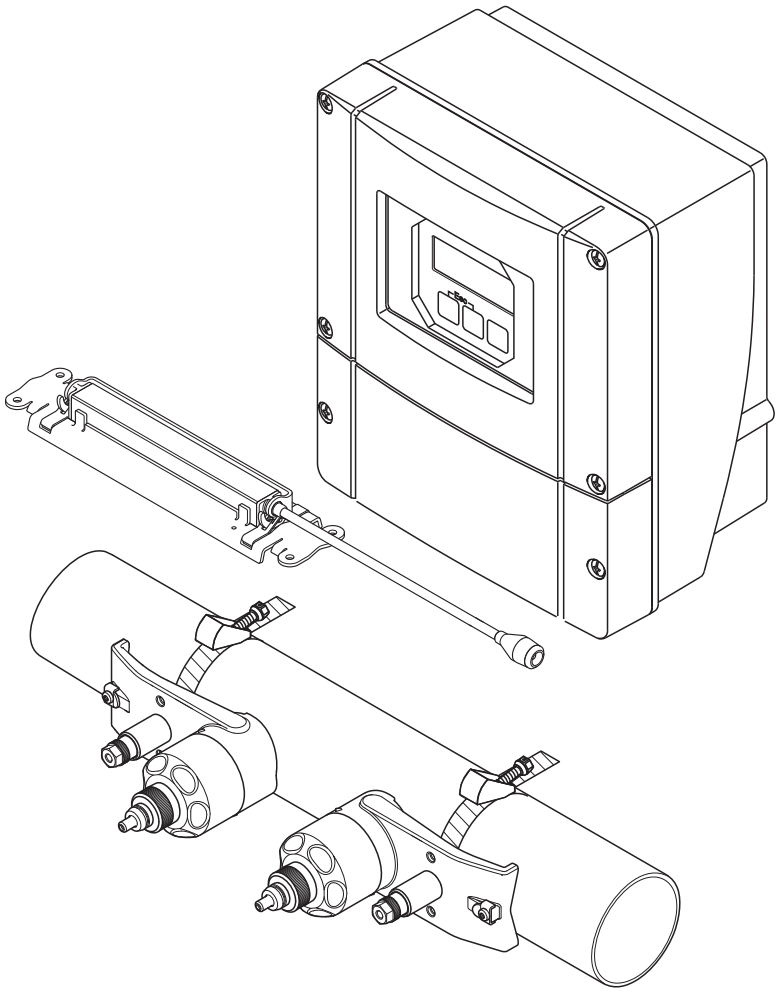
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Prosonic Flow 93 FOUNDATION Fieldbus

Ultrasonic flow measuring system

Fieldbus™ Foundation



BA00078D/06/EN/14.11
71139009

Valid as of version
V 2.03.XX (Device software)

Endress+Hauser

People for Process Automation

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 rate of liquids in closed pipes.

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

As well as measuring the volume flow, the sound velocity of the fluid is also always measured. Different fluids can be distinguished or the fluid quality can be monitored.

The operational safety of the measuring devices cannot be guaranteed if the system is used incorrectly or used for purposes other than those intended. The manufacturer accepts no liability for damages being produced from this.

1.2 Installation, commissioning and operation

Note the following points:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator.
  The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in these Operating Instructions is mandatory.
- Endress+Hauser is willing to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning.
  However, small changes in temperature, concentration or the degree of contamination in the process can result in changes to the corrosion resistance properties. Therefore, Endress+Hauser cannot guarantee or accept liability for the corrosion resistance properties of wetted materials in a specific application.
  The user is responsible for choosing suitable wetted materials in the process.
- If carrying out welding work on the piping, the welding unit may not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, except in cases where special protective measures have been taken (e.g. galvanically isolated power supply SELV or PELV).
- 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 this supplementary Ex documentation indicates the approval and inspection authority (e.g. Ⓔx Europe, <FM> USA, Ⓒ Canada).
- The measuring system complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326, and NAMUR Recommendation NE 21 and NE 43.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to this 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 duly completed "Declaration of Contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.

  Note!
  You will find a preprinted "Declaration of Contamination" form at the back of this manual.

- Enclose special handling instructions if necessary, for example a safety data sheet as per Regulation (EC) No 1907/2006 REACH.
- 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.

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 can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following 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 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use".

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" flowmeter system consists of the following components:
- Prosonic Flow 93 transmitter
- Sensor:
  - Prosonic Flow P Clamp-on version (DN 15 to 65 / ½ to 2½")
  - Prosonic Flow P Clamp-on version (DN 50 to 4000 / 2 to 160")
  - Prosonic Flow W Clamp-on version (DN 50 to 4000 / 2 to 160")
  - Prosonic Flow W Insertion version

The transmitter and sensor are mounted separately from one another and connected by a connecting cable.

2.1.1 Nameplate of the transmitter

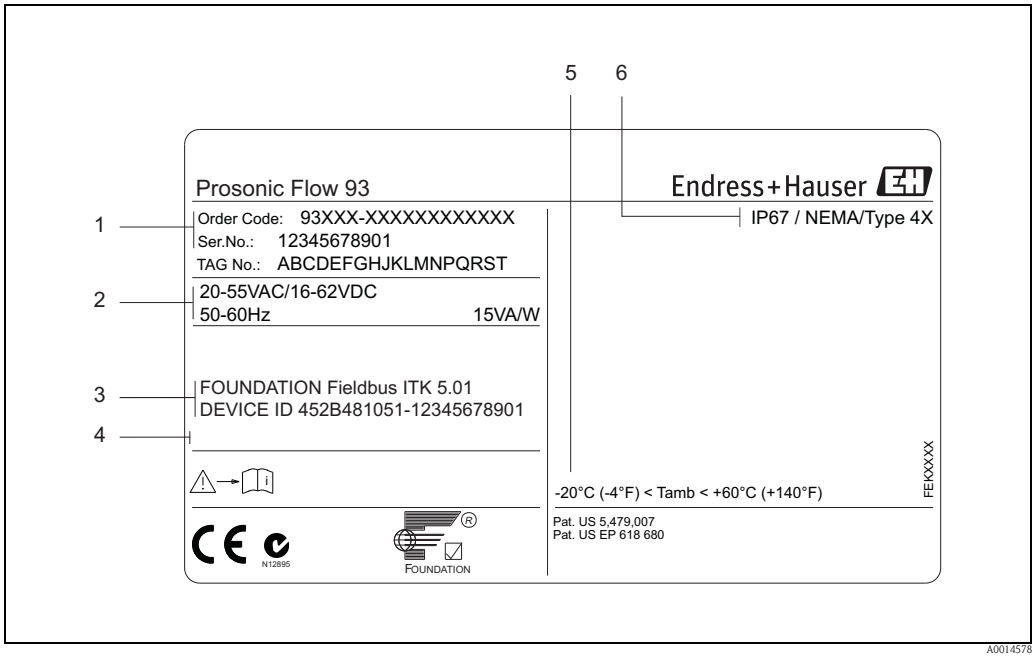


Fig. 1: Nameplate specifications for the "Prosonic Flow 93" transmitter (example)

1 Order code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply/frequency/power consumption
3 FOUNDATION Fieldbus:
Equipped with FOUNDATION Fieldbus-H1 interface
ITK 5.01: Certified by the Fieldbus Foundation; Interoperability Test Kit, revision 5.01 DEVICE ID: FOUNDATION Fieldbus device identification
4 Reserved for information on special products
5 Permitted ambient temperature range
6 Degree of protection

2.1.2 Nameplate of the sensor

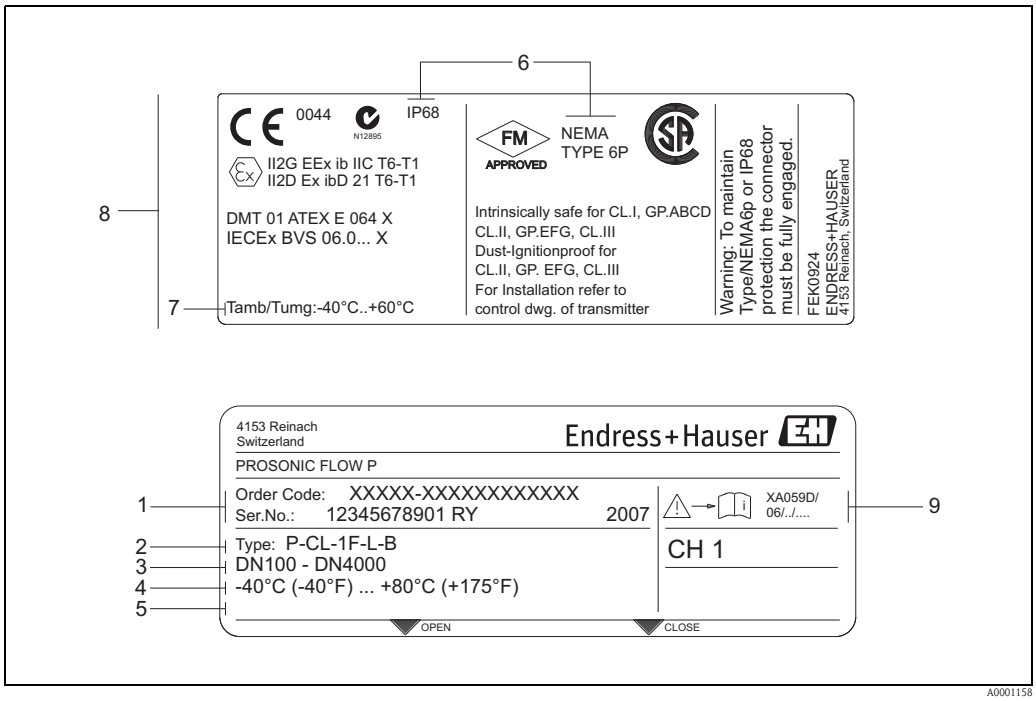


Fig. 2: Nameplate specifications for the "Prosonic Flow P" sensor (example)

1 Order 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 to 4000 (4 to 160")
4 Max. fluid temperature range: –40 to +80 °C (–40 to +175 °F)
5 Reserved for information on special products
6 Degree of protection
7 Permitted ambient temperature range
8 Data on explosion protection
Refer to the specific additional Ex documentation for detailed information.
Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.
9 Please refer to operating instructions / documentation

2.1.3 Nameplate for the connections

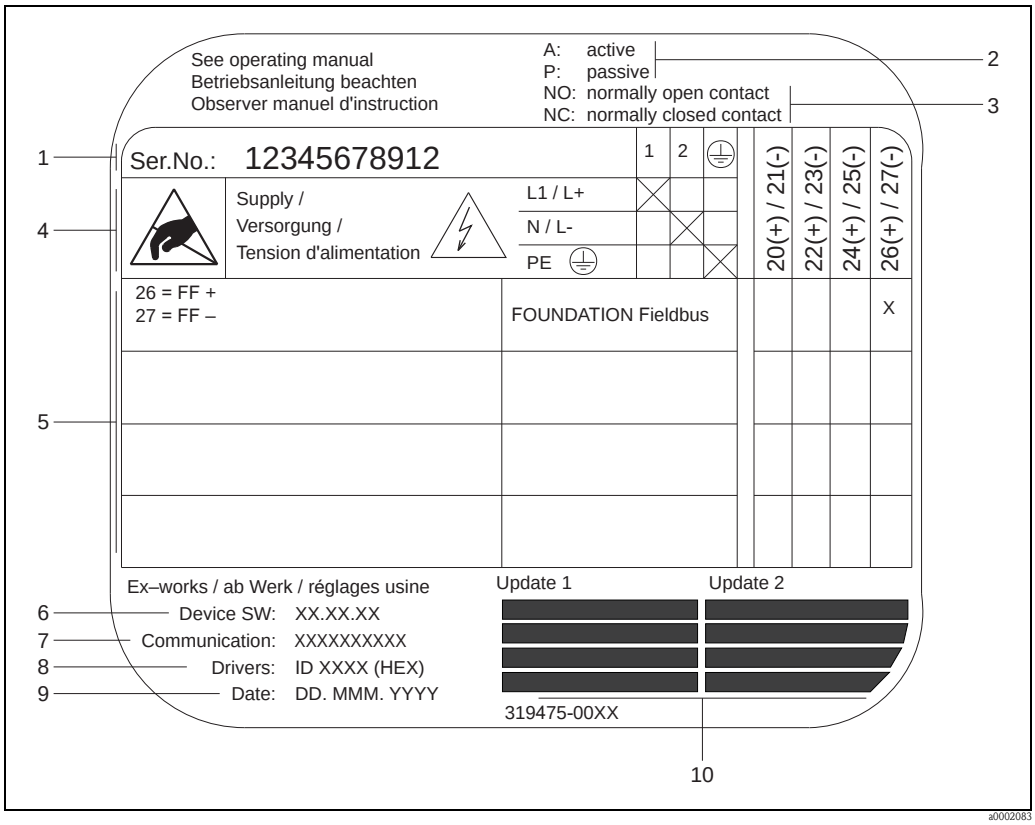


Fig. 3: Nameplate specifications for Proline transmitter (example)

1 Serial number
2 Possible configuration of current output
3 Possible configuration of the relay contacts
4 Terminal assignment, cable for power supply:
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L- for DC*
5 Signals present at the inputs and outputs, possible configuration and terminal assignment → 64
6 Version of device software currently installed (including language group)
7 Installed communication mode
8 Information on current communication software
9 Date of installation
10 Current updates to the information listed in Points 6 to 9

2.2 Certificates and approvals

The devices are designed in accordance with good engineering practice 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 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use" and with the EMC requirements of IEC/EN 61326.
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 to it the CE mark.
The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

2.3 FOUNDATION Fieldbus device certification

The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus FOUNDATION. The device thus meets all the requirements of the following specifications:

- Certified to FOUNDATION fieldbus specification
- The flowmeter meets all the specifications of the FOUNDATION Fieldbus-H1.
- Interoperability Test Kit (ITK), revision 5.01: The device can also be operated in conjunction with other-make certified devices.
- Physical Layer Conformance Test by Fieldbus Foundation

2.4 Registered trademarks

FOUNDATION™ Fieldbus
Registered trademark of the Fieldbus FOUNDATION, Austin, USA

HistoROM™, T-DAT™, FieldCare®, 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

On receipt of the goods, check 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

- 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 of the transmitter, the sensors and the corresponding sensor cables (→ 120).
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 Installation conditions

3.2.1 Dimensions

The dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document on the device in question. This can be downloaded as a PDF file from www.endress.com.
A list of the "Technical Information" documents available is provided on → 127

3.2.2 Mounting location

Correct flow measurement is possible only if a pipe is full. Entrained air or gas bubbles forming in the pipe can result in an increase in measuring errors.

Avoid the following locations in the pipe installation:
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.

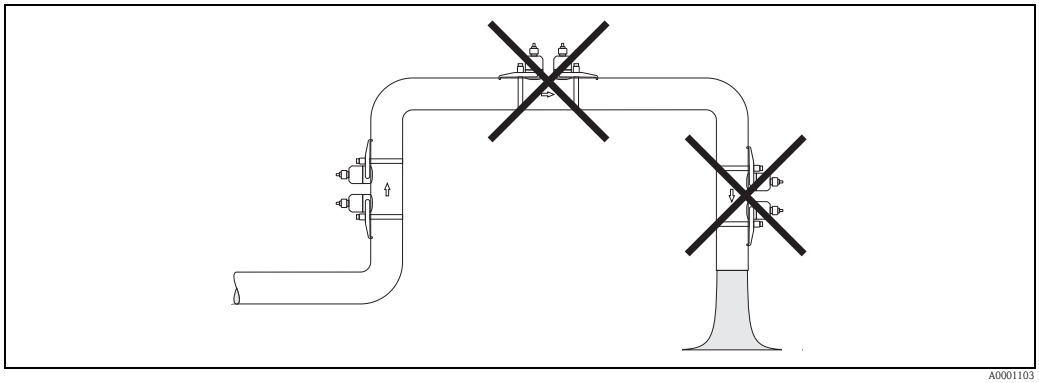


Fig. 4: Mounting location

3.2.3 Orientation

Vertical orientation

We recommend the sensor be mounted where there is upward direction of flow. With this orientation, entrained solids will sink down and gases will rise away from the sensor when the fluid is stagnant.

Horizontal orientation

We recommend the sensors be mounted within an angle of ±60° to the horizontal (area shaded gray in the graphic). With this orientation, flow measurement is less affected by any gas or air accumulation in the upper area of the pipe or by buildup at the bottom of the pipe.

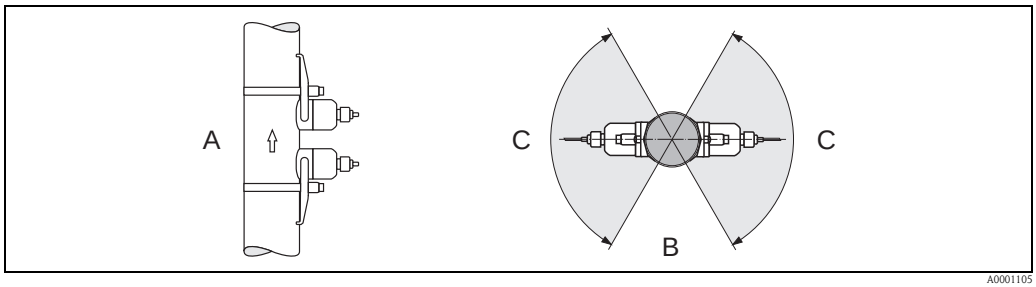


Fig. 5: Recommended orientation and recommended installation range

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

3.2.4 Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows, etc. Compliance with the following inlet and outlet runs is required in order to ensure measuring accuracy.

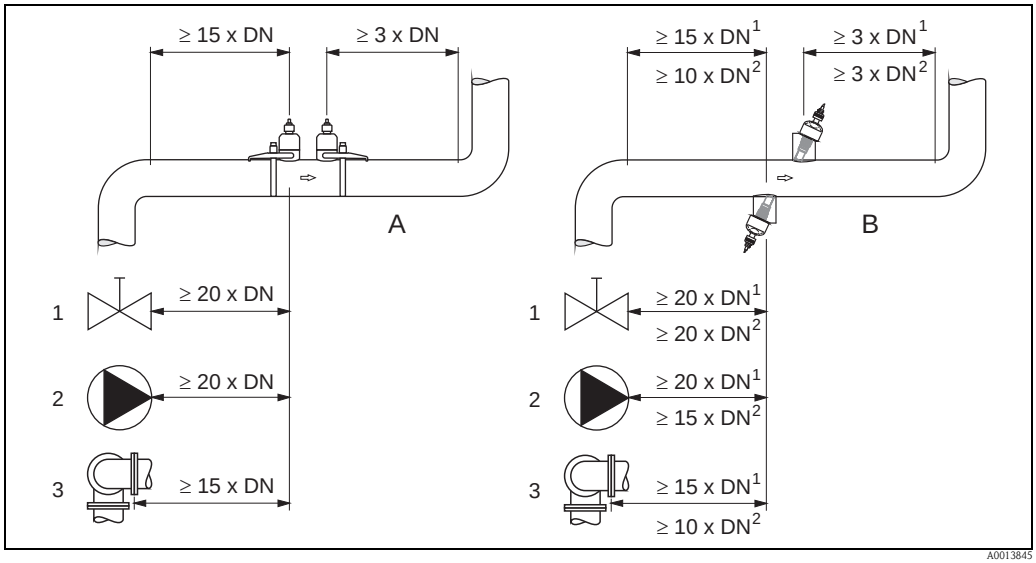


Fig. 6: Recommended inlet and outlet runs to comply with measuring accuracy specifications

A Clamp-on version
B Insertion version
[1] = values for single-path version
[2] = values for two-path version
1 Valve (2/3 open)
2 Pump
3 Two pipe bends in different directions

3.2.5 Sensor selection and arrangement

The sensors can be arranged in two ways:
- Mounting arrangement for measurement via one traverse: the sensors are located on opposite sides of the pipe.
- Mounting arrangement for measurement via two traverses: the sensors are located on the same side of the pipe.

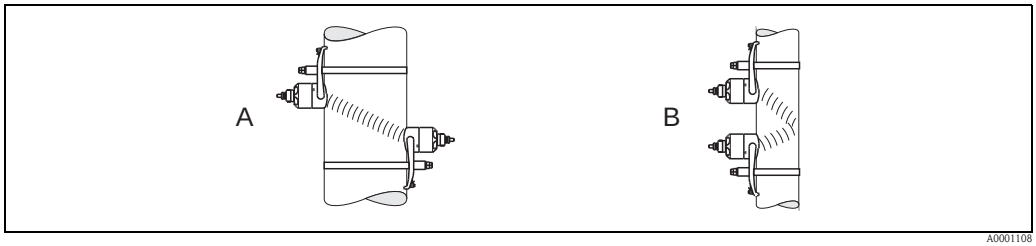


Fig. 7: Sensor mounting arrangement

A Mounting arrangement for measurement via one traverse
B Mounting arrangement for measurement via two traverses

The number of traverses required depends on the sensor type, the nominal diameter and the thickness of the pipe wall. We recommend the following types of mounting:

Sensor Type	Nominal Diameter	Sensor Frequency	Sensor ID	Type of Mounting [1]
Prosonic Flow P	DN 15 to 65 (½ to 2½")	6 MHz	P-CL-6F*	2 traverses [5]
	DN 50 to 65 (2 to 2½")	2 MHz	P-CL-6F* P-CL-2F*	2 (or 1) traverses
	DN 80 (3")	2 MHz	P-CL-2F*	2 traverses
	DN 100 to 300 (4 to 12")	2 MHz (or 1 MHz)	P-CL-2F* P-CL-1F*	2 traverses
	DN 300 to 600 (12 to 24")	1 MHz (or 2 MHz)	P-CL-1F* P-CL-2F*	2 traverses
	DN 650 to 4000 (26 to 160")	1 MHz	P-CL-1F*	1 traverse
Prosonic Flow W	DN 15 to 65 (½ to 2½")	6 MHz	W-CL-CF*	2 traverses [5]
	DN 50 to 65 (2 to 2½")	2 MHz	W-CL-2F*	2 (or 1) traverses [2]
	DN 80 (3")	2 MHz	W-CL-2F*	2 traverses
	DN 100 to 300 (4 to 12")	2 MHz (or 1 MHz)	W-CL-2F* W-CL-1F*	2 traverses [3]
	DN 300 to 600 (12 to 24")	1 MHz (or 2 MHz)	W-CL-1F* W-CL-2F*	2 traverses [3]
	DN 650 to 4000 (26 to 160")	1 MHz (or 0.5 MHz)	W-CL-1F* W-CL-05F*	1 traverse [3]

[1] The installation of clamp-on sensors is principally recommended in the 2 traverse type installation. This type of installation allows the easiest and most comfortable type of mounting and means that a system can also be mounted even if the pipe can only be accessed from one side. However, in certain applications a 1 traverse installation may be preferred. These include:
- Certain plastic pipes with wall thickness > 4 mm (0.16")
- Pipes made of composite materials such as GRP
- Lined pipes
- Applications with fluids with high acoustic damping

[2] If the pipe nominal diameter is small (DN 65 / 2½" and smaller), the sensor spacing with Prosonic Flow W can be too small for two traverse installation. In this case, the 1 traverse type of installation must be used.

[3] 0.5 MHz sensors are also recommended for applications with composite material pipes such as GRP and may be recommended for certain lined pipes, pipes with wall thickness > 10 mm (0.4"), or applications with media with high acoustic damping. In addition, for these applications we principally recommend mounting the W sensors in a 1 traverse configuration.

[4] Insertion W sensors are mounted in a 1 traverse configuration → 🖹 45.

[5] 6 MHz sensors for applications where flow velocity ≤ 10m/s (32.8Hz/s)

3.3 Two-channel operation

The transmitter is able to operate two independent measuring channels (measuring channel 1 and measuring channel 2). A pair of sensors is connected per measuring channel. Both measuring channels operate independently of one another and are supported by the transmitter to an equal extent.

Two-channel operation can be used for the following measurements:
- Two-channel measurement = flow measurement at two separate measuring points
- Two-path measurement = redundant flow measurement at one measuring point

3.3.1 Two-channel measurement

The flow is measured at two separate measuring points in the case of two-channel measurement.

The measured values of the two measuring channels can be processed and displayed differently. The following measured values can be output for two-channel measurement:
- Individual measured values per measuring channel (output independently of one another)
- The difference between the two measured values
- The sum of the two measured values

The two measuring channels can be configured individually. This makes it possible to independently configure and select the display, outputs, sensor type and type of installation.

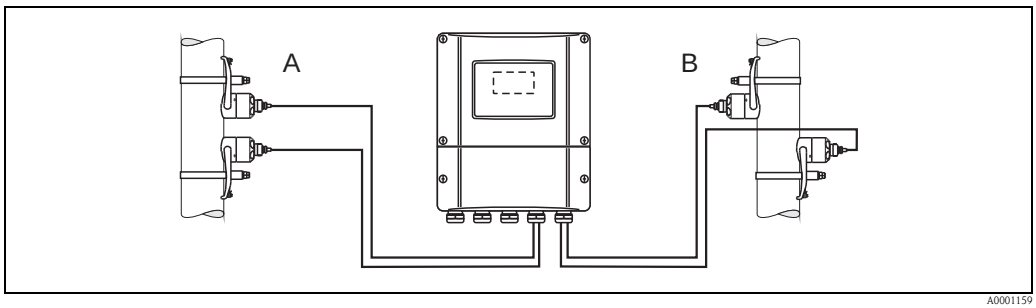


Fig. 8: Two-channel measurement: example of arranging sensor pairs at two separate measuring points

A Measuring channel 1: mounting the sensor pair for measurement via two traverses
B Measuring channel 2: mounting the sensor pair for measurement via one traverse

3.3.2 Two-path measurement

The flow is measured redundantly at one measuring point in the case of two-path measurement.

The measured values of the two measuring channels can be processed and displayed differently. The following measured values can be output for two-path measurement:
- Individual measured values per measuring channel (output independently of one another)
- The average of the two measured values.

The "Averaging" function generally provides you with a more stable measured value.
The function is thus suitable for measurements under conditions that are not ideal (e.g. short inlet runs).

The two measuring channels can be configured individually. This makes it possible to independently configure and select the display, outputs, sensor type and type of installation.
It is generally not necessary to individually configure the two measuring channels in the case of two-path measurement. However, in certain situations individual channel configuration can be used to balance out application-specific asymmetries.

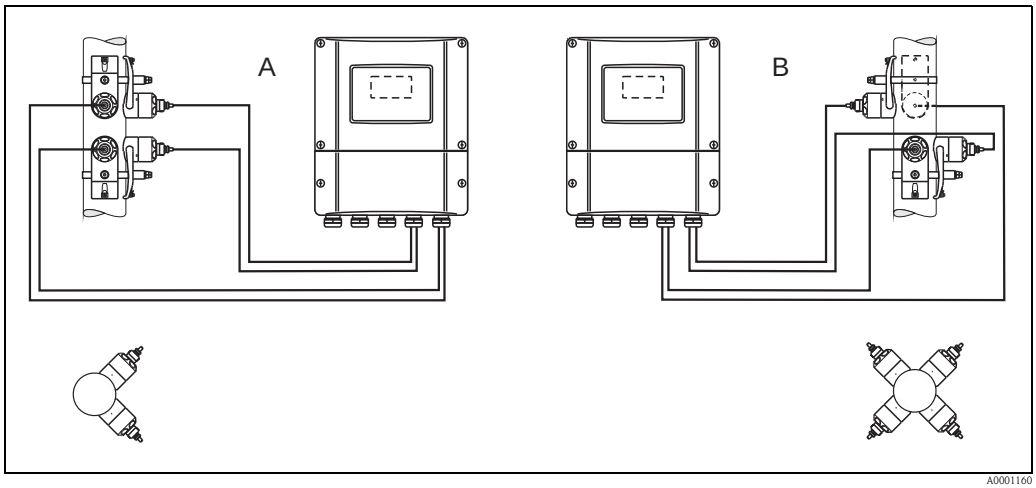


Fig. 9: Two-path measurement: examples of arranging sensor pairs at one measuring point

A Measuring channel 1 and measuring channel 2: mounting the two sensor pairs for one measurement per pair via two traverses

B Measuring channel 1 and measuring channel 2: mounting the two sensor pairs for one measurement per pair via one traverse

3.4 Preparatory steps prior to installation

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

1. Determination of the values for the necessary installation distances based on the conditions specific to the measuring point. A number of methods are available for determining the values:
   – Local operation of the device
   – FieldCare (operating program), connect a notebook to the transmitter
   – Applicator (software), online on the Endress+Hauser Internet site
2. Mechanical preparation of the clamp-on retainers for the sensors:
   – Premount the strapping bands (DN 50 to 200 / 2 to 8") or (DN 250 to 4000 / 10 to 160")
   – Fix the welded bolts

3.5 Determining the necessary installation distances

The installation distances that have to be maintained depend on:
- The type of sensor: P or W (DN 50 to 4000 / 2 to 160"), P or W (DN 15 to 65 / ½ to 2½")
- Type of mounting:
  – Clamp-on with strapping band or welded bolt
  – Insertion version, installation in the pipe
- Number of traverses or single-path/dual-path version

3.5.1 Installation distances for Prosonic Flow P or W clamp-on

DN 50 to 4000 (2 to 160")				DN 15 to 65 (½ to 2½")
Clamp-on Strapping band		Clamp-on Welded bolts		Clamp-on Strapping band
1 traverse	2 traverses	1 traverse	2 traverses	2 traverses
SENSOR DISTANCE	SENSOR DISTANCE	SENSOR DISTANCE	SENSOR DISTANCE	SENSOR DISTANCE
WIRE LENGTH	POSITION SENSOR	WIRE LENGTH	POSITION SENSOR	–

3.5.2 Installation distances for Prosonic W Insertion

DN 200 to 4000 (8 to 160") Insertion version	
Single-path	Dual-path
SENSOR DISTANCE	SENSOR DISTANCE
PATH LENGTH	ARC LENGTH

3.6 Determining values for installation distances

3.6.1 Determining installation distances via local operation

Perform the following steps to determine the installation distances:

1. Mount the wall-mount housing.
2. Connect the power supply.
3. Switch on the measuring device.
4. Run the "Sensor Installation" Quick Setup menu.

Installing the wall-mount housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories → 92)
- Pipe mounting (with separate mounting kit, accessories → 92)

Caution!
- Make sure that the permitted operating temperature range (-20 to +60 °C / –4 to +140 °F) is not exceeded at the mounting location. 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 → 17.
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 (0.26")
   – Screw head: max. Ø 10.5 mm (0.41")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

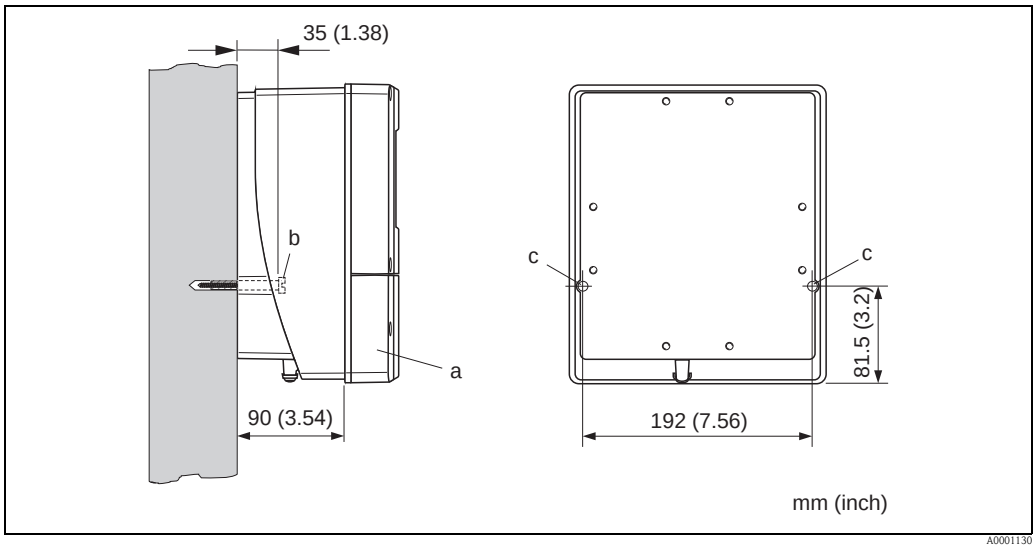


Fig. 10: Direct wall mounting

Panel mounting

1. Prepare the opening in the panel → 18.
2. Slide the housing into the panel cutout from the front.
3. Screw the retainers onto the wall-mount housing.
4. Screw the threaded rods into the retainers and tighten until the housing is solidly seated on the panel wall. Tighten the counter nuts. No further support is necessary.

