protection:
1.1 Enabled (factory setting) = Access to device parameters via PROFIBUS possible
1.2 Disabled (factory setting) = access to device parameters via PROFIBUS not possible

2 Jumpers with no function

LED (light-emitting diode at the back of the board):
– Lit continuously → Ready for operation
– Not lit → Not ready
– Flashing → Critical fault (no connection to measuring amplifier)

5.5.2 Configuration of the device address

Note the following points:
- In the case of a PROFIBUS-DP/-PA device, it will always be necessary to configure the address.
  Valid device addresses lie within the range 0…125. Each address can only be used once in a PROFIBUS-DP/-PA network. If an address is not configured correctly, the device will not be recognised by the master.
  The address 126 is used for initial commissioning and for service purposes.
- All devices have the address 126 and software addressing on leaving the factory.

Addressing using local operation → Page 85

Addressing using miniature switches

⚠ 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. Remove the screws and open the hinged cover (a) of the housing.
2. Remove the screws securing the electronics module (b). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Unplug ribbon cable connector (c) of the display module.
4. Remove the cover (d) from the electronics compartment by loosening the screws.
5. Removing the I/O board (e):
   Insert a thin pin into the opening provided and pull the board out of the holder.
6. Use a pointed object to adjust the positions of the miniature switches on the I/O board.
7. Installation is the reverse of the removal procedure.

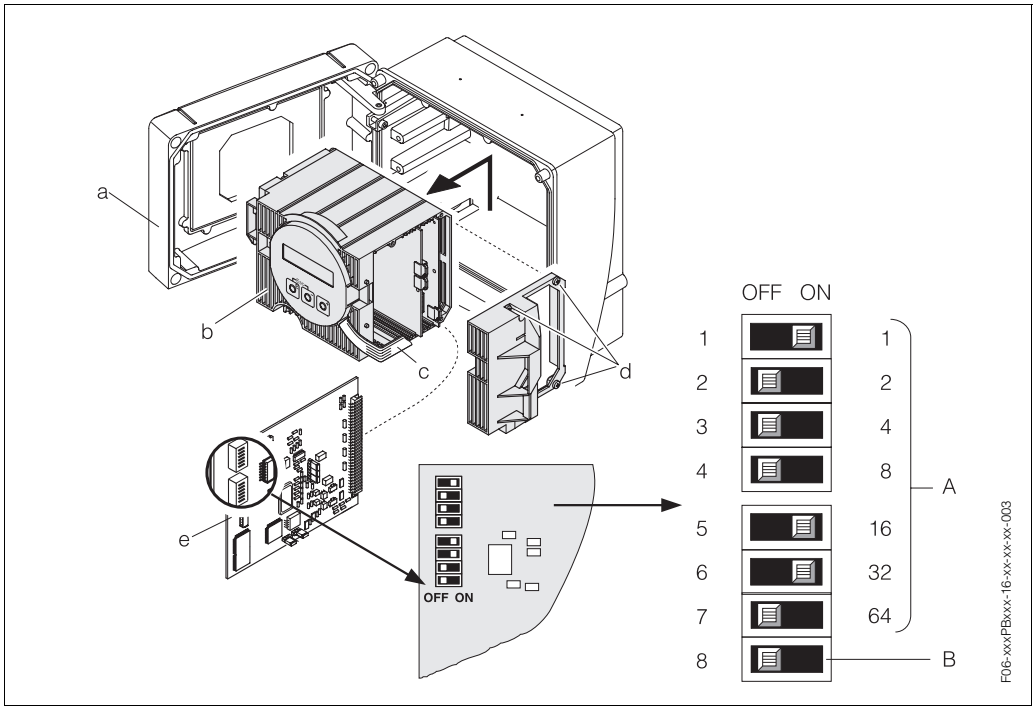


Fig. 64: Addressing using the miniature switches on the I/O board

A = Miniature switches Nos. 1–7 for defining the bus address (display: 1 + 16 + 32 = 49)
B = Miniature switch No. 8 for the address mode (type of addressing):
OFF = Software addressing via local display (factory setting)
ON = Software addressing via miniature switches No. 1–7

6 Commissioning

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- "Post-installation check" checklist → Page 40
- "Post-connection check" checklist → Page 54

✎ Note!
- The technical function data of the PROFIBUS interface in accordance with IEC 61158-2 (MBP) must be observed (FISCO model).
- The bus voltage of 9 ... 32 V and the current consumption of 11 mA at the device can be checked using a normal multimeter.
- Using the LED on the I/O board (see Page 78), it is possible to carry out a simple function check on the fieldbus communication in the non-hazardous area.

Switching on the measuring device
Once the function checks have been successfully completed, it is time to switch on the supply voltage. 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 93 **START-UP RUNNING**	Start-up message
▼	
PROSONIC FLOW 93 **SW AMPLIFIER V XX.XX.XX**	Display of current software
▼	
PROFIBUS-DP/-PA	Display of installed input/output modules
▼	
SYSTEM OK **→ OPERATION**	Beginning of standard measuring mode
▼	

Normal measuring mode commences as soon as start-up completes. 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 the local display

6.2.1 "Sensor Installation" Quick Setup

Use this "Quick Setup" to determine the sensor distance required for sensor installation.

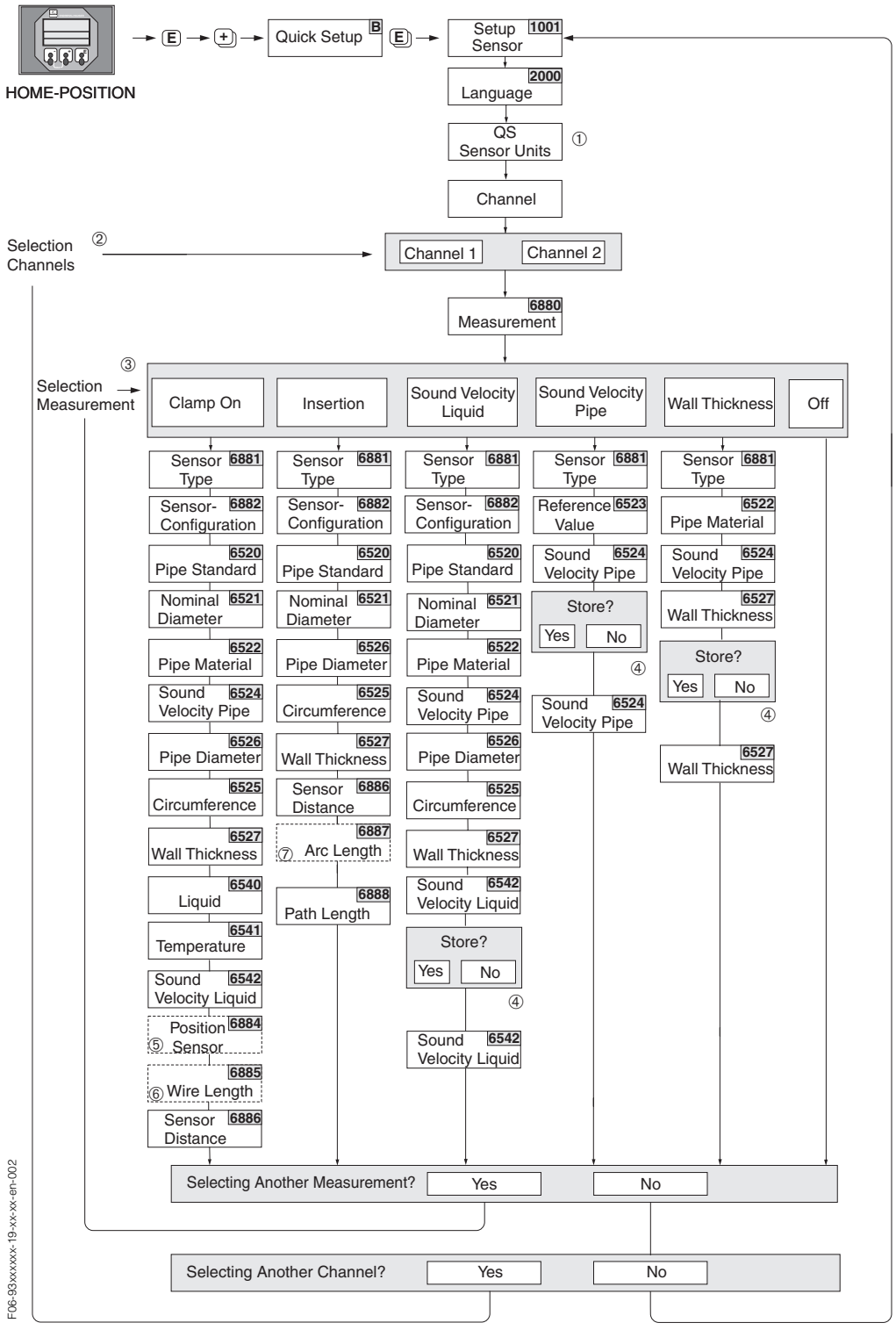


Fig. 65: "Sensor Installation" Quick Setup menu
For an explanation of points ①– ⑦: see next page

✎ Note!
The display returns to the cell SETUP SENSOR (1001) if you press the ESC key combination during interrogation.

①
Selection of the system units only influences the functions UNIT TEMPERATURE (0422), UNIT LENGTH (0424) and UNIT VELOCITY (0425).

②
If a channel is selected for which a Quick Setup has already been executed, the previous values are overwritten.

③
During each run, all the options can be selected. If settings were made during a previous run, these are overwritten.

④
Selection “YES”: The value measured during Quick Setup is accepted in the appropriate function. Selection “NO”: The measurement is discarded and the original value remains.

⑤
The function SENSOR POSITION (6884) only appears when the CLAMP ON option is set in the MEASUREMENT function and the number of traverses is 2 or 4 in the function SENSOR CONFIGURATION (6882).

⑥
The function WIRE LENGTH (6885) only appears when the CLAMP ON option is set in the MEASUREMENT function and the number of traverses is 1 or 3 in the function SENSOR CONFIGURATION (6882).

⑦
The function ARC LENGTH (6887) only appears when the INSERTION option is set in the MEASUREMENT function and the DUAL PATH option is selected in the SENSOR CONFIGURATION (6882) function.

6.2.2 "Commissioning" Quick Setup

If the measuring device is equipped with a local display, all the device parameters important for standard measuring mode can be configured easily and quickly using the "Commissioning" Quick Setup menu (Fig. 66).
If a measuring device does not have a local display, the individual parameters and functions must be configured via the configuration program, e.g. with Commuwin II (see Page 69).

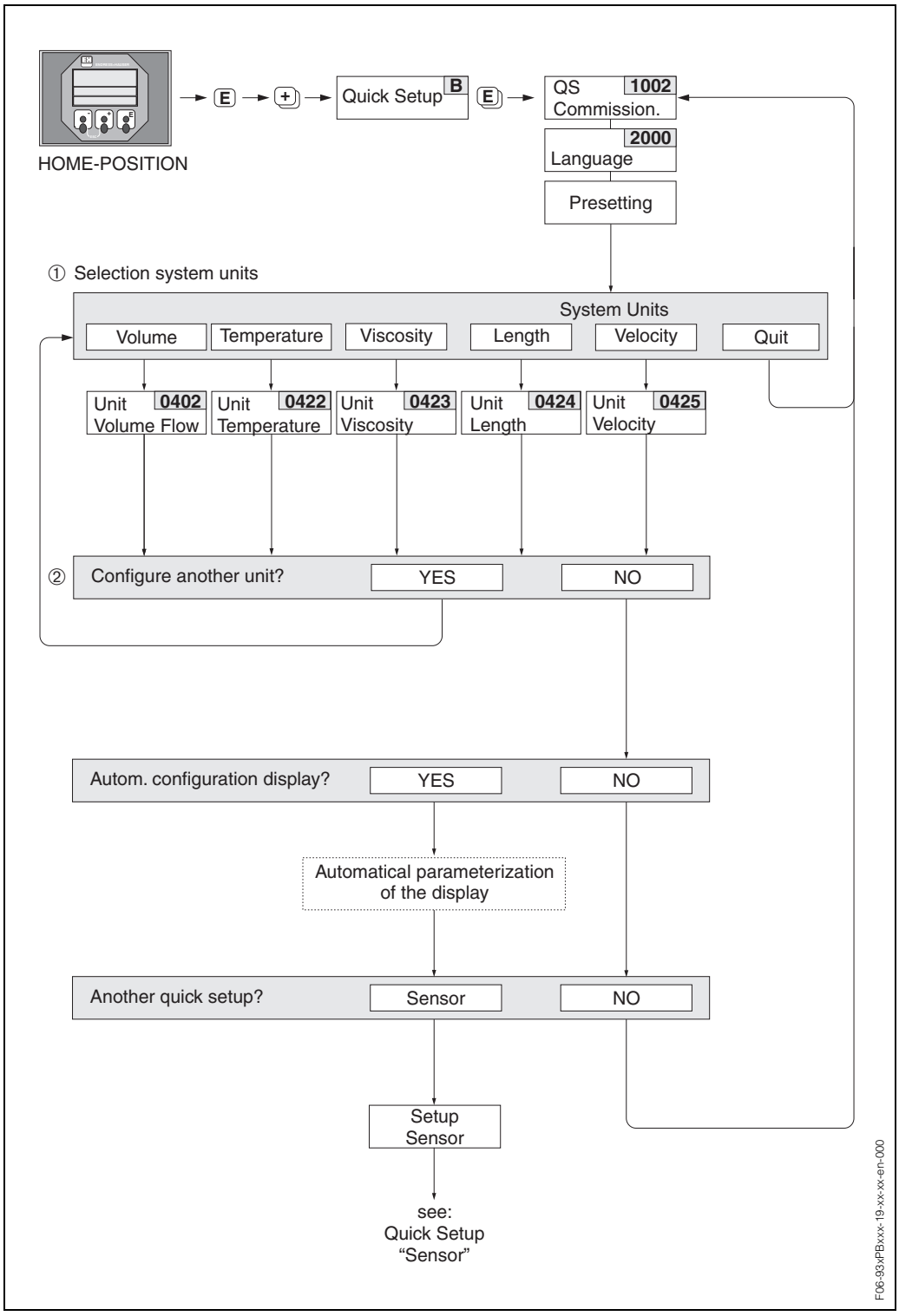


Fig. 66: "Commissioning" Quick Setup (only with local display)

6.2.3 Commissioning with local display

✎ Note!
You must enter a numerical code (factory setting: 93) before altering device functions, numerical values or factory settings → Page 60.

The following steps have to be carried out one after the other:

1. Check the hardware write protection:
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) →
   CONFIGURATION (610) → WRITE PROTECT (write protection, 6102)
2. Enter the tag name:
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) →
   CONFIGURATION (610) → TAG NAME (6100)
3. Assign a bus address if this has not already been effected via the corresponding miniature switches (see Page 79):
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) →
   CONFIGURATION (610) → BUS ADDRESS (6101)
4. Select the system unit:
   – Via the “System unit” group: MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) → UNIT VOLUME FLOW (0402) → UNIT VOLUME (0403)
   – The system unit set becomes effective in the automation system once the SET UNIT TO BUS function has been activated: BASIC FUNCTION (G) → PROFIBUSHDP/-PA (GBA/GCA) → OPERATION (614) → SET UNIT TO BUS (6141)

   ✎ Note!
   – Engineering units for the totalizers must be configured separately as explained in Point 5.
   – The measured values are transmitted in the system units - as described on Page 99 ff. - to the automation system via the cyclic data exchange. If the system unit of a measured value is changed using the local display, this will not have an immediate effect on the output of the Analog Input Block and therefore will not influence the measured value which is transmitted to the automation system. The altered system unit of the measured value will only be transmitted to the automation system once the “SET UNIT TO BUS“ function in the block BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) → OPERATION (614) → SET UNIT TO BUS (6141) has been activated.
5. Configuring totalizers 1–3:
   Prosonic Flow 93 has 3 totalizers. The following description provides an example for totalizer 1.
   – Select the process variable, e.g. VOLUME FLOW CH1: BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) → TOTALIZER (613) → CHANNEL (channel, 6133)
   – Enter the required totalizer units:
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) → TOTALIZER (613) → UNIT TOTALIZER (6134)
   – Configure totalizer status, e.g. for totalizing:
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) → TOTALIZER (613) → SET TOTALIZER (6135)
   – Configure totalizer mode, e.g. for balancing:
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) → TOTALIZER (613) → TOTALIZER MODE (6137)
6. Select the GSD file:
   BASIC FUNCTION (G) → PROFIBUS-DP/-PA (GBA/GCA) → OPERATION (614) → SELECT GSD (6140)

6.3 Commissioning via a configuration program

6.3.1 Sensor installation

For sensor installation, the various configuration and operating programmes (such as Commuwin II, FieldTool etc.) do not have any “Quick Setup” menus which correspond to the local operation.
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 87.