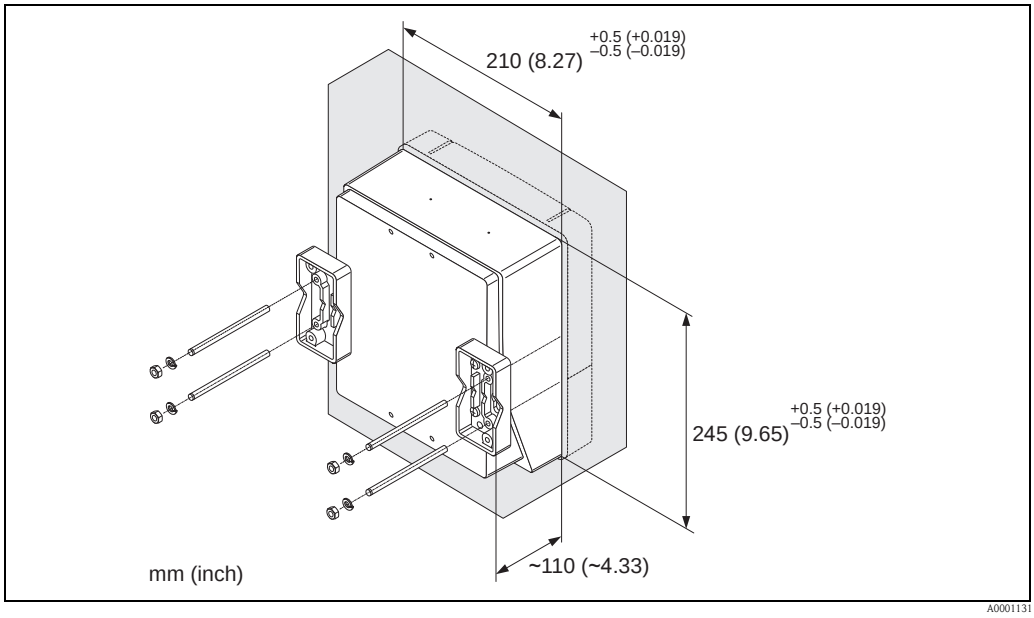


Fig. 11: Panel mounting (wall-mount housing)

Pipe mounting

The assembly should be performed by following the instructions on → 18.

Caution!
If a warm pipe is used for installation, make sure that the housing temperature does not exceed the max. permitted value of +60 °C (+140 °F).

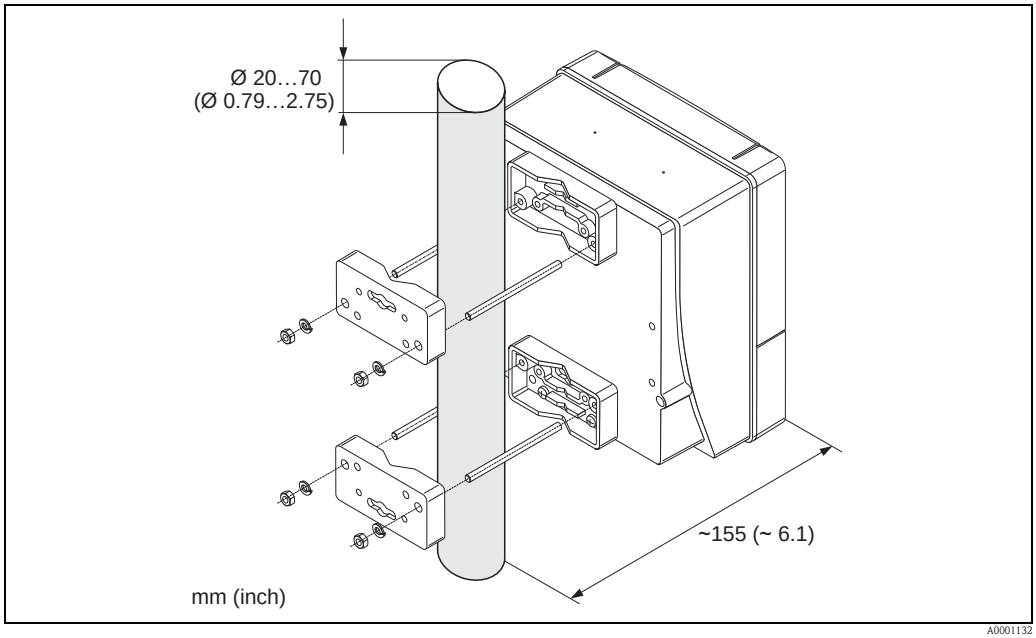


Fig. 12: Pipe mounting (wall-mount housing)

Connecting the power supply

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 Endress+Hauser sales office if you have any questions.

Note!
The measuring device does not have an internal power switch. For this reason, assign the measuring device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

Connecting the power supply

Warning!
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the ground terminal on the housing before the power supply is applied (not required for galvanically isolated power supply).
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

1. Remove the cover of the connection compartment from the transmitter housing.
2. Route the power supply cable through the cable entries.
3. Wire the power supply cable.
4. Tighten the cable gland.
5. Screw the connection compartment cover back onto the transmitter housing.

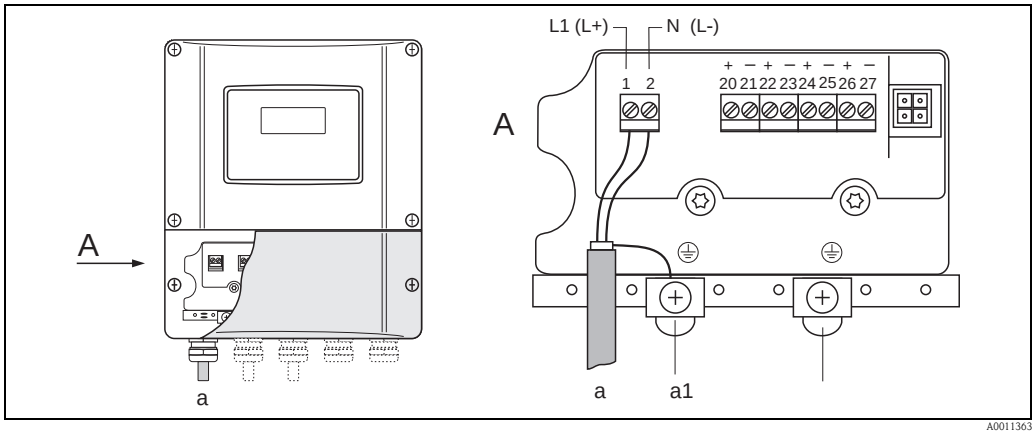


Fig. 13: Connecting the power supply; cable cross-section: max. 2.5 mm² (14 AWG)

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L- for DC*
a1 Ground terminal for protective ground

Switching on the measuring device

1. Perform the post-connection check as specified in the checklist → 📄 68.
2. Switch on the supply voltage for the device. The device performs internal test functions. Various messages appear on the display.
3. Normal measuring mode commences. Various measured value and/or status variables appear on the display (HOME position).

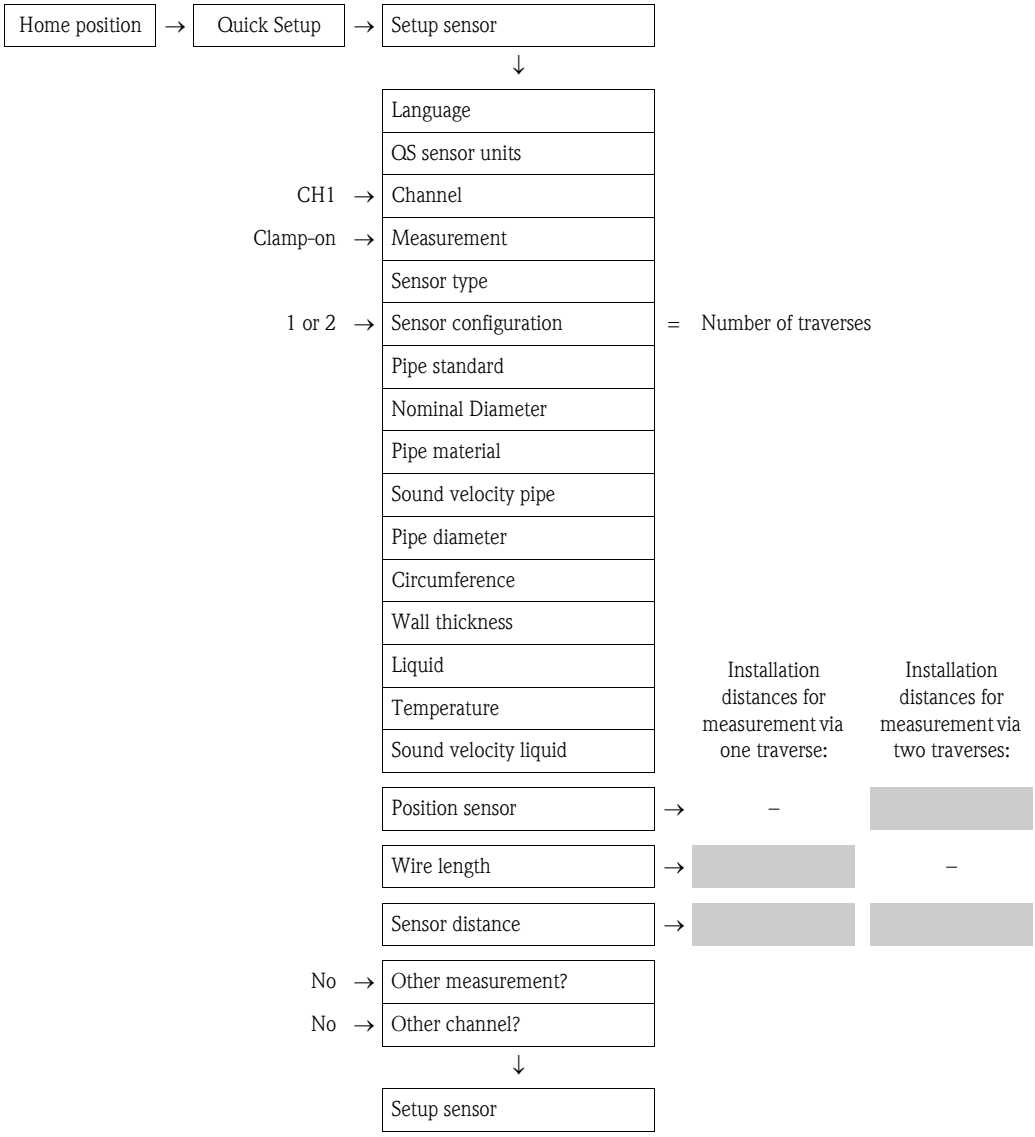
Note!
If startup fails, an appropriate error message is displayed, depending on the cause → 📄 96.

Running the "Sensor Installation" Quick Setup menu

Note!
- If you are not familiar with the operation of the device → 69.
- The following section only describes the steps necessary for clamp-on and insertion type of mounting within the "Sensor Installation" Quick Setup.

Running the Quick Setup for clamp-on type of mounting

1. Enter or select installation-specific values or the values specified here.
2. Read off the installation distances necessary for mounting.

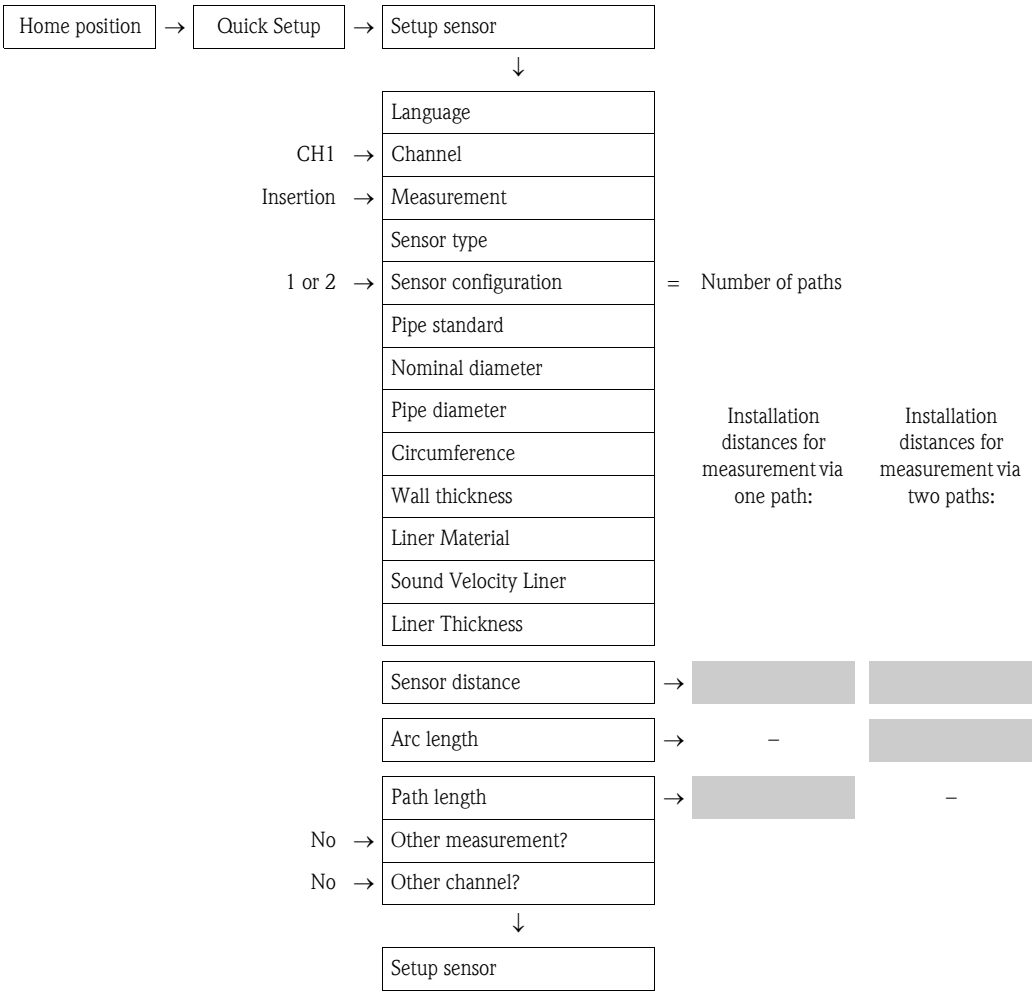


Subsequent procedure

The sensors can be installed once the installation distances have been determined:
- Prosonic Flow P (DN 15 to 65 / ½ to 2½") → 37
- Prosonic Flow P (DN 50 to 4000 / 2 to 160") → 37
- Prosonic Flow W → 41

Running the Quick Setup for insertion type of mounting

1. Enter or select installation-specific values or the values specified here.
2. Read off the installation distances necessary for mounting.



Subsequent procedure

The sensors can be installed once the installation distances have been determined:
■ Prosonic Flow W → 📄 45

3.6.2 Determining installation distances via FieldCare

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.
- FieldCare and the FXA193 service interface can be ordered as accessories → 92.

Perform the following steps to determine the installation distances:

1. Mount the wall-mount housing
2. Connecting the power supply
3. Connecting the PC to the plant asset management tool
4. Switch on the measuring device.
5. Read off the installation distances via FieldCare.

Installing the wall-mount housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories → 92)
- Pipe mounting (with separate mounting kit, accessories → 92)

Caution!
- Make sure that the permitted operating temperature range (-20 to +60 °C / –4 to +140 °F) is not exceeded at the mounting location. 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 → 22.
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 (0.26")
   – Screw head: max. Ø 10.5 mm (0.41")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

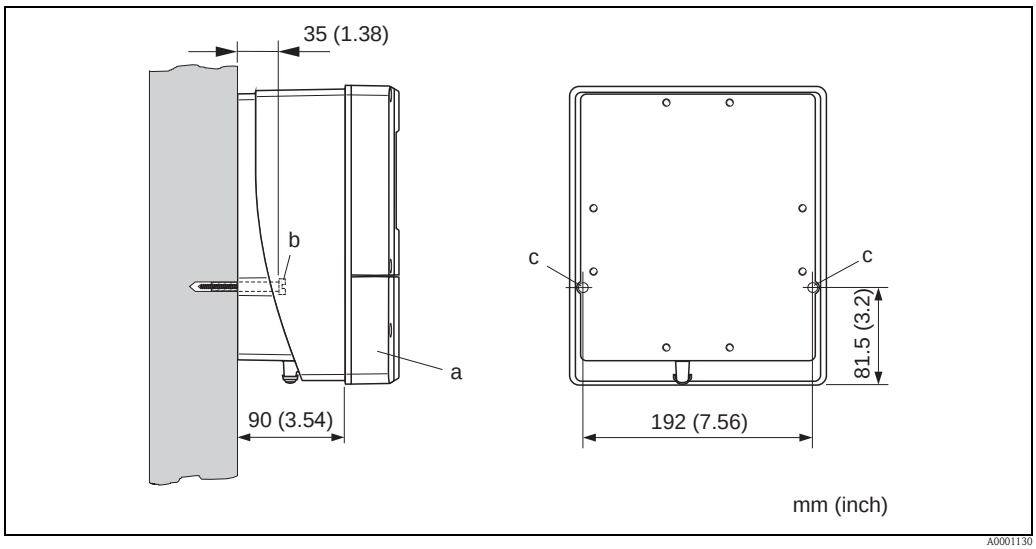


Fig. 14: Direct wall mounting

Panel mounting

1. Prepare the opening in the panel → 📄 23.
2. Slide the housing into the panel cutout from the front.
3. Screw the retainers onto the wall-mount housing.
4. Screw the threaded rods into the retainers and tighten until the housing is solidly seated on the panel wall. Tighten the counter nuts. No further support is necessary.

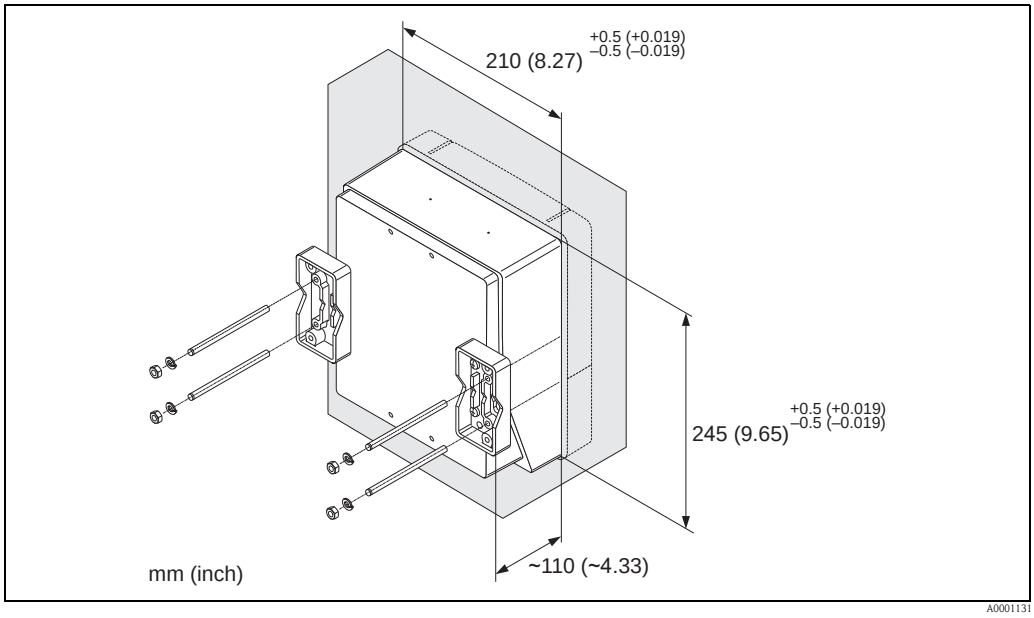


Fig. 15: Panel mounting (wall-mount housing)

Pipe mounting

The assembly should be performed by following the instructions on → 📄 23.

Caution!
If a warm pipe is used for installation, make sure that the housing temperature does not exceed the max. permitted value of +60 °C (+140 °F).

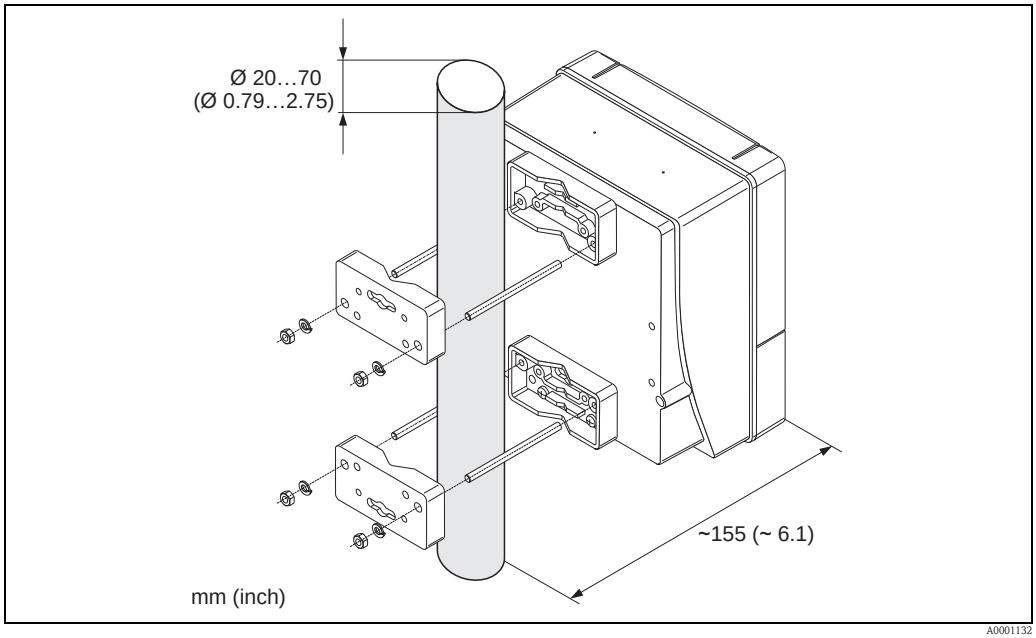


Fig. 16: Pipe mounting (wall-mount housing)

Connecting the power supply

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 Endress+Hauser sales office if you have any questions.

Note!
The measuring device does not have an internal power switch. For this reason, assign the measuring device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

Connecting the power supply

Warning!
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the ground terminal on the housing before the power supply is applied (not required for galvanically isolated power supply).
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

1. Remove the cover of the connection compartment from the transmitter housing.
2. Route the power supply cable through the cable entries.
3. Wire the power supply cable.
4. Tighten the cable gland.

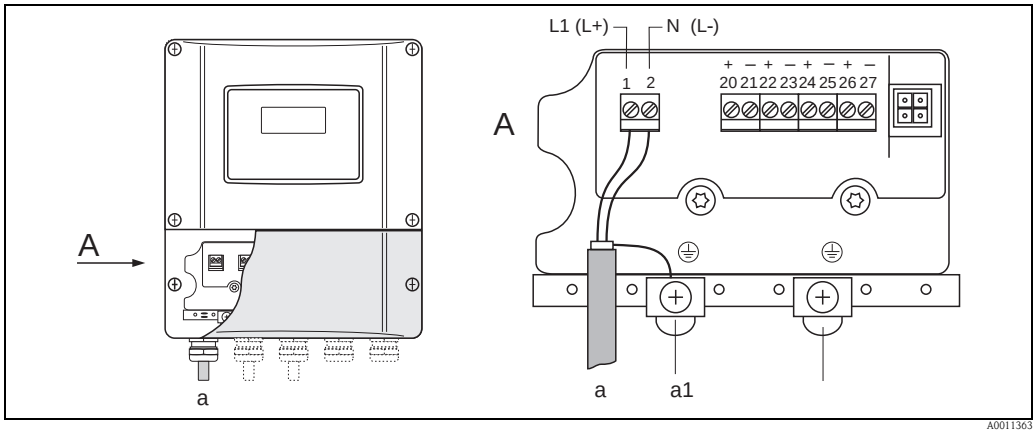


Fig. 17: Connecting the power supply; cable cross-section: max. 2.5 mm² (14 AWG)

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L- for DC*
a1 Ground terminal for protective ground

Connecting the PC to the plant asset management tool

A personal computer is connected to the FieldCare plant asset management tool via the service interface FXA 193. The service interface FXA 193 is connected to the service connector of the transmitter.

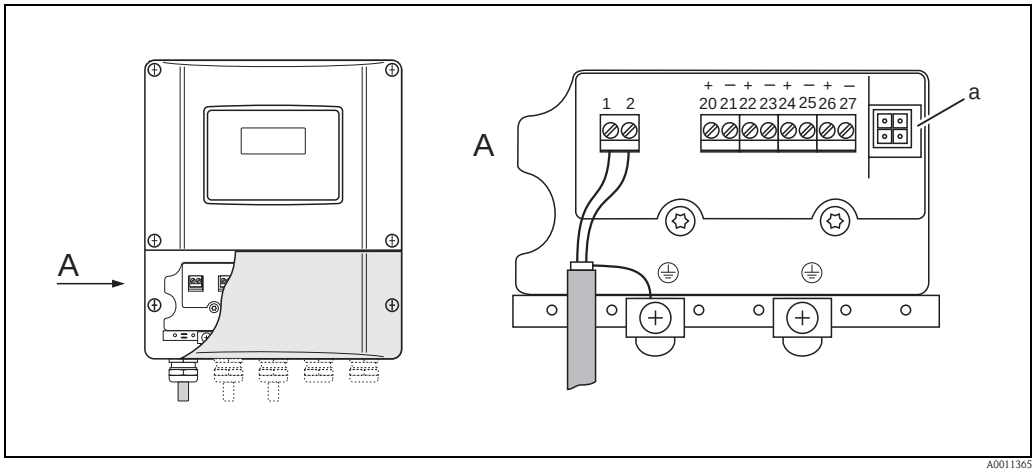


Fig. 18: Connecting a PC with the FieldCare operating software

a Service adapter for connecting service interface FXA193

Switching on the measuring device

1. Perform the post-connection check as specified in the checklist → 68.
2. Switch on the supply voltage for the device. The device performs internal test functions. Various messages appear on the display.
3. Normal measuring mode commences. Various measured value and/or status variables appear on the display (HOME position).

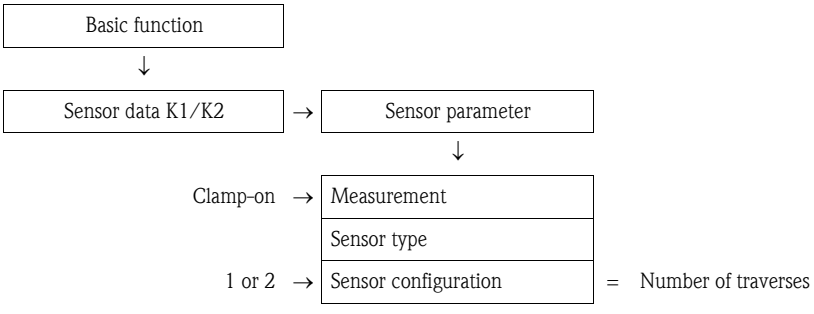
Note!
If startup fails, an appropriate error message is displayed, depending on the cause → 96.

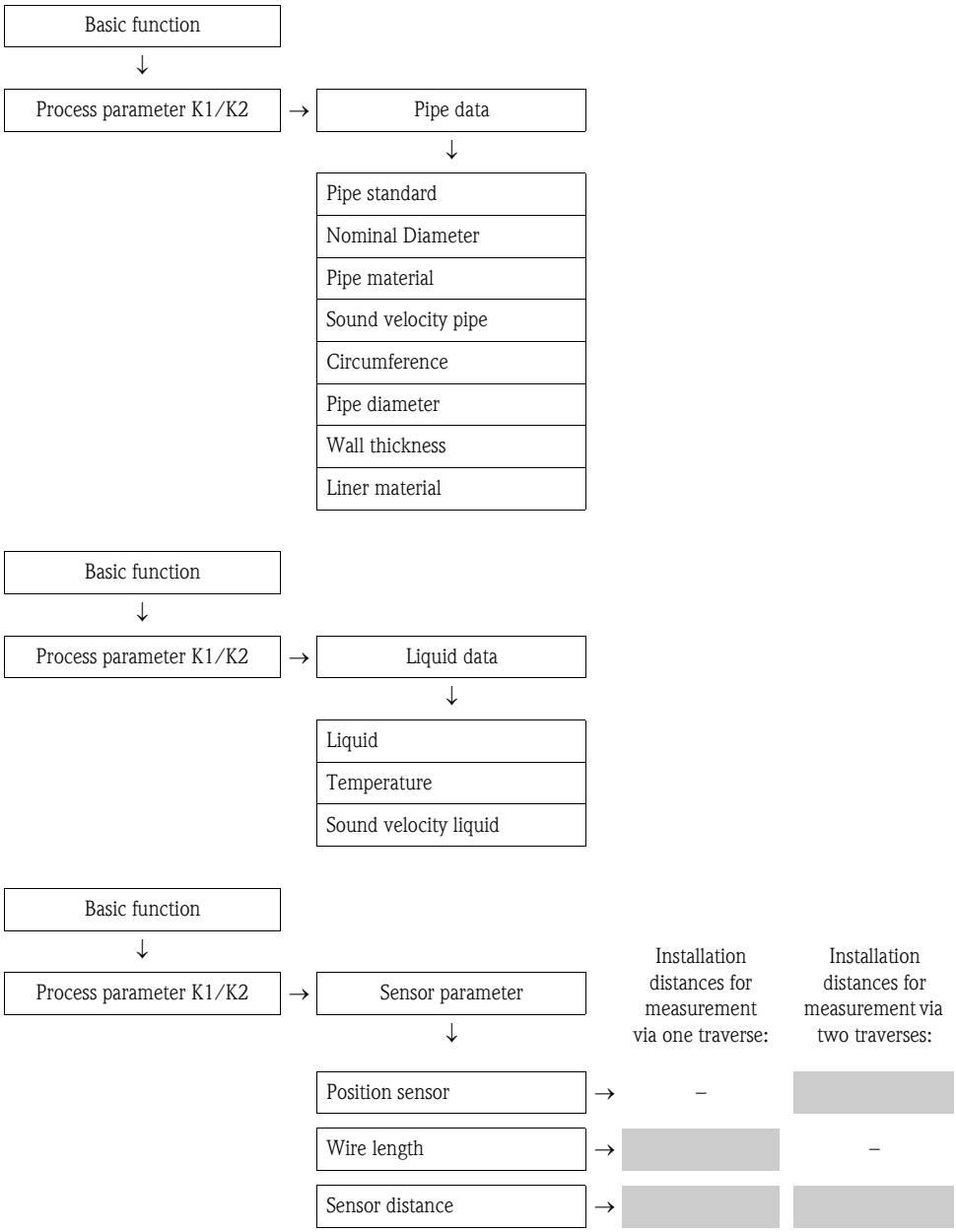
Reading off the installation distances via FieldCare

Note!
The following section only illustrates the functions necessary for clamp-on and insertion type of mounting.

Reading off installation distances via FieldCare for clamp-on type of mounting

1. Enter or select installation-specific values or the values specified here.
2. Read off the installation distances necessary for mounting.





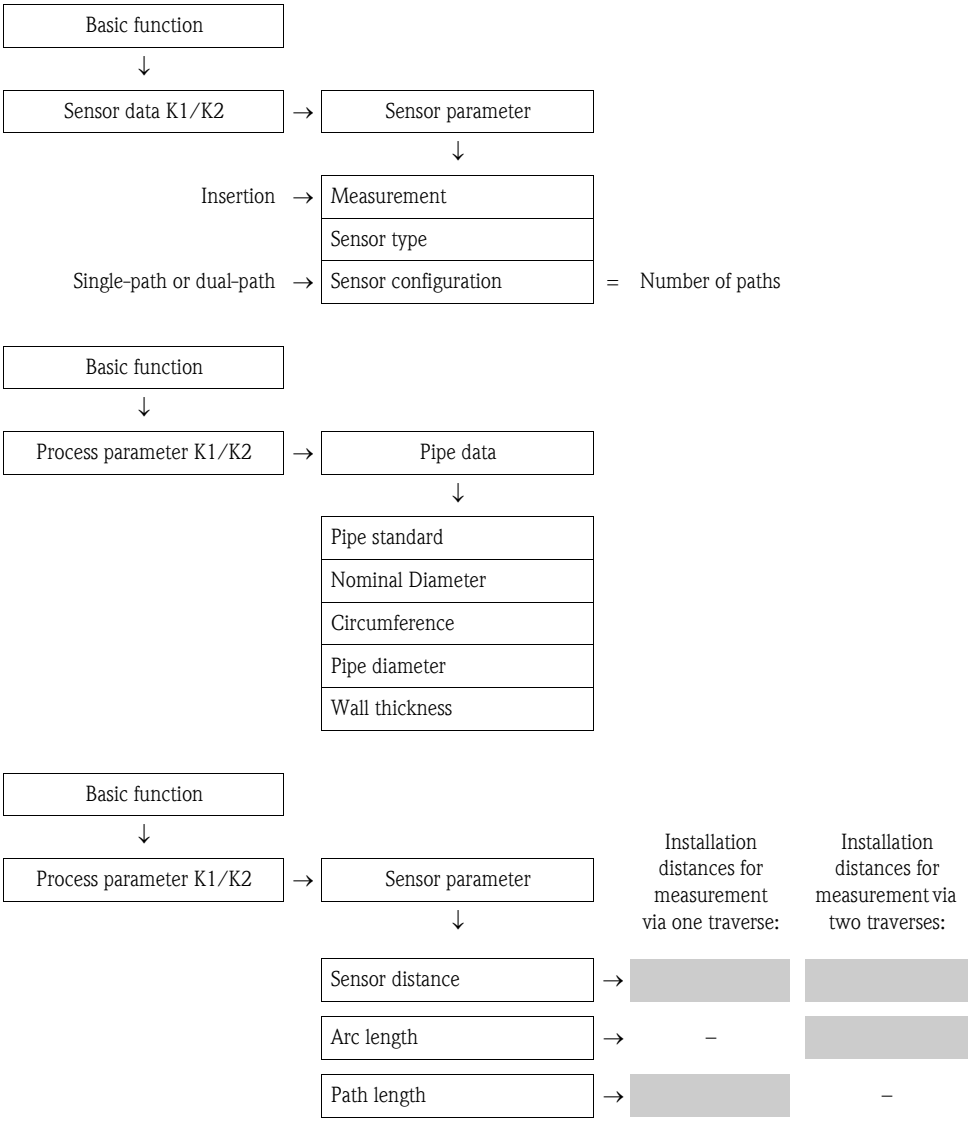
Subsequent procedure

The sensors can be installed once the installation distances have been determined:

- Prosonic Flow P (DN 15 to 65 / ½ to 2½") → 📄 35
- Prosonic Flow P (DN 50 to 4000 / 2 to 160") → 📄 37
- Prosonic Flow W (Clamp-on) → 📄 41

Reading off installation distances via FieldCare for insertion type of mounting

1. Enter or select installation-specific values or the values specified here.
2. Read off the installation distances necessary for mounting.



Subsequent procedure

The sensors can be installed once the installation distances have been determined:
■ Prosonic Flow W → 📄 45.

3.6.3 Determining installation distances via Applicator

Applicator is a software application for selecting and planning flowmeters. The installation distances required for installation can be determined without having to commission the transmitter beforehand.

Applicator is available:
- On a CD-ROM for installation on a local PC → 95.
- Via the Internet for direct online entry → www.endress.com → select country.
  On the Internet site, select → Instruments → Flow → Tooling → Applicator. In the "Applicator Sizing Flow" field, select the "Start Applicator Sizing Flow online" link.

Determining installation distances for clamp-on, measuring via one traverse

Determine the installation distances required via Applicator:
- Select the fluid.
- Select the device (e.g. 93P Clamp-on).
- Enter or select measuring point-specific values.
- Select the number of traverses: 1
- Read off the necessary installation distances:
  – Wire length: _____
  – Sensor distance: _____

Subsequent procedure

The sensors can be installed once the installation distances have been determined:
- Prosonic Flow P (DN 50 to 4000 / 2 to 160") → 37
- Prosonic Flow W → 41.

Determining installation distances for clamp-on, measuring via two traverses

Determine the installation distances required via Applicator:
- Select the fluid.
- Select the device (e.g. 93P Clamp-on).
- Enter or select measuring point-specific values.
- Select the number of traverses: 2
- Read off the necessary installation distances:
  – Sensor position: _____
  – Sensor distance: _____

Subsequent procedure

The sensors can be installed once the installation distances have been determined:
- Prosonic Flow P (DN 15 to 65 / ½ to 2½") → 39
- Prosonic Flow P (DN 50 to 4000 / 2 to 160") → 39
- Prosonic Flow W → 43.

Determining installation distances for insertion version, single-path measurement

Determine the installation distances required via Applicator:
- Select the fluid.
- Select the device (e.g. 93W Insert 1Ch).
- Enter or select measuring point-specific values.
- Read off the necessary installation distance:
  – Sensor distance: _____

Subsequent procedure

The sensors can be installed once the installation distances have been determined:
- Prosonic Flow W → 46.

Determining installation distances for insertion version, dual-path measurement

Determine the installation distances required via Applicator:
- Select the fluid.
- Select the device (e.g. 93W Insert 2Ch).
- Enter or select measuring point-specific values.
- Read off the necessary installation distances:
  – Sensor distance: _____
  – Arc length: _____

Subsequent procedure

The sensors can be installed once the installation distances have been determined:
- Prosonic Flow W → 📄 41.

3.7 Mechanical preparation

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

Overview of possible ways to secure the various sensors:

Prosonic Flow	For the measuring range	Pipe nominal diameter	Secured by
93W/93P	DN 15 to 65 (½ to 2½")	DN ≤ 32 (1¼")	Sensor holder with U-shaped screws → 30
		DN > 32 (1¼")	Sensor holder with strapping bands → 31
93P	DN 50 to 4000 (2 to 160")	DN ≤ 200 (8")	Strapping bands (medium nominal diameters) → 32
			Welded bolts → 34
		DN > 200 (8")	Strapping bands (large nominal diameters) → 33
			Welded bolts → 34
93W	DN 50 to 4000 (2 to 160")	DN ≤ 200 (8")	Strapping bands (medium nominal diameters) → 32
			Welded bolts → 34
		DN > 200 (8")	Strapping bands (large nominal diameters) → 33
			Welded bolts → 34
			Insertion version → 45

3.7.1 Mounting the sensor holder with U-shaped screws

- For mounting on a pipe with a nominal diameter of DN ≤ 32 (1¼")
- For sensors: Prosonic Flow 93W and P (DN 15 to 65 / ½ to 2½")

Procedure

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

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

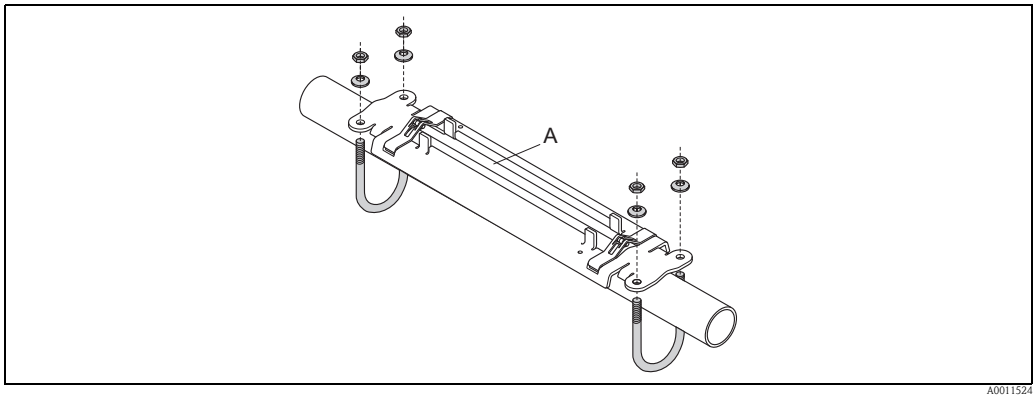


Fig. 19: Mounting the Prosonic Flow P sensor holder (DN 15 to 65 / ½ to 2½") with U-shaped screws

3.7.2 Mounting the sensor holder with strapping bands

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

For sensors:
- Prosonic Flow 93W and P (DN 15 to 65 / ½ to 2½")

Procedure

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

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

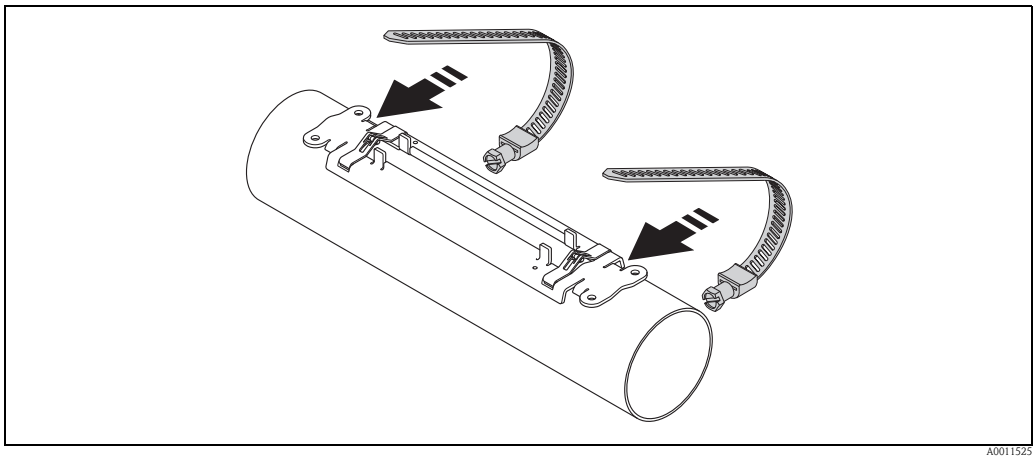


Fig. 20: Positioning the sensor holder and mounting the strapping bands

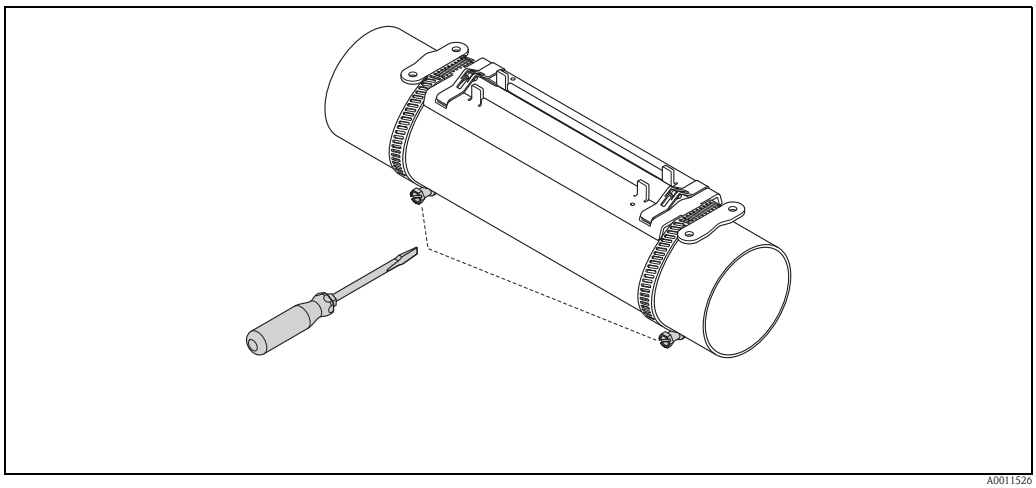


Fig. 21: Tightening the strapping screws of the strapping bands

3.7.3 Premounting the strapping bands (medium nominal diameters)

When mounting on a pipe with a nominal diameter of DN ≤ 200 (8")

For sensors:
- Prosonic Flow 93P (DN 50 to 4000 / 2 to 160")
- Prosonic Flow 93W

Procedure

First strapping band

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

Second strapping band

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

Both strapping bands

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

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

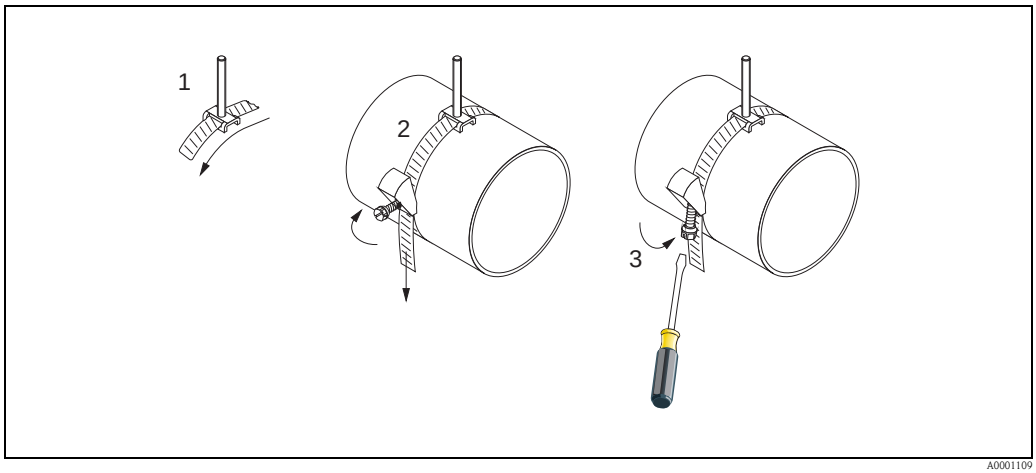


Fig. 22: Premounting strapping bands for pipe diameters DN ≤ 200 (8")

1 Mounting bolt
2 Strapping band
3 Strapping screw

3.7.4 Premounting the strapping bands (large nominal diameters)

When mounting on a pipe with a nominal diameter of DN > 200 (8")

For sensors:
- Prosonic Flow 93P (DN 50 to 4000 / 2 to 160")
- Prosonic Flow 93W

Procedure

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

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

First strapping band

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

Second strapping band

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

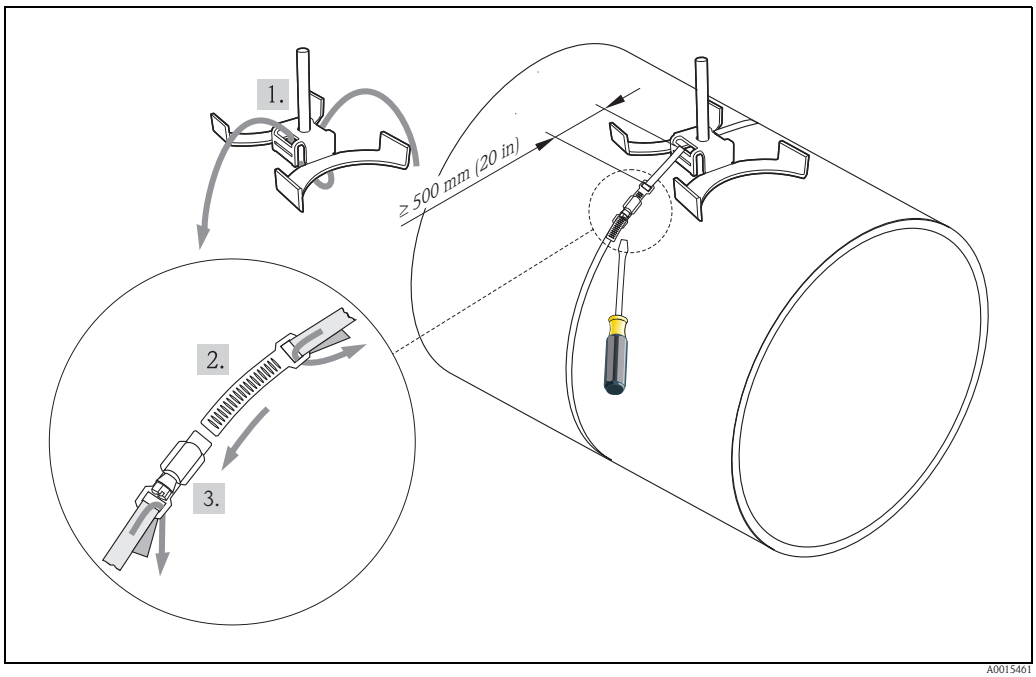


Fig. 23: Premounting strapping bands for pipe diameters DN > 600 (24")

*1 Mounting bolt with guide**
*2 Strapping band**
2 Strapping screw
** Distance between mounting bolt and strapping band lock min. 500 mm (20 in)*

3.7.5 Mounting the welded bolts

When mounting on a pipe with a nominal diameter of DN 50 to 4000 (2 to 160")

For sensors:
- Prosonic Flow 93P (DN 50 to 4000 / 2 to 160")
- Prosonic Flow 93W

Procedure

The welded bolts must be fixed at the same installation distances as the mounting bolts with strapping bands. The following sections explain how to the align the mounting bolts depending on the type of mounting and the measurement method:
- Prosonic Flow P (DN 50 to 4000 / 2 to 160"), Clamp-on
  - Installation for measurement via one traverse → 37
  - Installation for measurement via two traverses → 39.
- Prosonic Flow W, Clamp-on
  - Installation for measurement via one traverse → 41
  - Installation for measurement via two traverses → 43.

The sensor holder is secured with a retaining nut with a metric ISO M6 thread as standard. If you want to use another thread to secure the sensor holder, you must use a sensor holder with a removable retaining nut (order number: 93WAx - xBxxxxxxxxxx).

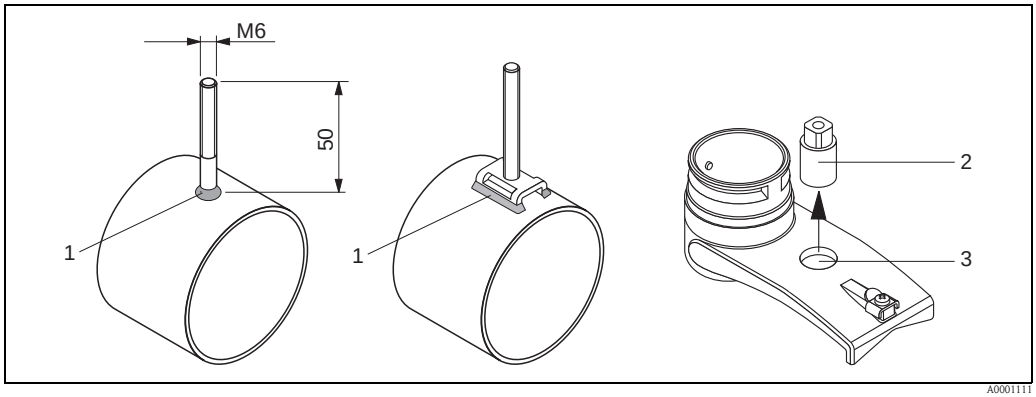


Fig. 24: Use of welded bolts

1 Welding seam
2 Retaining nut
3 Hole diameter max. 8.7 mm (0.34")

3.8 Installing Prosonic Flow W and P DN 15 to 65 (½ to 2½")

3.8.1 Mounting the sensor

Prerequisites

- The installation distance (sensor distance) is known → 16.
- The sensor holder is already mounted → 30.

Material

The following material is needed for mounting:
- Sensor incl. adapter cable
- Connecting cable for connecting to the transmitter
- Coupling fluid for an acoustic connection between the sensor and pipe

Procedure

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

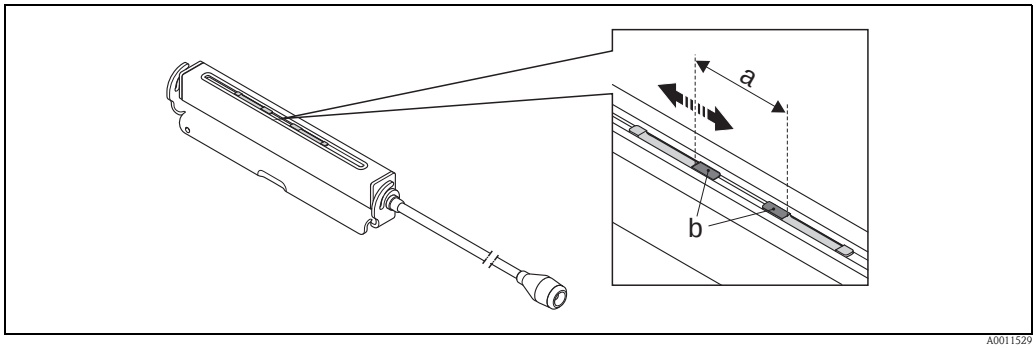


Fig. 25: Setting the distance between the sensors as per the value for the sensor distance

a Sensor distance
b Contact surfaces of the sensor

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

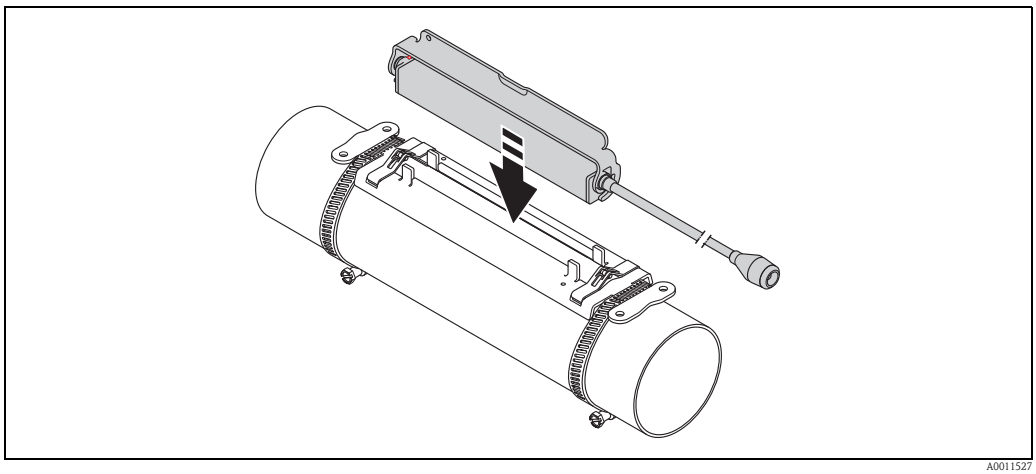


Fig. 26: Fitting the sensor housing

4. Fix the sensor housing with the bracket.

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

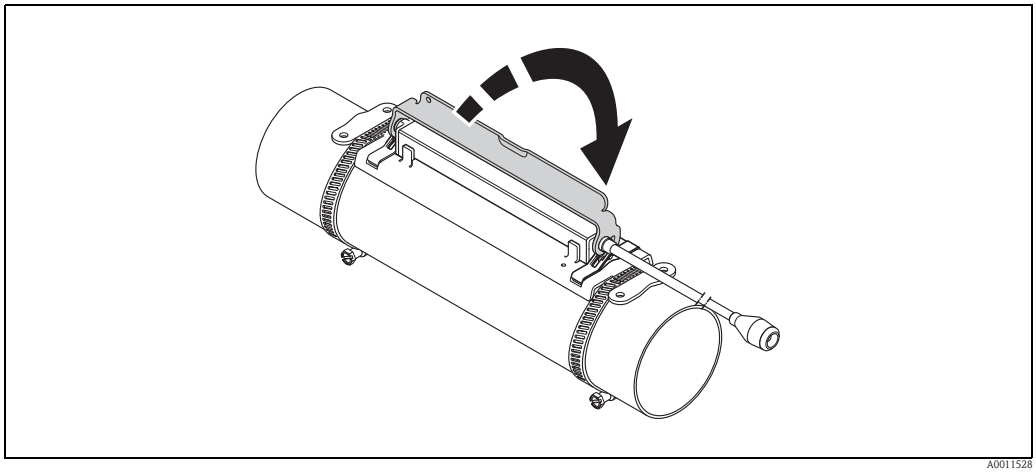


Fig. 27: Fixing the sensor housing

5. Connect the connecting cable to the adapter cable.

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 61.

3.9 Installing Prosonic Flow P DN 50 to 4000 (2 to 160"), Clamp-on

3.9.1 Installation for measurement via one traverse

Prerequisites

- The installation distances (sensor distance and wire length) are known → 16.
- The strapping bands are already mounted → 30.

Material

The following material is needed for mounting:
- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 30)
- Two measuring wires, each with a cable lug and a fixer to position the strapping bands
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

Procedure

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

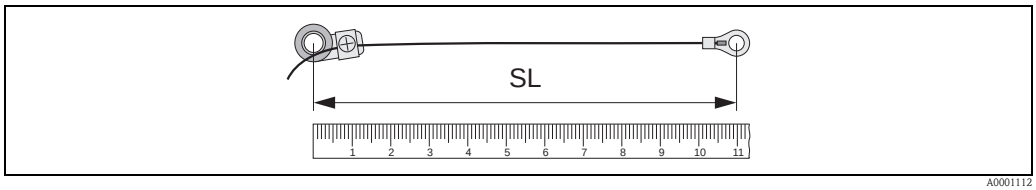


Fig. 28: Fixer (a) and cable lugs (b) at a distance that corresponds to the wire length (SL)

2. With the first measuring wire:
   – Fit the fixer over the mounting bolt of the strapping band that is already securely mounted.
   – Run the measuring wire **clockwise** around the pipe.
   – Fit the cable lug over the mounting bolt of the strapping band that can still be moved.
3. With the second measuring wire:
   – Fit the cable lug over the mounting bolt of the strapping band that is already securely mounted.
   – Run the measuring wire **counterclockwise** around the pipe.
   – Fit the fixer over the mounting bolt of the strapping band that can still be moved.
4. Take the still movable strapping band, incl. the mounting bolt, and move it until both measuring wires are evenly tensioned and tighten the strapping band so that it cannot slip.

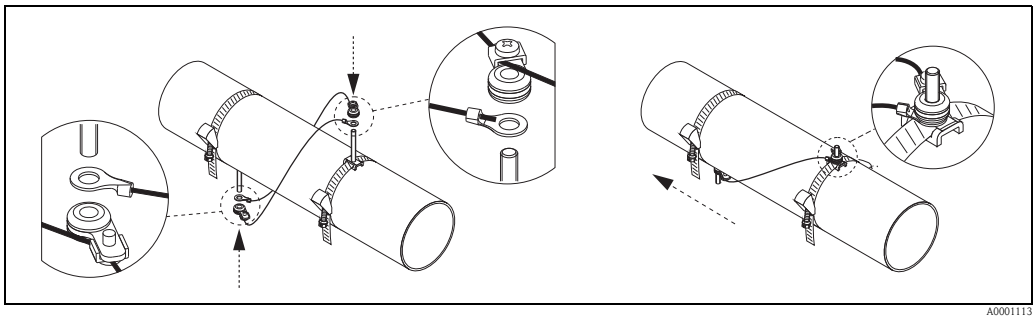


Fig. 29: Positioning the strapping bands (steps 2 to 4)

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

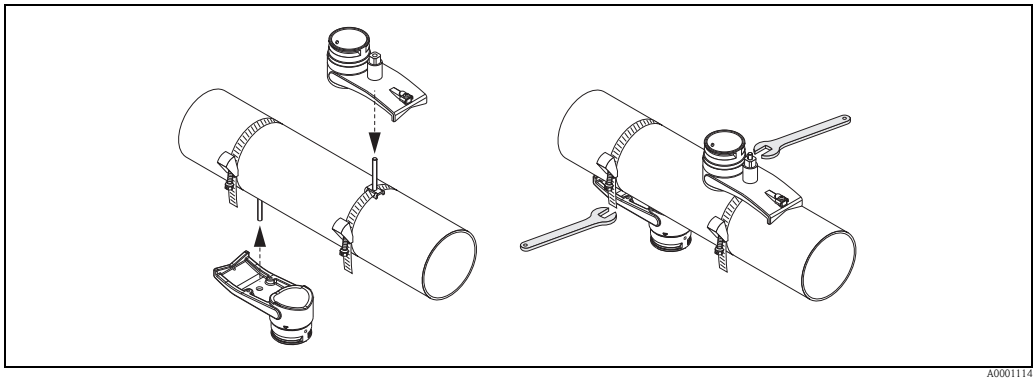


Fig. 30: Mounting the sensor holders

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

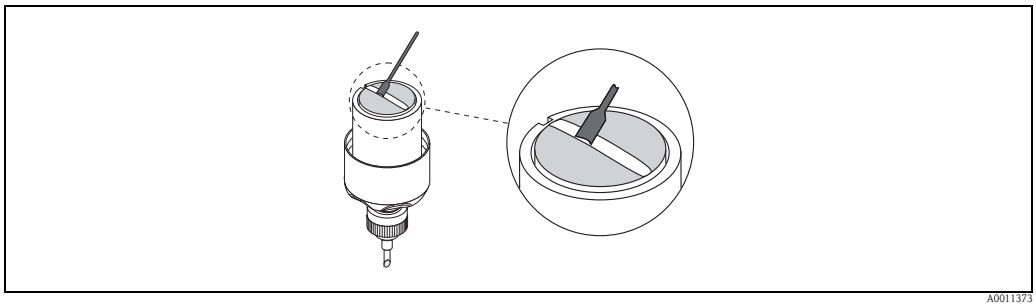


Fig. 31: Coating the contact surfaces of the sensor with coupling fluid

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

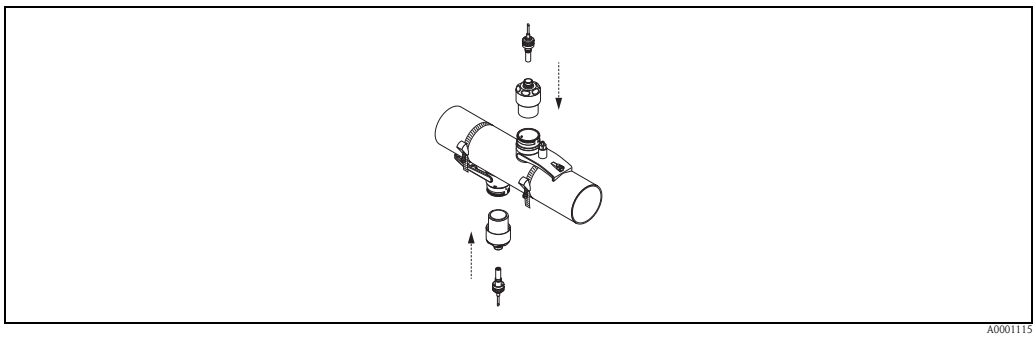


Fig. 32: Mounting the sensor and connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🖹 61.