Sensor type	Required values for the sensor mounting procedure	PROFIBUS configuration programm [1]	Local display [2]	FieldTool [3]	Applicator [4]
Clamp On version	Sensor position	x	x	x	x
	Wire length	x	x	x	x
	Sensor distance	x	x	x	x
Insertion version	Sensor distance	x	x	x	x
	Arc length	x	x	x	x
	Path length	x	x	x	x

1) Conditions that must be met before determining the values via a PROFIBUS configuration program (see Page 87):
- Transmitter installed (see Page 38)
- Transmitter connected to power supply (see Page 48)
- PROFIBUS interface has been commissioned (see Page 93)

2) Conditions that must be met before determining the values via the local display using the “Sensor” Quick Setup (see Page 82):
- Transmitter installed (see Page 38)
- Transmitter connected to power supply (see Page 48)

3) FieldTool is a configuration and service software for flowmeters in the field.
Conditions that must be met before determining the values via the FieldTool:
- Transmitter installed (see Page 38)
- Transmitter connected to power supply (see Page 48)
- “FieldTool” configuration and service software installed on a notebook/PC
- Connection made between notebook/PC and device via the FXA 193 service interface (see Page 49)

4) 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 87
- "Insertion" sensor installation → Page 89
- "Liquid sound velocity" measurement (only for Clamp On) → Page 90
- "Pipe sound velocity" measurement (only for Clamp On) → Page 91
- "Wall thickness" measurement (only for Clamp On) → Page 92

Note!
- You must enter a valid release code before device parameters can be changed or activated. The code (factory setting = 93) is entered by means of the corresponding matrix cell. This is V2H0 for Commuwin II.
- Commuwin II: You can use the VAH5 matrix cell to select various partial matrixes required for configuration.

"Clamp On" sensor installation

Procedure Selection - Input - display	**Local display (Quick Setup)** ▼	**FieldTool** ▼	**Commuwin II** ▼
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Type of measurement	MEASUREMENT (6880)	MEASUREMENT	MEASUREMENT CH1 (V3H0) / CH2 (V6H0)
Sensor type	SENSOR TYPE (6881)	SENSOR TYPE	SENSOR TYPE CH1 (V3H1) SENSOR TYPE CH2 (V6H1)
Sensor configuration	SENSOR CONFIGURATION (6882)	SENSOR CONFIGURATION	SENSOR CONFIG. CH1 (V3H2) SENSOR CONFIG. CH2 (V6H2)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → DE. MATRIX CH1/2 (VAH5) → PIPE DATA CH1/CH2
Standard pipe selection	PIPE STANDARD (6520)	PIPE STANDARD	PIPE STANDARD CH1/CH2 (V4H0)
Nominal diameter pipe	NOMINAL DIAMETER (6521)	NOMINAL DIAMETER	NOMINAL DIAMETER CH1/CH2 (V4H1)
Pipe material	PIPE MATERIAL (6522)	PIPE MATERIAL	PIPE MATERIAL CH1/CH2 (V4H2)
Pipe sound velocity	SOUND VELOCITY PIPE (6524)	SOUND VELOCITY PIPE	SOUND VELOC. PIPE CH1/CH2 (V4H4)
Pipe circumference	CIRCUMFERENCE (6525)	CIRCUMFERENCE	CIRCUMFERENCE CH1/CH2 (V4H5)
Pipe diameter	PIPE DIAMETER (6526)	PIPE DIAMETER	PIPE DIAMETER CH1/CH2 (V4H6)
Wall thickness	WALL THICKNESS (6527)	WALL THICKNESS	WALL THICKNESS CH1/CH2 (V4H7)

Liner material	LINER MATERIAL(6528)	LINER MATERIAL	LINER MATERIAL CH1/CH2 (V4H8)
Liner sound velocity	SOUND VELOCITY LINER (6529)	SOUND VELOCITY LINER	→ ADJUSTMENT/PIPE CH1/CH2
			SOUND VEL. LINER CH1/CH2 (V5H1)
Liner thickness	LINER THICKNESS (6530)	LINER THICKNESS	LINER THICKNESS CH1/CH2 (V5H2)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → LIQUID DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → LIQUID DATA	→ LIQUID DATA CH1/CH2
Liquid in the pipe	LIQUID (6540)	LIQUID	LIQUID CH1/CH2 (V9H0)
Liquid temperature	TEMPERATURE (6541)	TEMPERATURE	TEMPERATURE CH1/CH2 (V9H1)
Liquid sound velocity	SOUND VELOCITY LIQUID (6542)	SOUND VELOCITY LIQUID	SOUND VELOCITY CH1/CH2 (V9H2)
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block “PROSONIC 93 PBUS”: → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Didsplay sensorposition (for sensor installation)	POSITION SENSOR (6884)	POSITION SENSOR	SENSOR POSITION CH1 (V3H4) SENSOR POSITION CH2 (V6H4)
Didsplay wire length (for sensor installation)	WIRE LENGTH (6885)	CABLE LENGTH	WIRE LENGTH CH1 (V3H5) WIRE LENGTH CH2 (V6H5)
Didsplay sensor distance (for sensor installation)	SENSOR DISTANCE (6886)	SENSOR DISTANCE	SENSOR DISTANCE CH1 (V3H6) SENSOR DISTANCE CH2 (V6H6)

✎ 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 82.

"Insertion" sensor installation			
Procedure Selection - Input - display	**Local display (Quick Setup)** ▼	**FieldTool** ▼	**Commuwin II** ▼
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Type of measurement	MEASUREMENT (6880)	MEASUREMENT	MEASUREMENT CH1 (V3H0) / CH2 (V6H0)
Sensor type	SENSOR TYPE (6881)	SENSOR TYPE	SENSOR TYPE CH1 (V3H1) SENSOR TYPE CH2 (V6H1)
Sensor configuration	SENSOR CONFIGURATION (6882)	SENSOR CONFIGURATION	SENSOR CONFIG. CH1 (V3H2) SENSOR CONFIG. CH2 (V6H2)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → DE. MATRIX CH1/2 (VAH5) → PIPE DATA CH1/CH2
Standard pipe selection	PIPE STANDARD (6520)	PIPE STANDARD	PIPE STANDARD CH1/CH2 (V4H0)
Nominal diameter pipe	NOMINAL DIAMETER (6521)	NOMINAL DIAMETER	NOMINAL DIAMETER CH1/CH2 (V4H1)
Pipe circumference	CIRCUMFERENCE (6525)	CIRCUMFERENCE	CIRCUMFERENCE CH1/CH2 (V4H5)
Pipe diameter	PIPE DIAMETER (6526)	PIPE DIAMETER	PIPE DIAMETER CH1/CH2 (V4H6)
Wall thickness	WALL THICKNESS (6527)	WALL THICKNESS	WALL THICKNESS CH1/CH2 (V4H7)
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Didsplay sensor distance (for sensor installation)	SENSOR DISTANCE (6886)	SENSOR DISTANCE	SENSOR DISTANCE CH1 (V3H6) SENSOR DISTANCE CH2 (V6H6)
Didsplay arc length (for sensor installation)	ARC LENGTH (6887)	ARC LENGTH	ARC LENGTH CH1 (V3H7) ARC LENGTH CH2 (V6H7)
Didsplay path length (for sensor installation)	PATH LENGTH (6888)	PATH LENGTH	PATH LENGTH CH1 (V3H8) PATH LENGTH CH2 (V6H8)

✎ 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 82.

"Liquid sound velocity" measurement (only for Clamp On)			
Procedure Selection - Input - display	**Local display (Quick Setup)** ▼	**FieldTool** ▼	**Commuwin II** ▼
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Type of measurement	MEASUREMENT (6880)	MEASUREMENT	MEASUREMENT CH1 (V3H0) / CH2 (V6H0)
Sensor type	SENSOR TYPE (6881)	SENSOR TYPE	SENSOR TYPE CH1 (V3H1) SENSOR TYPE CH2 (V6H1)
Sensor configuration	SENSOR CONFIGURATION (6882)	SENSOR CONFIGURATION	SENSOR CONFIG. CH1 (V3H2) SENSOR CONFIG. CH2 (V6H2)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → DE. MATRIX CH1/2 (VAH5) → PIPE DATA CH1/CH2
Standard pipe selection	PIPE STANDARD (6520)	PIPE STANDARD	PIPE STANDARD CH1/CH2 (V4H0)
Nominal diameter pipe	NOMINAL DIAMETER (6521)	NOMINAL DIAMETER	NOMINAL DIAMETER CH1/CH2 (V4H1)
Pipe material	PIPE MATERIAL (6522)	PIPE MATERIAL	PIPE MATERIAL CH1/CH2 (V4H2)
Pipe sound velocity	SOUND VELOCITY PIPE (6524)	SOUND VELOCITY PIPE	SOUND VELOC. PIPE CH1/CH2 (V4H4)
Pipe circumference	CIRCUMFERENCE (6525)	CIRCUMFERENCE	CIRCUMFERENCE CH1/CH2 (V4H5)
Pipe diameter	PIPE DIAMETER (6526)	PIPE DIAMETER	PIPE DIAMETER CH1/CH2 (V4H6)
Wall thickness	WALL THICKNESS (6527)	WALL THICKNESS	WALL THICKNESS CH1/CH2 (V4H7)
Liner material	LINER MATERIAL(6528)	LINER MATERIAL	LINER MATERIAL CH1/CH2 (V4H8)
Liner sound velocity	SOUND VELOCITY LINER (6529)	SOUND VELOCITY LINER	→ ADJUSTMENT/PIPE CH1/CH2 SOUND VEL. LINER CH1/CH2 (V5H1)
Liner thickness	LINER THICKNESS (6530)	LINER THICKNESS	LINER THICKNESS CH1/CH2 (V5H2)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → LIQUID DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → LIQUID DATA	→ LIQUID DATA CH1/CH2
Display of liquid sound velocity	SOUND VELOCITY LIQUID (6542)	SOUND VELOCITY LIQUID	SOUND VELOCITY CH1/CH2 (V9H2)

✎ 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 82.

"**Pipe sound velocity" measurement (only for Clamp On)**			
Procedure Selection - Input - display	**Local display (Quick Setup)** ▼	**FieldTool** ▼	**Commuwin II** ▼
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Type of measurement	MEASUREMENT (6880)	MEASUREMENT	MEASUREMENT CH1 (V3H0) / CH2 (V6H0)
Sensor type	SENSOR TYPE (6881)	SENSOR TYPE	SENSOR TYPE CH1 (V3H1) SENSOR TYPE CH2 (V6H1)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → DE. MATRIX CH1/2 (VAH5) → PIPE DATA CH1/CH2
Thickness reference value	REFERENCE VALUE (6523)	REFERENCE VALUE	REFERENCE VALUE (V4H3)
Pipe sound velocity	SOUND VELOCITY PIPE (6524)	SOUND VELOCITY PIPE	→ ADJUSTMENT/PIPE CH1/CH2
			SOUND VEL. LONGI CH1/CH2 (V5H4)
▼			
Display of pipe sound velocity	SOUND VELOCITY PIPE (6524)	SOUND VELOCITY PIPE	SOUND VEL. LONGI CH1/CH2 (V5H6)

✎ 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 82.

"Wall thickness" measurement (only for Clamp On)			
Procedure Selection - Input - display	**Local display (Quick Setup)** ▼	**FieldTool** ▼	**Commuwin II** ▼
▼	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	→ BASIC FUNCTION → SENSOR DATA CH1/CH2 → SENSOR PARAM.	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → SENSOR DATA (VAH5) → SENSOR PARAM. CH1/CH2
Type of measurement	MEASUREMENT (6880)	MEASUREMENT	MEASUREMENT CH1 (V3H0) / CH2 (V6H0)
Sensor type	SENSOR TYPE (6881)	SENSOR TYPE	SENSOR TYPE CH1 (V3H1) SENSOR TYPE CH2 (V6H1)
▼	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	→ BASIC FUNCTION → PROCESS PARAM. CH1/CH2 → PIPE DATA	Manufacturer-specific Transducer Block "PROSONIC 93 PBUS": → DE. MATRIX CH1/2 (VAH5) → PIPE DATA CH1/CH2
Pipe material	PIPE MATERIAL (6522)	PIPE MATERIAL	PIPE MATERIAL CH1/CH2 (V4H2)
Pipe sound velocity	SOUND VELOCITY PIPE (6524)	SOUND VELOCITY PIPE	SOUND VELOC. PIPE CH1/CH2 (V4H4)
Wall thickness	WALL THICKNESS (6527)	WALL THICKNESS	→ ADJUSTMENT/PIPE CH1/CH2 WALL THICKNESS CH1/CH2 (V4H7)
▼			
Display of wall thickness	WALL THICKNESS (6527)	WALL THICKNESS	→ PIPE DATA CH1/CH2 WALL THICKNESS CH1/CH2 (V4H7)

✎ 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 82.

6.3.2 Commissioning, Configuration of the BUS interface

Operation with Commuwin II is described in the E+H documentation BA 124F/00/a2. Steps 1–5 can be dealt with in the same order as described in Section 6.2.3 “Commissioning with local display”.

The configuration parameters can be found in the Commuwin II operating matrix in the manufacturer-specific matrix or in the individual profile blocks:
- In the Physical Block → Page 74
- In the manufacturer-specific device matrix (positions V6 and V7) → Page 69, 70
- In the Analog Input Block → Page 76
- In the Totalizer Block (position V1) → Page 77

1. Parametering the “Physical Block”:
   – Open the Physical Block.
   – Software and hardware write protection is disabled in Prosonic 93 so that you can access all the write parameters. Check this status with the parameters WRITE LOCKING (V3H0, software write protection) and HW WRITE PROTECT. (V3H1, hardware write protection).
   – Enter the tag name.

2. Parametering the manufacturer-specific device parameters of the Transducer Block “PROSONIC 93 PBUS”:
   – Open the manufacturer-specific Transducer Block “PROSONIC 93 PBUS”.
   – Enter the desired name for the block (tag name). Factory setting: no block name (tag name)
   – Now configure the device-specific parameters for flow measurement.

   ✎ Note!
   Other matrixes can be selected in the matrix cell VAH5 if you wish to configure further manufacturer-specific parameters.
   Please note that alterations made to device parameters will only be activated once a valid access code has been entered. The access code can be entered in the matrix cell V2H0 (factory setting: 93).

3. Parametering the “Analog Input function block”:
   Prosonic Flow 93 has eight Analog Input function blocks to which various process variables can be assigned as required (see table). These are selected using the connection clearance list. The following description provides an example for Analog Input function block 1.
   – Enter the required name for Analog Input function block 1 (factory setting: ANALOG INPUT 1 BLOCK).
   – Open the Analog Input function block.
   – Use the CHANNEL (V8H5) parameter to select the process variable which should be used as the input variable for the function block algorithm (scaling and limit value monitoring functions).

   The following settings are possible:

CHANNEL = 273 (volume flow channel 1)
CHANNEL = 293 (sound velocity channel 1)
CHANNEL = 309 (flow velocity channel 1)
CHANNEL = 529 (volume flow channel 2)
CHANNEL = 549 (sound velocity channel 2)
CHANNEL = 565 (flow velocity channel 2)
CHANNEL = 567 (average volume flow)

CHANNEL = 570 (average sound velocity)
CHANNEL = 568 (total volume flow)
CHANNEL = 569 (volume flow difference)
CHANNEL = 571 (average flow velocity)

– In the Analog Input function block, the input value or the input range can be scaled in accordance with the requirements of the automation system (see Page 95).
– If necessary, set a limit value.

4. Parametering the “Totalizer Block”:
Prosonic Flow 93 has three Totalizer function blocks. These are selected using the “TOTAL” profile blocks in the connection clearance list.
– Enter the required name for the Totalizer function block (factory setting: TOTALIZER BLOCK).
– Select the process variable, e.g. volume flow, via the CHANNEL (V8H5) parameter:

Channel 1 = active
CHANNEL = 273 (volume flow channel 1)
Channel 1 + Channel 2 = active
CHANNEL = 273 (volume flow channel 1)
CHANNEL = 529 (volume flow channel 2)
CHANNEL = 567 (average volume flow)
CHANNEL = 568 (total volume flow)
CHANNEL = 569 (volume flow difference)

– Enter the required units for the totalizer (TOTAL. UNIT, V1H0).
– Configure the totalizer status (SET TOTALIZER, V1H1), e.g. for totalizing.
– Configure the totalizer mode (TOTALIZER MODE , V1H3), e.g. for balancing.

5. Configuration of the cyclic data traffic:
All the relevant data are described in the “System Integration” Section (see Page 96). We recommend that the “Coupling Documentation” be used for step-by-step configuration. This can be obtained from Endress+Hauser Process Solutions for various automation systems and programmable logic controls.
The files required for commissioning and network configuration can be obtained as described on Page 96.

6.3.3 Rescaling the input value

In the Analog Input function block, the input value or input range can be scaled in accordance with the automation requirements.

Example:
- The system unit in the Transducer Block is m^3/h.
- The measuring range of the sensor is 0...30 m^3/h.
- The output range to the automation system should be 0 ... 100%.
- The measured value from the Transducer Block (input value) is rescaled linearly via the input scaling PV_SCALE to the desired output range OUT_SCALE.

Parameter group PV_SCALE (see “Description of Device Functions” manual)
PV_SCALE_MIN (V1H0) → 0
PV_SCALE_MAX (V1H1) → 30

Parameter group OUT_SCALE (see “Description of Device Functions“ manual)
OUT_SCALE_MIN (V1H3) → 0
OUT_SCALE_MAX (V1H4) → 100
OUT_UNIT (V1H5) → [%]

The result is that with an input value of, for example 15 m^3/h, a value of 50% is output via the OUT parameter.