3.9.2 Installation for measurement via two traverses

Prerequisites

- The installation distance (position sensor) is known → 16.
- The strapping bands are already mounted → 30.

Material

The following material is needed for mounting:
- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 30)
- A mounting rail to position the strapping bands
- Two mounting rail retainers
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

Mounting rail and POSITION SENSOR installation distance

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

Procedure

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

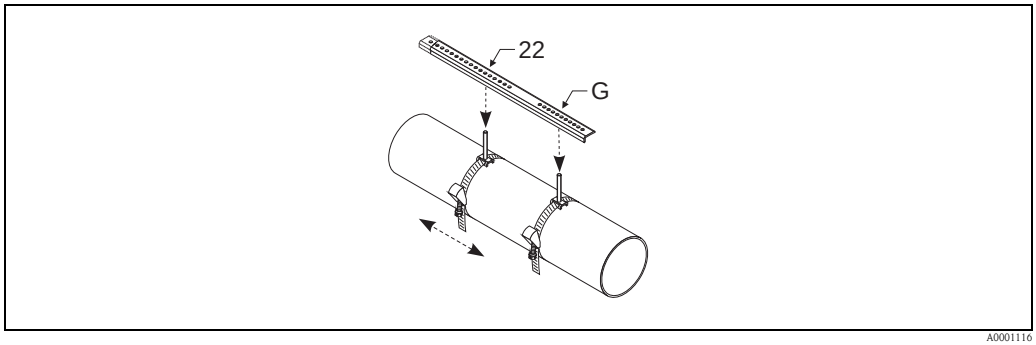


Fig. 33: Determining the distance in accordance with the mounting rail (e.g. POSITION SENSOR G22)

2. Tighten the strapping band so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.
5. Screw the retainers of the mounting rail onto the sensor holder in question.
6. Screw the mounting rail onto the sensor holders.

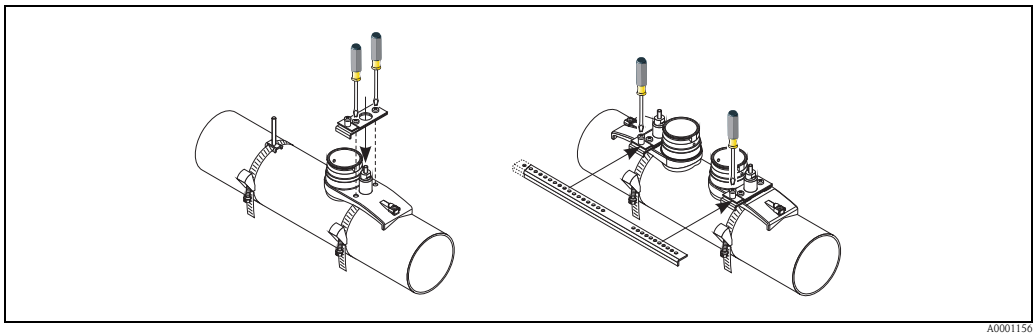


Fig. 34: Mounting the sensor holders and mounting rail

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

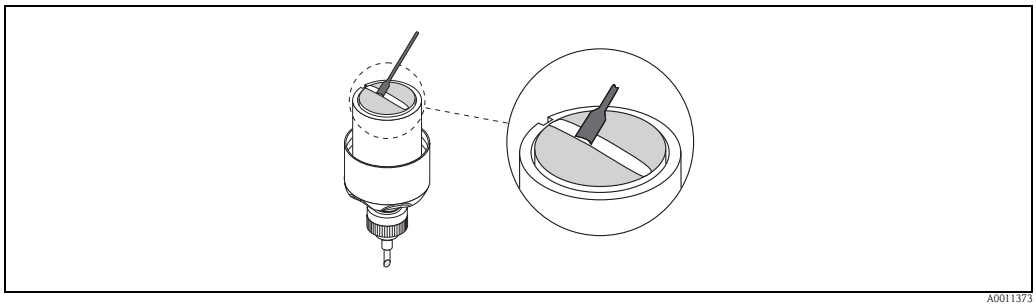


Fig. 35: Coating the contact surfaces of the sensor with coupling fluid

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

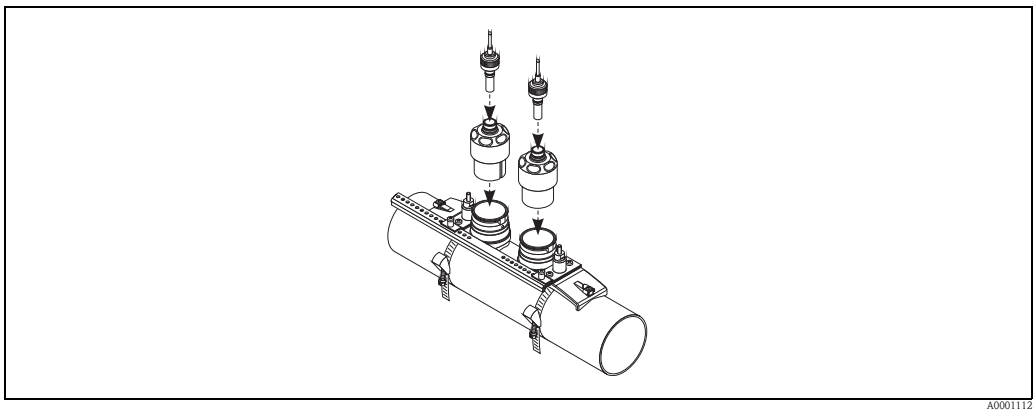


Fig. 36: Mounting the sensor and connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🖹 61.

3.10 Installing Prosonic Flow W (Clamp-on)

3.10.1 Installation for measurement via one traverse

Prerequisites

- The installation distances (sensor distance and wire length) are known → 16.
- The strapping bands are already mounted → 30.

Material

The following material is needed for mounting:
- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 30)
- Two measuring wires, each with a cable lug and a fixer to position the strapping bands
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

Procedure

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

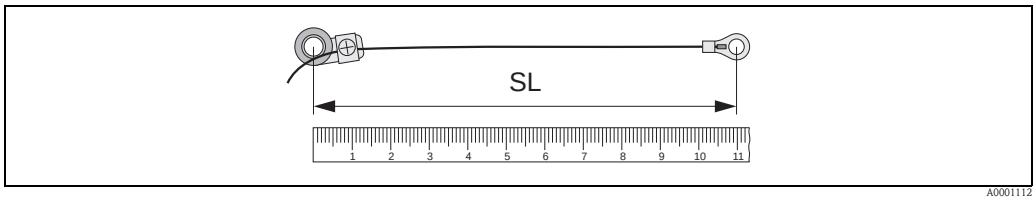


Fig. 37: Fixer (a) and cable lugs (b) at a distance that corresponds to the wire length (SL)

2. With the first measuring wire:
   – Fit the fixer over the mounting bolt of the strapping band that is already securely mounted.
   – Run the measuring wire **clockwise** around the pipe.
   – Fit the cable lug over the mounting bolt of the strapping band that can still be moved.
3. With the second measuring wire:
   – Fit the cable lug over the mounting bolt of the strapping band that is already securely mounted.
   – Run the measuring wire **counterclockwise** around the pipe.
   – Fit the fixer over the mounting bolt of the strapping band that can still be moved.
4. Take the still movable strapping band, incl. the mounting bolt, and move it until both measuring wires are evenly tensioned and tighten the strapping band so that it cannot slip.

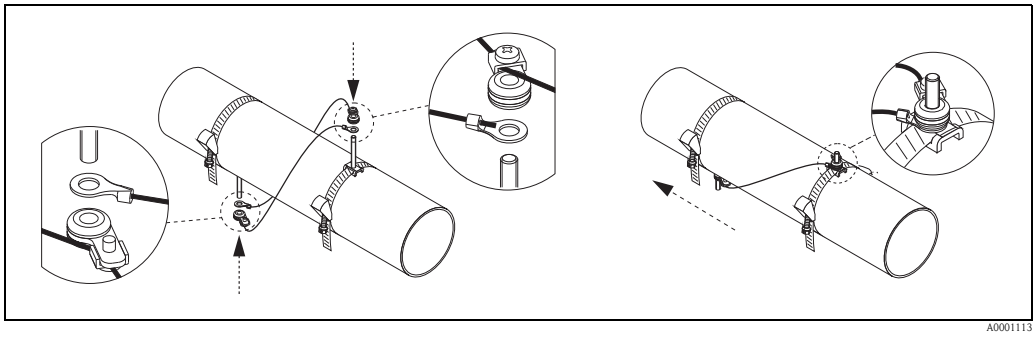


Fig. 38: Positioning the strapping bands (steps 2 to 4)

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

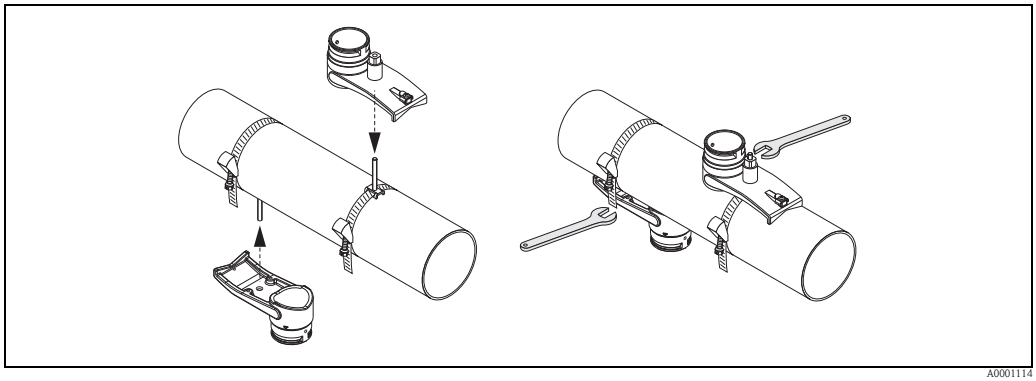


Fig. 39: Mounting the sensor holders

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

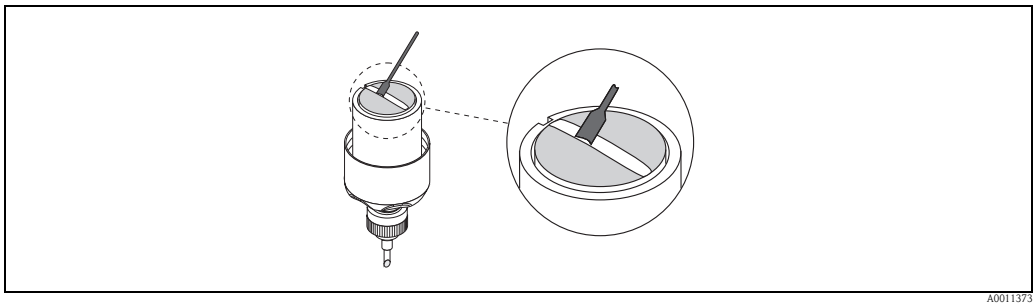


Fig. 40: Coating the contact surfaces of the sensor with coupling fluid

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

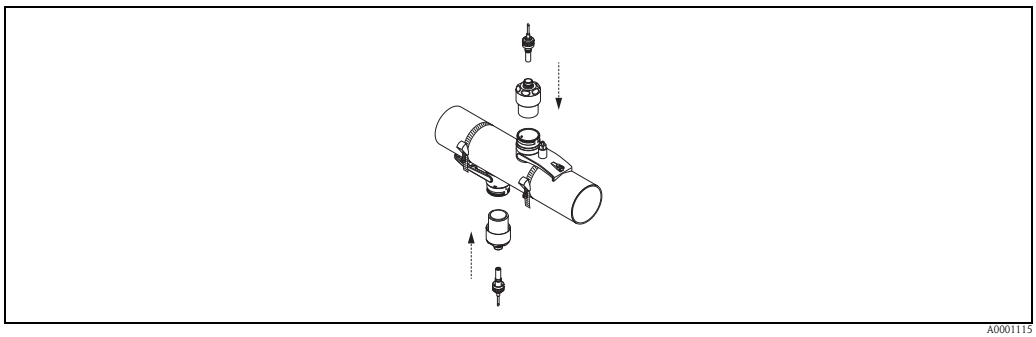


Fig. 41: Mounting the sensor and connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🖹 61.

3.10.2 Installation for measurement via two traverses

Prerequisites

- The installation distance (position sensor) is known → 16.
- The strapping bands are already mounted → 30.

Material

The following material is needed for mounting:
- Two strapping bands incl. mounting bolts and centering plates where necessary (already mounted → 30)
- A mounting rail to position the strapping bands
- Two mounting rail retainers
- Two sensor holders
- Coupling fluid for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables.

Mounting rail and POSITION SENSOR installation distance

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

Procedure

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

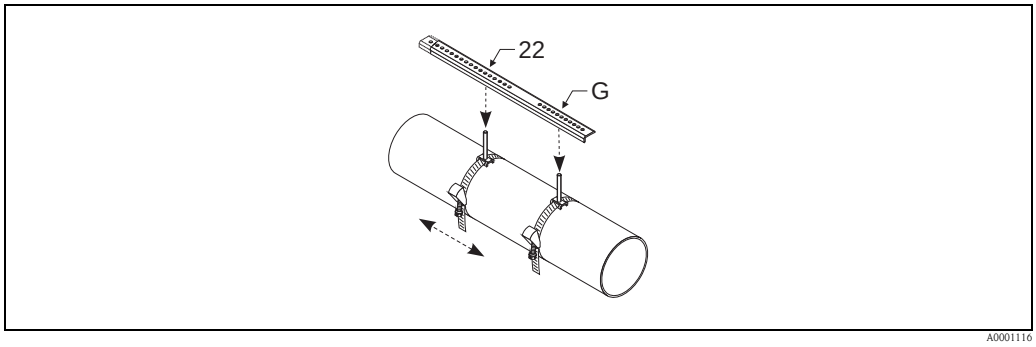


Fig. 42: Determining the distance in accordance with the mounting rail (e.g. POSITION SENSOR G22)

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

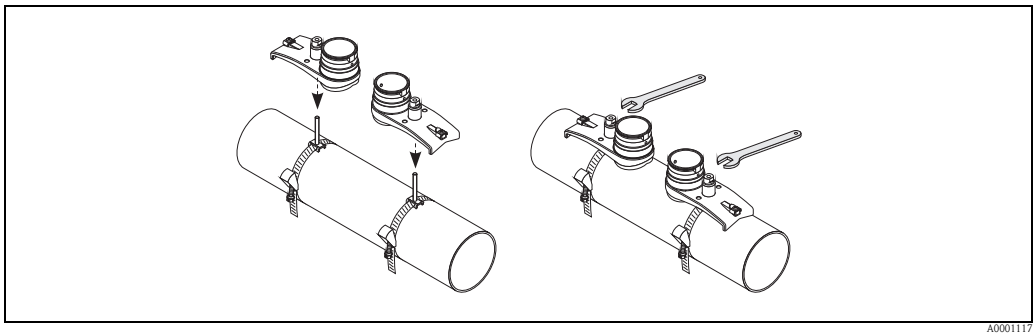


Fig. 43: Mounting the sensor

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

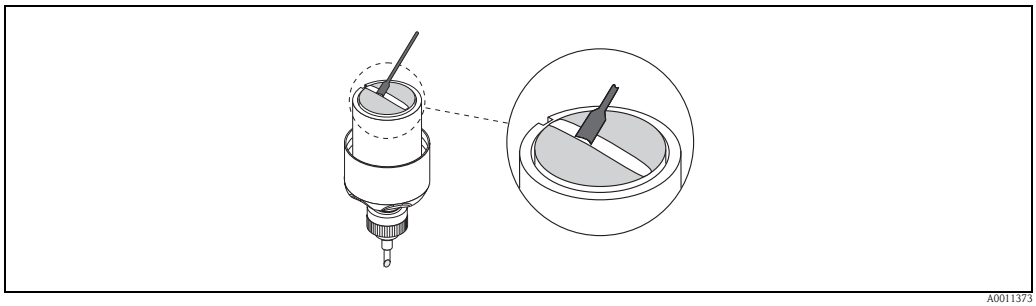


Fig. 44: Coating the contact surfaces of the sensor with coupling fluid

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

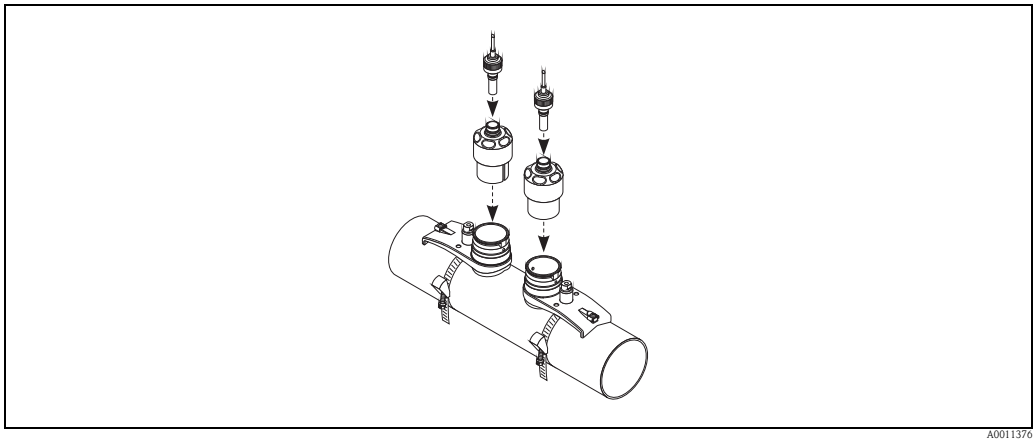


Fig. 45: Connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 61.

3.11 Installing Prosonic Flow W (Insertion version)

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

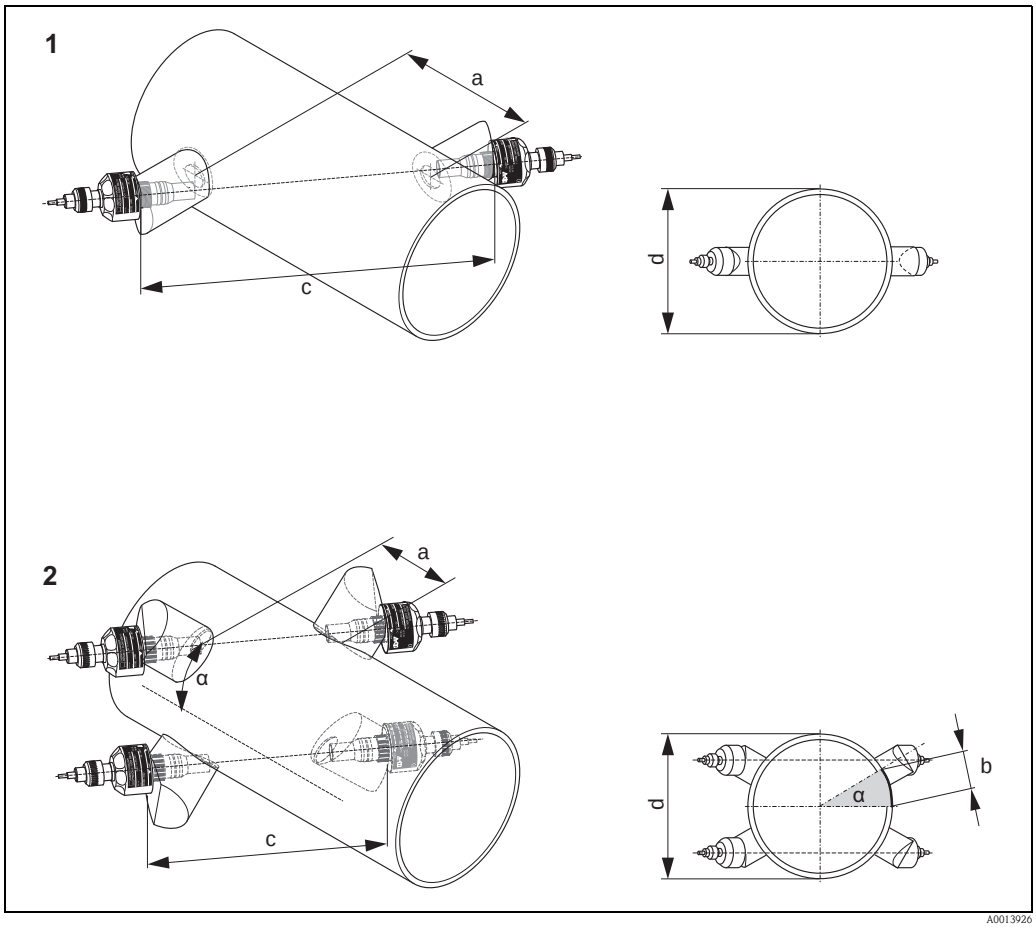


Fig. 46: Explanation of terms

1 Single-path version
2 Dual-path version

a Sensor distance
b Arc length
c Path length
d Pipe outer diameter (is determined by the application)

3.11.1 Installation for measurement as single-path insertion version

1. Determine the installation area (e) on the pipe section:
   – Mounting location → 📄 11
   – Inlet/outlet run → 📄 12
   – Space required by the measuring point: approx. 1× 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 / 2.56").

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

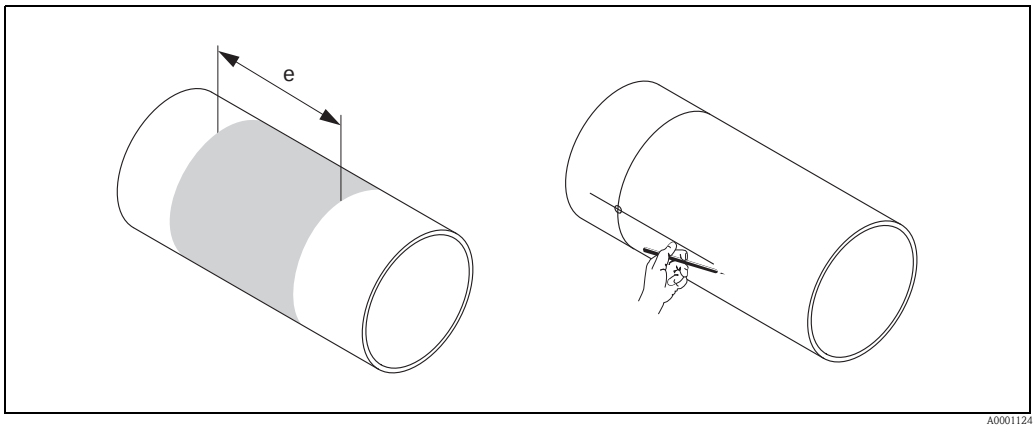


Fig. 47: Installing the measuring sensors, steps 1 and 2

3. Cut the first hole, e.g. with a plasma cutter. Measure the wall thickness of the pipe if it is not known.
4. Determine the sensor distance.

   ✎ Note!
   Determine the sensor distance as follows:
   – Via the Quick Setup "Sensor Installation" for measuring devices with local operation. Run the Quick Setup as described on → 📄 84. The sensor distance is displayed in the SENSOR DISTANCE function. The transmitter must be installed and connected to the power supply before you can run the "Sensor Installation" Quick Setup.
   – As explained on → 📄 84 for transmitters without local operation.

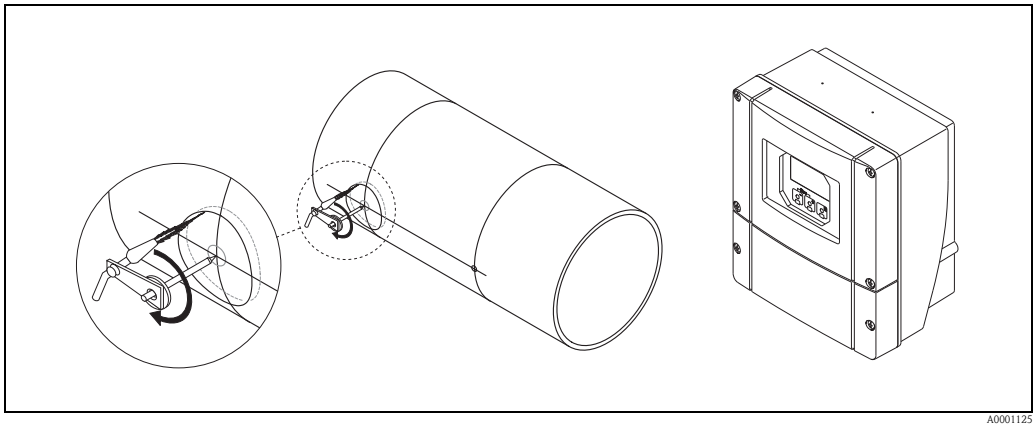


Fig. 48: Installing the measuring sensors, steps 3 and 4

5. Draw the sensor distance (a) starting from the middle line of the first drillhole.

6. Project the middle line to the back of the pipe and draw it on.

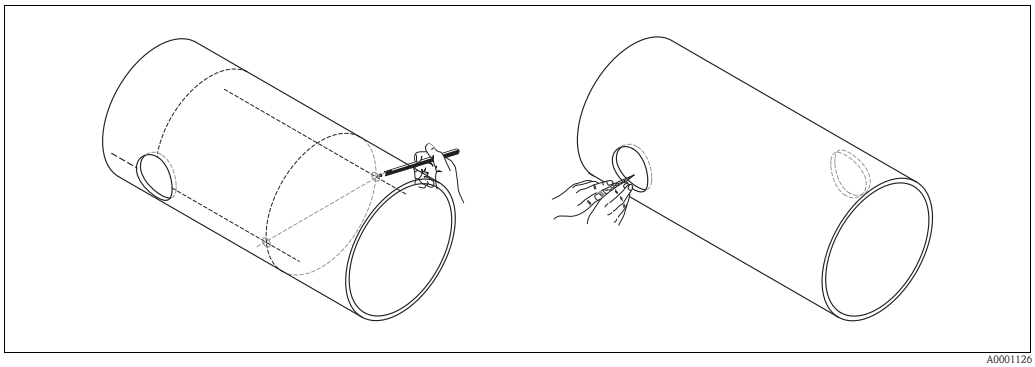


Fig. 49: Installing the measuring sensors, steps 5 and 6

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.).

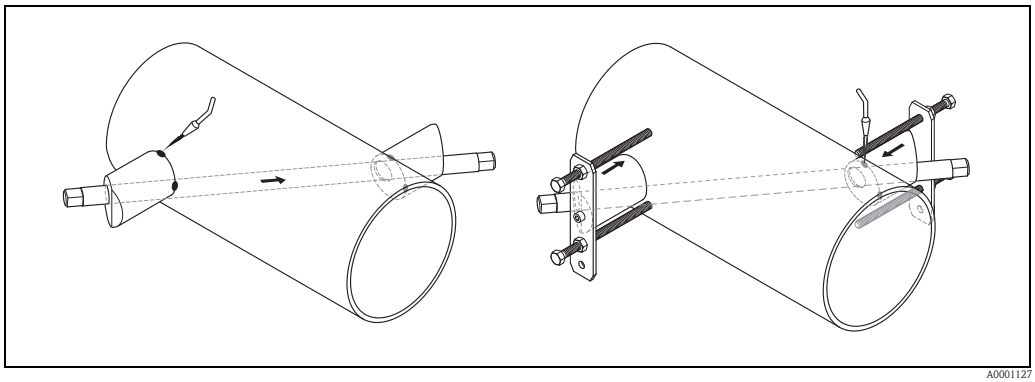


Fig. 50: Installing the measuring sensors, steps 7 and 8

9. Insert the sensor holders into the two drillholes. To adjust the weld-in depth, you can fix both sensor holders with the special tool for insertion depth regulation (optional) and then align using the tie rod. The sensor holder must be flush with the inner side of the pipe.
10. Spot-weld both sensor holders.

    Note!
    To align the tie rod, you have to screw two guide bushings into the sensor holders.

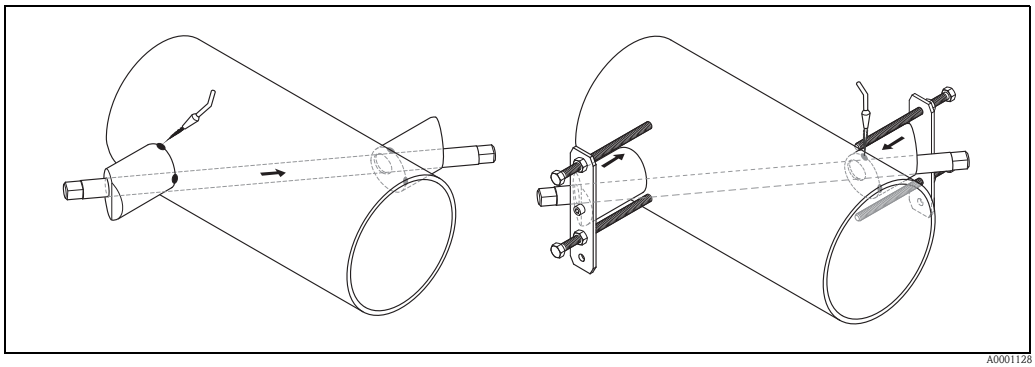


Fig. 51: Installing the measuring sensors, steps 9 and 10

11. Weld in both sensor holders.

12. Check the distance between the drillholes once again and determine the path length.

    ✎ Note!
    Determine the path length as follows:
    – Via the Quick Setup "Sensor Installation" for measuring devices with local operation. Run the Quick Setup as described on → 📄 84. The path length is displayed in the PATH LENGTH function. The transmitter must be installed and connected to the power supply before you can run the "Sensor Installation" Quick Setup.
    – As explained on → 📄 84 for transmitters without local operation.

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

14. Insert the sensor cable connectors into the opening provided and manually tighten the connectors to the stop.

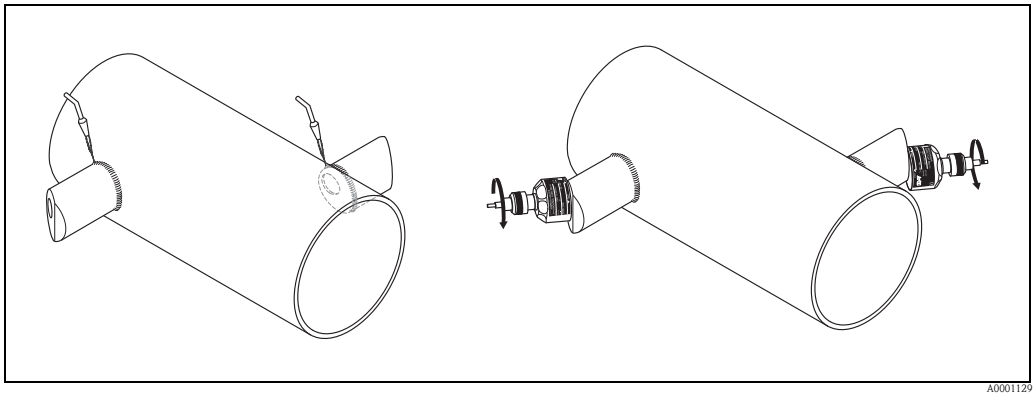


Fig. 52: Installing the measuring sensors, steps 11 to 14

3.11.2 Installation for measurement as dual-path insertion version

1. Determine the installation area (e) on the pipe section:
   – Mounting location → 📄 11
   – Inlet/outlet run → 📄 12
   – Space required by the measuring point: approx. 1× pipe diameter.
2. Mark the middle line on the pipe at the mounting location.

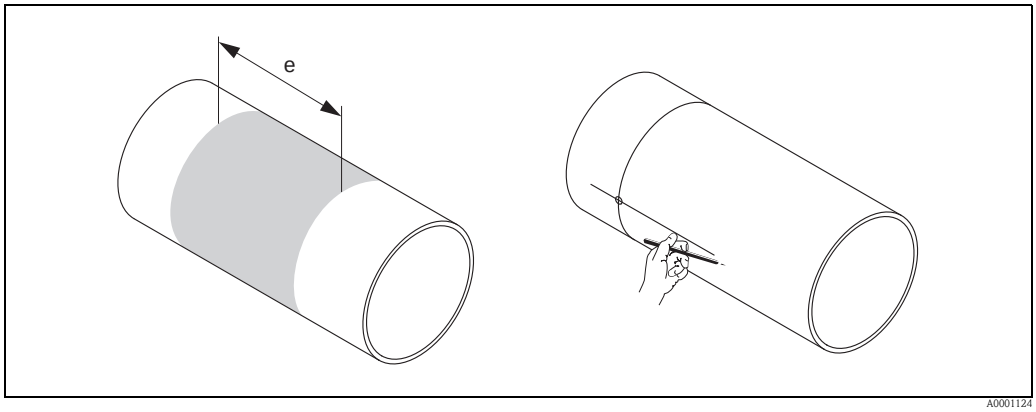


Fig. 53: Installing the dual-path measuring sensors, steps 1 and 2

3. At the mounting location of the sensor holder, mark the length of the arc (b) to one side of 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 to 82 mm / 3.19 to 3.23").

   ✎ Note!
   Make the lines longer than the drillhole!
4. Cut the first hole, e.g. with a plasma cutter. Measure the wall thickness of the pipe if it is not known.

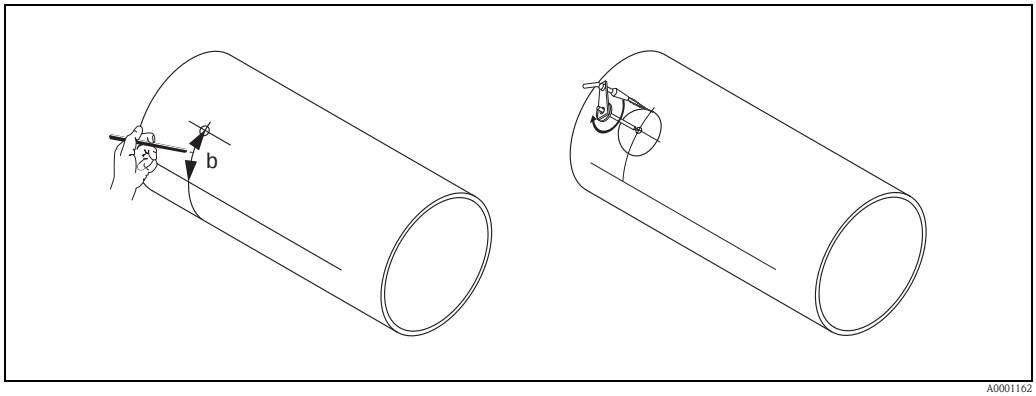


Fig. 54: Installing the dual-path measuring sensors, steps 3 and 4

5. Determine the space between the distancing holes (sensor distance) and the arc length between the sensors of the measuring groups.

   ✎ Note!
   Determine the sensor distance as follows:
   – Via the Quick Setup "Sensor Installation" for measuring devices with local operation. Run the Quick Setup as described on → 📄 84. The sensor distance is displayed in the SENSOR DISTANCE function (6886) and the arc length in the ARC LENGTH function (6887). The transmitter must be installed and connected to the power supply before you can run the "Sensor Installation" Quick Setup.
   – As explained on → 📄 84 for transmitters without local operation.

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

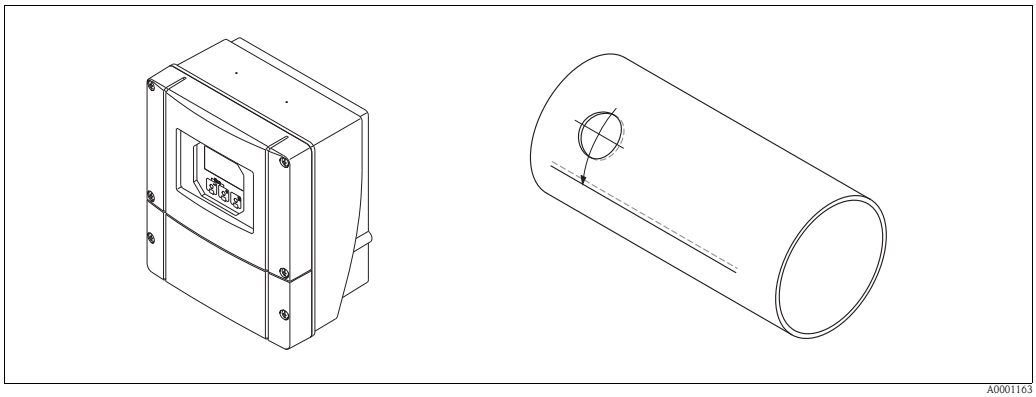


Fig. 55: Installing the dual-path measuring sensors, steps 5 and 6

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.

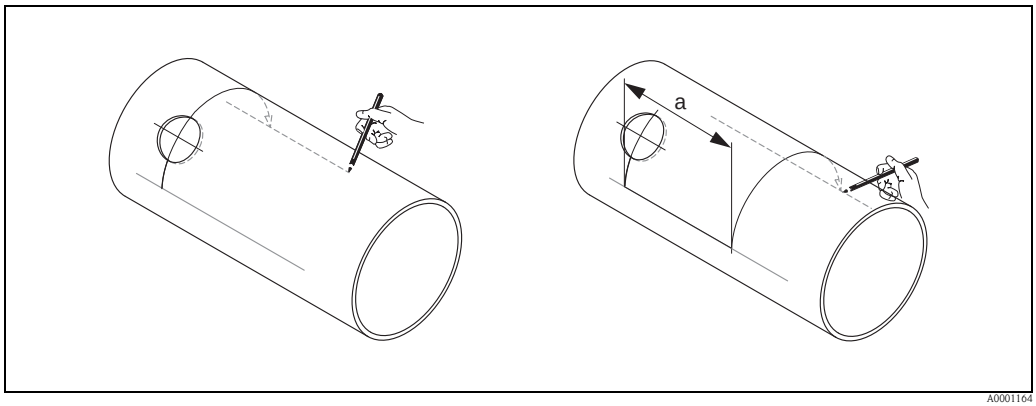


Fig. 56: Installing the dual-path measuring sensors, steps 7 and 8

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 in 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).

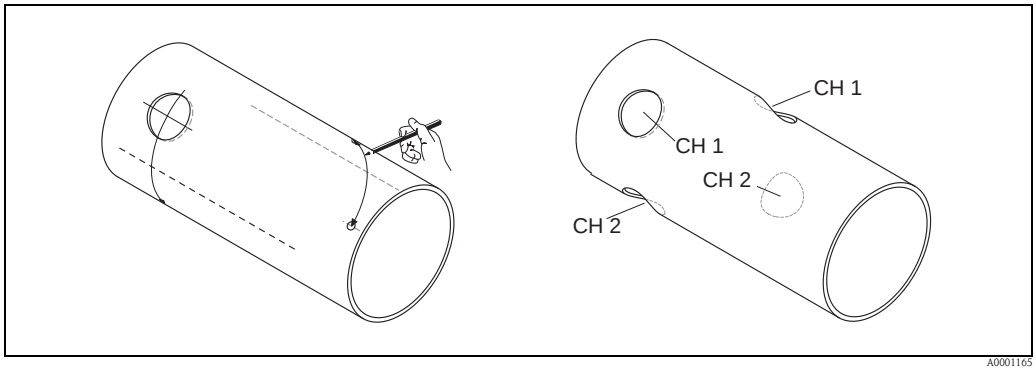


Fig. 57: Installing the dual-path measuring sensors, steps 9 and 10

11. Insert the sensor holders into the first pair of drillholes and align with the tie rod (alignment tool). Spot-weld with the wedding apparatus and then permanently weld both sensor holders.

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

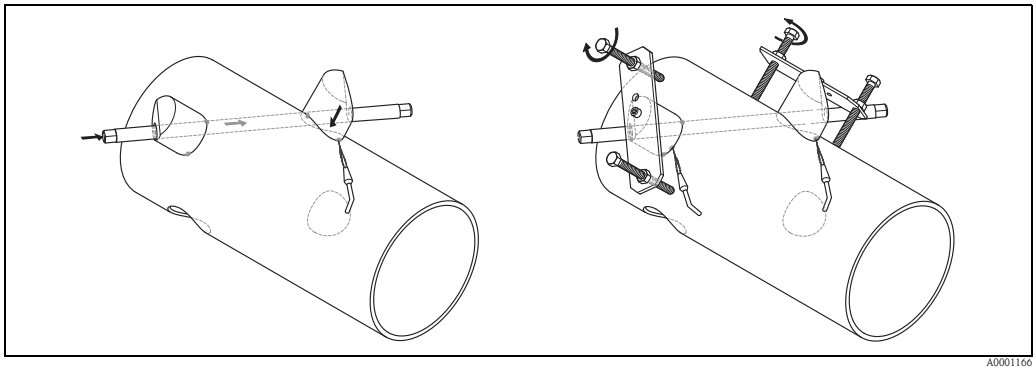


Fig. 58: Installing the dual-path measuring sensors, step 11

12. Weld in both sensor holders.
13. Check the path length, sensor distances 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.
14. Insert the second pair of sensor holders into the two remaining drillholes as described in step 12.

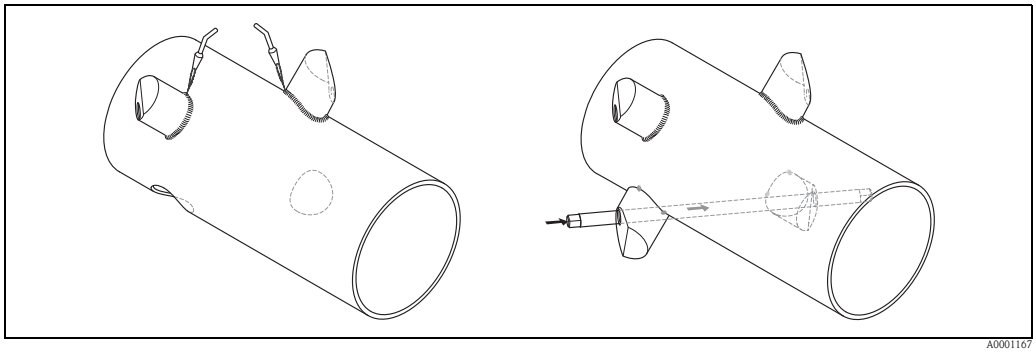


Fig. 59: Installing the dual-path measuring sensors, steps 13 and 14

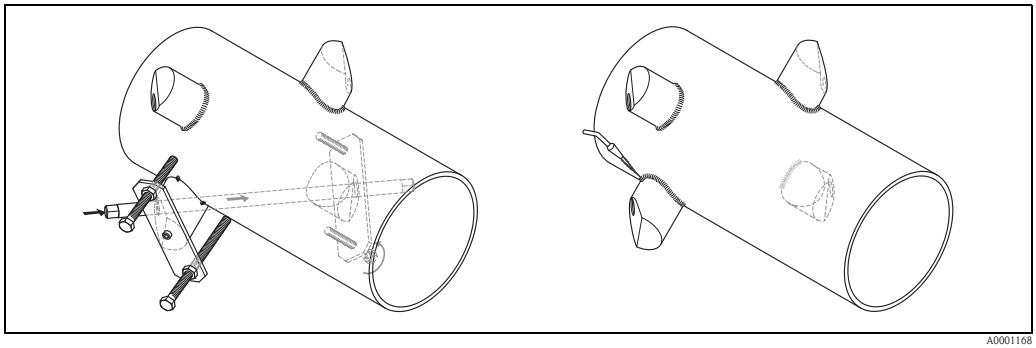


Fig. 60: Installing the dual-path measuring sensors, step 13

15. Then screw the sensors into the sensor holders by hand. If you use a tool, the maximum torque permissible is 30 Nm.
16. Insert the sensor cable connectors into the opening provided and manually tighten the connectors to the stop.

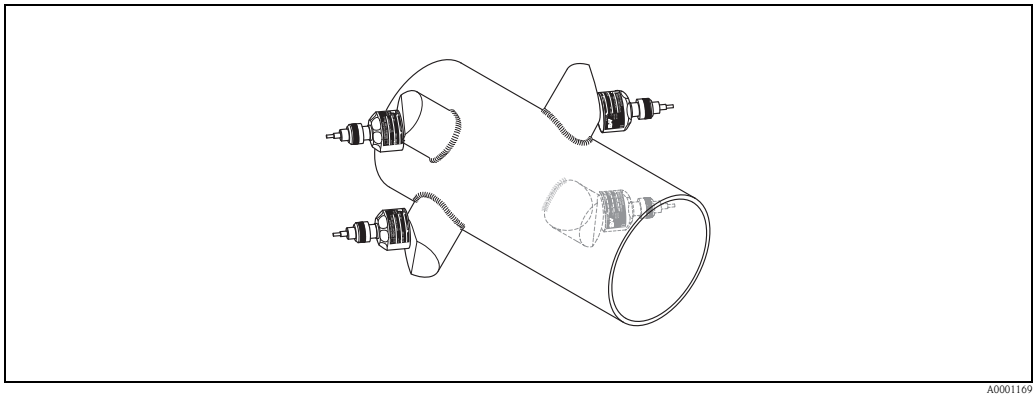


Fig. 61: Installing the dual-path measuring sensors, step 14 and 15

3.12 Installing sensor DDU18

1. Premount the strapping band:
   – Nominal diameters DN ≤ 200 (8") → 📄 32
   – Nominal diameters DN > 200 (8") → 📄 33
   The two mounting bolts must be positioned opposite each other on either side of the pipe.
2. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.
3. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.
4. Insert the sensor into the sensor holder.
5. Fit the sensor cover on the sensor holder and turn until:
   – The sensor cover engages with a click
   – The arrows (▲ / ▼ "close") are pointing towards one another.
6. Screw the connecting cable into the individual sensor.

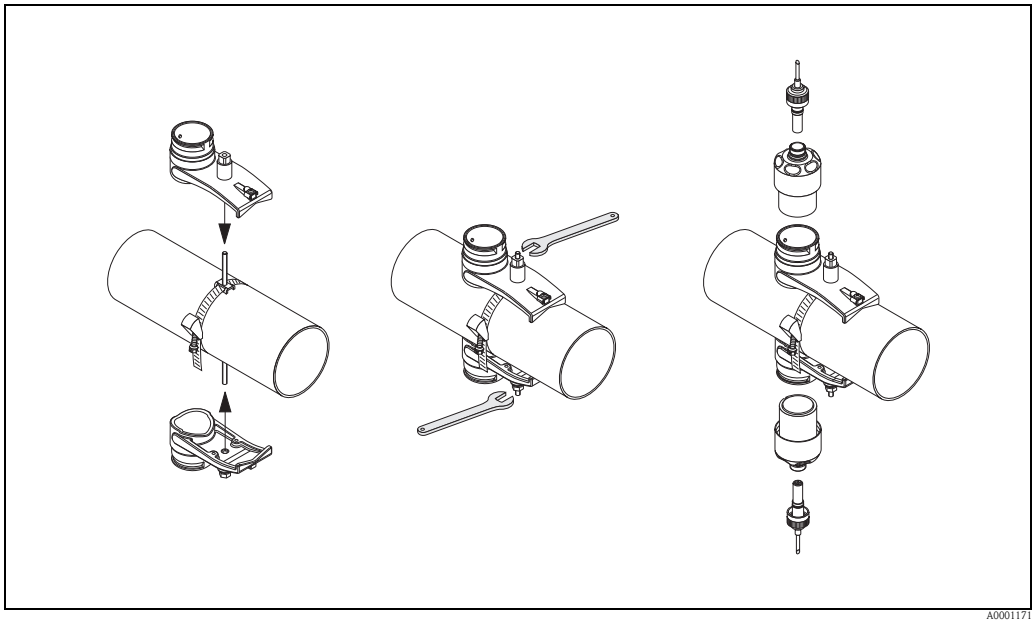


Fig. 62: Steps 1 to 5, installing the sound velocity measuring sensors

3.13 Installing sensor DDU19

3.13.1 Version 1

1. Premount the strapping band:
   – Nominal diameters DN ≤ 200 (8") → 📄 32
   – Nominal diameters DN > 200 (8") → 📄 33
   The two mounting bolts must be positioned opposite each other on either side of the pipe.
2. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.
3. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.
4. Insert the sensor into the sensor holder.
5. Fit the sensor cover on the sensor holder and turn until:
   – The sensor cover engages with a click
   – The arrows (▲ / ▼ "close") are pointing towards one another.
6. Screw the connecting cable into the connections of the sensor.
7. After determining the pipe wall thickness, replace the wall thickness sensor DDU19 with the appropriate flow sensor.

Note!
Clean the coupling point carefully before the flow sensor coated with new coupling fluid is inserted.

3.13.2 Version 2

This is only suitable if the transmitter is within range of the measuring point.

1. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.
2. Hold the sensor vertically by hand on the pipe for measurement. Operate the local operation with your other hand.

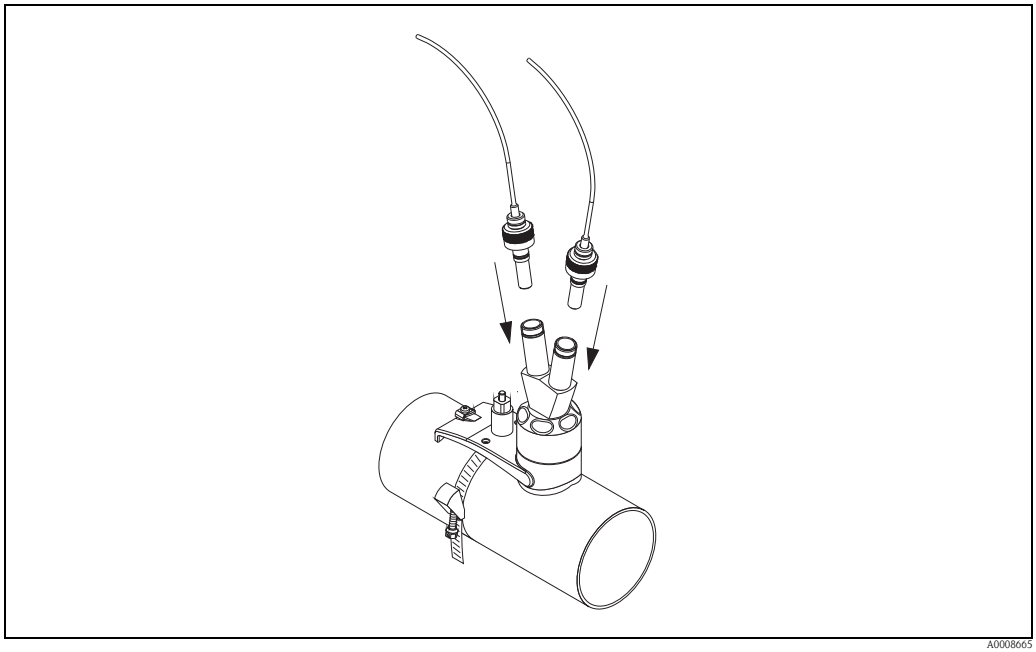


Fig. 63: Installing the wall thickness measuring sensor

3.14 Installing the wall-mount housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories → 92)
- Pipe mounting (with separate mounting kit, accessories → 92)

Caution!
- Make sure that the permitted operating temperature range (–20 to +60 °C / –4 to 140 °F) is not exceeded at the mounting location. 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.

3.14.1 Direct wall mounting

1. Drill the holes → 55.
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 (0.26")
   – Screw head: max. Ø 10.5 mm (0.41")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

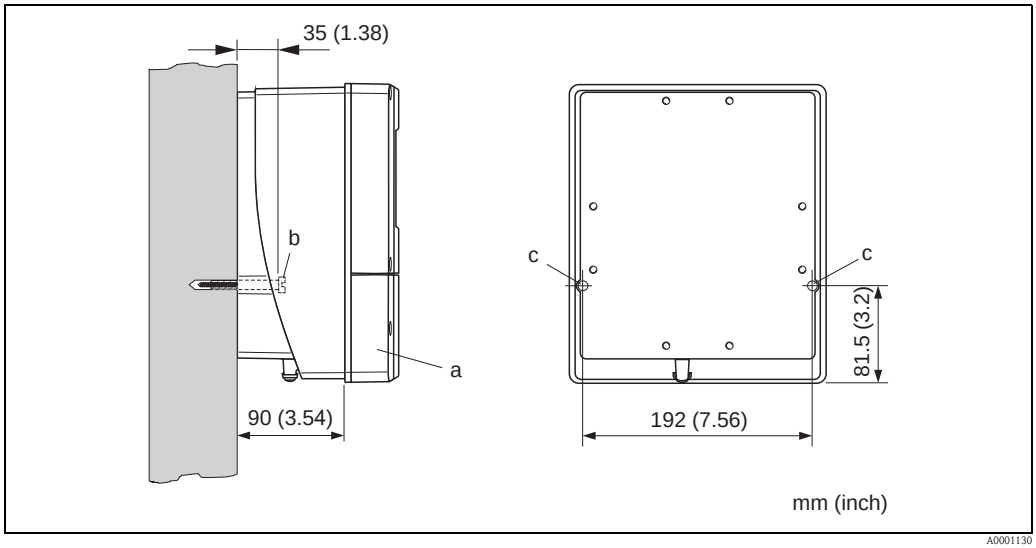


Fig. 64: Direct wall mounting

3.14.2 Panel mounting

1. Prepare the opening in the panel → 65.
2. Slide the housing into the panel cutout from the front.
3. Screw the retainers onto the wall-mount housing.
4. Screw the threaded rods into the retainers and tighten until the housing is solidly seated on the panel wall. Tighten the counter nuts. No further support is necessary.

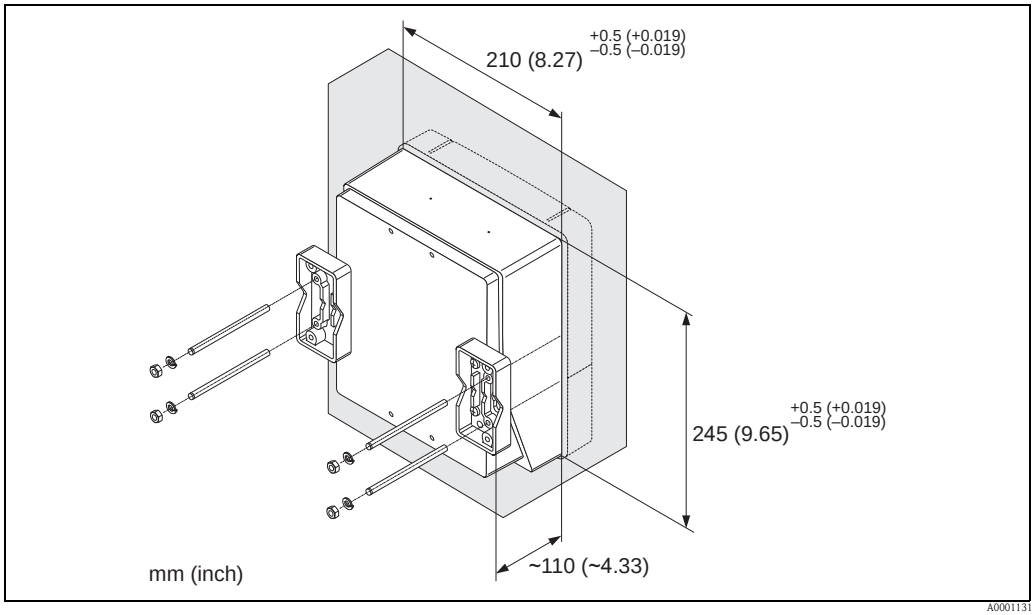


Fig. 65: Panel mounting (wall-mount housing)

3.14.3 Pipe mounting

The assembly should be performed by following the instructions on → 56.

Caution!
If a warm pipe is used for installation, make sure that the housing temperature does not exceed the max. permitted value of +60 °C (+140 °F).

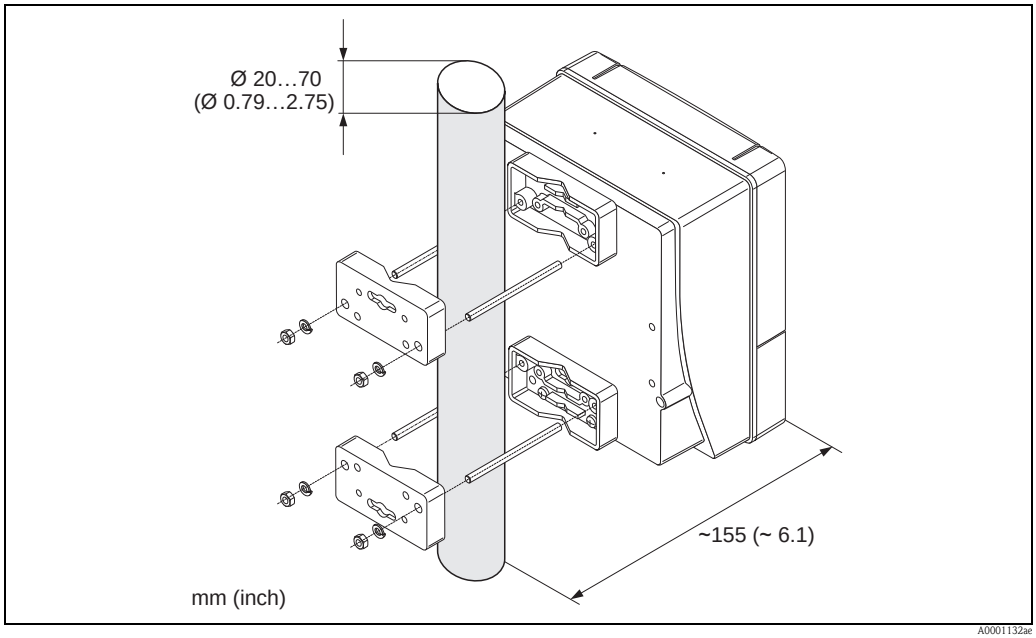


Fig. 66: Pipe mounting (wall-mount housing)

3.15 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.?	→ 120
Installation	Notes
Are the measuring point number and labeling correct (visual inspection)?	–
Process environment / process conditions	Notes
Have the inlet and outlet runs been observed?	→ 12
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 Endress+Hauser sales office if you have any questions.

Note!
The device does not have an internal power switch. For this reason, assign the device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

4.1 FOUNDATION Fieldbus cable specification

4.1.1 Cable type

Twin-core cable is recommended for connecting the flowmeter to the FOUNDATION Fieldbus H1. Following IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the FOUNDATION 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. With cable type B more than one fieldbus (with the same degree of protection) may be operated in a 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.

	Type A	Type B
Cable structure	twisted pair, shielded	One or more twisted pairs, fully shielded
Wire cross-section	0.8 mm^2 (AWG 18)	0.32 mm^2 (AWG 22)
Loop-resistance (DC)	44 Ω/km	112 Ω/km
Characteristic impedance at 31.25 kHz	100 Ω ± 20%	100 Ω ± 30%
Attenuation constant at 39 kHz	3 dB/km	5 dB/km
Capacitive asymmetry	2 nF/km	2 nF/km
Envelope delay distortion (7.9 to 39 kHz)	1.7 µs/km	*
Shield coverage	90%	*
Max. cable length (incl. spurs >1 m)	1900 m (6233 ft)	1200 m (3937 ft)
* Not specified		

Suitable fieldbus cables (Type A) from various manufacturers for the non-hazardous area are listed below:
- Siemens: 6XV1 830-5BH10
- Belden: 3076F
- Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

4.1.2 Maximum overall cable length

The maximum network expansion depends on the type of 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 (3.28 ft).

Note the following points:
- The maximum permissible overall cable length depends on the cable type used (→ 📄 58).
- If repeaters are used, the maximum permissible cable length is doubled.
  A maximum of three repeaters are permitted between user and master.

4.1.3 Maximum spur length

The line between the 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 (>3.28 ft):

Number of spurs	1…12	13…14	15…18	19…24	25…32
Max. length per spur	120 m (393 ft)	90 m (295 ft)	60 m (196 ft)	30 m (98 ft)	1 m (3.28 ft)

4.1.4 Number of field devices

According to IEC 61158-2 (MBP) a maximum of 32 field devices may be connected per fieldbus segment. However, this number may be restricted in certain circumstances (type of ignition protection, bus power option, current consumption of field device).
A maximum of four field devices can be connected to a spur.

4.1.5 Shielding and grounding

The optimum electromagnetic compatibility of the fieldbus system is guaranteed only when system components and in particular lines are shielded and the shielding provides the most complete coverage possible. Shield coverage of 90% is ideal.

Shielding should be connected as often as possible with the reference ground. The national regulations and guidelines governing the installation of electrical equipment also apply where relevant!
Where there are large differences in potential between the individual grounding points, only one point of the shielding is connected directly with the reference ground. In systems without potential equalization, cable shielding of fieldbus systems should therefore only be grounded on one side, for example at the fieldbus supply unit or at safety barriers.

Caution!
If the cable shielding is grounded at more than one point in systems without potential equalization, network frequency equalization currents can occur that damage the bus cable or the bus shielding and substantially affect signal transmission.

4.1.6 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 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.

4.1.7 Further information

General information and further notes on connections can be found on the website (www.fieldbus.org) of the Fieldbus Foundation or in the Operating Instructions "FOUNDATION Fieldbus Overview" (acquired at: → www.endress.com → Download).

4.2 Sensor/transmitter connecting cable

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

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

4.2.1 Connecting and grounding Prosonic Flow W and P (DN 50 to 4000 / 2 to 160") Two Single coaxial cables

Procedure → 62

1. Remove the cover (a) of the connection compartment.
2. Remove the dummy cover from the cable entry (b).
3. Route the two connecting cables (c) of channel 1 through the cable gland (d).
4. Route the two connecting cables of channel 1 through the cable entry (b) and into the connection compartment of the transmitter.
5. Place the cable retaining sleeves (e) of the two connecting cables at the ground contact terminals (f) (Detail B).
6. Twist down the ground contact terminals (f) so that the two cable retaining sleeves (e) are firmly seated.
7. Screw the ground contact terminals (f) tight.

   Note!
   The Prosonic Flow W and Prosonic Flow P DN 15 to 65 (½ to 2½") is grounded via the cable gland → 63.
8. Connect the connecting cable:
   – Channel 1 upstream = 1
   – Channel 1 downstream = 2
   – Channel 2 upstream = 3
   – Channel 3 downstream = 4
9. Spread the rubber seal (g) along the side slit with a suitable tool (e.g. a large screwdriver) and fix both connecting cables into place.
10. Push the rubber seal (g) up into the cable entry (b).
11. Tighten the cable gland (d).
12. Fit the cover (a) on the connection compartment and screw it on.

    Note!
    The connection compartment does not have to be assembled if the transmitter is wired (power supply and signal cable) directly afterwards.