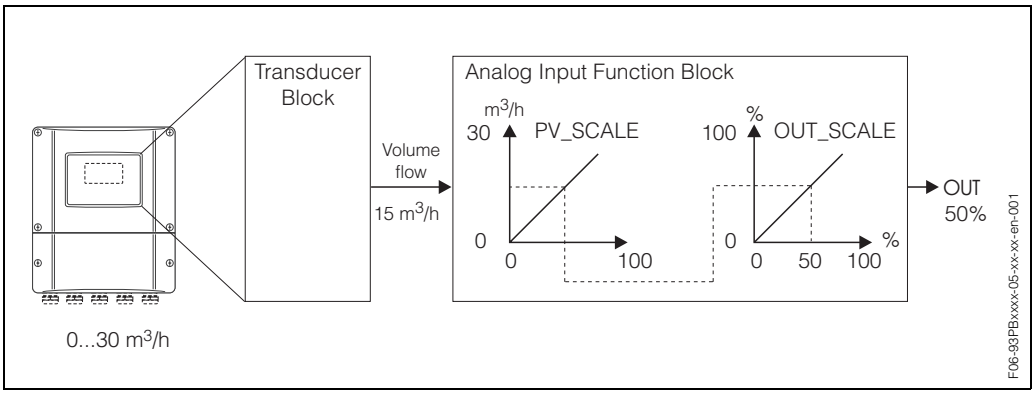


Fig. 67: Scaling the input value for the Analog Input function block

Note!
The “OUT_UNIT” does not have any effect on the scaling. It should be set nevertheless for clarity purposes.

6.4 System integration

The device will be ready for system integration once commissioning has been effected via the local display or the Class 2 master (Commuwin II). The PROFIBUS-DP system will require a description of the device parameters, e.g. output data, input data, data format and supported transmission rate so that it can integrate the field devices into the bus system.
This data is contained in a Device Master File (GSD file) which will be placed at the disposal of the PROFIBUS-DP master while the communication system is being commissioned.
Device bitmaps, which appear as symbols in the network tree, can also be integrated. The Profile 3.0 Device Master File (GSD) allows field devices from various producers to be exchanged without having to reconfigure.

Generally, a distinction can be made between three different types of GSD (factory setting: manufacturer-specific GSD):

Manufacturer-specific GSD: This GSD guarantees the unlimited functionality of the field device. Device-specific process parameters and functions are therefore available.

Profile GSD: This GSD is different in terms of the number of Analog Input Blocks (AI) and the measuring principles. If a system is configured with profile GSDs, it will be possible to exchange devices that are supplied by various manufacturers. It is, however, essential that the cyclic process values follow the same sequence.

Example:
Prosonic Flow 93 supports Profile GSD PA039741.gsd (RS 485) or PA139741.gsd (IEC 61158-2 (MBP)). This GSD comprises two AI Blocks and one Totalizer Block. The AI Blocks are assigned to the following measured variables:
AI 1 = Volume flow, AI 2 = Sound velocity channel 1.

Profile GSD (multi-variable) with the ID No. 9760_{Hex}: This GSD contains all function blocks such as AI, DO, DI.... This GSD is not supported by Prosonic Flow 93.

Note!
- A decision should be made with respect to which GSD is to be used before configuration takes place.
- The configuration can be altered using the local display or a configuration program (Class 2 master). Configuration using the local display → Page 85 ff.

Prosonic Flow 93 supports the following GSD files:

Name of device	**Manufacturer-specific ID No.**	**Profile 3.0 ID No.**	**Manufacturer-specific GSD**
Prosonic Flow 93 PA PROFIBUS-PA (IEC 61158-2 (MBP))	1530 (Hex)	9741 (Hex)	EH3_1530.gsd EH3X1530.gsd
	Profile 3.0 GSD	**Type file**	**Bitmaps**
	PA139741.gsd	EH_1530.200	EH_1530_d.bmp/.dib EH_1530_n.bmp/.dib EH_1530_s.bmp/.dib
	Manufacturer-specific ID No.	**Profile 3.0 ID No.**	**Manufacturer-specific GSD**
Prosonic Flow 93 DP PROFIBUS-DP (RS 485)	1531 (Hex)	9741 (Hex)	EH3_1531.gsd EH3X1531.gsd
	Profile 3.0 GSD	**Type file**	**Bitmaps**
	PA039741.gsd	EH_1531.200	EH_1531_d.bmp/.dib EH_1531_n.bmp/.dib EH_1531_s.bmp/.dib

Each device is assigned an identification number by the Profibus User Organisation (PNO). The name of the Device Master File (GSD) is derived from this.
At Endress+Hauser, this ID No. starts with the manufacturer ID 15xx.
In order to ensure clarity and make assignment easier, the GSD names (with the exception of type files) at Endress+Hauser are as follows:

EH3_15xx	EH = Endress + Hauser 3 = Profile 3.0 _ = Standard identification 15xx = ID No.
EH3x15xx	EH = Endress + Hauser 3 = Profile 3.0 x = Extended identification 15xx = ID No.

The GSD files for all Endress+Hauser devices can be acquired in the following manner:
- Internet (Endress+Hauser) → http://www.endress.com (Products → Process Solutions → PROFIBUS → GSD files)
- Internet (PNO) → http://www.profibus.com (GSD library)
- On CD-ROM from Endress+Hauser: order number 56003894

Structure of GSD files from Endress+Hauser
In the case of the Endress+Hauser field devices with PROFIBUS interface, all the files which are needed for configuration are contained in one file. Once unpacked, the file will create the following structure:
- Version #xx stands for the corresponding device version. Device-specific bitmaps can be found in the directories “BMP” and “DIB”. The utilisation of these will depend on the configuration software that is being used.
- The GSD files are saved in the subdirectories “Extended” and “Standard” which can be found in the “GSD” folder. Information relating to the implementation of the field transmitter and any dependencies in the device software can be found in the “Info” folder. Please read this carefully before configuration takes place. The files with the extension *.200 have been saved in the “TypDat” folder.

Standard and extended formats
The modules of some GSD files are transmitted with an extended identification (e.g. 0x42, 0x84, 0x08, 0x05). These GSD files can be found in the “Extended” folder.
All GSD files that have a standard identification (e.g. 0x94) can be found in the “Standard” folder.
When integrating field transmitters, the GSD files with the extended identification should be used first. If, however, the integration is not successful, the standard GSD should be used. This differentiation is the result of a specific implementation in the master systems.

Contents of the download file from the Internet and the CD-ROM
- All Endress+Hauser GSD files
- Endress+Hauser type files
- Endress+Hauser bitmap files
- Useful information relating to the devices

Working with GSD / type files
The GSD files must be integrated into the automation system.
Depending on the software that is being used, the GSD files can be copied to the program-specific directory or can be read into the database using the import function within the configuration software.

Example 1:
In the case of the configuration software Siemens STEP 7 (Siemens PLC S7-300 / 400) the files are copied to the subdirectory ...\ siemens \ step7 \ s7data \ gsd.
The GSD files also contain bitmap files. These bitmap files are used to display the measuring points in image form. The bitmap files will have to be saved to the directory ...\ siemens \ step7 \ s7data \ nsbmp.

Example 2:
If you have a PLC Siemens S5 where the PROFIBUS-DP network is configured with the configuration software COM ET 200, you will have to use the type files (x.200 files).

If you are using configuration software other than that referred to above, ask your PLC manufacturer which directory you should use.

Compatibility of Profile 2.0 and 3.0 devices
It is possible to operate Profile 2.0 and 3.0 devices with different GSD files in one system using one DP master as the cyclic data for the automation system in both profile versions is compatible.

Note!
In most cases, it is also possible to replace Profile 2.0 devices with Profile 3.0 devices of the same type without having to repeat the configuration process.
This does not apply when replacing an E+H Profile 2.0 flow device with a Profile 3.0 flow device. The functionality of the new generation of devices PROline (Profile 3.0) differs from that of Profile 2.0 devices as do the names.
For this reason, PROline devices (Profile 3.0) have been issued with a new identification number and as a result, an exchange of devices will involve the reconfiguration of the automation system.

6.4.1 Cyclic data exchange

Structure of a cyclic data telegram
In the case of PROFIBUS-DP/-PA, the cyclic transmission of analogue values to the automation system is effected in data blocks 5 bytes in length. The measured value is portrayed in the first 4 bytes in the form of floating point numbers in accordance with IEEE 754 standard (see IEEE floating point number). The 5th byte contains status information pertaining to the measured value which is implemented in accordance with the Profile 3.0 Specifications (see Page 96). The status is indicated on the device display (if present), (see Page 58).

✎ Note!
An exact description of the data types can be found in the slot/index lists in the "Description of Device Functions" manual.

IEEE floating point number
Conversion of a hexadecimal value into an IEEE floating point number for measured value detection.
The measured values are shown in numerical format IEEE-754 in the following manner and are transferred to the Class 1 master:

Byte n			Byte n+1		Byte n+2		Byte n+3
Bit 7	Bit 6 Bit 0		Bit 7	Bit 6 Bit 0	Bit 7 Bit 0		Bit 7 Bit 0
Sign	2^7 2^6 2^5 2^4 2^3 2^2 2^1		2^0	2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5} 2^{-6} 2^{-7}	2^{-8} 2^{-9} 2^{-10} 2^{-11} 2^{-12} 2^{-13} 2^{-14} 2^{-15}		2^{-16}...2^{-23}
	Exponents			**Mantissa**	**Mantissa**		**Mantissa**

Formula value = $(-1)^{sign} * 2^{(exponent\ -127)} * (1 + mantissa)$

Example: 40 F0 00 00 hex= 0100 0000 1111 0000 0000 0000 0000 0000 binary
Value = $(-1)^0 * 2^{(129-127)} * (1 + 2^{-1} + 2^{-2} + 2^{-3})$
$= 1 * 2^2 * (1 + 0.5 + 0.25 + 0.125)$
$= 1 * 4 * 1.875 = 7.5$

Block model
The process variables and control blocks transmitted by Prosonic Flow 93 during cyclic data exchange are as follows:

Process variables	Assignment to the AI Blocks
– Volume flow channel 1 – Sound velocity channel 1 – Flow velocity channel 1 – Volume flow channel 2 – Sound velocity channel 2 – Flow velocity channel 2 – Average volume flow – Average sound velocity – Total volume flow – Volume flow difference – Average flow velocity	Process variables which can be assigned as required to the Analog Input function blocks AI 1...AI 8.
– Totalizer 1–3 incl. controls – Display value – Control block for manufacturer-specific functions	**Cannot** be assigned to the Analog Input function blocks AI 1...AI 8.

Note!
- Prosonic Flow 93 has eight Analog Input function blocks to which various process variables can be assigned as required.
- Totalizers 1–3 can be configured in various combinations with the totalizer controls. It is possible to configure totalizers 1–3 only, or additionally integrate one or two output control bytes in order to reset totalizer 1 or stop totalizing, for example. The configuration is explained in detail on Page 103.

The block model illustrated (Fig. 68) shows which input and output data Prosonic Flow 93 provides for cyclic data exchange.

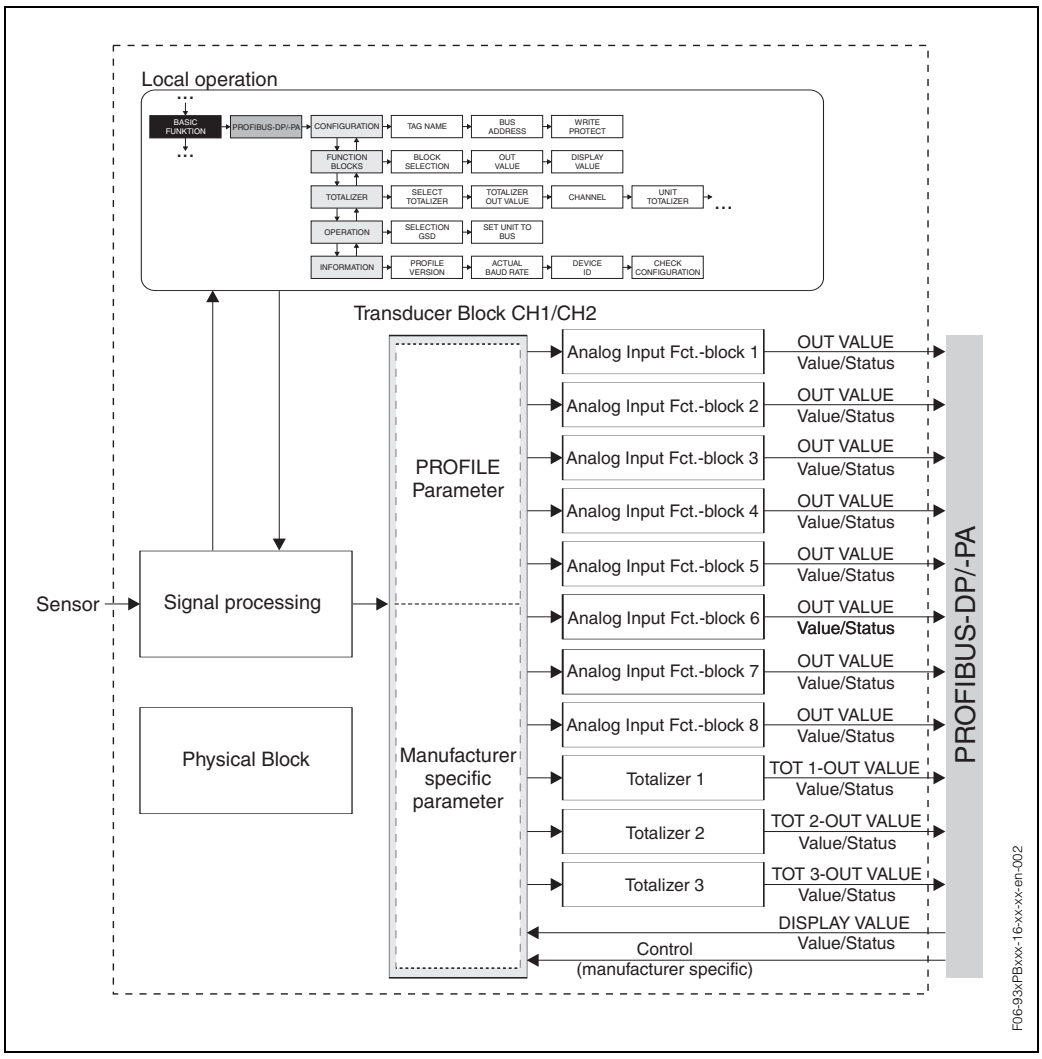


Fig. 68: Block model for Prosonic Flow 93 PROFIBUS-DP/-PA Profile 3.0

Input data
Input data are:
- Volume flow channel 1
- Sound velocity channel 1
- Flow velocity channel 1
- Volume flow channel 2
- Sound velocity channel 2
- Flow velocity channel 2
- Average volume flow
- Average sound velocity
- Total volume flow
- Volume flow difference
- Average flow velocity
- Totalizers 1–3

Using these process variables, the current measured value can be transmitted to the automation system.

Data transfer from Prosonic Flow 93 to the automation system
The assignment of the process variables to the Analog Input function blocks can be configured as required, whereby the sequence of the Totalizer function blocks is fixed. If addressing is effected automatically using the configuration program, the numerical values of the input and output data may deviate from the values in the following table.

✎ Note!
- The configuration in the following table corresponds to the factory configuration which can be modified depending on the process.
- Process variables can be assigned to the individual Analog Input function blocks using a configuration program (Class 2 master) namely by means of the “Channel” V8H5 parameter in the “ANALOG INPUT 1...8” matrix.
- The system unit in the following table corresponds to the predefined scales which are transmitted during cyclic data exchange.
- Process variables can be assigned to the individual totalizers 1–3 using a configuration program (Class 2 master) or the local display, namely by means of the “Channel” V8H5 parameter in the “TOTALIZER 1...3“ matrix.
- The process variable/totalizer 1–3 assignment can be set individually.

The “Channel” parameter is described in more detail in a separate manual, namely the “Description of Device Functions” manual.

The following process variables can be assigned to the totalizer 1–3:

Totalizer 1–3: process variable assignment	
Channel 1 = active	Channel 1 + channel 2 = active
OFF CHANNEL = 273 (volume flow channel 1)	OFF CHANNEL = 273 (volume flow channel 1 in m^3) CHANNEL = 529 (volume flow channel 2 in m^3) CHANNEL = 567 (average volume flow in m^3) CHANNEL = 568 (total volume flow in m^3) CHANNEL = 569 (volume flow difference in m^3)
Factory setting: volume flow channel 1 in m^3	

Input byte	Process parameter	Access type	Comment/Data format	Factory setting unit
0, 1, 2, 3	Volume flow CH1 (Channel: 273)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m^3/h
4	Status volume flow CH1	read	Status code → Page 112	–
5, 6, 7, 8	Sound velocity CH1 (Channel: 293)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m/s
9	Status sound velocity CH1	read	Status code → Page 112	–
10, 11, 12, 13	Flow velocity CH1 (Channel: 309)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m/s
14	Status flow velocity CH1	read	Status code → Page 112	–
15, 16, 17, 18	Volume flow CH2 (Channel: 529)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m^3/h
19	Status volume flow CH2	read	Status code → Page 112	–
20, 21, 22, 23	Sound velocity CH2 (Channel: 549)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m/s
24	Status sound velocity CH2	read	Status code → Page 112	–
25, 26, 27, 28	Flow velocity CH2 (Channel: 565)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m/s
29	Status flow velocity CH2	read	Status code → Page 112	–
30, 31, 32, 33	Average volume flow (Channel: 567)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m^3/h
34	Status average volume flow	read	Status code → Page 112	–
35, 36, 37, 38	Average sound velocity (Channel: 570)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m/s
39	Status average sound velocity	read	Status code → Page 112	–
–	Total volume flow (Channel: 568)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99 **can be assigned as required!**	m^3/h
–	Status total volume flow	read	Status code → Page 112	–
–	Volume flow difference (Channel: 569)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99 **can be assigned as required!**	m^3/h

Input byte	Process parameter	Access type	Comment/Data format	Factory setting unit
–	Status volume flow difference	read	Status code → Page 112	–
–	Average flow velocity (Channel: 571)	read	32-bit floating point number (IEEE-754) Illustrated → Page 99 **can be assigned as required!**	m/s
–	Status flow velocity	read	Status code → Page 112	–
40, 41, 42, 43	Totalizer 1	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m^3
44	Totalizer 1 status	read	Status code → Page 112	–
45, 46, 47, 48	Totalizer 2	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m^3
49	Totalizer 2 status	read	Status code → Page 112	–
50, 51, 52, 53	Totalizer 3	read	32-bit floating point number (IEEE-754) Illustrated → Page 99	m^3
54	Totalizer 3 status	read	Status code → Page 112	–

Control variables for totalizers 1–3 (output data)
These functions allow totalizers 1–3 to be controlled from the automation system. The following controls are possible: totalizing, resetting, activation of a predefined value, balancing, totalisation of positive flow only, totalisation of negative flow only and stopping of totalizing.