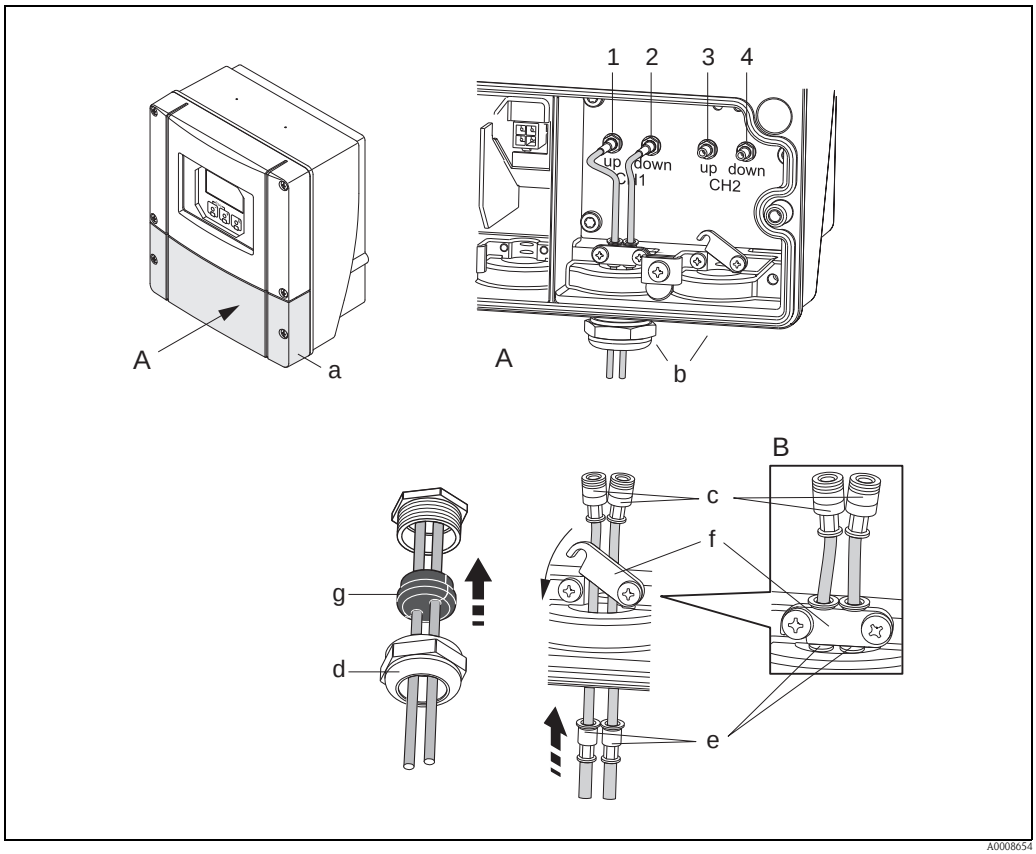


Fig. 67: Connecting the connecting cable for sensor/transmitter (with cable gland for two connecting cables per cable entry)

A View A
B Detail B

1 Sensor cable connector, channel 1 upstream
2 Sensor cable connector, channel 1 downstream
3 Sensor cable connector, channel 2 upstream
4 Sensor cable connector, channel 2 downstream

a Connection compartment cover
b Cable entries
c Connecting cables
d Cable gland
e Cable retaining sleeves
f Ground contact terminals (only Prosonic Flow P DN 50 to 4000 / 2 to 160", for grounding of the Prosonic Flow P DN 15 to 65 / ½ to 2½", see next section)
g Rubber seal

4.2.2 Connecting and Grounding Prosonic Flow W and Prosonic Flow P DN 15 to 65 (½ to 2½") Multicore cable

The Prosonic Flow W/P DN 15 to 65 (½ to 2½") is grounded via the cable gland.

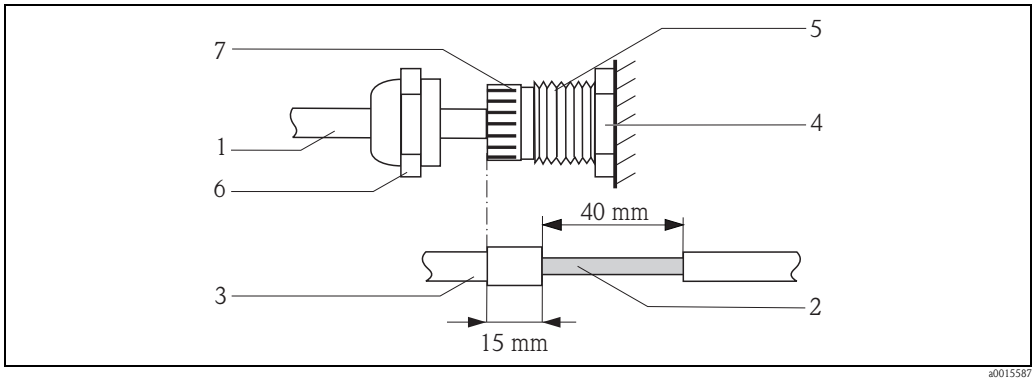


Fig. 68: Connecting and grounding the measuring system

A Cable sheath
B Bared braided screen (pre-prepared)
C Rubber grommet
D Internal contact point for the grounding on this level (External inspection not possible)
E Cable gland
F Cable gland cover
G Grounding mechanism

Procedure

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

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

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

4.2.3 Cable specification for connecting cable

Only use the connecting cables supplied by Endress+Hauser.
The connecting cables are available in different lengths → 92.

For the cable specifications, see → 119.

Operation in areas with strong electrical interference

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

4.3 Connecting the measuring unit

Field instruments can be connected to the FOUNDATION Fieldbus in two ways:

- Connection via conventional cable gland → 65
- Connection using prefabricated fieldbus connector (option) → 66

4.3.1 Terminal assignment

Note!
The electrical characteristic quantities are listed in the "Technical data" section.

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 = FF + [1]** **27 = FF – [1]**
93***-**********G	-	-	-	FOUNDATION Fieldbus Ex i
93***-**********K	-	-	-	FOUNDATION Fieldbus

[1] With integrated reverse polarity protection

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

1. Remove the cover of the connection compartment (a) from the transmitter housing.
2. Feed the power supply cable (b) and fieldbus cable (d) through the corresponding cable entries.
3. Carrying out the wiring:
   – Wiring diagram → 📄 65
   – Terminal assignment → 📄 64
4. Screw the connection compartment cover (a) back onto the transmitter housing.

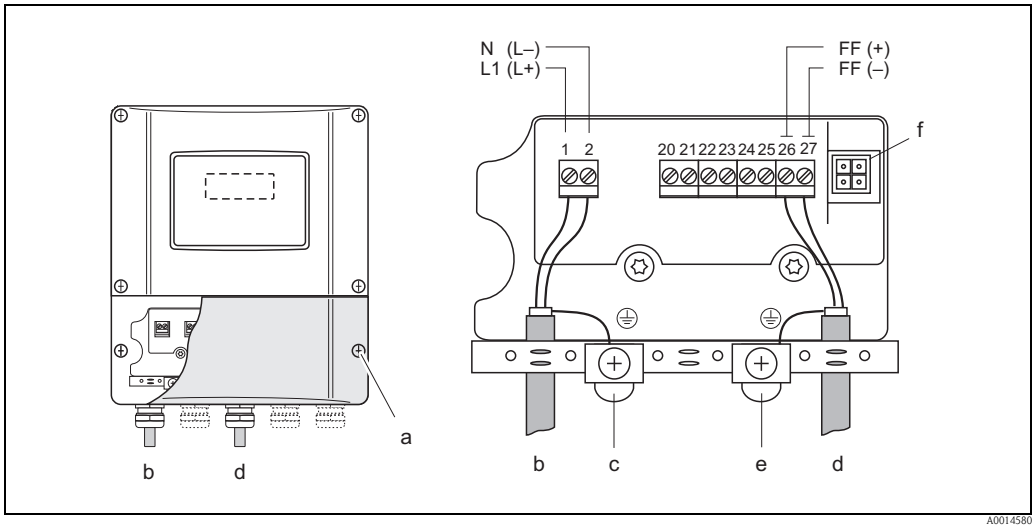


Fig. 69: Connecting the transmitter, cable cross-section: max. 2.5 mm² (14 AWG)

a Connection compartment cover
b Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L– for DC
c Ground terminal for protective ground
d Fieldbus cable:
Terminal No. 26: FF + (with reverse polarity protection)
Terminal No. 27: FF – (with reverse polarity protection)
e Ground terminal for signal cable shield
Observe the following:
– the shielding and grounding of the fieldbus cable → 📄 59
– that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

4.3.3 Fieldbus connector

The connection technology of FOUNDATION Fieldbus 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. Communication is not interrupted.
- Installation and maintenance are significantly easier.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel distribution modules.

  – The device can therefore be supplied with the option of a ready-mounted fieldbus connector. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as a spare part→ 📄 109.

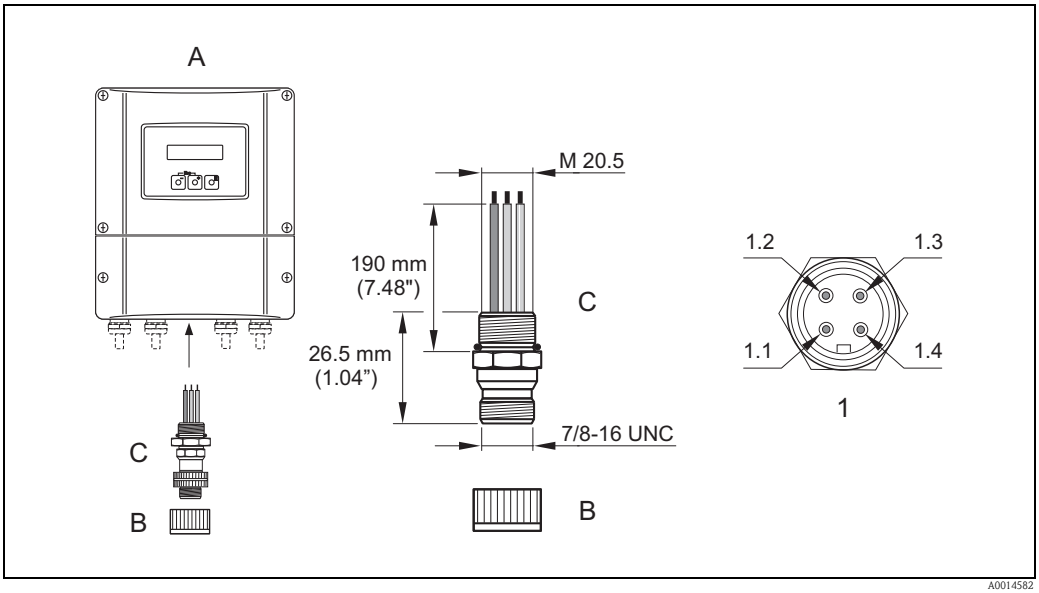


Fig. 70: Connector for connecting to the FOUNDATION Fieldbus

A Wall-mount housing
B Protection cap for connector
C Fieldbus connector

1 Fieldbus connector (pin assignment/color codes)
1.1 Brown wire: FF + (terminal 26)
1.2 Blue wire: FF– (terminal 27)
1.3 Not assigned
1.4 Green/yellow: ground (notes on connection → 📄 59, 64)

Technical data, connector:
– Degree of protection IP 67
– Ambient temperature range: –40 to +150 °C (–40 to +302 °F)

4.4 Degree of protection

Transmitter (wall-mount housing)

The transmitter fulfills all the requirements for IP 67.

Caution!
Do not loosen the screws of the sensor housing, as otherwise the degree of protection guaranteed by Endress+Hauser no longer applies.

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 greased, cleaned or replaced if necessary.
- All the threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter → 64.
- Securely tighten the cable entries → 67.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

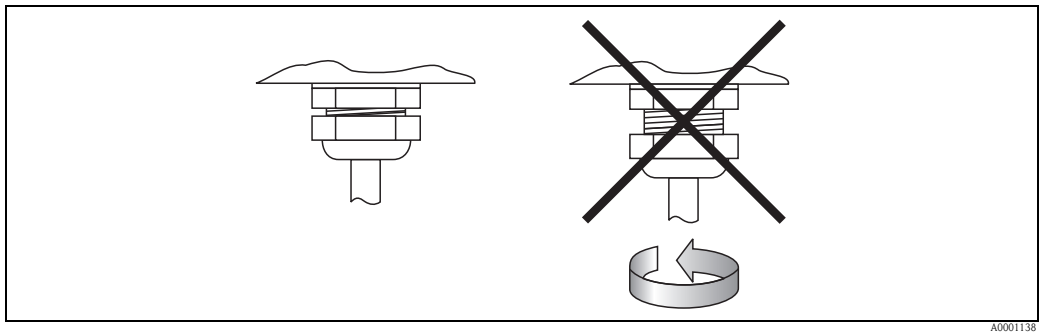


Fig. 71: Installation instructions for cable entries on the transmitter housing

Prosonic Flow P and W sensor (Clamp-on / Insertion version), DDU 18

The flowrate sensors Prosonic Flow P and W, as well as the sound velocity sensors DDU 18, meet all the requirements for IP 67 or IP 68 degree of protection (please observe the information on the nameplate of the sensor).

Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67/68 protection is maintained:
- Only use connecting cables supplied by Endress+Hauser with the corresponding cable connectors.
- When connecting, do not jam the cable connectors. Tighten them to the stop.
- The cable connector seals must be clean, dry and undamaged when inserted in the seal groove → 67 (1).

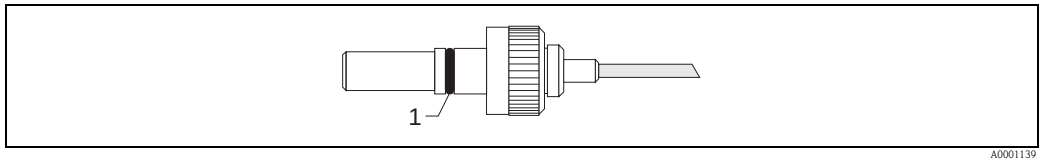


Fig. 72: Cable connector

1 Cable connector seal

4.5 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 to 260 V AC (45 to 65 Hz) 20 to 55 V AC (45 to 65 Hz) 16 to 62 V DC
Do the cables comply with the specifications?	→ 58
Do the cables have adequate strain relief?	-
Is the cable type route completely isolated? Without loops and crossovers?	-
Are the power supply and signal cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	-
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as "water traps"?	→ 67
Are all the housing covers installed and tightened?	-
Electrical connection of FOUNDATION Fieldbus	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 FOUNDATION Fieldbus specifications?	→ 59
Has the max. length of the spurs been observed in accordance with the FOUNDATION Fieldbus specifications?	→ 59
Is the fieldbus cable fully shielded (90%) and correctly grounded?	→ 59

5 Operation

5.1 Quick operation guide

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

1. **Local display (option)** → 📄 70
   The local display enables you to read all important variables directly at the measuring point, configure device-specific parameters in the field and perform commissioning.
2. **Operating programs** → 📄 76
   FOUNDATION Fieldbus functions and device-specific parameters are configured primarily via the fieldbus interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.
3. **Jumpers for diverse hardware settings** → 📄 78
   Jumpers on the I/O board provide the means of setting the following hardware parameters for the FOUNDATION Fieldbus:
   - Enabling/disabling the simulation mode in the Function Blocks (e.g. AI, DO Function Block)
   - Switching hardware write protection on and off

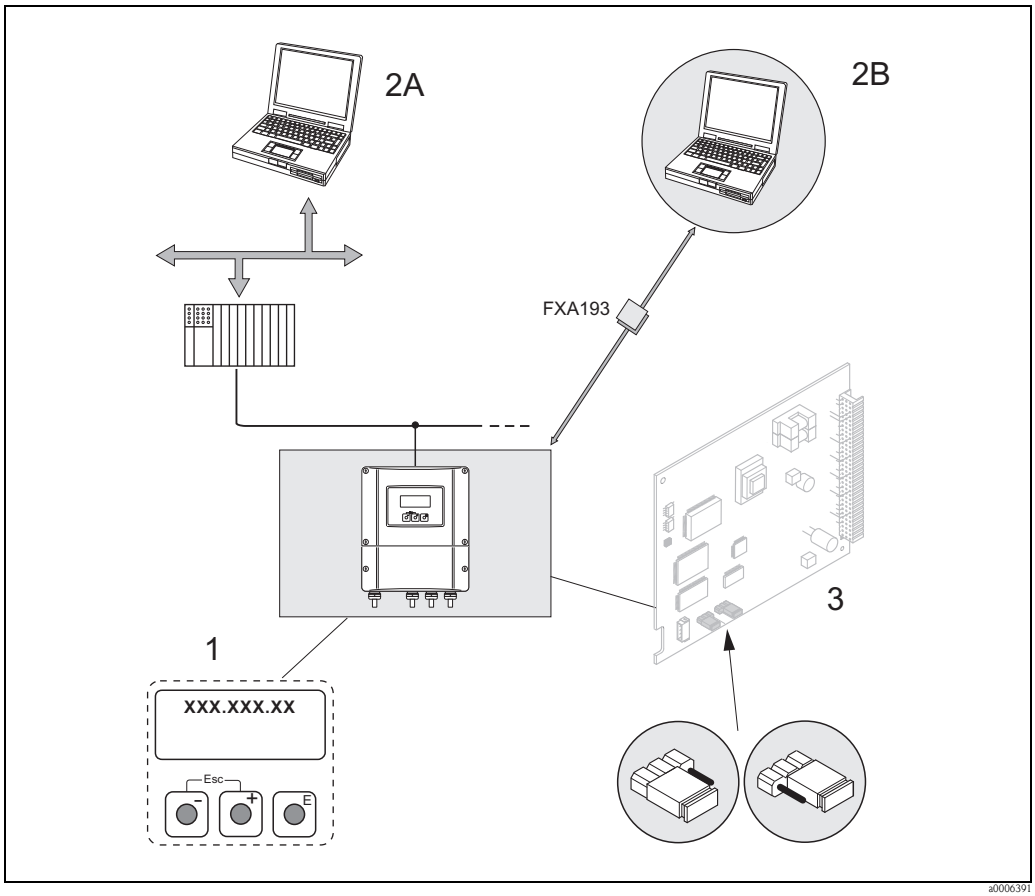


Fig. 73: FOUNDATION Fieldbus operating options

1 Local display for device operation in the field (option)
2A Configuration/operating programs for operating via the FOUNDATION Fieldbus (FF functions, device parameters)
2B Configuration/operating program for operation via the FXA193 service interface (e.g. FieldCare)
3 Jumper/miniature switches for hardware settings (write protection, simulation mode)

5.2 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, empty pipe, 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).

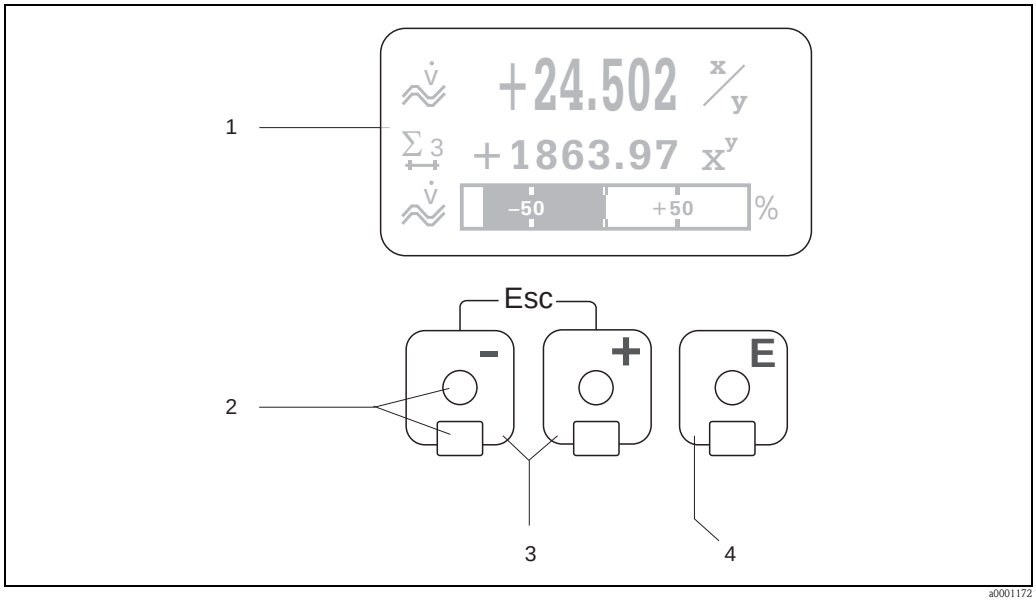


Fig. 74: Display and operating elements

1 Liquid crystal display
The backlit, four-line liquid-crystal display shows measured values, dialog texts, error messages and notice messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode).
Display

2 Optical sensors for "Touch Control"

3 ⊞/⊟ keys
- *HOME position → Direct access to totalizer values and actual values of inputs/outputs*
- *Enter numerical values, select parameters*
- *Select different blocks, groups and 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 longer than 3 seconds → Return directly to HOME position*
- *Cancel data entry*

4 Ⓔ key
- *HOME position → Entry into the function matrix*
- *Save the numerical values you input or settings you change*

5.2.2 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:
Display and presentation of system/process errors → 📄 75

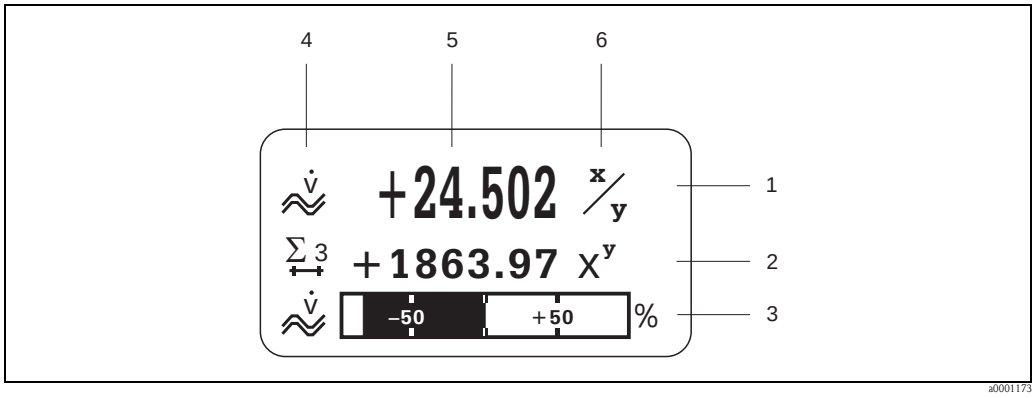


Fig. 75: Typical display for standard operating mode (HOME position)

1 Main line: shows the main measured values
2 Additional line: shows additional measured variables and status variables
3 Information line: shows additional information on the measured variables and status variables, e.g. bar graph display
4 "Info icons" field: icons representing additional information on the measured values are shown in this field → 📄 72.
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

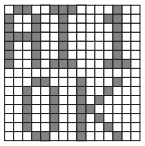
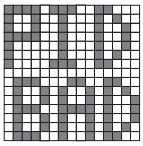
5.2.3 Additional display functions

In the HOME position, you can use the ⊞/⊟ keys to call up a list containing the following information:
- Totalizers (including overflow)
- Tag name (DEVICE PD-TAG)

⊞⊟ → Scan of individual values within the Info Menu
⊟⊞ (Esc key) → Return to HOME position

5.2.4 Icons

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

Icon	Meaning	Icon	Meaning
S	System error	P	Process error
ϟ	Fault message (measuring is interrupted)	!	Notice message (measuring continues despite the message)
Σ 1 to n	Totalizer 1 to n	AI 1 (to n)	Analog Input Function Block 1 (to n), output value OUT
PID	PID Function Block: A PID Function Block value as listed below is output, depending on the assignment of the lines in the local display: – OUT value (= manipulated variable) – IN value (= control variable) – CAS_IN value (= external set point)		
The messages listed below describe the status of the OUT value of the Analog Input Function Block and the value assigned to the PID Function Block.			
OK	Status = GOOD (valid)	UNC	Status = UNCERTAIN (valid to a certain extent)
BAD	Status = BAD (not valid)	Example:   a0006255	
 a0001182	Measuring mode: SYMMETRY (bidirectional)	 a0001183	Measuring mode: STANDARD
 a0001184	Counting mode, totalizer: BALANCE (forward and reverse flow)	 a0001185	Counting mode, totalizer: forward
 a0001186	Counting mode, totalizer: reverse	 a0001188	Volume flow

5.3 Brief guide to the function matrix

Note!
- See the general notes → 74
- Function descriptions → see the "Description of Device Functions" manual"

1. HOME position → E → Entry into the function matrix
2. Select a block (e.g. MEASURED VARIABLES)
3. Select a group (e.g. SYSTEM UNITS)
4. Select a function group (e.g. CONFIGURATION)
5. Select a function (e.g. UNIT VOLUME FLOW)
   Change parameter / enter numerical values:
   ± → Select or enter enable 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

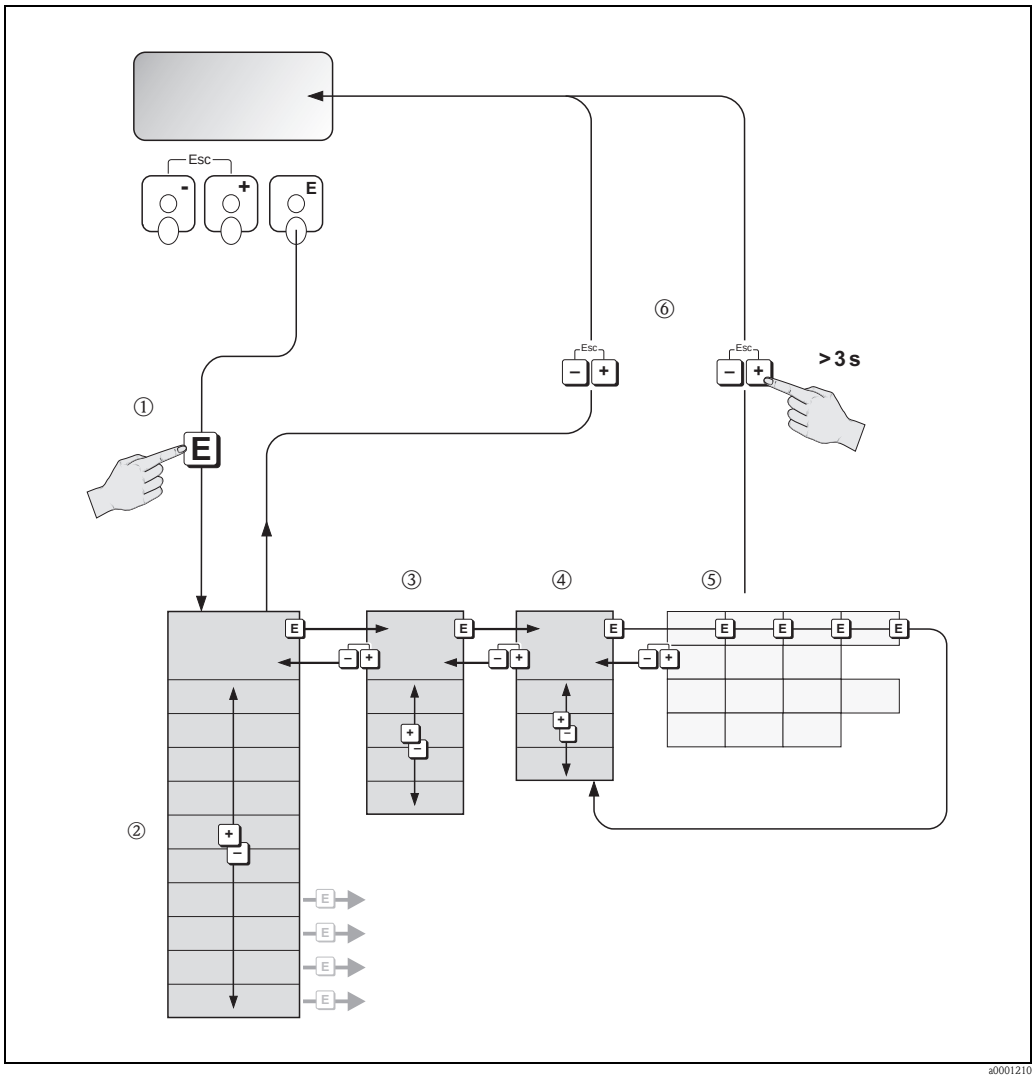


Fig. 76: Selecting functions and configuring parameters (function matrix)

5.3.1 General notes

The Quick Setup menu contains the default settings that are adequate for commissioning. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customize 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 → 73.
  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 Ⓔ 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.
- Programming mode is disabled automatically if you do not press a key within 60 seconds following automatic return to the HOME position.

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.

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

5.3.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 93) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ See the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the ⊞⊟ operating elements 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 Endress+Hauser service organization 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 Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.
- With FOUNDATION Fieldbus, programming is enabled separately in the Transducer Block.

5.3.3 Disabling the programming mode

Programming mode is disabled if you do not press an operating element 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).

5.4 Error messages

5.4.1 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 the one shown on the display.

The measuring system distinguishes between two types of error:
- *System errors:*
  Includes all device errors, for example communication errors, hardware errors, etc. → 📄 101
- *Process errors:*
  Includes all application errors, for example inhomogenous fluid, etc. → 📄 107

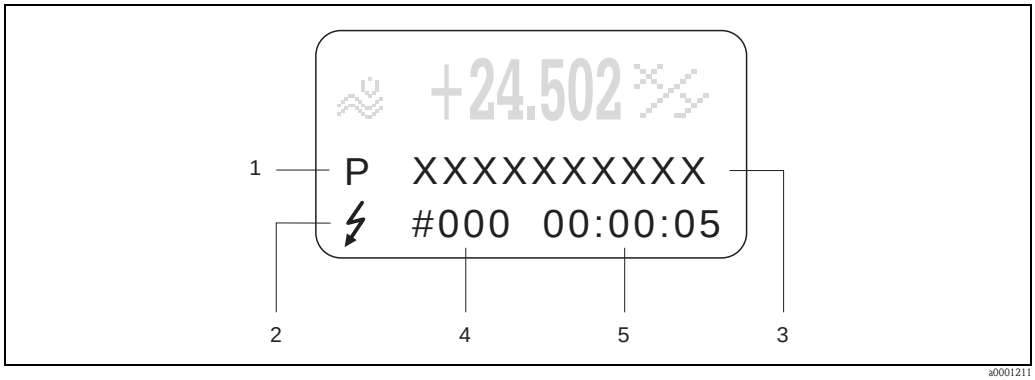


Fig. 77: Error messages on the display (example)

1 Error type: P = process error, S = system error
2 Error message type: ϟ = fault message, ! = notice message
3 Error designation
4 Error number
5 Duration of most recent error occurrence (hours:minutes:seconds)

5.4.2 Error message types

The measuring device always assigns system and process errors which occur to two types of error messages (**fault** or **notice messages**), resulting in different weightings → 📄 100.
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 the current measuring operation.
- Displayed as → Exclamation mark (!), type of error (S: system error, P: process error)
- Presentation on the FOUNDATION Fieldbus → Notice messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "UNCERTAIN" of the output value OUT (AI Block).

Fault message (ϟ)
- The error in question interrupts or stops the current measuring operation.
- Displayed as → Lightning flash (ϟ), type of error (S: system error, P: process error)
- Presentation on the FOUNDATION Fieldbus → Fault messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "BAD" of the output value OUT (AI Block).

5.5 Operating options

5.5.1 Operating program "FieldCare"

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.

5.5.2 Operating via FOUNDATION Fieldbus configuration programs

The user can obtain special configuration and operating programs offered by the different manufacturers for use in configuration. These can be used for configuring both the FOUNDATION Fieldbus functions and all the device-specific parameters. The predefined Function Blocks allow uniform access to all the network and fieldbus device data.