Data transfer from the automation system to Prosonic Flow 93 (totalizer controls)

Output byte	Process parameter	Access type	Comment/Control variable	Factory setting unit
0 2 4	SET_TOT 1 SET_TOT 2 SET_TOT 3	write write write	The following control variables can be entered for totalizers 1–3 using these parameters. **Control variable for SET_TOT:** 0: Totalizing 1: Reset totalizer 2: Preset totalizer	–
1 3 5	MODE_TOT 1 MODE_TOT 2 MODE_TOT 3	write write write	**Control variable for MODE_TOT:** 0: Balancing 1: Only positive flow detection 2: Only negative flow detection 3: Stop totalizing	–

✎ Note!
- A control variable can be executed through the cyclic data exchange each time the output byte changes from one bit pattern to any other bit pattern.
- It is only possible to preset a predefined totalizer value via the local operation or the Class 2 master!

Example of SET_TOT and MODE_TOT:
If the control variable SET_TOT is set to “1” (1 = Reset the totalizer) the value of the totalizer will be set to “0”. The value of the totalizer will now be added up starting from “0”.
If the totalizer is to retain the value “0”, it will be necessary to set the control variable MODE_TOT to “3” (3 = STOP totalizing). The totalizer will now stop adding up. The control variable SET_TOT can be set to “1” at a later point in time (1 = Reset the totalizer).

Output data display value
The display value allows you to transmit a measured value, calculated in the automation system, directly to Prosonic Flow 93. This measured value is a display value which can be assigned to the main line, the secondary line and the info line of the local display. The display value comprises 4 bytes measured value and 1 byte status. The status is displayed as being OK, uncertain or bad (see Page 58 ff.).

Data transfer from the automation system to Prosonic Flow 93 (display value)

Output byte	Process parameter	Access type	Comment/Data format	Factory setting unit
6, 7, 8, 9	Display value	write	32-bit floating point number (IEEE-754) Illustrated → Page 99	ao
10	Display value status	write	–	–

Note!
The status can be entered manually and is interpreted in accordance with the status coding in Profile Specification 3.0.

Example:
The concentration can be calculated in % $f_{(temperature/density)}$ in an automation system. The temperature and density status is transmitted with the two cyclic measured values and can therefore be shown directly on the display together with the calculated concentration.

Control variables (output data) manufacturer-specific
Prosonic Flow 93 is capable of processing control variables (output data) during cyclic data exchange. An example of this could be activating positive zero return.
The following table shows the control variables (output data) that can be transmitted to Prosonic Flow 93.

Data transfer from the automation system to Prosonic Flow 93 (control)

Output byte	Process parameter	Access type	Comment/Control variable	Factory setting unit
11	Control variable	write	This parameter is manufacturer-specific and can process the following control variables: **Control variable for the control:** 0 → 1: Reserved 0 → 2: Positive zero return CH1 **ON** 0 → 3: Positive zero return CH1 **OFF** 0 → 4: Zero point adjustment CH1 0 → 5: Reserved 0 → 6: Reserved 0 → 7: Reserved 0 → 8: Measuring mode CH1 (unidirectional) 0 → 9: Measuring mode CH1 (bidirectional) 0 → 10-15: Reserved 0 → 16: Positive zero return CH2 **ON** 0 → 17: Positive zero return CH2 **OFF** 0 → 18: Zero point adjustment CH2 0 → 19-21: Reserved 0 → 22: Measuring mode CH2 (unidirectional) 0 → 22: Measuring mode CH2 (bidirectional)	–

✎ Note!
A control variable can be executed via the cyclic data exchange each time the output byte changes from “0” to another bit pattern. The transition from any bit pattern to “0” will not have any effect.

Factory settings for the cyclic measured variables
The following measured variables are configured in Prosonic Flow 93 at the factory:
- Volume flow channel 1 → AI 1
- Sound velocity channel 1 → AI 2
- Flow velocity channel 1 → AI 3
- Volume flow channel 2 → AI 4
- Sound velocity channel 2 → AI 5
- Flow velocity channel 2 → AI 6
- Average volume flow → AI 7
- Average sound velocity → AI 8
- Totalizer 1 (with control variable SET_TOT and MODE_TOT)
- Totalizer 2 (with control variable SET_TOT and MODE_TOT)
- Totalizer 3 (with control variable SET_TOT and MODE_TOT)
- Display value
- Control (Control_Block), manufacturer-specific

If not all measured variables are required, you can use the placeholder “EMPTY_MODULE” (0x00) – which can be found in the GSD file – to deactivate individual measured variables using the configuration software of the Class 1 master.
Examples of configuration → Page 106 ff.

Note!
Only activate the data blocks which are to be processed in the automation system. This will improve the data throughput rate of a PROFIBUS-DP/-PA network.
A double-arrow symbol (direction alternating) will appear on the display to show that Prosonic Flow 93 is communicating with the automation system.

Caution!
- It is essential to adhere to the following sequence when configuring the measured variables: AI 1...AI 8, totalizer 1–3, display value and control.
- The device must be reset once the process variables have been configured in the automation system. This can be effected in either of two ways:
  – Local display: HOME → Block J (SUPERVISION) → Group JAA (SYSTEM) → Function group 804 (OPERATION) → Function 8046 (SYSTEM RESET)
  – Commuwin II: Manufacturer-specific Transducer Block (PROSONIC 93 PBUS) → Partial matrix “Version info” → Function “SYSTEM RESET” (V0H2)
  – Switch supply voltage off and then on again.

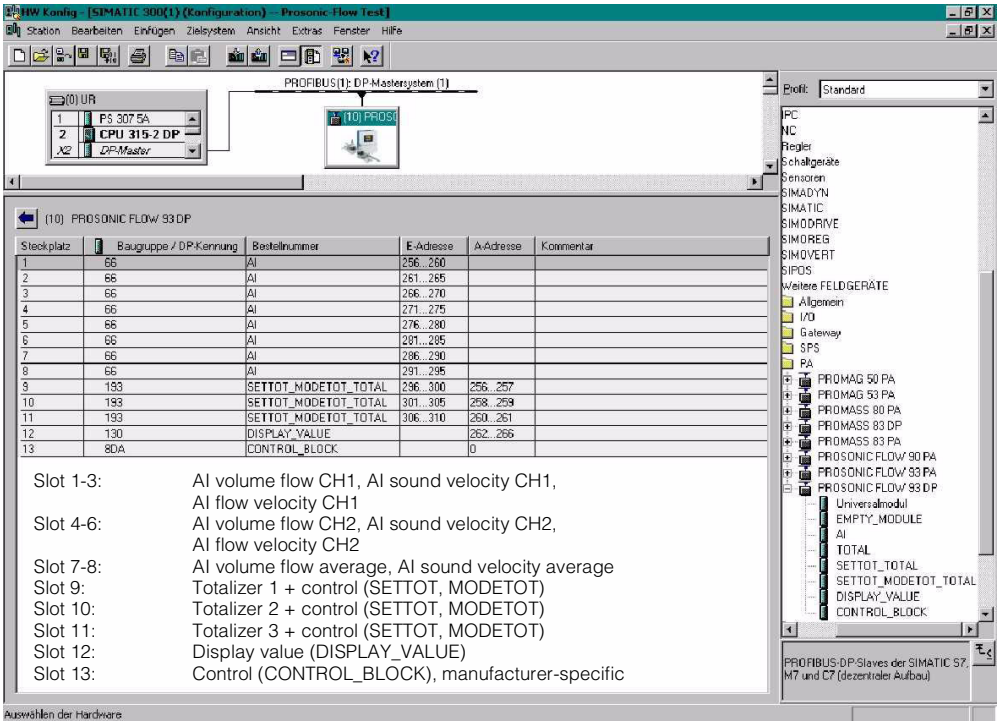
System units
The measured values are transmitted in the scaling (system units) as described in the table on Page 102, to the automation system via cyclic data exchange.
If the system unit of a measured value is changed using local operation, this will not have an immediate effect on the output of the AI Block (Analog Input Block) and therefore will not influence the measured value which is transmitted to the automation system.
The altered scaling (system unit) of the measured value will only be transmitted to the automation system once the function “SET UNIT TO BUS“ in Block G (BASIC FUNCTIONS) → Group GBA/GCA (PROFIBUS-DP/-PA) → Function group 614 (OPERATION) → Function 6141 (SET UNIT TO BUS) has been activated.
This can also be activated using a Class 2 master (e.g. Commuwin II):
Manufacturer-specific Transducer Block (PROSONIC 93 PBUS) → Partial matrix “Device matrix CH1/CH2” → Function “SET UNIT TO BUS” (V6H2)

Examples of configuration
The configuration of a PROFIBUS-DP system is normally effected in the following manner:

1. The field devices (Prosonic Flow 93) which are to be configured are integrated into the configuration program of the automation system via the PROFIBUS-DP network. The GSD file is used here. Measured variables required can be configured “off-line” using the configuration software.
2. The automation system's user program will have to be programmed now. On the one hand, the input and output data are controlled in the user program and on the other hand the location of the measured variables is defined so that they can be processed further.
   An additional measured value configuration module may have to be used in the case of automation systems which do not support the IEEE-754 floating point format.
   It may also be necessary to change the byte sequence (byte swapping) depending on the type of data management employed in the automation system (little-endian format or big-endian format).
3. When configuration has been completed, this will be transferred to the automation system in the form of a binary file.
4. The system can be started now. The automation system will establish a connection to the configured devices. The device parameters which are relevant for the process can now be set using a Class 2 master, e.g. with Commuwin II (see Page 93).

6.4.2 Configuration examples with Simatic S7 HW-Konfig

Example 1:
Full configuration using the manufacturer-specific GSD file



Steckplatz	Baugruppe / DP-Kennung	Bestellnummer	E-Adresse	A-Adresse	Kommentar
1	66	AI	256...260		
2	66	AI	261...265		
3	66	AI	266...270		
4	66	AI	271...275		
5	66	AI	276...280		
6	66	AI	281...285		
7	66	AI	286...290		
8	66	AI	291...295		
9	193	SETTOT_MODETOT_TOTAL	296...300	256...257	
10	193	SETTOT_MODETOT_TOTAL	301...305	258...259	
11	193	SETTOT_MODETOT_TOTAL	306...310	260...261	
12	130	DISPLAY_VALUE		262...266	
13	8DA	CONTROL_BLOCK		0	

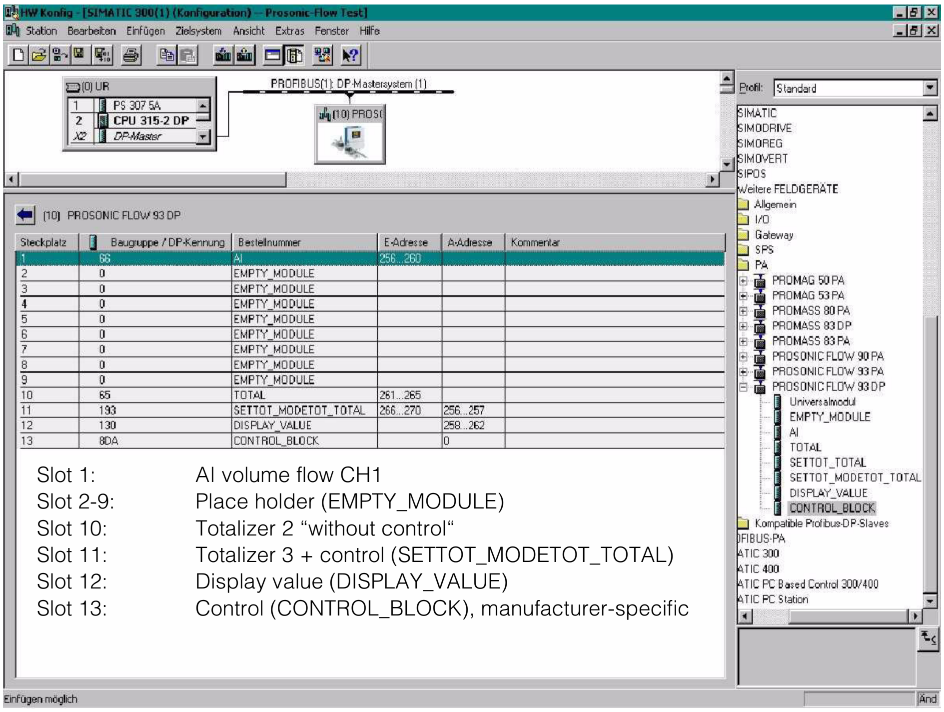
Slot 1-3: AI volume flow CH1, AI sound velocity CH1, AI flow velocity CH1
Slot 4-6: AI volume flow CH2, AI sound velocity CH2, AI flow velocity CH2
Slot 7-8: AI volume flow average, AI sound velocity average
Slot 9: Totalizer 1 + control (SETTOT, MODETOT)
Slot 10: Totalizer 2 + control (SETTOT, MODETOT)
Slot 11: Totalizer 3 + control (SETTOT, MODETOT)
Slot 12: Display value (DISPLAY_VALUE)
Slot 13: Control (CONTROL_BLOCK), manufacturer-specific

F06-93PBxxxx-20-xx-xx-xx-001

This form of configuration activates all data blocks which are supported by Prosonic Flow 93. The significance of SETTOT and MODETOT is described on Page 104.

Configuration data							
Byte length (Input)	Byte length (Output)	Data blocks	Status	Access type	GSD Block designation	GSD Extended block identification	GSD Standard block identification
0...4	–	Volume flow CH1 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
5...9	–	Sound velocity CH1 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
10...14	–	Flow velocity CH1 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
15...19	–	Volume flow CH2 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
20...24	–	Sound velocity CH2 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
25...29	–	Flow velocity CH2 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
30...34	–	Volume flow average + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
35...39	–	Sound velocity average + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
40...44	0 + 1	Totalizer 1 + status + control	active	read + write	SETTOT_MODETOT_ TOTAL	0xC1, 0x81, 0x84, 0x85	0xC1, 0x81, 0x84, 0x85
45...49	2 + 3	Totalizer 2 + status + control	active	read + write	SETTOT_MODETOT_ TOTAL	0xC1, 0x81, 0x84, 0x85	0xC1, 0x81, 0x84, 0x85
50...54	4 + 5	Totalizer 3 + status + control	active	read + write	SETTOT_MODETOT_ TOTAL	0xC1, 0x81, 0x84, 0x85	0xC1, 0x81, 0x84, 0x85
–	6...10	Display value	active	write	DISPLAY_VALUE	0x82, 0x84, 0x08, 0x05	0xA4
–	11	Control variable	active	write	CONTROL_BLOCK	0x20	0x20

Example 2:
Replacing measured variables with placeholders (EMPTY_MODULE) using the manufacturer-specific GSD file:

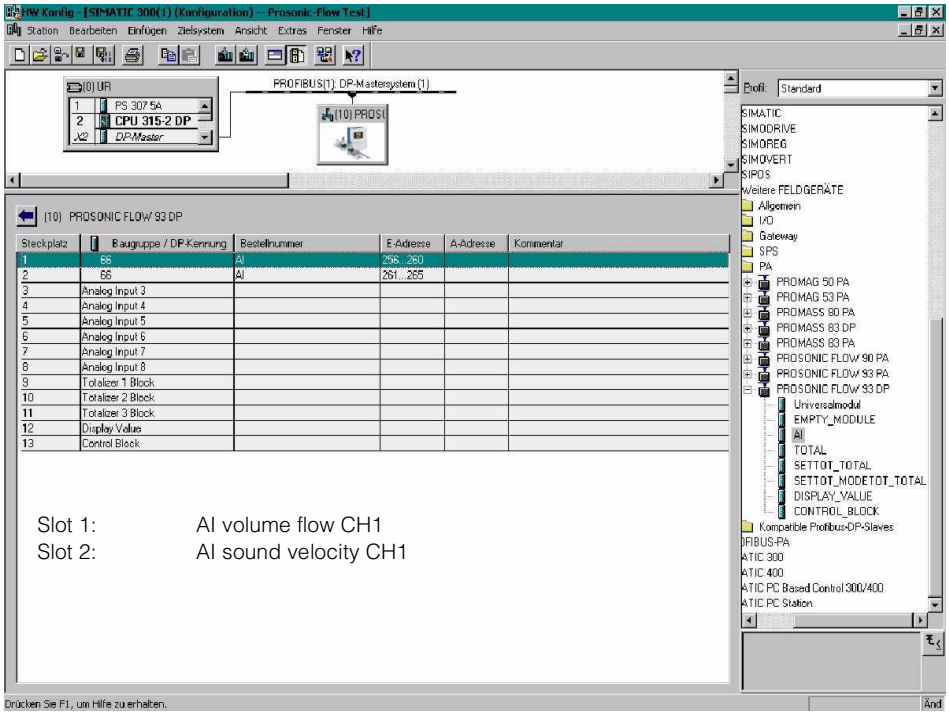


F06-93PBxxxx-20-xx-xx-xx-002

This form of configuration activates the volume flow channel 1, totalizer 2 “without control”, totalizer 3 with control, display value and the manufacturer-specific control block. In this example, totalizer 2 “without control” only provides the measured value and thus cannot be controlled. It is not possible to reset or stop totalizer 2.