A step-by-step description of the procedure for commissioning the FF functions is given on → 📄 79, along with the configuration of device-specific parameters.
General information on FOUNDATION Fieldbus is provided in the Operating Instructions "FOUNDATION Fieldbus Overview" (BA013S) acquired at: → www.endress.com → Download.

System files

You will need the following files for commissioning and network configuration:
- Commissioning → Device description (Device Description: *.sym, *.ffo)
- Network configuration → CFF file (Common File Format: *.cff)

You can obtain these files as follows:
- Free of charge via the Internet → www.endress.com
- From Endress+Hauser stating the order number (No. 56003896)
- Via the Fieldbus Foundation Organization → www.fieldbus.org

Note!
Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up via the following functions/parameters:

Local display:
- HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DEVICE REVISION (6243)
- HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DD REVISION (6244)

FOUNDATION Fieldbus interface
- Resource Block → Parameter DEV_REV
- Resource Block → Parameter DD_REV

Example (with local display):
Display in the DEVICE REVISION (6243) function → 03
Display in the DD REVISION (6244) function → 01
Device description file (DD) required → 0301.sym / 0301.ffo

5.5.3 Device description files for operating programs

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

Operation via FOUNDATION Fieldbus:

Valid for device software	3.00.XX	→ Function "Device software" (8100)
Device data FOUNDATION Fieldbus Manufacturer ID: Device ID:	 11_{hex} (ENDRESS+HAUSER) 1059_{hex}	 → Function "Manufacturer ID" (6040) → Function "Device ID" (6041)
FOUNDATION Fieldbus version data	Device Revision 3/DD Revision 1	
Software release	06.2009	
Operating program	**How to acquire:**	
Device Description (DD) and Capability File (CFF)	■ www.endress.com → Download ■ www.fieldbus.org ■ CD–ROM (Endress+Hauser order number: 56004088)	
Device driver for FF host systems:	**How to acquire:**	
ABB (FieldController 800)	www.abb.com	
Allen Bradley (Control Logix)	see FF standard device driver	
Emerson (Delta V)	www.easydeltav.com	
Endress+Hauser (ControlCare)	see FF standard device driver	
Honeywell (Experion PKS)	www.honeywell.com	
SMAR (System 302)	see FF standard device driver	
Yokogawa (CENTUM CS 3000)	www.yokogawa.com	
Device drivers for additional FF operating programs:	**Sources for obtaining updates:**	
Handheld terminal 375	www.fieldcommunicator.com Note! The device drivers can be added and updated via the update function of the handheld terminal 375.	

Tester/simulator:	**Sources for obtaining device descriptions:**
Fieldcheck	■ Update by means of FieldCare with the Flow Device FXA193/291 DTM in the Fieldflash Module

Note!
The Fieldcheck tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.

5.6 FOUNDATION Fieldbus hardware settings

5.6.1 Switching hardware write protection on and off

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

⚠ 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 → 📄 110.
3. Configure hardware write protection and simulation mode appropriately using the jumpers (see graphic).
4. Installation of the I/O board is the reverse of the removal procedure.

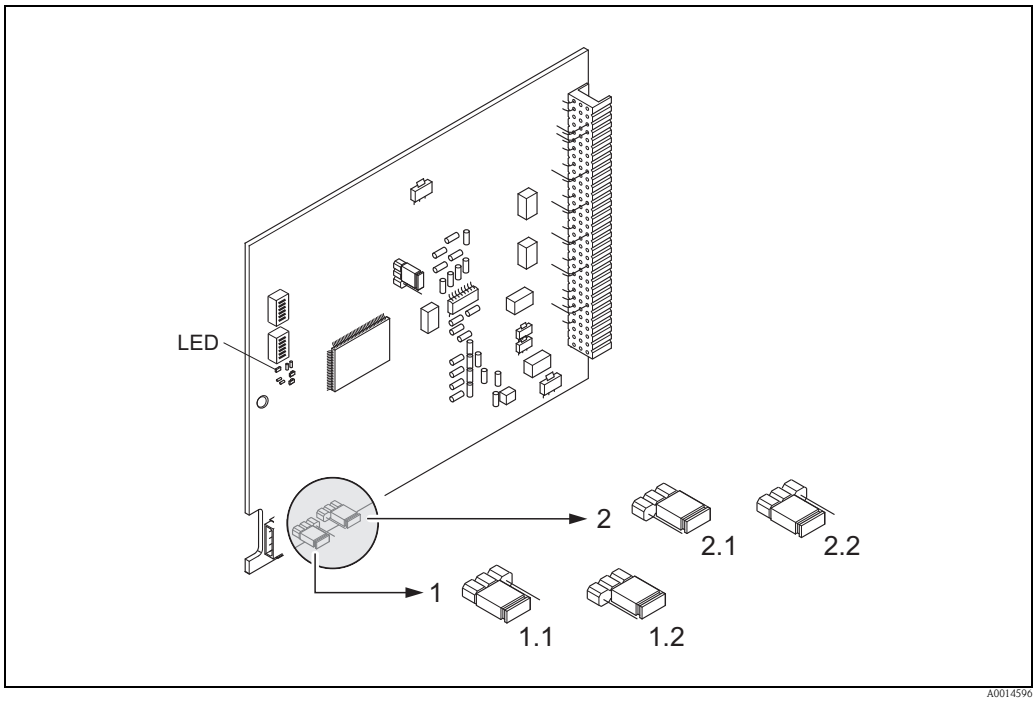


Fig. 78: Hardware configuration (I/O board)

1 Jumper for enabling/disabling write protection:
*1.1 Write protection enabled = it is **not** possible to write-access device functions via the FF interface*
1.2 Write protection disabled (factory setting) = it is possible to write-access the device functions via the FF interface

2 Jumper for simulation mode:
2.1 Simulation mode enabled (factory setting) = simulation in the Analog Input Function Block and in the Discrete Output Function Block is possible
*2.2 Simulation mode disabled = simulation in the Analog Input Function Block and in the Discrete Output Function Block is **not** possible*

LED (light emitting diode):
- *Continuously lit → Ready (no communication via FF active)*
- *Not lit → Not ready for operation*
- *Flashes slowly → Ready (communication via FF active)*
- *Flashes quickly → Device error present (error message type "fault message") → 📄 96*

6 Commissioning

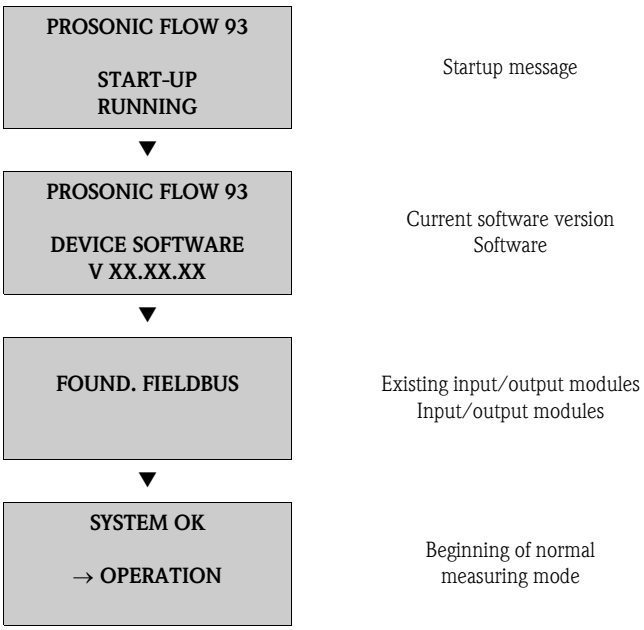
6.1 Function check

Make sure that the following function checks have been performed successfully before switching on the supply voltage for the measuring device:
- Checklist for "Post-installation check" → 📄 57
- Checklist for "Post-connection check" → 📄 68

Note!
- The FOUNDATION FIELDBUS interface's technical data must be maintained in accordance with IEC 61158-2 (MBP).
- A normal multimeter can be used to check the bus voltage of 9 to 32 V and the current consumption of 11 mA at the device (FF interface).

6.2 Switching on the measuring device

Once the function check has been performed successfully, the device is operational and can be switched on via the supply voltage. The device then performs internal test functions and the following messages are shown on the local display:



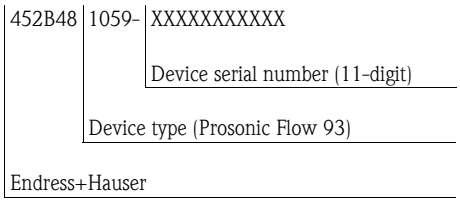
Normal measuring mode commences as soon as startup completes.
Various measured value and/or status variables appear on the display (HOME position).

Note!
If startup fails, an appropriate error message is displayed, depending on the cause.

6.3 Commissioning via FOUNDATION Fieldbus

Note the following points:
- The files required for commissioning and network configuration can be obtained as described on → 📄 76.
- The device is identified by the FOUNDATION Fieldbus in the host or configuration system via the device ID (DEVICE_ID). The DEVICE_ID is a combination of the manufacturer ID, device type and device serial number. It is unique and can never be duplicated.

  The DEVICE_ID of the Prosonic Flow 93 is composed as follows:



Commissioning

The following description allows step-by-step commissioning of the measuring device and all the necessary configuration for the FOUNDATION Fieldbus:

1. Switch on the measuring device.
2. Note the DEVICE_ID on the device nameplate (→ 📄 8).
3. Open the configuration program.
4. Load the device description file or CFF file into the host system or into the configuration program. Ensure you use the correct system files. Refer to the example on → 📄 76.
   The first time it is connected the measuring device reports as follows:

   – EH_PROSONIC_FLOW_93_ xxxxxxxxxxx (Tag name PD-TAG)
   – 452B481059- xxxxxxxxxxx (Device_ID)
   – Block structure:

Display text (xxx... = serial number)	Base index	Description
RESOURCE_ xxxxxxxxxxx	400	Resource Block
TRANSDUCER_CH1_xxxxxxxxxxx	1400	Transducer Block "Flow Channel 1"
TRANSDUCER_CH2_xxxxxxxxxxx	1500	Transducer Block "Flow Channel 2"
TRANSDUCER_DIAG_xxxxxxxxxxx	1600	"Diagnosis" Transducer Block
TRANSDUCER_SERV_xxxxxxxxxxx	1700	Transducer Block "Service"
TRANSDUCER_DISP_xxxxxxxxxxx	1800	"Display" Transducer Block
TRANSDUCER_TOT_xxxxxxxxxxx	1900	"Totalizer" Transducer Block
ANALOG_INPUT_1_ xxxxxxxxxxx	500	Analog Input function block 1
ANALOG_INPUT_2_ xxxxxxxxxxx	550	Analog Input function block 2
ANALOG_INPUT_3_ xxxxxxxxxxx	600	Analog Input function block 3
ANALOG_INPUT_4_ xxxxxxxxxxx	650	Analog Input function block 4
ANALOG_INPUT_5_ xxxxxxxxxxx	700	Analog Input function block 5
ANALOG_INPUT_6_ xxxxxxxxxxx	750	Analog Input function block 6
ANALOG_INPUT_7_ xxxxxxxxxxx	800	Analog Input function block 7
ANALOG_INPUT_8_ xxxxxxxxxxx	850	Analog Input function block 8
DISCRETE_OUTPUT_ xxxxxxxxxxx	900	Discrete Output Function Block (DO)
PID_ xxxxxxxxxxx	1000	PID Function Block (PID)

Display text (xxx... = serial number)	Base index	Description
ARITHMETIC_xxxxxxxxxxx	1100	Arithmetic Function Block (ARTH)
INPUT_SELECTOR_xxxxxxxxxxx	1150	Input Selector Function Block (ISEL)
SIGNAL_CHARACT_xxxxxxxxxxx	1200	Signal Characterizer Function Block (CHAR)
INTEGRATOR_xxxxxxxxxxx	1250	Integrator Function Block (INTG)

Note!
This measuring device is supplied with the bus address "250" and is thus in the address range reserved for readdressing field devices, between 248 and 251. This means that the LAS (Link Active Scheduler) automatically assigns the device a free bus address in the initialization phase.

5. Identify the field device using the DEVICE_ID that you noted down and assign the desired field device tag name (PD_TAG) to the fieldbus device in question.
   Factory setting: EH_PROSONIC_FLOW_93_xxxxxxxxxxx

Configuration of the "Resource Block" (base index 400)

6. Open the Resource Block.
7. On delivery, hardware write protection is disabled so that you can access all the write parameters via FOUNDATION Fieldbus. Check this status via the parameter WRITE_LOCK:
   – Write protection activated = LOCKED
   – Write protection deactivated = NOT LOCKED

   Deactivate the write protection if necessary → 78.
8. Enter the desired block name (optional).
   Factory setting: RESOURCE_ xxxxxxxxxxx
9. Set the operating mode in the parameter group MODE_BLK (parameter TARGET) to AUTO.

Configuration of the "Transducer Blocks"

The individual Transducer Blocks comprise various parameter groups ordered by device-specific functions:

Transducer Block	Base index	Description
Transducer Block "Flow Channel 1"	1400	Flow measurement channel 1
Transducer Block "Flow Channel 2"	1500	Flow measurement channel 2
"Diagnosis" Transducer Block	1600	Diagnostic functions
Transducer Block "Service"	1700	Service functions
"Display" Transducer Block	1800	Local display functions
"Totalizer" Transducer Block	1900	Totalizer 1 to 3

The following description provides an example for the "Flow Channel 1" Transducer Block (base index: 1400).

10. Enter the desired block name (optional).
    Factory setting: TRANSDUCER_CH1_xxxxxxxxxxx
11. Open the "Flow Channel 1" Transducer Block.

12. Now configure the device-specific parameters relevant for your application:

    ✎ Note!
    – Note that changes to the device parameters can only be made after entering a valid access code in the parameter "Access – Code".
    – The selection of the system units in the "Flow" Transducer Block has no effect on the output value OUT (AI Block). Units of the process variables which are transmitted via the FOUNDATION Fieldbus interface must be specified separately in the Analog Input Function Block via the XD_SCALE and OUT_SCALE parameter group.

13. Set the "Flow" and "Totalizer" Transducer Blocks to AUTO in the MODE_BLK parameter group (TARGET parameter). Only then is it ensured that the process variables can be processed correctly by the downstream AI Function Block.

Configuration of the "Analog Input Function Blocks"

The measuring device has seven Analog Input Function Blocks that can be assigned to the various process variables. The following description provides an example for the Analog Input Function Block 1 (base index: 500).

14. Enter the desired name for the Analog Input Function Block (optional).
    Factory setting: ANALOG_INPUT_1xxxxxxxxxx
15. Open the Analog Input Function Block 1.
16. Set the operating mode in the parameter group MODE_BLK (parameter TARGET) to OOS, i.e. block Out Of Service.
17. Using the parameter CHANNEL select the process variable that is to be used as the input value for the Function Block algorithm (scaling and limit value monitoring functions). The following settings are possible:

Process variable	Channel parameter
Volume flow channel 1	2
Totalizer 1	7
Totalizer 2	8
Totalizer 3	9
Volume flow channel 2	20
Sound velocity channel 1	21
Sound velocity channel 2	22
Flow velocity channel 1	23
Flow velocity channel 2	24
Average volume flow	25
Volume flow sum	26
Volume flow difference	27
Average sound velocity	28
Average flow velocity	29
Signal strength channel 1	30
Signal strength channel 2	31

18. In the parameter group XD_SCALE, select the desired engineering unit and the block input range (measurement range of the flow application) for the process variable in question (see following example).

    ☝ Caution!
    Make sure that the selected unit is suitable for the measurement variable of the selected process variable. Otherwise the parameter BLOCK_ERROR will display the error message "Block Configuration Error" and the block operating mode cannot be set to AUTO.

19. In the L_TYPE parameter, select the mode of linearization for the input variable (Direct, Indirect, Indirect Sq Root) → See the "Description of Device Functions" manual.

    ☝ Caution!
    Note that with the type of linearization "Direct" the configuration of the parameter group OUT_SCALE must agree with the configuration of the parameter group XD_SCALE. Otherwise the block operating mode cannot be set to AUTO. Such incorrect configuration is indicated via the parameter BLOCK_ERROR with the "Block Configuration Error" message.

    Example:
    – The measurement range of the sensor is 0 to 30 m^3/h.
    – The output range to the process control system should be 0 to 30 m^3/h as well.
    The following settings should be made:
    – Analog Input Function Block / parameter CHANNEL (selection of input value), selection: 1 → Volume flow
    – Parameter L_TYPE → Direct
    – Parameter group XD_SCALE
      XD_SCALE 0% = 0
      XD_SCALE 100% = 30
      XD_SCALE UNIT = m^3/h
    – Parameter group OUT_SCALE
      OUT_SCALE 0% = 0
      OUT_SCALE 100% = 30
      OUT_SCALE UNIT = m^3/h

20. Use the following parameters to define the limit values for alarm and warning messages:
    – HI_HI_LIM → Limit value for the upper alarm
    – HI_LIM → Limit value for the upper warning
    – LO_LIM → Limit value for the lower warning
    – LO_LO_LIM → Limit value for the lower alarm
    The limit values entered must be within the value range specified in the parameter group OUT_SCALE.

21. In addition to the actual limit values you must also specify the action taken if a limit value is exceeded using so-called "alarm priorities" (parameters HI_HI_PRI, HI_PRI, LO_PR, LO_LO_PRI) → See the "Description of Device Functions" manual. Reporting to the fieldbus host system only takes place if the alarm priority is higher than 2.

22. System configuration/connection of Function Blocks:
    A concluding "overall system configuration" is essential so that the operating mode of the Analog Input Function Block can be set to AUTO and so that the field device is integrated into the system application. To do this, configuration software is used to connect the Function Blocks to the desired control strategy - generally graphically - and then the sequence of the individual process control functions is specified.

23. After specifying the active LAS, download all the data and parameters into the field device.

24. Set the operating mode in the parameter group MODE_BLK (parameter TARGET) to AUTO. This is only possible under two conditions, however:
    – The Function Blocks are correctly connected with each other.
    – The Resource Block is in operating mode AUTO.

6.4 Quick Setup

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the operating program, e.g. FieldCare.
If the measuring device is equipped with a local display, all the important device parameters for standard operation, as well as additional functions, can be configured quickly and easily by means of the following Quick Setup menus.

6.4.1 Quick Setup "Sensor Installation"

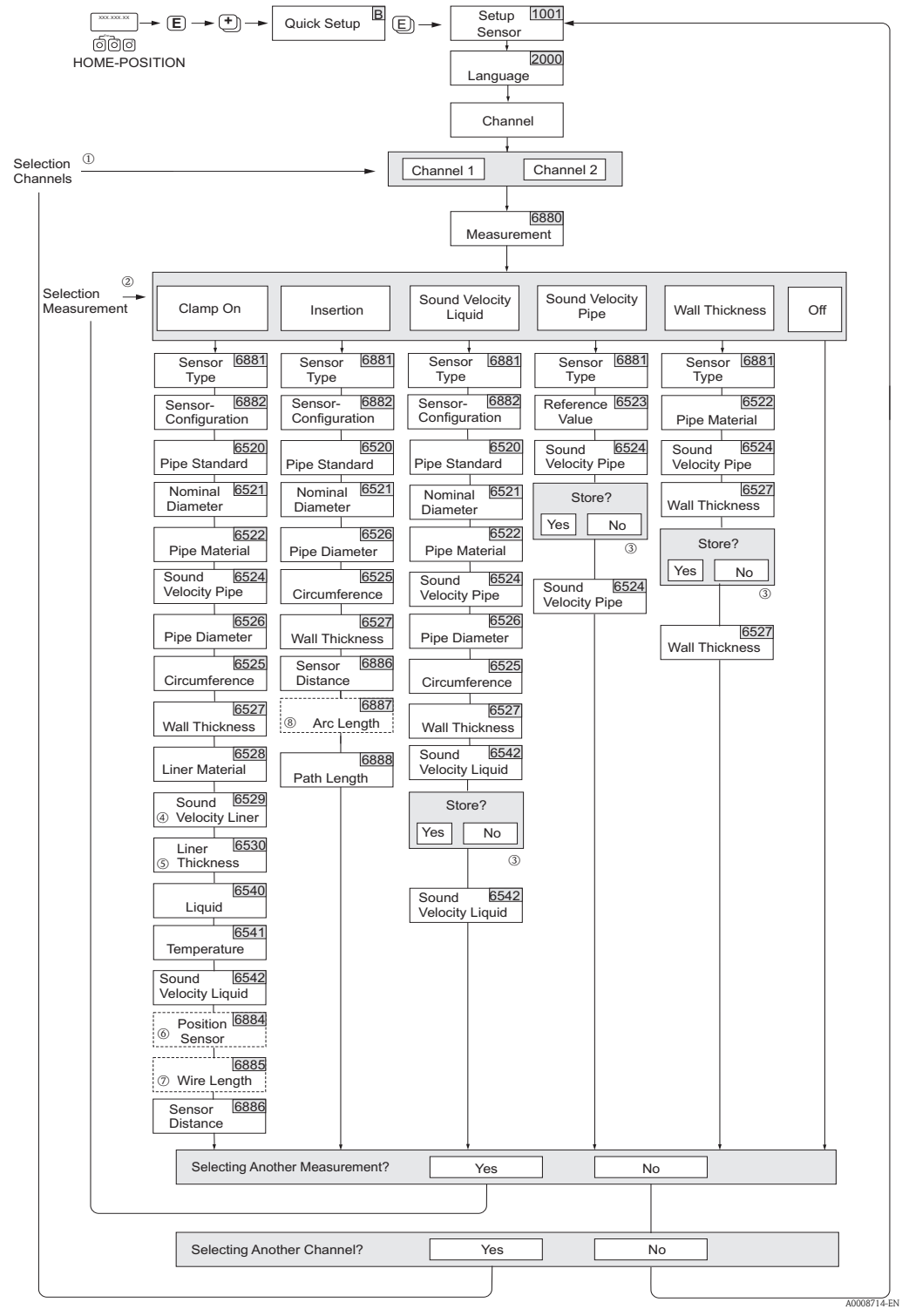


Fig. 79: Quick Setup for sensor mounting

✎ Note!
The display returns to the cell SETUP SENSOR (1001) if you press the ⌐┘ key combination during parameter interrogation. The stored parameters remain valid.

① If a channel is selected for which a Quick Setup has already been executed, the previous values are overwritten.

② During each run, all the options can be selected. If settings were made during a previous run, these are overwritten.

③ "Save?" prompt for pipe sound velocity::
- YES = The value measured during Quick Setup is accepted in the appropriate function.
- NO = The measurement is discarded and the original value remains.

④ The SOUND VELOCITY LINER (6529) only appears if:
- The LINER MATERIAL is selected to something ohter than NONE (6528).

⑤ The LINER THICKNESS (6530) only appears if:
- The LINER MATERIAL is selected to something ohter than NONE (6528).

⑥ The POSITION SENSOR function (6884) only appears if:
- The CLAMP ON option is selected in the MEASUREMENT function (6880)

and
- Two traverses are selected in the SENSOR CONFIGURATION function (6882)

⑦ The WIRE LENGTH function (6885) only appears if:
- The CLAMP ON option is selected in the MEASUREMENT function (6880)

and
- One traverse is selected in the SENSOR CONFIGURATION function (6882)

⑧ The ARC LENGTH function (6887) only appears if:
- The INSERTION option is selected in the MEASUREMENT function (6880)

and
- The DUAL-PATH option is selected in the SENSOR CONFIGURATION function (6882)

6.4.2 Quick Setup "Commissioning"

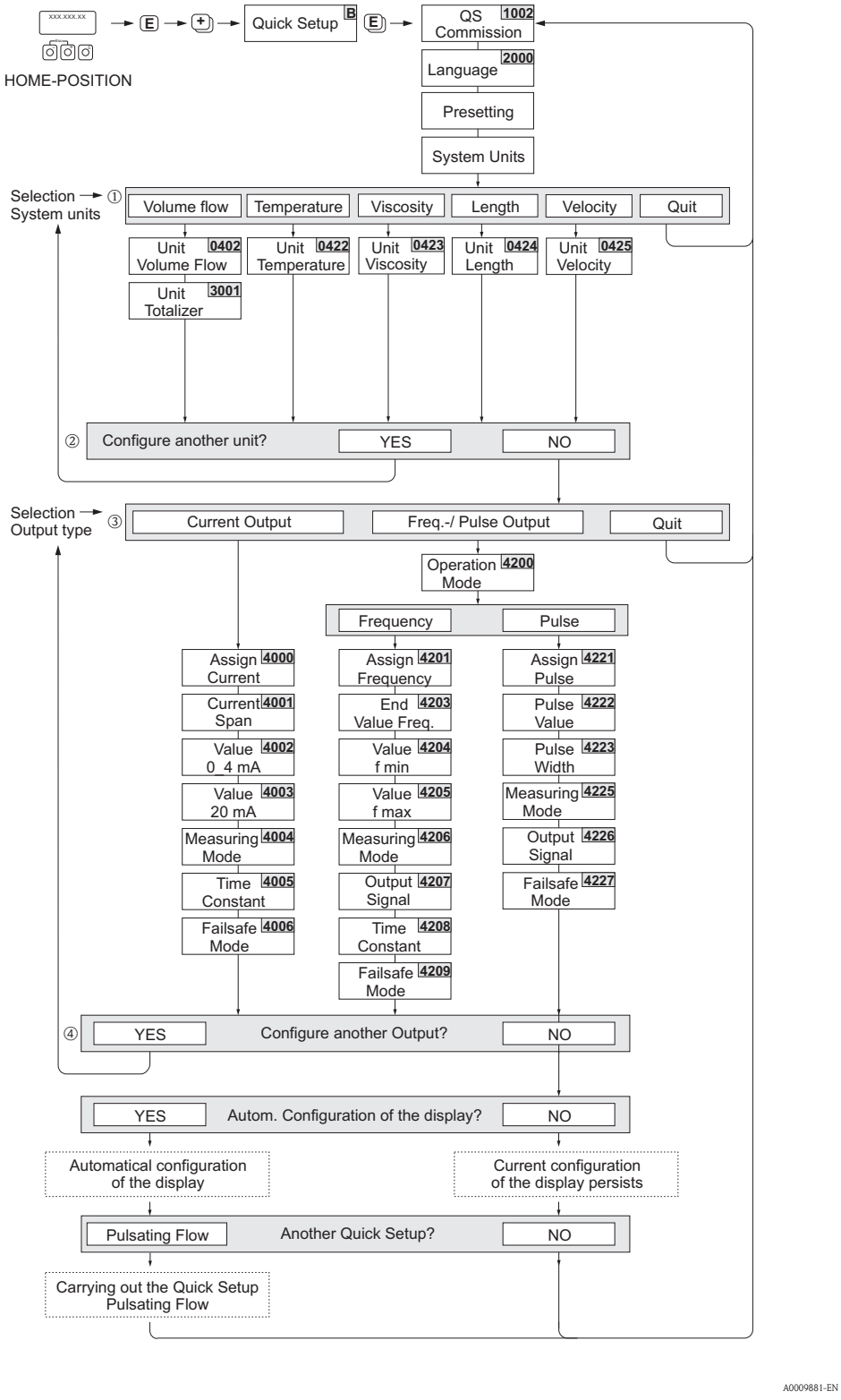


Fig. 80: Quick Setup "Commissioning"

✎ Note!

- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ⊡+⊡ key combination during parameter interrogation. The stored parameters remain valid.
- The "Commissioning" Quick Setup must be carried out before one of the Quick Setups explained below is run.

① The "DELIVERY SETTINGS" option sets every selected unit to the factory setting.
The "ACTUAL SETTINGS" accepts the units you configured beforehand.

② Only units not yet configured in the current Quick Setup are offered for selection in each cycle. The volume unit is derived from the volume flow unit.

③ The "YES" option remains visible until all the units have been configured.
"NO" is the only option displayed when no further units are available.

④ The "automatic parameterization of the display" option contains the following basic settings/factory settings

YES Main line = volume flow
Additional line = totalizer 1
Information line = operating/system condition

NO The existing (selected) settings remain.

⑤ The execution of other Quick Setups is described in the following sections.

6.4.3 Data backup/transmission

Using the T-DAT SAVE/LOAD function, you can transfer data (device parameters and settings) between the T-DAT (exchangeable memory) and the EEPROM (device storage unit).

This is required in the following instances:
- Creating a backup: current data are transferred from an EEPROM to the T-DAT.
- Replacing a transmitter: current data are copied from an EEPROM to the T-DAT and then transferred to the EEPROM of the new transmitter.
- Duplicating data: current data are copied from an EEPROM to the T-DAT and then transferred to EEPROMs of identical measuring points.

Note!
For information on installing and removing the T-DAT → 📄 109 ff.

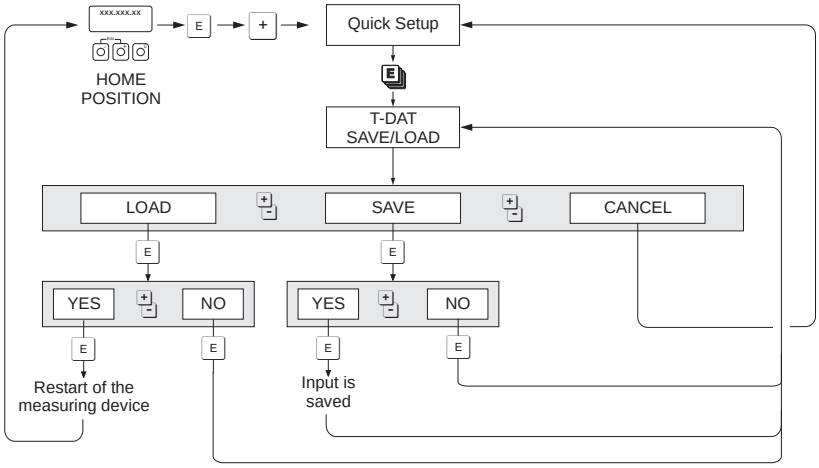


Fig. 81: Data backup/transmission with T-DAT SAVE/LOAD function

Information on the LOAD and SAVE options available:

LOAD: Data are transferred from the T-DAT to the EEPROM.

Note!
- Any settings already saved on the EEPROM are deleted.
- This option is only available, if the T-DAT contains valid data.
- This option can only be executed if the software version of the T-DAT is the same or newer than that of the EEPROM. Otherwise, the error message "TRANSM. SW-DAT" appears after restarting and the LOAD function is then no longer available.

SAVE:
Data are transferred from the EEPROM to the T-DAT

6.5 Adjustment

All measuring devices are calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate.
Calibration takes place under reference operating conditions → 📄 120 ff.
Consequently, the zero point adjustment is generally **not** necessary!