Configuration data							
Byte length (Input)	Byte length (Output)	Data blocks	Status	Access type	GSD Block designation	GSD Extended block identification	GSD Standard block identification
0...4	–	Volume flow CH1 + Status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
–	–	Placeholder	inactive	–	EMPTY_MODULE	0x00	0x00
5...9	–	Totalizer 2 + status	active	read	TOTAL	0x41, 0x84, 0x85	0x41, 0x84, 0x85
10...14	0 + 1	Totalizer 3 + status + control	active	read + write	SETTOT_MODETOT_ TOTAL	0xC1, 0x81, 0x84, 0x85	0xC1, 0x81, 0x84, 0x85
–	2...6	Display value	active	write	DISPLAY_VALUE	0x82, 0x84, 0x08, 0x05	0xA4
–	7	Control variable	active	write	CONTROL_BLOCK	0x20	0x20

Example 3:
Configuration of the measured variables without placeholders (EMPTY_MODULE) using the manufacturer-specific GSD file.



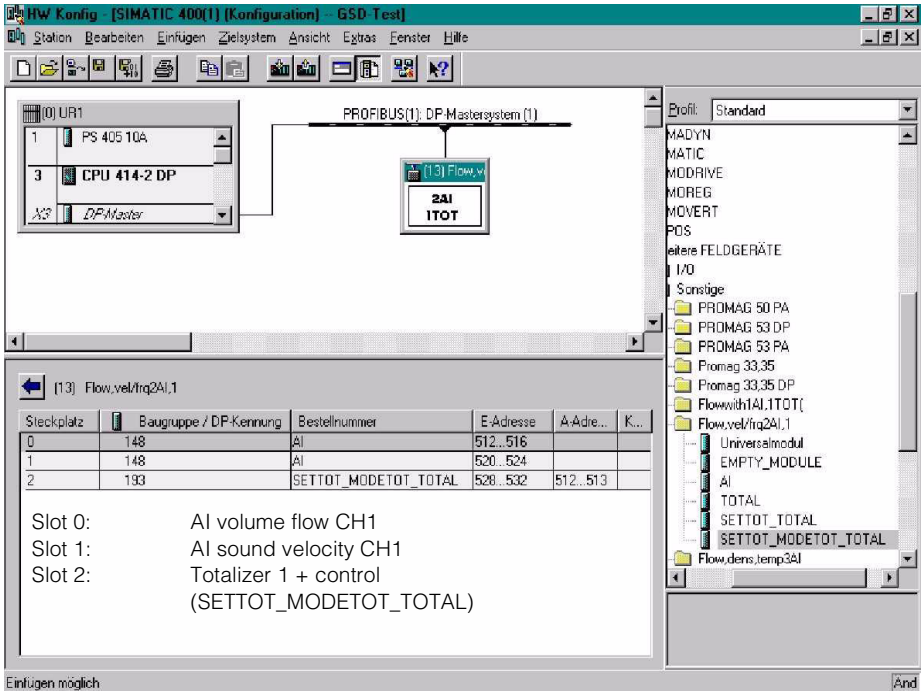
F06-93PBxxxx-20-xx-xx-xx-003

This configuration transmits the volume flow channel 1 and the sound velocity channel 1.

Note!
If no further measured variables are required, the placeholders will not have to be used. This only applies if no manufacturer-specific controls are used.

Configuration data							
Byte length (Input)	Byte length (Output)	Data blocks	Status	Access type	GSD Block designation	GSD Extended block identification	GSD Standard block identification
0...4	–	Volume flow CH1 + Status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94
5...9	–	Sound velocity CH1 + status	active	read	AI	0x42, 0x84, 0x08, 0x05	0x94

Example 4:
Full configuration using the Profile GSD files PA039741.gsd (RS 485) and PA139741.gsd (IEC 61158-2 (MBP))



F06-93PBxxxx-20-xx-xx-xx-004

This configuration transmits the volume flow channel 1, the sound velocity channel 1 and the totalizer 1 + control.

Configuration data							
Byte length (Input)	Byte length (Output)	Data blocks	Status	Access type	GSD Block designation	GSD Extended block identification	GSD Standard block identification
0..4	–	Volume flow CH1 + status	active	read	AI	–	0x94
5...9	–	Sound velocity CH1 + status	active	read	AI	–	0x94
10...14	0...1	Totalizer 1 + status + control	active	read + write	SETTOT_MODETOT_ TOTAL	–	0xC1, 0x81, 0x84, 0x85

Note!
There is no difference between the block ID's of the two Profile GSD files PA039741.gsd (RS 485) and PA139741.gsd (IEC 61158-2 (MBP)).
There is, however, a difference in the baud rates that are supported and the Min_Slave_Interval.

Status code

The status codes which are supported by the AI Blocks (Analog Input), TOT (Totalizers 1...3) and display value are listed in the following table.
The coding of the status corresponds to the "PROFIBUS-PA Profile for Process Control Devices - General Requirements" V 3.0:

Status Code	Meaning	Device status	Limits
0x1C 0x1D 0x1E 0x1F	out of operation	bad	OK LOW_LIM HIG_LIM CONST
0x10 0x11 0x12	sensor error below sensor limit sensor limit exceeded	bad	NO_LIMIT LOW_LIM HIG_LIM
0x0C 0x0D 0x0E 0x0F	device failure	bad	OK LOW_LIM HIG_LIM CONST
0x18	no communication	bad	NO_LIMIT
0x08 0x09 0x0A 0x0B	function block not available	bad	OK LOW_LIM HIG_LIM CONST
0x40 0x41 0x42 0x43	non-specific	uncertain	OK LOW_LIM HIG_LIM CONST
0x44 0x45 0x46 0x47	last useable value	uncertain	OK LOW_LIM HIG_LIM CONST
0x48 0x49 0x4A 0x4B	substitute set	uncertain	OK LOW_LIM HIG_LIM CONST
0x4C 0x4D 0x4E 0x4F	values which are not saved after the device or parameters have been reset	uncertain	OK LOW_LIM HIG_LIM CONST
0x50 0x51 0x52 0x53	measured value of sensor inaccurate	uncertain	OK LOW_LIM HIG_LIM CONST
0x60 0x61 0x62 0x63	simulated value	uncertain	OK LOW_LIM HIG_LIM CONST
0x80 0x81 0x82 0x83	measuring system OK	good	OK LOW_LIM HIG_LIM CONST
0x84 0x85 0x86 0x87	change of parameters	good	OK LOW_LIM HIG_LIM CONST
0x8C 0x8D 0x8E 0x8F	critical alarm: alarm limits exceeded	good	OK LOW_LIM HIG_LIM CONST
0x88 0x89 0x8A 0x8B	warning: early warning limit exceeded	good	OK LOW_LIM HIG_LIM CONST

6.5 Application-specific commissioning

6.5.1 Zero point adjustment

A 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 with very low 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 sensor or by using existing valves and gates (Fig. 69).
  – 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 E+H service centre.
- You can view the zero point value currently valid using the “ZERO POINT” function (see the “Description of Device Functions” manual).
  – PROFIBUS interface / configuration program: manufacturer-specific Transducer Block (PROSONIC 93 PBUS) → Matrix “Sensor data” → ZERO POINT CH1 (V4H1) / CH2 (V7H1)
  – Local display: HOME → E → ± → BASIC FUNCTIONS → E → ± → SENSOR DATA → E → ± → CALIBRATION DATA → E → ZERO POINT

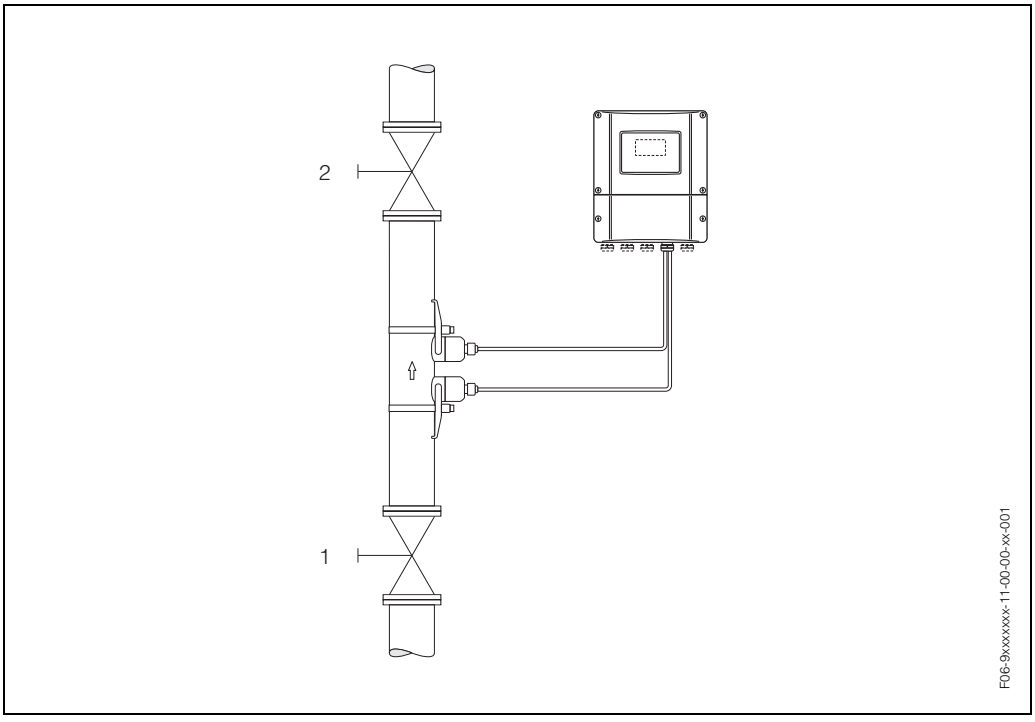


Fig. 69: Zero point adjustment and shut-off valves

Performing a zero point adjustment (with local display)

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 → ± → BASIC FUNCTIONS
   BASIC FUNCTIONS → E → ± → PROCESS PARAMETER CH1/CH2
   PROCESS PARAMETER → E → ± → CALIBRATION
   CALIBRATION → E → ZERO POINT ADJUSTMENT
6. If the function matrix is still locked, then you are automatically prompted to enter the access code when pressing the ± keys. 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 zero point adjustment is in progress.
   – If the flow 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 completes, the “ZERO ADJUST” function reappears on the display.
8. Back to the HOME position
   – Press and hold down the Esc keys (Esc − +) for longer than three seconds.
   – Repeatedly press and release the Esc keys (Esc − +).

Performing a zero point adjustment (with configuration program 💻)

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. Open the configuration program and then the Physical Block.
6. Check whether the write protection for software and hardware is disabled:
   – Software → WRITE LOCKING (V3H0), disabled = 2457, enabled = 0
   – Hardware → HW WRITE PROTEC (V3H1), disabled = 0, enabled = 1

   Disable the write protection, if necessary → Page 78
7. Open the manufacturer-specific Transducer Block (PROSONIC 93 PBUS).
8. Enable the programming level:
   – Enter the access code in the “ACCESS CODE (V2H0)” parameter (factory setting = 93).
   – “ACCESS CUSTOMER” should now be displayed in the “STATUS ACCESS (V2H2)” parameter.
9. Start zero point adjustment:
   – Select the setting “START” in the “ZERO POINT ADJUSTMENT (V5H0)” device matrix function.
   – Start the adjustment by sending this setting to the field device. If the fluid velocity exceeds 0.1 m/s, the error message “Adjust zero fail.” appears in the “Version info” matrix / “ACT. SYS. CONDITION (V0H0)” function.
10. Close the configuration program.

6.6 Data storage device (DAT, F-Chip)

T-DAT (transmitter DAT)
The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.
The operator has to transfer specific parameterisation values from the EEPROM to the T-DAT and vice versa. Detailed instructions regarding this can be found in the "Description of Device Functions" manual (function "T-DAT SAVE/LOAD", No.1009).

F-CHIP (function chip)
The F-Chip is a microprocessor chip that contains additional software packages that extend the functionality and application possibilities of the transmitter.
In the case of a later upgrade, the F-Chip can be ordered as an accessory (see Page 119) and can simply be plugged onto the I/O board (see Page 136). After start up, the software is immediately made available to the transmitter.

Caution!
To ensure an unambiguous assignment, the F-Chip is coded with the transmitter serial number once it is plugged onto the I/O board. Thus, it **cannot** be used with other transmitters.

7 Maintenance

The Prosonic Flow 93 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.

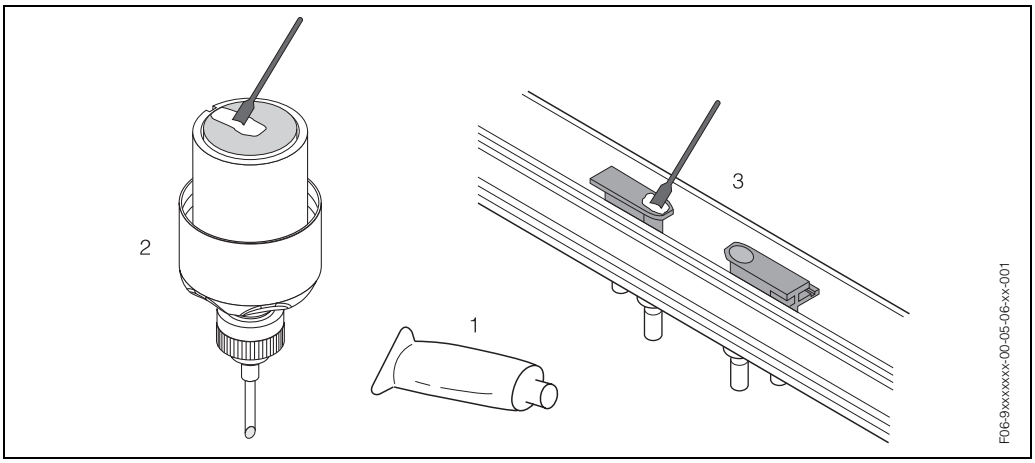


Fig. 70: Application of the coupling fluid

1 Coupling fluid
2 Sensor surface Prosonic Flow W
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 E+H service organisation can provide detailed information on the ordering codes of your choice.
set

Accessory	Description	Order Code
Transmitter Wall-mount housing PROline Prosonic Flow 93 PROFIBUS-DP/-PA	Transmitter for replacement or for stock. Use the ordering code to define the following specifications: – Approvals – Degree of protection / version – Cable entries – Display / power supply / operation – Software – Outputs / inputs	93XXX–XXXXX ********
Mounting set for transmitter 90 and 93	Mounting set for the wall-mount housing (remote version). Suitable for: – Wall mounting – Pipe mounting – Panel mounting Mounting set for aluminium 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 –20...+80 °C; DN 50...300 Insertion sensor: –40...+80 °C; DN 200...4000	 DK9WF – A DK9WF – B 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	 DK9PF – A DK9PF – B DK9PF – E DK9PF – 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, dual 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 sensors	– 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 sensors	– Without mounting support tool – 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 sensors	Sensor cable conduit adapter incl. sensor cable glands M20x1.5 Sensor cable conduit adapter incl. sensor cable glands ½" NPT Sensor cable conduit adapter incl. sensor cable glands G½" NPT	DK9CA –1 DK9CA –2 DK9CA –3
Acoustic coupling medium	– Coupling medium –40...+80 °C, standard – 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	DK9CM – 1 DK9CM – 2 DK9CM – 3 DK9CM – 4 DK9CM – 5 DK9CM – 6
Sound velocity measuring sensor DDU 18	– Sensor –40...+80 °C – Sensor 0...+170 °C	50091703 50091704
Wall thickness measuring sensor DDU 19	Sensor for measuring pipe wall thickness	50091713
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 E+H representative for more information.	DKA80 – *

Accessory	Description	Order Code
FieldTool	Configuration and service software for flowmeters in the field: – Commissioning, maintenance analysis – Configuring measuring devices – Service functions – Visualisation of process data – Trouble-shooting – Controlling the “FieldCheck” tester/simulator Contact your E+H representative for more information.	DXS10 – *****
FieldCheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the “FieldTool” software package, test results can be imported into a database, printed and used for official certification. Contact your E+H 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. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

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 duly completed “Declaration of contamination” form. You will find a preprinted form at the back of this manual.

Check the display	
No display visible and no output signals present.	1. Check supply voltage → Terminal 1, 2 (Page 49) 2. Check device fuse → Page 140 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. Measuring electronics defective → Order spare part → Page 136
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 138 2. Display module defective → Order spare part → Page 136 3. Measuring electronics defective → Order spare part → Page 136
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the +/– keys and switch on the measuring device again. The display text will appear in English (default) and is displayed at maximum contrast.

▼

Error messages on display	
Errors which occur during commissioning or measuring operation are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows (example): – Error type: **S** = System error, **P** = Process error – Error message type: ϟ = 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 61 ff.! • The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.	
Error number: No. 001 – 399 No. 501 – 699	System error (device error) has occurred → Page 125 ff.
Error number: No. 400 – 499 No. 700 – 799	Process error (application error) has occurred → Page 125 ff.

▼

Faulty connection to control system	
No connection can be made between the control system and the flowmeter. Check the following points:	
Supply voltage Transmitter	Check supply voltage → Terminal 1/2 (Page 49)
Device fuse	Check device fuse → Page 140 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
Fieldbus connection	PROFIBUS-DP: Check data line: Terminal 26 = B, Terminal 27 = A (Page 49) PROFIBUS-PA: Check data line: Terminal 26 = PA+, Terminal 27 = PA– (Page 49)
Fieldbus connector (only for PROFIBUS-PA, option)	– Check pin assignment/wiring → Page 50 – Check connection between connector/fieldbus port. Is the coupling ring tightened correctly?
Fieldbus voltage (only for PROFIBUS-PA)	Check that a min. bus voltage of 9 V DC is present at terminals 26/27. Permissible range: 9 ... 32 V DC
Network structure	Check permissible fieldbus length and number of spurs: PROFIBUS-DP → Page 41 ff. PROFIBUS-PA → Page 44 ff.
Basic current	Is there a basic current of min. 11 mA?
Bus address	Check bus address: Ensure there are no double-assignments
Terminators	Has the PROFIBUS network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise interference may affect communication.
Current consumption Permissible feed current (only for PROFIBUS-PA)	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all fieldbus stations) must not exceed the max. permissible feed current of the fieldbus power supply.

▼

System or process error messages
System or process errors which occur during commissioning or during a measuring operation can also be displayed in the manufacturer-specific device controls using the Commuwin II operating program → Page 125 ff..

▼

Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → Page 135

9.2 System and process error messages

General notes
The measuring device always assigns system and process errors which occur to two types of error messages, resulting in different weightings.

Error message type "Fault message":
- If this message occurs, measuring operation is immediately interrupted or stopped!
- Display on the PROFIBUS → Fault messages are relayed to downstream function blocks or higher-level process control systems with the status "BAD" of the corresponding process variable.
- The fault messages can be displayed in the automation system by means of the manufacturer-specific diagnosis message.
- Local display → A lightning symbol (ϟ) flashes on the display.

Error message type "Notice message":
- Normal measuring operation continues despite this message!
- Display on the PROFIBUS → Notice messages are relayed to downstream function blocks or higher-level process control systems with the status "UNCERTAIN" of the corresponding process variable.
- The fault messages can be displayed in the automation system by means of the manufacturer-specific diagnosis message.
- Local display → An exclamation mark (!) flashes on the display.

Serious system errors, e.g. electronic module defects, are always categorised and displayed as "Fault messages" by the measuring device. On the other hand, the measuring system interprets simulations and positive zero return as "Notice messages".

Error messages in the configuration program (Class 2 master) → see table
In Prosonic Flow 93, system/process errors are recognised and reported in the Transducer and Analog Input Block. The following table contains a list of device status messages pertaining to the Analog Input Blocks (PROFIBUS Profile 3.0) as well as a description of the possible device status messages on the display.

Error messages on the local display → see table

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
ROM / RAM failure	S CRITICAL FAILURE ϟ # 001	1	device failure	BAD 0x0F constant	*Cause:* System error. ROM / RAM error. Error when accessing the program memory (ROM) or random access memory (RAM) of the processor. *Remedy:* Replace the amplifier board. Spare parts → Page 136
Amplifier EEPROM failure	S AMP HW EEPROM ϟ # 011	11	device failure	BAD 0x0F constant	*Cause:* System error. Measuring amplifier has faulty EEPROM *Remedy:* Replace the amplifier board. Spare parts → Page 136

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Amplifier EEPROM data inconsistent	S AMP SW-EEPROM ϟ # 012	12	device failure	BAD 0x0F constant	*Cause:* System error. Error when accessing data of the measuring amplifier EEPROM. *Remedy:* Execute a warm start (= start up the measuring system without network interruption). • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Version info (V0H2) • Local display: SUPERVISION → SYSTEM → OPERATION → SYSTEM RESET (→ RESTART SYSTEM)
T-DAT failure	S TRANSM. HW-DAT ϟ # 041	41	device failure	BAD 0x0F constant	*Cause:* System error 1. T-DAT is defective 2. T-DAT is not plugged into the amplifier board (missing). *Remedy:* 1. Replace the T-DAT. Spare parts → Page 136 Check the spare part set number to ensure that the new replacement DAT is compatible with the measuring electronics. 2. Plug T-DAT into the amplifier board → Page 138
T-DAT data inconsistent	S TRANSM. SW-DAT ϟ # 042	42	device failure	BAD 0x0F constant	*Cause:* System error. Error accessing the calibration values stored in the T-DAT. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 138 2. Replace the T-DAT if it is defective. Spare parts → Page 136 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. 3. Replace measuring electronics board if necessary. Spare parts → Page 136

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Compatibility Amp. - I/O Mod.	S A / C COMPATIB. ϟ # 051	51	device failure	BAD 0x0F constant	*Cause:* The I/O board and the amplifier board are not compatible. *Remedy:* Use only compatible assemblies and boards. Check the compatibility of the assemblies used. Check the: – Spare part set number – Hardware revision code
F-CHIP failure	S HW F-CHIP ϟ # 061	61	device failure	BAD 0x0F constant	*Cause:* Transmitter F-Chip 1. F-Chip is defective. 2. F-Chip is not plugged into the I/O board or is missing. *Remedy:* 1. Replace the F-Chip. Accessories → Page 136 2. Plug the F-Chip into the I/O board → Page 138
Interruption between sensor and transmitter CH1	S SENS. DOWN CH1 ϟ # 082	82	sensor failure	BAD 0x13 constant	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – 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 Change sensor type specification: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Sensor data (V3H1) • Local display: BASIC FUNCTIONS → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Interruption between sensor and transmitter CH2	S SENS. DOWN CH2 ϟ # 083	83	sensor failure	BAD 0x13 constant	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – 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 Change sensor type specification: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Sensor data (V3H1) • Local display: BASIC FUNCTIONS → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE
Interruption between sensor and transmitter CH1	S SENSOR UP CH1 ϟ # 085	85	sensor failure	BAD 0x13 constant	*Cause:* System error. The connection between sensor and transmitter is interrupted. *Remedy:* – 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 Change sensor type specification: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Sensor data (V3H1) • Local display: BASIC FUNCTIONS → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Interruption between sensor and transmitter CH2	S SENSOR UP CH2 ϟ # 086	86	sensor failure	BAD 0x13 constant	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – 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 Change sensor type specification: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Sensor data (V3H1) • Local display: BASIC FUNCTIONS → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE
TOT could not be restarted	S CHECKSUM. TOTAL. ϟ # 111	111	device failure	BAD 0x0F constant	*Cause:* System error. Totalizer checksum error *Remedy:* 1. Restart the measuring device 2. Replace the amplifier board if necessary. Spare parts → Page 136
SW. Compatibility AMP-I/O Modul	S A / C COMPATIB. ϟ # 121	121	device failure	BAD 0x0F constant	*Cause:* System error. Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). *Remedy:* Replace module with lower software version. Spare parts → Page 136

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Save to T-DAT failed	S LOAD T-DAT ϟ # 205	205	device failure	BAD 0x0F constant	*Cause:* System error. Data backup to T-DAT failed or error when accessing the calibration values stored in the T-DAT. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 138 2. Replace the T-DAT if it is defective. Spare parts → Page 136 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. 3. Replace measuring electronics board if necessary. Spare parts → Page 136
Restore from T-DAT failed	S SAVE T-DAT ϟ # 206	206	device failure	BAD 0x0F constant	*Cause:* System error. Data backup to T-DAT failed or error when accessing the calibration values stored in the T-DAT. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 138 2. Replace the T-DAT if it is defective. Spare parts → Page 136 Check the spare part set number to ensure that the new replacement DAT is compatible with the measuring electronics. 3. Replace measuring electronics board if necessary. Spare parts → Page 136
Communication failure	S COMMUNICAT. I/O ϟ # 261	261	no communication	BAD 0x18 no limits	*Cause:* System error. Communication error. No data reception between amplifier and I/O board or faulty internal data transfer. *Remedy:* Check whether the electronics boards are correctly inserted in their holders. → Page 138

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Attenuation of acoustic measurement section too high	S SIGNAL LOW CH1 ϟ # 392	392	device failure	BAD 0x0F constant	*Cause:* System error. Attenuation of acoustic measurement section too high. *Remedy:* – 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 distance (installation dimensions). – Reduce the number of traverses if possible.
	S SIGNAL LOW CH2 ϟ # 393	393			
Pipe data ? CH1	P PIPE DATA ? CH 1 ϟ # 469	469	device failure	BAD 0x0F constant	*Cause:* The inner diameter is negative. *Remedy:* In the function group PIPE DATA check the values of the functions CIRCUMFERENCE and WALL THICKNESS resp. LINER THICKNESS.
Pipe data ? CH2	P PIPE DATA ? CH 2 ϟ # 470	470			
Sound velocity in CH1 outside the range	P S.V. RANGE CH1 ϟ # 492	492	non specific	BAD 0x03 constant	*Cause:* Process error. Sound velocity in channel 1/2 is outside the search range of the transmitter. *Remedy:* – 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 93 (BA 077D/06/en) manual under the SOUND VELOCITY LIQUID (6542) function or under Commuwin II → Parameter SOUND VELOCITY LIQUID ((V9H2).
Sound velocity in CH2 outside the range	P S.V. RANGE CH2 ϟ # 493	493			

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Interference CH1	P INTERFERENCE CH1 ! # 495	495	non specific	UNCERTAIN 0x43 constant	*Cause:* 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. *Remedy:* – In the SENSOR CONFIGURATION function, change the number of traverses from 2 or 4 to 1 or 3 and mount the sensors accordingly.
Interference CH2	P INTERFERENCE CH2 ! # 496	496			
Positive zero return active CH1	S POS. 0-RET CH1 ! # 602	602	sensor conversion not accurate (measured value from sensor not accurate)	UNCERTAIN 0x53 constant	*Cause:* System error Positive zero return channel 1 active *Remedy:* Switch off positive zero return • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Device matrix CH1/CH2 (V8H3) • Local display: BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → POSITIVE ZERO RETURN (→ OFF)
Positive zero return active CH2	S POS. 0-RET CH2 ! # 603	603			
Positive zero return active CH1&2	S POS. 0-RET CH1&2 ! # 604	604	sensor conversion not accurate (measured value from sensor not accurate)	UNCERTAIN 0x53 constant	*Cause:* System error Positive zero return channel 1+2 active. *Remedy:* Switch off positive zero return • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Device matrix CH1+CH2 (V8H3) • Local display: BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → POSITIVE ZERO RETURN (→ OFF)

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Simulation failsafe active	S SIM. FAILSAFE ! # 691	691	substitute set	UNCERTAIN 0x48...0x4B low/high constant	*Cause:* System error Simulation of response to error is active. *Remedy:* Switch off simulation: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Version info (V4H2) • Local display: SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
Simulation of measuring CH1 active	S SIM. MEASUR. CH1 ! # 694	694	simulated value (manually defined value)	UNCERTAIN 0x60...0x63 low/high constant	*Cause:* System error Channel 1 volume flow simulation active *Remedy:* Switch off simulation: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Version info (V4H0) • Local display: SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)
Simulation of measuring CH2 active	S SIM. MEASUR. CH2 ! # 695	695	simulated value (manually defined value)	UNCERTAIN 0x60...0x63 low/high constant	*Cause:* System error Channel 2 volume flow simulation active *Remedy:* Switch off simulation: • PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Service info (V5H0) • Local display: SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)
Zeropoint adjustment is not possible	P 0-ADJ. FAIL CH1 ϟ # 743	743	non specific	UNCERTAIN 0x40 no limits	*Cause:* Zero point adjustment of channel 1 is not possible or was cancelled. *Remedy:* Make sure that zero point adjustment is carried out at “zero flow” only (v = 0 m/s) → Page 113.

Device status and diagnosis message (Control system)	Device status message (Display)	No.	Initial status Analog Input Block/ Totalizer Block	Measured value Quality / Substatus / Alarm limit	Cause/remedy
Zeropoint adjustment is not possible	P 0-ADJ. FAIL CH2 ϟ # 744	744	non specific	UNCERTAIN 0x40 no limits	*Cause:* Zero point adjustment of channel 2 is not possible or was cancelled. *Remedy:* Make sure that zero point adjustment is carried out at “zero flow” only (v = 0 m/s) → Page 113.
No communication to amplifier	–	–	device failure	BAD 0x0F constant	*Cause:* Communication error. No communication to the amplifier. *Remedy:* 1. Switch power supply off and then on again 2. Check whether the electronics boards are correctly inserted in their holders → Page 138

9.3 Process errors without messages

Symptoms	Rectification
Remark: You may have to change or correct certain settings in parameters in order to rectify the fault. The following parameters 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 the wiring of the sensor cable → Page 46 If necessary, swap the connections of the terminals “up” and “down”. 2. Change the sign of the flow rate variable: – PROFIBUS: Manufacturer-specific Transducer Block → Device matrix CH1/CH2 (V8H1) – Local display: HOME → BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → INSTALL DIRECT. SENSOR
Measured value reading fluctuates even though flow is steady.	1. Check the fluid for presence of gas bubbles. 2. Increase the following values: – PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Device matrix CH1/CH2 → FLOW DAMPING (V8H2), Analog Input function block → RISING TIME (V1H8) – Local display: HOME → BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → FLOW DAMPING 3. Increase the value for the display damping: – PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Display functions → DISPLAY DAMPING (V3H1) – Local display: HOME → USER INTERFACE → OPERATION → BASIC CONFIGURATION→ DISPLAY DAMPING
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. Enter a value for the low flow cutoff or increase this value: – PROFIBUS (Commuwin II): Manufacturer-specific Transducer Block → Device matrix CH1/CH2 → ON-VALUE LOW FLOW CUTOFF (V3H1) – Local display: BASIC FUNCTIONS → PROCESS PARAMETER → CONFIGURATION → ON VALUE LOW FLOW CUTOFF
The fault cannot be rectified or some other fault not described above has occurred. In these instances, please contact your E+H service organisation.	The following options are available for tackling problems of this nature: **Request the services of an E+H 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 data (Page 9 ff.): Order code and serial number **Returning devices to E+H** The procedures on Page 8 must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. Always enclose a duly completed “Declaration of Contamination” form with the flowmeter. You will find a copy of this form at the back of these Operating Instructions. **Replace transmitter electronics** Components in the measuring electronics defective → Order spare part → Page 136

9.4 Spare parts

Section 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 E+H service organisation by providing the serial number printed on the transmitter nameplate (see Page 9).

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

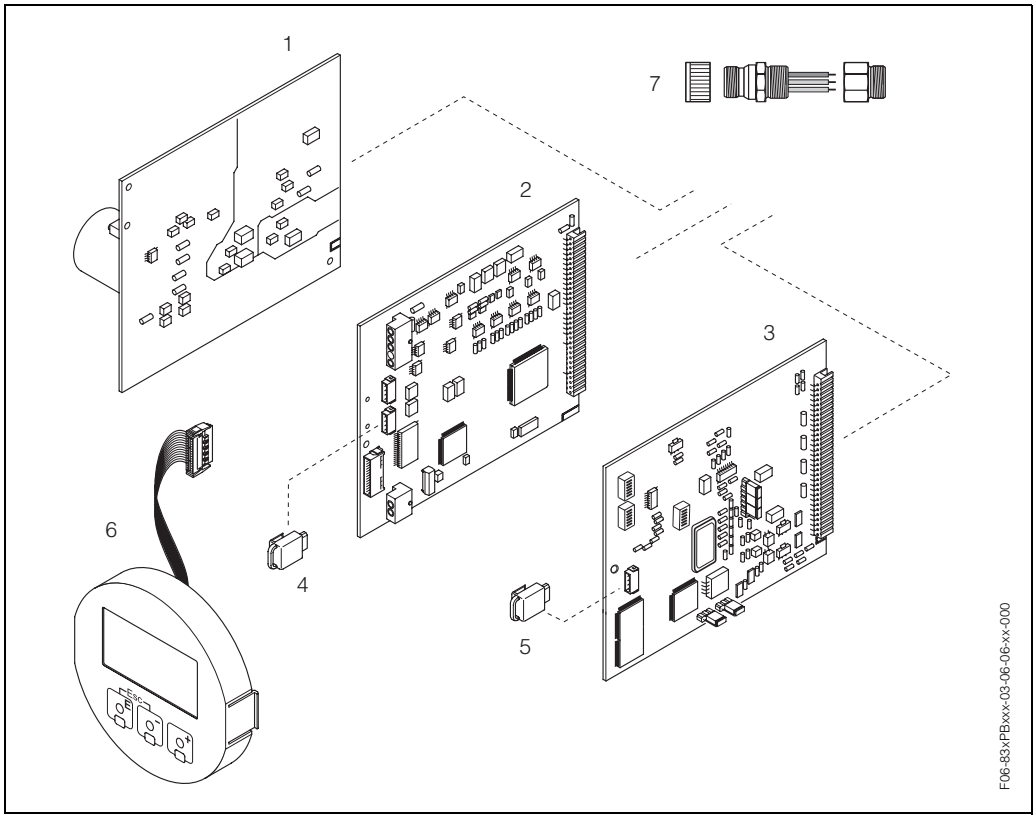


Fig. 71: Spare parts for Prosonic Flow 93 transmitter (wall-mount housing)

1 Power unit board (85...260 V AC, 20...55 V AC, 16...62 V DC)
2 Amplifier board
3 I/O board (Type PROFIBUS-DP/-PA)
4 T-DAT (transmitter data storage device)
5 F-Chip (function chip for optional software)
6 Display module
7 Fieldbus connectors comprising protective cap, connector, adapter piece PG 13.5/M20.5 (only for PROFIBUS-PA, Order no. 50098037).

9.5 Installing and removing electronics boards

- 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, purposely 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. 72):

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):
   – Sensor signal cable plug (7.1)
   – Unplug ribbon cable (3) of the display module
4. Remove the cover (4) from the electronics compartment by loosening the screws.
5. Remove the boards (6, 7, 8):
   Insert a thin pin into the opening provided (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.

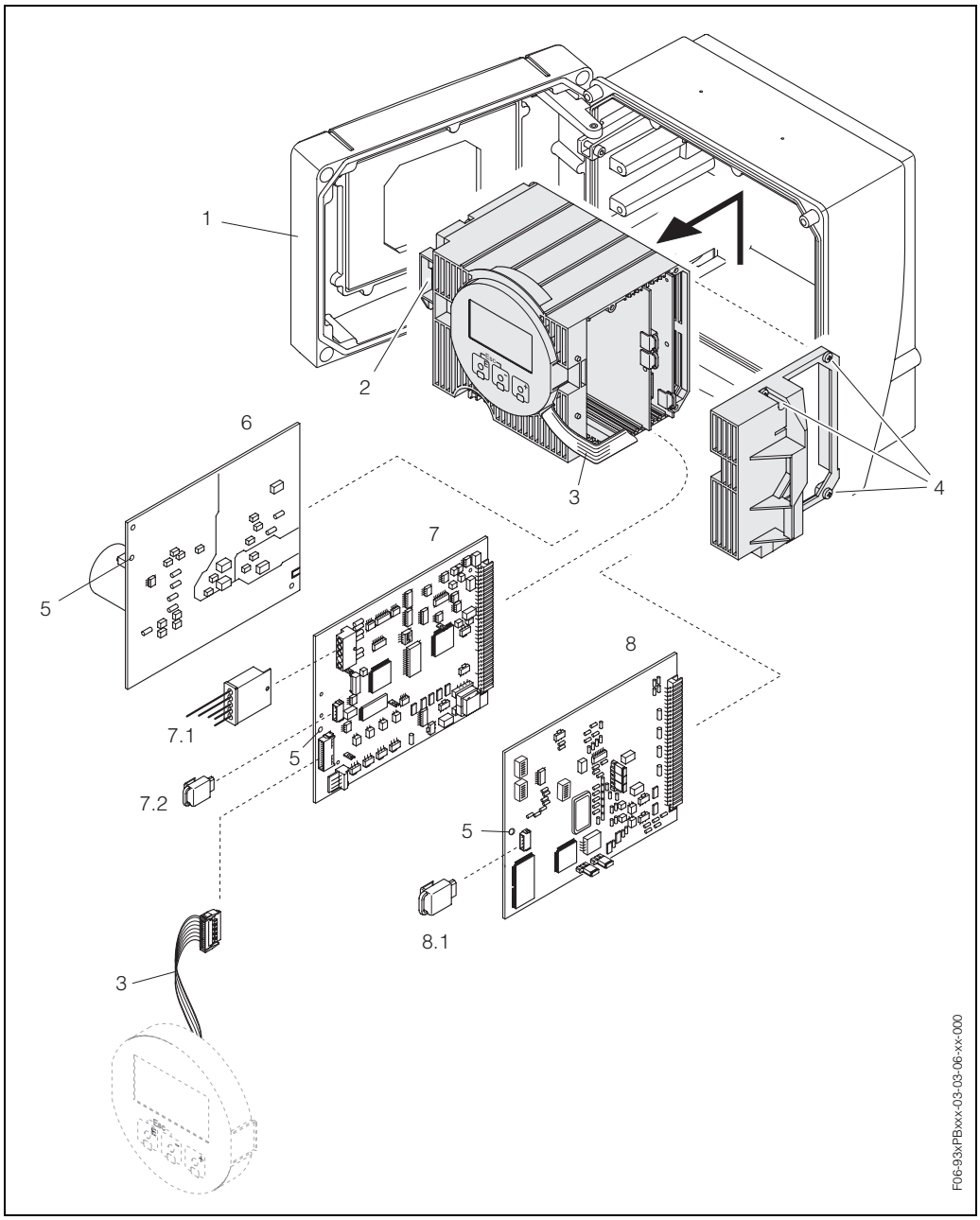


Fig. 72: Wall-mount housing: Removing and installing electronics boards

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
7.2 T-DAT (transmitter data storage device)
8 I/O board (Type PROFIBUS-DP/-PA)
8.1 F-Chip™ (function chip for optional software)

9.6 Installation / removal of sensor W “Insertion”

The active part of the flowrate measuring 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.

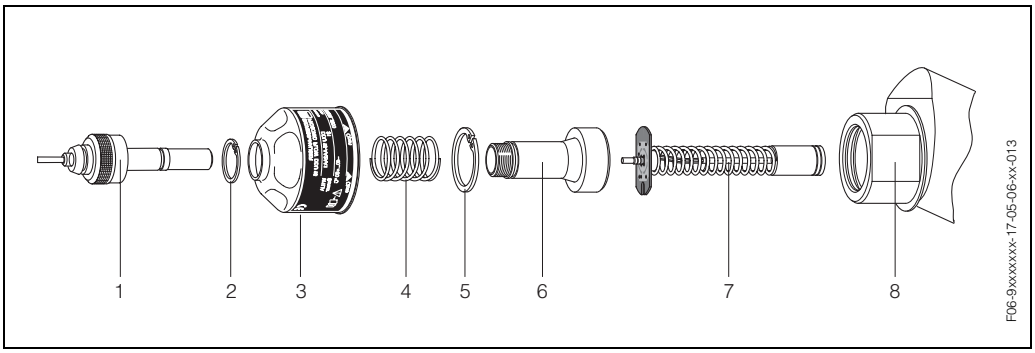


Fig. 73: Flowrate measuring sensor W “Insertion”: installing/removing

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

9.7 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 device fuse is on the power unit board (Fig. 74).
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove power unit board → Page 137
3. Remove 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 / 250 V; 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.

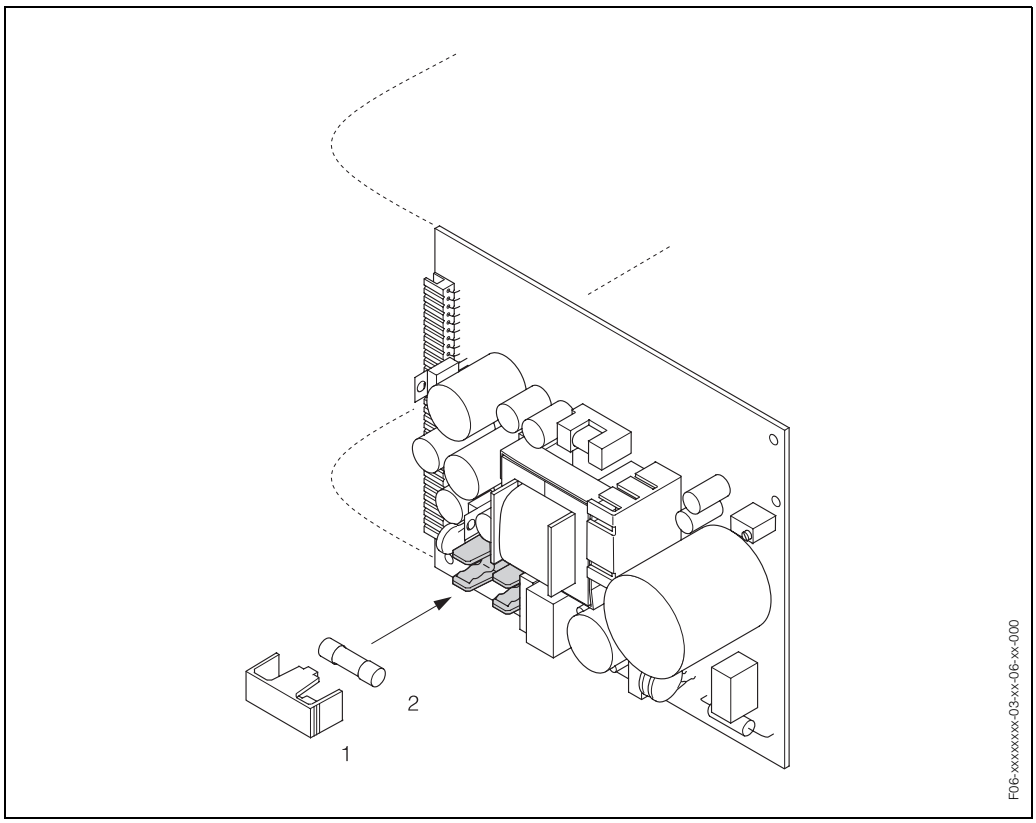


Fig. 74: Replacing the device fuse on the power unit board

1 Protection cap
2 Device fuse

9.8 Software history

Software version / date	Changes to software	Changes to documentation
Amplifier		
V 1.01.00 / 05.2002	Original software Compatible with: – FieldTool – Commuwin II (version 2.07.02 and higher) – PROFIBUS-DP/-PA version 3.0	–
V 1.05.00 / 12.2002	Software adaptation new functionalities	Prosonic Flow U sensors Prosonic Flow 93C
I/O board, communication module (inputs/outputs)		
V 2.00.01 / 05.2002	Original software	–
V 2.02.00 / 12.2002	Software adaptation new functionalities	• new error massages – PIPE DATA CH1/CH2 (#469–470) – INTERFERENCE CH1/CH2 (#495–496) • Update Commuwin II Matrix • Update GSD

10 Technical data

10.1 Technical data at a glance

10.1.1 Application

- Measuring the flow rate of liquids 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 measuring sensors.
Two versions are available:
- Version for installation in the safe zone and for Ex Zone 2
- Version for installation in Ex Zone 1 (see separate additional Ex documentation)

Transmitter:
- Prosonic Flow 93 PROFIBUS-DP/-PA

Measuring sensors:
- Prosonic Flow P (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
- Prosonic Flow DDU 18 sound velocity measuring sensors
  for nominal diameters DN 50...3000
- Prosonic Flow DDU 19 wall thickness measuring sensor
  for wall thicknesses of 2...50 mm for steel pipes and
  for wall thicknesses of 4...15 mm for plastic pipes (for limited service at PTFE or PE pipes)

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

10.1.4 PROFIBUS output variables

Output signal	PROFIBUS-DP/-PA interface: PROFIBUS-DP/PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), Profile Version 3.0, galvanically isolated
Signal on alarm	PROFIBUS-DP/-PA interface: Status and alarm messages in accordance with PROFIBUS-PA Profile Version 3.0.
Current consumption	11 mA
Permissible feed voltage	9...32 V, not intrinsically safe
FDE (Fault Disconnection Electronic)	0 mA
Data transmission rate	PROFIBUS-PA: supported baud rate = 31.25 kBaud PROFIBUS-DP: supported baud rate = 9.6 kBaud...12 MBaud
Signal coding	PROFIBUS-PA: Manchester II PROFIBUS-DP: NRZ code

10.1.5 Power supply

Electrical connection	see Page 48 ff.
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
Potential equalisation	• For potential equalisation no special measures are necessary. • For instruments for use in hazardous areas, observe the corresponding guidelines in the specific Ex documentation.
Cable entry	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. 48 on Page 46): A special cable gland allows you to insert both sensor cables (per channel) 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 specification	• Sensor cable → Page 47 • PROFIBUS → Page 41
Power consumption	AC: <18 VA (incl. sensor) DC: <10 W (incl. sensor) 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 cycle frequency: • EEPROM or T-DAT save measuring system data if power supply fails.

10.1.6 Performance characteristics

Reference operating conditions

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

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

Max. measured error

For flow velocities > 0.3 m/s and a Reynolds number >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.

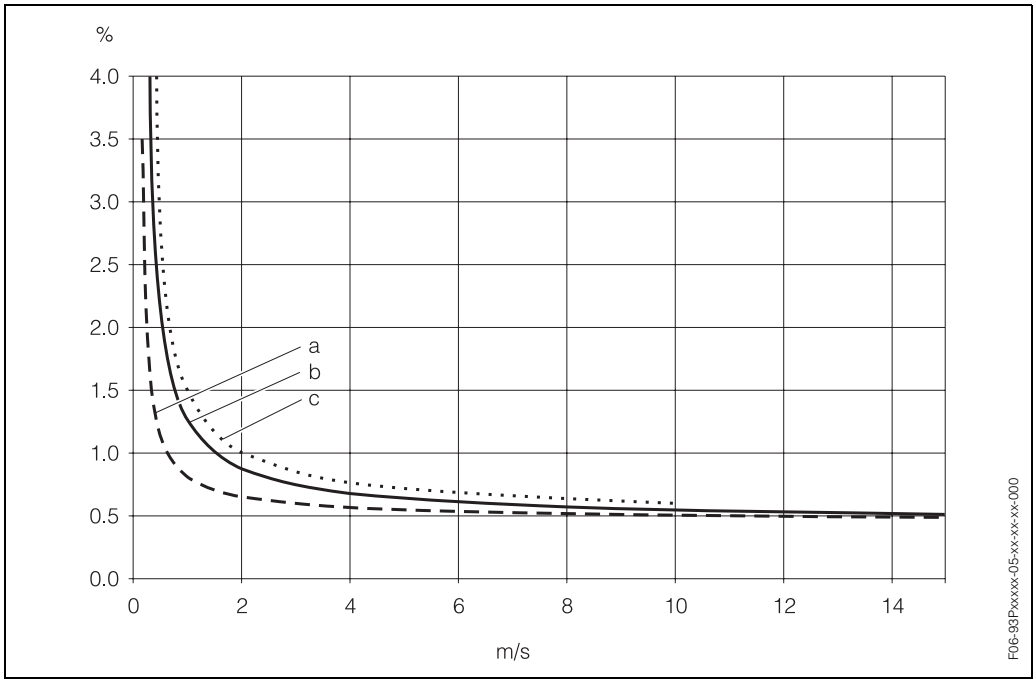


Fig. 75: Max. measured error (wet calibration) in % of reading

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 run	Clamp On version → Page 15 Insertion version → Page 16
Length of connecting cable	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 range	• Transmitter Prosonic Flow 93: –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 version): –40...+80 °C • Sound velocity measuring sensors DDU 18: –40...+80 °C / 0...+170 °C • Wall thickness measuring sensor DDU 19: 0...+60 °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 ambient temperature range of the measuring transmitter and the appropriate measuring sensors and the corresponding sensor cable (see above).

Degree of protection	• Transmitter Prosonic Flow 93: 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 52 • Flowrate measuring sensors Prosonic Flow W (Insertion version): IP 68 (NEMA 6P) • Sound velocity measuring sensors DDU 18: IP 68 (NEMA 6P) • Wall thickness measuring sensor DDU 19: IP 67 (NEMA 4X)
Shock and vibration resistance	According to IEC 68-2-6
Electromagnetic compatibility (EMC)	To EN 61326/A1 (IEC 1326) “Emmision to class A requirements” and NAMUR Recommendations NE 21
	Process
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 • Sound velocity measuring sensors DDU 18: –40...+80 °C / 0...+170 °C • Wall thickness measuring sensor DDU 19: 0...+60 °C
Medium pressure range (nominal pressure)	Perfect measurement requires that the static fluid pressure is higher than vapour pressure. Maximum 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 152 ff.

Weight

Transmitter wall-mount housing: 6.0 kg

Measuring sensors:
- Flowrate measuring sensors P incl. mounting rail and tensioning band: 2.8 kg
- Flowrate measuring sensors W (Clamp On) incl. mounting rail and tensioning bands: 2.8 kg
- Flowrate measuring sensors W (Insertion / single path version): 4.5 kg
- Flowrate measuring sensors U (clamp on): 1 kg
- Flowrate measuring sensors W (Insertion / dual path version): 12.0 kg
- Sound velocity measuring sensors DDU 18 incl. tensioning bands: 2.4 kg
- Wall thickness measuring sensor DDU 19 incl. tensioning band: 1.5 kg

Material

Transmitter housing 93 (wall-mount housing):
Powder-coated die-cast aluminum

Standard designations of the materials
(measuring sensors P / W / U / DDU 18 / DDU 19):

	DIN 17660	**UNS**
Sensor housing W (clamp on) Nickled brass	2.0401	C38500
Standard sensor cable – Cable connector (nickled brass) – Cable sheath	2.0401 PVC	C38500 PVC
	DIN 17440	**AISI**
Sensor holder W (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: back-lit, four lines with 16 characters • Custom configurations for presenting different measured value and status variables • 3 totalizers
Operating elements	• Local operation with three optical sensor keys (–, +, E) • Application-specific Quick Setups for quick and easy commissioning
Remote operation	Operation via PROFIBUS-DP/-PA

10.1.10 Certificates and approvals

Ex approval	Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your E+H Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.
CE approval	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing the CE mark.
Certification PROFIBUS-PA	The Prosonic Flow 93 flowmeter has passed all the test procedures implemented and has been certified and registered by the PNO (PROFIBUS User Organisation). The flowmeter thus meets all the requirements of the specifications listed below: • Certified for PROFIBUS-PA, Profile Version 3.0 Device certification number: available upon request • The device may also be operated using certified devices from other manufacturers (interoperability).
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) “Emmision to class A requirements” Electromagnetic compatibility (EMC requirements) NAMUR NE 21 Electromagnetic compatibility (EMC) of imdustrial process and laboratory control equipment. MAMUR NE 43 Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.

10.1.11 Ordering information

The E+H service organisation can provide detailed ordering information and information on the ordering 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 119). The E+H service organisation can provide detailed information on the ordering codes of your choice.

10.1.13 Documentation

- System Information Prosonic Flow 90/93 (SI 034D/06/en)
- Technical Information Prosonic Flow 93 P (TI 056D/06/en)
- Technical Information Prosonic Flow 90/93 W/U/C (TI 057D/06/en)
- Description of Device Functions Prosonic Flow 93 (BA 077D/06/en)
- Supplementary Ex documentation: ATEX, FM, CSA, etc.

10.2 Dimensions of wall-mount housing

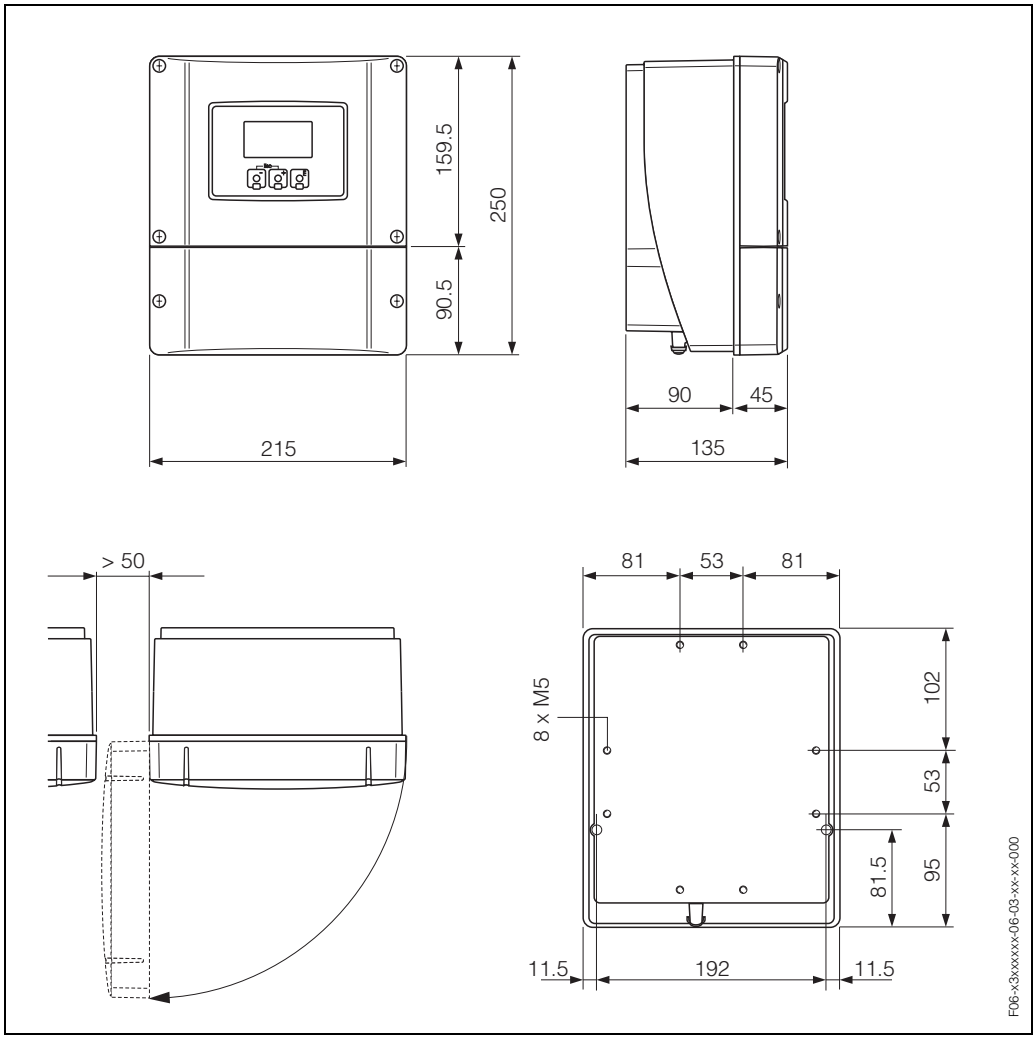


Fig. 76: Dimensions of wall-mount housing

10.3 Dimensions of P sensors

2 or 4 traverses version

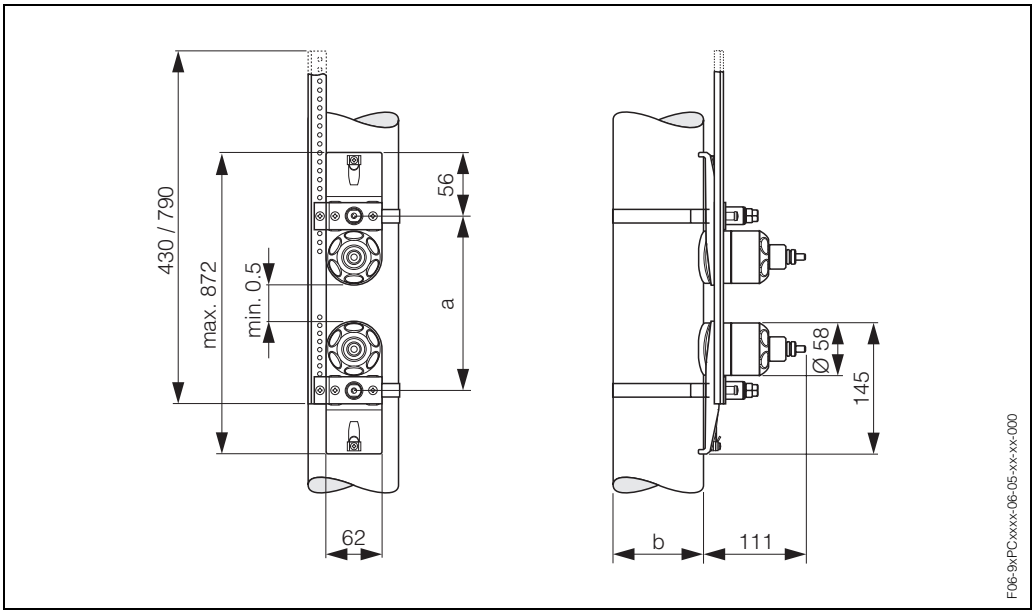


Fig. 77: Dimensions of P sensor (2 or 4 traverses version)

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

1 or 3 traverses version

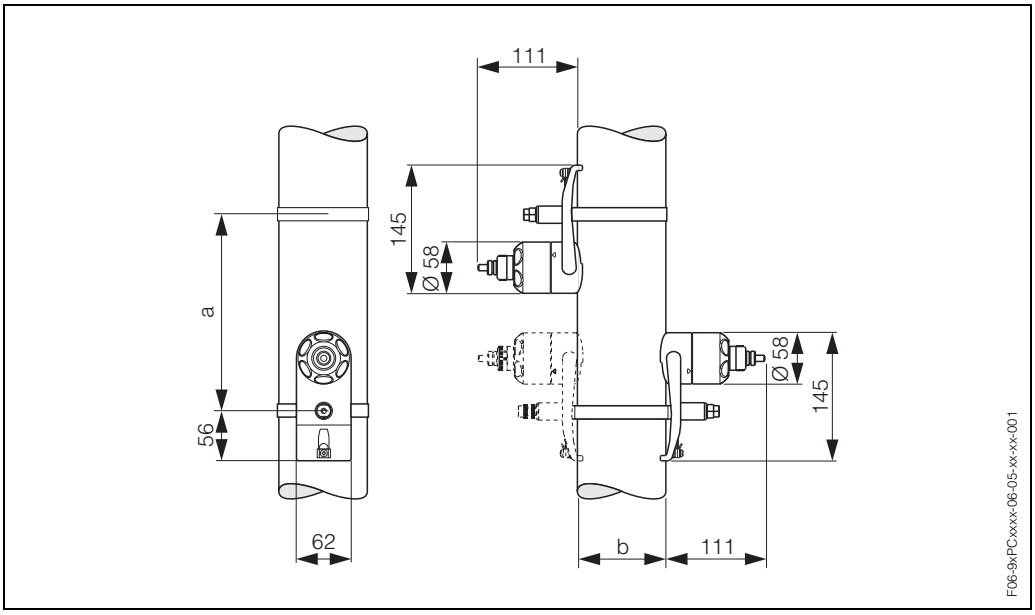


Fig. 78: Dimensions of P sensor (1 or 3 traverses version)

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

10.4 Dimensions of W sensors (Clamp On)

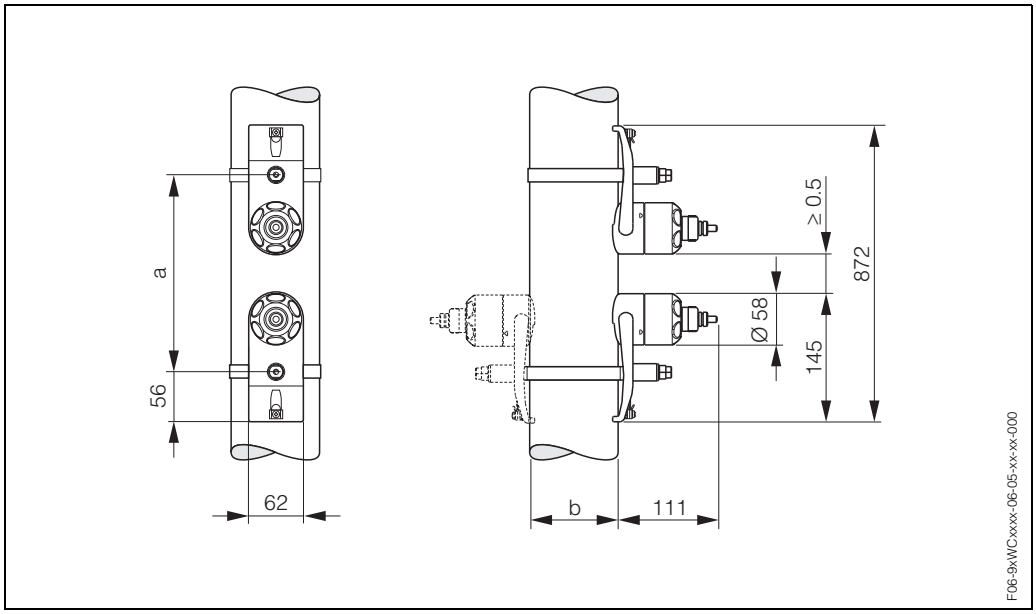


Fig. 79: Dimensions of W sensor (Clamp On)

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

10.5 Dimensions of U sensors (clamp on)

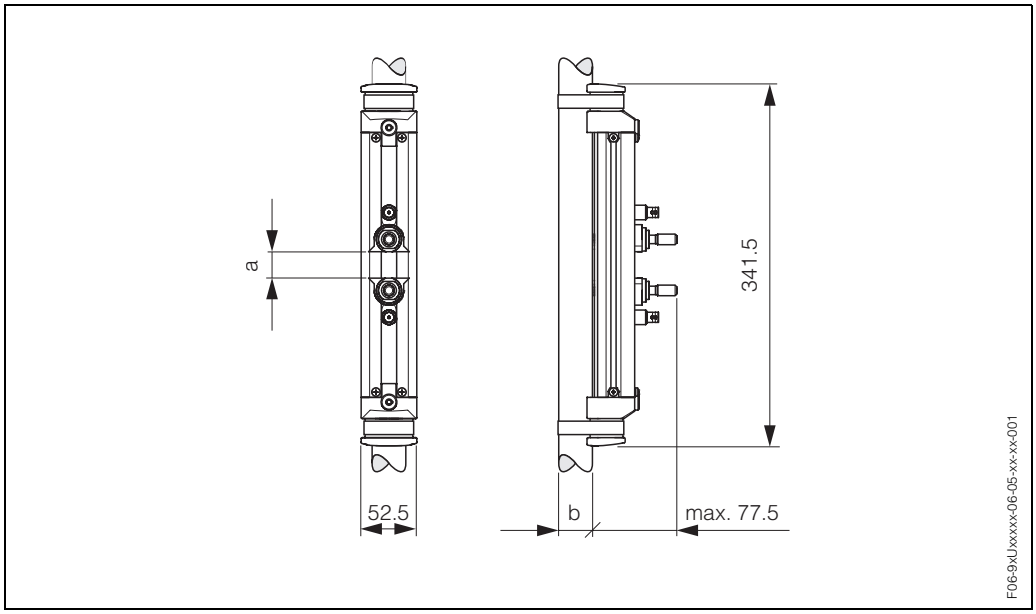


Fig. 80: Dimensions of U sensor (clamp on)

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)

Single path version

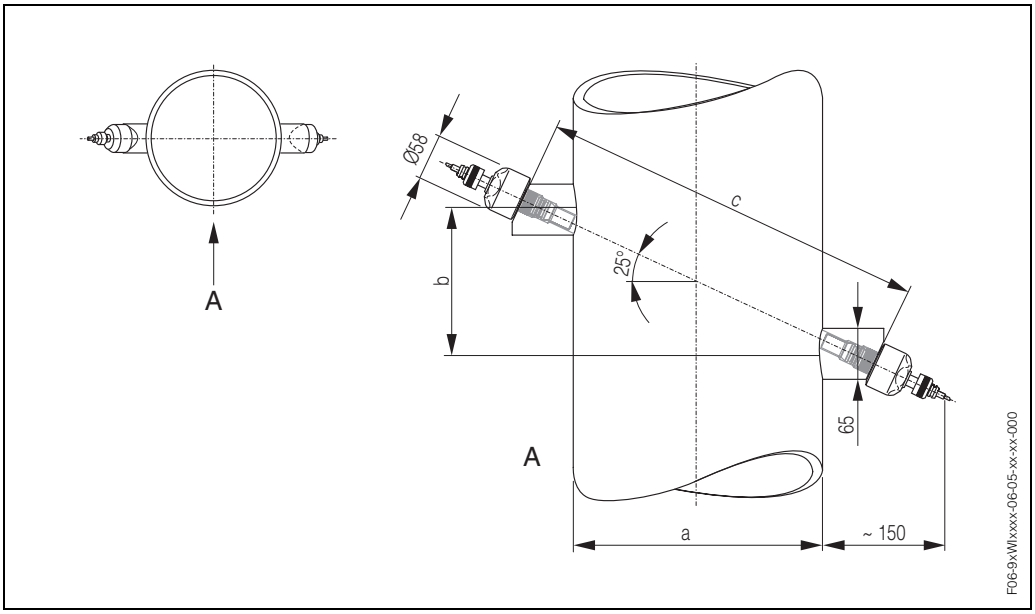


Fig. 81: Dimensions of W sensor (Insertion version, single path)

A = View A
a = Pipe outer diameter (defined by the application)
b = Sensor distance can be determined using Quick Setup
c = Path length can be determined using Quick Setup

Dual path version

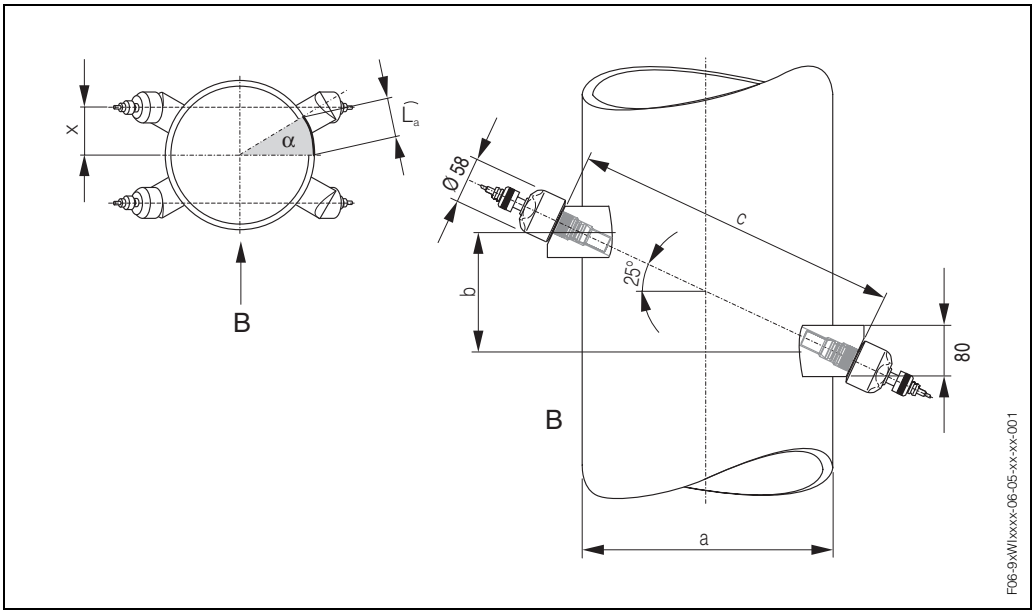


Fig. 82: Dimensions of W sensor (Insertion version, dual path)

B = View B
a = Pipe outer diameter (defined by the application)
b = Sensor distance can be determined using Quick Setup
c = Path length can be determined using Quick Setup

Arc length: $\overset{\frown}{L}_a = \frac{\Pi \cdot d \cdot \alpha}{360°}$

Offset: $x = \frac{d \cdot \sin\alpha}{2}$

Index

Declaration of contamination

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

type of instrument / sensor: _____ serial number: _____

medium / concentration: _____ temperature: _____ pressure: _____

cleaned with: _____ conductivity: _____ viscosity: _____

Warning hints for medium used:

☐ radioactive ☐ explosive ☐ caustic ☐ poisonous ☐ harmful of health ☐ biological hazardous ☐ inflammable ☐ safe

Please mark the appropriate warning hints.

Reason for return:

_____

_____

Company data:

company: _____ contact person: _____

_____ _____

_____ department: _____

address: _____ phone number: _____

_____ 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.

_____ _____

(Date) (company stamp and legally binding signature)

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Photonika GmbH
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❑ Endress+Hauser Systems & Gauging Inc.
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