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

Preconditions for a zero point adjustment
Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that have no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  – 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

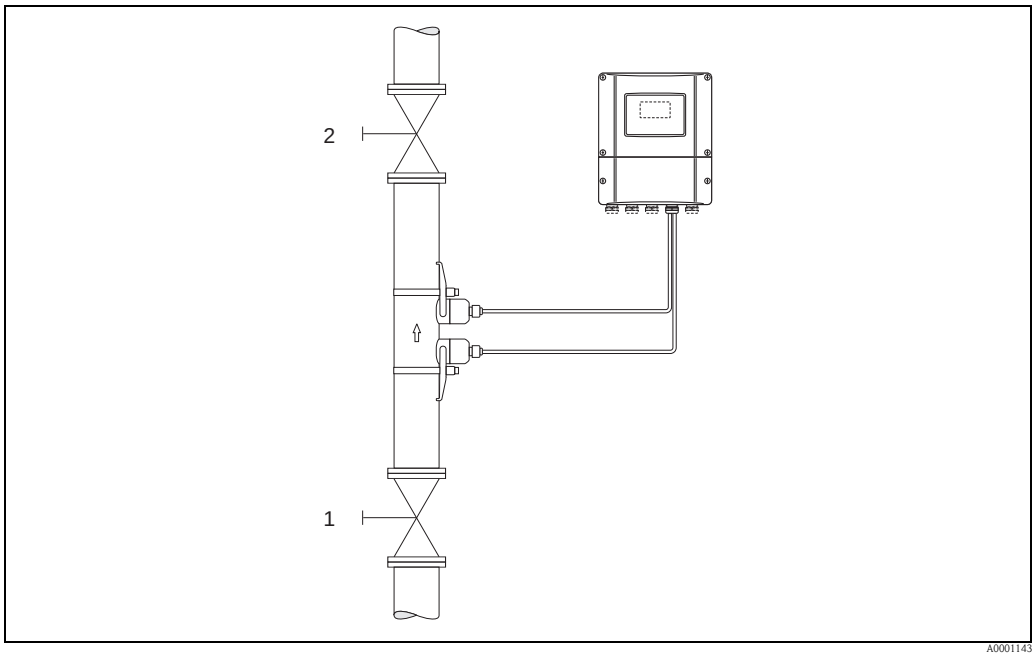


Fig. 82: Zero point adjustment and shutoff valves

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

Performing 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 have no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  – 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

1. Operate the system until normal operating conditions resume.
2. Stop the flow (v = 0 m/s).
3. Check the shutoff valves for leaks.
4. Check that operating pressure is correct.
5. Using the local display or an operating program, select the ZEROPOINT ADJUSTMENT function in the function matrix:
   BASIC FUNCTION (G) → PROCESS PARAMETER (GIA) → ADJUSTMENT (648) → ZERO POINT ADJUST (6480).
6. When you press ⊞ or ⊟ you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code (factory setting = 93).
7. Now use ⊞ or ⊟ to select START and confirm with Ⓔ. Acknowledge the security prompt with YES and confirm again with Ⓔ. Zero point adjustment is now started.
   – The message "ZEROPOINT ADJUST RUNNING" appears on the display for 30 to 60 seconds while adjustment is in progress.
   – If the flow in the pipe exceeds 0.1 m/s (0.3 ft/s), the following error message appears on the display: ZERO ADJUST NOT POSSIBLE.
   – When the zero point adjustment is completed, the "ZERO ADJUST" function reappears on the display.
8. Back to the HOME position:
   – Press and hold down the Esc keys (⊟+⊞) for longer than three seconds or
   – Repeatedly press and release the Esc keys (⊟+⊞).

6.6 Memory (HistoROM)

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data are stored. By plugging and unplugging such modules, device configurations can be duplicated onto other measuring devices to cite just one example.

6.6.1 HistoROM/T-DAT (transmitter-DAT)

The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.
Storing of specific parameter settings from the EEPROM to the T-DAT and vice versa has to be carried out by the user (= manual save function). Please refer to Page 88 for a description of the related function (T-DAT SAVE/LOAD) and the exact procedure for managing data.

7 Maintenance

The flow measuring system Prosonic Flow 93 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.

Note!

- Clean and reapply new coupling fluid when sensor is removed from the pipe.
- Avoid to use a thick layer of the coupling fluid (less is more).
- On rough pipe surface e.g. GRP pipes ensure that the gaps crevices within the surface roughness are filled. Apply sufficient coupling fluid.
- On rough pipe surfaces where a thicken layer of coupling fluid has been applied the risk for dust collection on washing away is present. In such cases it is recommended to seal the external gap between the sensor holder and the pipe surface e.g. with.
- A change in the signal strength might indicate a change of the coupling fluid. No action is required as long as the signal strength is higher than 50 dB.

8 Accessories

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

Device-specific accessories

Accessory	Description	Order code
Wall-mount housing, transmitter Prosonic Flow 93	Transmitter for replacement or for stock. Use the order code to define the following specifications: ■ Approvals ■ Degree of protection/version ■ Cable entry ■ Display / power supply / operation ■ Software ■ Outputs / inputs	Single-channel version: 93XXX - XX1XX******** Two-channel version: 93XXX - XX2XX********
Conversion kit, inputs/outputs	Conversion kit with appropriate plug-in point modules for converting the current input/output configuration to a new version.	DK9UI - **
Sensor P (DN 15 to 65 / ½ to 2½") Clamp-on version	DN 15 to 65 (½ to 2½") ■ –40 to +100 °C (–40 to +212 °F) ■ –40 to +150 °C (–40 to +302 °F)	 DK9PS - 1* DK9PS - 2*
Sensor P (DN 50 to 4000 / 2 to 160") Clamp-on version	DN 50 to 300 (2 to 12") ■ –40 to +80 °C (–40 to +176 °F) ■ –40 to +170 °C (–40 to +338 °F) DN 100 to 4000 (4 to 160") ■ –40 to +80 °C (–40 to +176 °F) ■ –40 to +170 °C (–40 to +338 °F	 DK9PS - B* DK9PS - F* DK9PS - A* DK9PS - E*
Sensor W (DN 15 to 65 / ½ to 2½") Clamp-on version	DN 15 to 65 (½ to 2½"), –40 to +80 °C (–4 to +176 °F), 6.0 MHz ■ IP 67 / NEMA 4X ■ IP 68 / NEMA 6P DN 15 to 65 (½ to 2½"), –40 to +130 °C (–4 to +266 °F), 6.0 MHz ■ IP 67 / NEMA 4X ■ IP 68 / NEMA 6P	 DK9WS -1 DK9WS -3 DK9WS -2 DK9WS -4
Sensor W (DN 50 to 4000 / 2 to 160") Clamp-on version	DN 50 to 300 (2 to 12"), –20 to +80 °C (–4 to +176 °F), 2.0 MHz ■ IP 67 / NEMA 4X ■ IP 68 / NEMA 6P DN 100 to 4000 (4 to 160"), –20 to +80 °C (–4 to +176 °F), 1.0 MHz ■ IP 67 / NEMA 4X ■ IP 68 / NEMA 6P DN 100 to 4000 (4 to 160"), 0 to +130 °C (+32 to +266 °F), 1.0 MHz ■ IP 67 / NEMA 4X DN 50 to 300 (2 to 12"), 0 to +130 °C (+32 to +266 °F), 2.0 MHz ■ IP 67 / NEMA 4X DN 100 to 4000 (4 to 160"), –20 to +80 °C (–4 to +176 °F), 0.5 MHz ■ IP 67 / NEMA 4X ■ IP 68 / NEMA 6P	 DK9WS - B* DK9WS - N* DK9WS - A* DK9WS - M* DK9WS - P* DK9WS - S* DK9WS - R* DK9WS - T*
Sensor W (DN 200 to 4000 / 8 to 160") Insertion version	DN 200 to 4000 (8 to 160"), –40 to +80 °C (–40 to +176 °F)	DK9WS - K*

Accessory	Description	Order code
Sensor DDU18	Sensor for sound velocity measurement ■ –40 to +80 °C (–40 to +176 °F) ■ 0 to +170 °C (+32 to +338 °F)	 50091703 50091704
Sensor DDU19	Sensor for wall thickness measurement.	50091713

Measuring principle-specific accessories

Accessory	Description	Order code
Mounting kit for aluminum field housing	Mounting kit for wall-mount housing. Suitable for: ■ Wall mounting ■ Pipe mounting ■ Panel mounting	DK9WM - A
Mounting kit for field housing	Mounting kit for aluminum field housing: Suitable for pipe mounting (¾ to 3")	DK9WM - B
Sensor holder set	■ Prosonic Flow P and W (DN 15 to 65 / ½ to 2½"): Sensor holder, Clamp-on version ■ Prosonic Flow P and W (DN 50 to 4000 / 2 to 160") – Sensor holder, fixed retaining nut, Clamp-on version – Sensor holder, removable retaining nut, Clamp-on version	DK9SH - 1 DK9SH - A DK9SH - B
Clamp-on installation set Clamp-on	Sensor fastening for Prosonic Flow P and W (DN 15 to 65 / ½ to 2½") ■ U-shaped screw DN 15 to 32 (½ to 1¼") ■ Strapping bands DN 40 to 65 (1½ to 2½") Sensor fastening for Prosonic Flow P and W (DN 50 to 4000 / 2 to 160") ■ Without sensor fastening ■ Strapping bands DN 50 to 200 (2 to 8") ■ Strapping bands DN 200 to 600 (8 to 24") ■ Strapping bands DN 600 to 2000 (24 to 80") ■ Strapping bands DN 2000 to 4000 (80 to 160") ■ Without mounting tools ■ Assembly jig DN 50 to 200 (2 to 8") ■ Assembly jig DN 200 to 600 (8 to 24") ■ Mounting rail DN 50 to 200 (2 to 8") ■ Mounting rail DN 200 to 600 (8 to 24")	 DK9IC - 1* DK9IC - 2* DK9IC - A* DK9IC - B* DK9IC - C* DK9IC - D* DK9IC - E* DK9IC - *1 DK9IC - *2 DK9IC - *3 DK9IC - *4 DK9IC - *5
Conduit adapter for connecting cable	Prosonic Flow P and W (DN 15 to 65 / ½ to 2½") ■ Conduit adapter incl. cable entry M20 × 1.5 ■ Conduit adapter incl. cable entry ½" NPT ■ Conduit adapter incl. cable entry G½" Prosonic Flow P and W (DN 50 to 4000 / 2 to 160") ■ Conduit adapter incl. cable entry M20 × 1.5 ■ Conduit adapter incl. cable entry ½" NPT ■ Conduit adapter incl. cable entry G½"	 DK9CB - BA1 DK9CB - BA2 DK9CB - BA3 DK9CB - BB1 DK9CB - BB2 DK9CB - BB3
Connecting cable for Prosonic Flow P/W	Prosonic Flow P and W (DN 15 to 65 / ½ to 2½") 5 m sensor cable, TPE-V, –20 to +70 °C (–4 to +158 °F) 10 m sensor cable, TPE-V, –20 to +70 °C (–4 to +158 °F) 15 m sensor cable, TPE-V, –20 to +70 °C (–4 to +158 °F) 30 m sensor cable, TPE-V, –20 to +70 °C (–4 to +158 °F) Prosonic Flow P/W (DN 50 to 4000 / 2 to 160") 5 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 10 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 15 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 30 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 5 m sensor cable, PTFE, –40 to +170 °C (–40 to +338 °F) 10 m sensor cable, PTFE, –40 to +170 °C (–40 to +338 °F) 15 m sensor cable, PTFE, –40 to +170 °C (–40 to +338 °F) 30 m sensor cable, PTFE, –40 to +170 °C (–40 to +338 °F)	 DK9SS - BAA DK9SS - BAB DK9SS - BAC DK9SS - BAD DK9SS - BBA DK9SS - BBB DK9SS - BBC DK9SS - BBD DK9SS - BBE DK9SS - BBF DK9SS - BBG DK9SS - BBH

Accessory	Description	Order code
Acoustic coupling fluid	■ Coupling fluid –40 to +170 °C (–40 to 338 °F), high temperature, standard ■ Adhesive coupling fluid –40 to +80 °C (–40 to +176 °F) ■ Water-soluble coupling fluid –20 to +80 °C (–4 to +176 °F) ■ Coupling fluid DDU 19, –20 to +60 °C (–4 to +140 °F) ■ Coupling fluid –40 to +100 °C (–40 to +212 °F), standard, type MBG2000	DK9CM - 2 DK9CM - 3 DK9CM - 4 DK9CM - 6 DK9CM - 7

Communication-specific accessories

Accessory	Description	Order code
HART handheld terminal FieldXpert	Handheld terminal for remote configuration and for obtaining measured values via the HART current output (4 to 20 mA) and FOUNDATION Fieldbus. Contact your Endress+Hauser representative for more information.	SFX100 - *******
Fieldgate FXA320	Gateway for remote interrogation of HART sensors and actuators via Web browser: ■ 2-channel analog input (4 to 20 mA) ■ 4 binary inputs with event counter function and frequency measurement ■ Communication via modem, Ethernet or GSM ■ Visualization via Internet/Intranet in the Web browser and/or WAP cellular phone ■ Limit value monitoring with alarm signaling via e-mail or SMS ■ Synchronized time stamping of all measured values.	FXA320 - *****
Fieldgate FXA520	Gateway for remote interrogation of HART sensors and actuators via Web browser: ■ Web server for remote monitoring of up to 30 measuring points ■ Intrinsically safe version [EEx ia]IIC for applications in hazardous areas ■ Communication via modem, Ethernet or GSM ■ Visualization via Internet/Intranet in the Web browser and/or WAP cellular phone ■ Limit value monitoring with alarm signaling via e-mail or SMS ■ Synchronized time stamping of all measured values ■ Remote diagnosis and remote configuration of connected HART devices	FXA520 - ****
FXA195	The Commubox FXA195 connects intrinsically safe Smart transmitters with HART protocol to the USB port of a personal computer. This makes the remote operation of the transmitters possible with the aid of configuration programs (e.g. FieldCare). Power is supplied to the Commubox by means of the USB port	FXA195 – *

Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and planning flowmeters. The Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.	DXA80 – *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser website: www.endress.com
FXA193	Ser.vice interface from the measuring device to the PC for operation via FieldCare.	FXA193 – *
Communication cable	Communication cable for connecting the Prosonic Flow 93 transmitter to the FXA193 service interface.	DK9ZT – A

9 Troubleshooting

9.1 Troubleshooting instructions

Always start troubleshooting with the following checklist if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

Caution!

9. In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. Important procedures must be carried out before you return a flowmeter to Endress+Hauser → 📄 6.

Always enclose a duly completed "Declaration of Contamination" form. A copy of the form can be found at the end of these Operating Instructions!

Check the display	
No display visible. No connection to the FF host system	1. Check the supply voltage → Terminals 1, 2 2. Check device fuse → 📄 113 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V 3. Meter electronics defective → Order spare part → 📄 109
No display visible. Connection to the FF host system established however.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → 📄 109 2. Display module defective → Order spare part → 📄 109 3. Meter electronics defective → Order spare part → 📄 109
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the ⊞/⊟ keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
No connection can be established with the FF host system, even though measured value reading is visible.	Measuring electronics defective → order spare parts → 📄 109

▼

Error messages on display
Errors that occur during commissioning or measuring are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows: – Type of error: **S** = system error, **P** = process error – Error message type: ϟ = fault message, **!** = notice message – **MEDIUM INHOM.** = error designation (e.g. fluid is not homogeneous) – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – **#702** = Error number Caution! Also refer to the information on → 📄 75
System error (device error) has occurred→ 📄 101
Process error (application error) has occurred→ 📄 107

▼

▼

Faulty connection to the fieldbus host system	
No connection can be made between the fieldbus host system and the measuring device. Check the following points:	
Supply voltage Transmitter	Check the supply voltage → Terminals 1/2
Device fuse	Check device fuse → 📄 113 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V
Fieldbus connection	Check the data cable: Terminal 26 = FF + Terminal 27 = FF –
Fieldbus connector (Option)	■ Check pin assignment/wiring → 📄 66 ■ Check connection between connector/fieldbus port. Is the coupling ring tightened correctly?
Fieldbus voltage	Check that a min. bus voltage of 9 V DC is present at terminals 26/27. Permissible range: 9 to 32 V DC
Network structure	Check permissible fieldbus length and number of spurs. → 📄 59
Basic current	Is there a basic current of min. 11 mA?
Bus address	Check bus address: make sure there are no double assignments
Bus termination (Termination)	Is the FOUNDATION Fieldbus-H1 network correctly terminated? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in data transmission.
Current consumption, permissible feed current	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply.
Device Description (DD)	Install the DD if you cannot access the manufacturer-specific parameters. ✎ Note! Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up via the following functions/parameters: Local display: ■ HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DEVICE REVISION (6243) ■ HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DD REVISION (6244) FF configuration program: ■ Resource Block → Parameter DEV_REV ■ Resource Block → Parameter DD_REV Example (with local display): Display in the DEVICE REVISION (6243) function → 03 Display in the DD REVISION (6244) function → 01 Device description file (DD) required → 0301.sym / 0301.ffo

▼

▼

Problems with configuration of Function Blocks	
Transducer Blocks: The operating mode cannot be set to AUTO.	Check whether the operating mode of the Resource Block is in AUTO mode → Parameter group MODE_BLK / parameter TARGET.
Analog Input fct. block: The operating mode cannot be set to AUTO.	There may be several reasons for this. Check the following in sequence: 1. Check whether the operating mode of the Analog Input Function Block is in AUTO mode → Parameter group MODE_BLK / parameter TARGET. If not and the mode cannot be set to AUTO, first check the following. 2. Make sure that the CHANNEL parameter (selection process variable) is configured in the Analog Input Function Block → 📄 109. The selection "CHANNEL = 0" (Uninitialized) is not valid. 3. Make sure that the XD_SCALE parameter group (input range, unit) is configured in the Analog Input Function Block → 📄 109 (incl. configuration example) ☝ Caution! Make sure that the selected unit is suitable for the process variable selected in the CHANNEL parameter. Otherwise the parameter BLOCK_ERROR will display the error message "Block Configuration Error". In this status the block operating mode cannot be set to AUTO.
Analog Input fct. block: The operating mode cannot be set to AUTO.	4. Make sure that the L_TYPE parameter (type of linearization) is already configured in the Analog Input Function Block → 📄 109. ☝ Caution! Make sure that with the type of linearization "Direct" the scaling of the parameter group OUT_SCALE is identical to that of the parameter group XD_SCALE. If set incorrectly the parameter BLOCK_ERROR will display the error message "Block Configuration Error". In this status the block operating mode cannot be set to AUTO. Configuration example → 📄 109 5. Check whether the operating mode of the Resource Block is in AUTO mode → Parameter group MODE_BLK/parameter TARGET 6. Make sure that the Function Blocks are correctly interconnected and that this system configuration has been sent to the fieldbus station → 📄 109.
Analog Input Function Block: The operating mode is set to AUTO but the status of the AI output value OUT is BAD or UNCERTAIN.	1. Check whether the operating mode of the Transducer Blocks is set to AUTO→ MODE_BLK parameter group / TARGET parameter. Using the various CHANNEL parameters (→ 📄 116) set the Transducer Blocks to the AUTO operating mode. 2. Check whether an error is pending in the "Diagnosis" Transducer Block (base index: 1600) → "Diagnosis" Transducer Block (base index: 1600) → "Diag. - Act.Sys.Condition" parameter. Error messages→ 📄 100
Parameters cannot be modified or no write access to parameters.	1. Parameters that only display values or settings cannot be modified! 2. Hardware write protection is enabled → Deactivate the write protection → 📄 109 ✎ Note! You can use the parameter WRITE_LOCK in the Resource Block to check whether hardware write protection is activated or deactivated: LOCKED = write protection enabled (activated) UNLOCKED = no write protection (deactivated) 3. The block operating mode is wrong. Certain parameters can only be changed in the OOS (out of service) or MAN (manual) mode → Set the operating mode of the block to the necessary mode → MODE_BLK parameter group. 4. The value entered is outside the specified input range for the parameter in question: → Enter suitable value → Increase input range if necessary 5. Transducer Blocks: The programming level is not enabled → Enable by entering the code in the "Access – Code" parameter or by means of the service code in the service parameters.

Transducer Block The manufacturer-specific parameters are not visible.	The device description file (Device Description, DD) has not been loaded into the host system or the configuration program → Load the file into the configuration system. Reference sources of the DD → 📄 109 ✎ Note! Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up in the measuring device via the following functions/parameters: Local display: ■ HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DEVICE REVISION (6243) ■ HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DD REVISION (6244) FF configuration program: ■ Resource Block → Parameter DEV_REV ■ Resource Block → Parameter DD_REV Example (local display): Display in the DEVICE REVISION (6243) function → 03 Display in the DD REVISION (6244) function → 01 Required device description file (DD) → 0301.sym / 0301.ffo
Analog Input fct. block: The output value OUT is not updated despite having a GOOD status.	Simulation is active → Deactivate simulation via parameter group SIMULATE.

▼

Error messages
Error messages in the FF configuration program → 📄 101 Error messages on the local display → 📄 101

▼

Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → 📄 108

9.2 System/process error messages

General notes

The flowmeter assigns current system and process errors to two error message types in accordance with a predefined algorithm and classifies them accordingly:

Error message type "Fault message":
- A message of this type immediately interrupts or stops measurement.
- Presentation on the FOUNDATION Fieldbus → Fault messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "BAD" of the AI output parameter OUT (AI Block).
- Local display → A flashing lightning symbol (ϟ) is displayed

Error message type "Notice message":
- Measurement continues despite this message.
- Presentation on the FOUNDATION Fieldbus → Notice messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "UNCERTAIN" of the AI output parameter OUT (AI Block).
- Local display → A flashing exclamation mark (!) is displayed.

Serious system errors, e.g. module defects, are always classed and displayed as "fault messages" by the measuring device. Simulations in the "Flow" Transducer Block and positive zero return, on the other hand, are identified as "notice messages" only.

Error messages in the FF configuration programs → 🖹 101

System and process errors are recognized and reported in the Transducer Blocks. Such errors are displayed via the following parameters specified in the FOUNDATION Fieldbus specification:
- BLOCK_ERR
- Transducer Error

In the "Diagnosis" Transducer Block (base index: 1600), detailed reasons for errors and device status messages are displayed by means of the "Diag. - Act.Sys.Condition" parameter (manufacturer-specific) → Table.

Error messages on the local display → 🖹 101

You will find more details on how error messages are presented on → 🖹 75.

9.2.1 List of system error messages

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 109)
* With FOUNDATION Fieldbus, error messages are displayed in the "Diagnosis" Transducer Block (base index: 1600) by means of the "Diag. – Act.Sys.Condition" parameter (manufacturer-specific). S = System error ϟ = Fault message (with an effect on operation) ! = Notice message (without any effect on operation)				
No. # 0xx → Hardware error				
001	*Device status message (FF):* ROM/RAM Failure – Err. No. 001 *Local display:* S: CRITICAL FAILURE ϟ: # 001	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* ROM/RAM error. Error when accessing the program memory (ROM) or random access memory (RAM) of the processor. *Remedy:* Replace the amplifier board.
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
011	*Device status message (FF):* Amplifier EEPROM failure – Err. No. 011 *Local display:* S: AMP HW EEPROM ϟ: # 011	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Amplifier with faulty EEPROM *Remedy:* Replace the amplifier board.
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
012	*Device status message (FF):* Amplifier EEPROM data inconsistent – Err. No. 012 *Local display:* S: AMP SW EEPROM ϟ: # 012	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Error when accessing data of the measuring amplifier EEPROM *Remedy:* Perform a "warm start" (= start the measuring system without disconnecting main power). – FF: "Diagnosis" Transducer Block (base index: 1600) → "Sys. – Reset" parameter RESTART SYSTEM – Local display: SUPERVISION → SYSTEM → OPERATION → SYSTEM RESET (→ RESTART SYSTEM)
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
041	*Device status message (FF):* T-DAT failure – Err. No. 041 *Local display:* S: TRANSM. HW-DAT ϟ: # 041	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* 1. T-DAT is not plugged into the amplifier board correctly (or is missing). 2. T-DAT is defective. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board. 2. Replace the T-DAT if it is defective. Check that the new, replacement DAT is compatible with the measuring electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronic boards if necessary. 4. Plug the T-DAT into the amplifier board.
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
042	*Device status message (FF):* T-DAT data inconsistent – Err. No. 042 *Local display:* S: TRANSM. SW-DAT ϟ: # 042	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
		Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 109)
082	*Device status message (FF):* Interruption between sensor and transmitter CH1 – Err. No. 082 *Local display:* S: SENS. DOWN CH1 ϟ: # 082	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* 1. Check the cable connection between the sensor and the transmitter. 2. Check that the sensor connector is fully screwed in. 3. Check that the correct sensor has been connected. 4. Local display: In the SENSOR TYPE function (6881), check that the correct sensor has been selected for Channel 1 or Channel 2. 5. FOUNDATION Fieldbus: In the "Sensor Param. – Sensor Type" parameter, check whether the correct sensor has been selected for error number 82 or 83. 6. The sensor may be defective.
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
083	*Device status message (FF):* Interruption between sensor and transmitter CH2 – Err. No. 083 *Local display:* S: SENS. DOWN CH2 ϟ: # 083	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
085	*Device status message (FF):* Interruption between sensor and transmitter CH1 – Err. No. 085 *Local display:* S: SENS. UP CH1 ϟ: # 086	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* 1. Check the cable connection between the sensor and the transmitter. 2. Check that the sensor connector is fully screwed in. 3. Check that the correct sensor has been connected. 4. Check that the correct sensor has been selected. – FF: Transducer Block "Transducer_CH1" (base index: 1400) or Transducer Block "Transducer_CH2" (base index: 1500)→ Parameter "Sensor Param. – Sensor Type" – Onsite display: BASIC FUNCTION → SENSOR DATA CH1 or CH2 → SENSOR PARAMETERS → SENSOR TYPE 5. The sensor may be defective.
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
086	*Device status message (FF):* Interruption between sensor and transmitter CH2 – Err. No. 086 *Local display:* S: SENS. DOWN CH2 ϟ: # 086	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
No. # 1xx → Software error				
111	*Device status message (FF):* Totalizer could not be restored at startup – Err. No. 111 *Local display:* S: CHECKSUM TOTAL. ϟ: # 111	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Checksum error of the totalizer. *Remedy:* 1. Restart the measuring device. 2. Replace the amplifier board.
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 109)
121	*Device status message (FF):* Software compatibility problem amplifier – I/O module – Err. No. 121 *Local display:* S: A / C COMPATIB. !: # 121	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). ✎ Note! – This is indicated on the display as a warning message for only 30 seconds (with entry in error history). – This situation in which the software versions differ can occur if only one electronics board has been exchanged; the extended software functionality is not available. The previously existing software functionality is still available and measurement operation is possible.
		Transducer_Error = I/O failure (input/output error)	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
No. # 2xx → Error in DAT / no communication				
205	*Device status message (FF):* Save to T-DAT failed – Err. No. 205 *Local display:* S: LOAD T-DAT !: # 205	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Data backup (download) to T-DAT failed, or error when accessing (uploading) the calibration values stored in the T-DAT. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board. 2. Replace T-DAT if faulty. Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the: – Spare part set number – Hardware revision code 3. Replace measuring electronics boards if necessary.
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
206	*Device status message (FF):* Restore from T-DAT failed – Err. No. 206 *Local display:* S: SAVE T-DAT !: # 206	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
261	*Device status message (FF):* Communication failure amplifier – Err. No. 261 *Local display:* S: COMMUNICAT. I/O ϟ: # 261	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* 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
		Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 109)
No. # 3xx → System limits exceeded				
392	*Device status message (FF):* Attenuation of acoustic measurement section too high CH1 – Err. No. 392 *Local display:* S: SIGN. LOW CH1 ϟ: # 392	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Attenuation of acoustic measurement section too high. *Remedy:* 1. Check to see if the coupling fluid must be renewed. 2. It is possible that the fluid indicates too much attenuation. 3. It is possible that the pipe indicates too much attenuation. 4. Check the sensor spacing (Installation dimensions). 5. Reduce the number of traverses if possible.
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
393	*Device status message (FF):* Attenuation of acoustic measurement section too high CH2 – Err. No. 393 *Local display:* S: SIGN. LOW CH2 ϟ: # 393	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
No. # 5xx → Application error				
501	*Device status message (FF):* Download device software active – Err. No. 501 *Local display:* S: SW.-UPDATE ACT. !: # 501	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* New amplifier or communication software version is being loaded to the device. Currently no other functions are possible. *Remedy:* Wait until process is finished. The device will restart automatically.
		Transducer_Error = General Error	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
502	*Device status message (FF):* Up-/Download device software active – Err. No. 502 *Local display:* S: UP-/DOWNLO. ACT. !: # 502	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Up- or downloading the device data via operating program. Currently no other functions are possible. *Remedy:* Wait until process is finished.
		Transducer_Error = General Error	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
592	*Device status message (FF):* Channel initialization run CH1 – Err. No. 592 *Local display:* S: INIT. RUN CH1 ϟ: # 592	BLOCK_ERR = No Error	OUT. QUALITY = UNCERTAIN	*Cause:* Initialization running. *Remedy:* Wait until process is finished.
			OUT. SUBSTATUS = Non specific	
593	*Device status message (FF):* Channel initialization run CH2 – Err. No. 593 *Local display:* S: INIT. RUN CH2 ϟ: # 593	BLOCK_ERR = No Error	OUT. QUALITY = UNCERTAIN	
			OUT. SUBSTATUS = Non specific	

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 109)
No. # 6xx → Simulation mode active				
602	*Device status message (FF):* Positive zero return active CH1 – Err. No. 602 *Local display:* S: POS. 0-RET. CH1 !: # 602	BLOCK_ERR = No Error	OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific	*Cause:* Positive zero return is active. *Remedy:* Deactivate positive zero return: ■ FF: Transducer Block "Transducer_CH1" (base index: 1400) or Transducer Block "Transducer_CH2" (base index: 1500) → Parameter "Sys. - Positive Zero Return" → OFF ■ Local display: BASIC FUNCTIONS → SYSTEM PARAMETERS → CONFIGURATION → POS. ZERO RETURN (→ OFF)
603	*Device status message (FF):* Positive zero return active CH2 – Err. No. 603 *Local display:* S: POS. 0-RET. CH2 !: # 603	BLOCK_ERR = No Error	OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific1	
604	*Device status message (FF):* Positive zero return active CH1&2 – Err. No. 604 *Local display:* S: POS. 0-RET. CH1&2 !: # 604	BLOCK_ERR = No Error	OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific	
691	*Device status message (FF):* Simulation failsafe active – Err. No. 691 *Local display:* S: SIM. FAILSAFE. !: # 691	BLOCK_ERR = Simulation active Transducer_Error = No Error	OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific	*Cause:* Simulation of response to error (outputs) is active *Remedy:* Switch off simulation: ■ FF: "Diagnosis" Transducer Block (base index: 1600) → "Sys. – Sim.Failsafe Mode" parameter → OFF ■ Local display: SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
692	*Device status message (FF):* Simulation Volume flow active - Err. No. 692 *Local display:* S: SIM. MEASURAND !: # 692	BLOCK_ERR = Simulation active Transducer_Error = No Error	OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific	*Cause:* Simulation of measured variable is active. *Remedy:* Switch off simulation: ■ FF: "Flow" Transducer Block (base index: 1400) → "Simulation - Measurand" parameter → OFF ■ Local display: SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 109)
694	*Device status message (FF):* Simulation of measuring CH1 active - Err. No. 694 *Local display:* S: SIM. MEASUR. CH1 ϟ: # 694	BLOCK_ERR = Simulation active	OUT. QUALITY = UNCERTAIN	*Cause:* Simulation is active. *Remedy:* Switch off simulation: ■ FF: Transducer Block "Transducer_CH1" (base index: 1400) or Transducer Block "Transducer_CH2" (base index: 1500) → Parameter "Simulation - Measurand" → OFF ■ Local display: SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)
		Transducer_Error = No Error	OUT. SUBSTATUS = Non specific	
695	*Device status message (FF):* Simulation of measuring CH2 active - Err. No. 695 *Local display:* S: SIM. MEASUR. CH2 ϟ: # 695	BLOCK_ERR = Simulation active	OUT. QUALITY = UNCERTAIN	
		Transducer_Error = No Error	OUT. SUBSTATUS = Non specific	
No. # 7xx → Application error				
743	*Device status message (FF):* Zero point adjustment CH1 is not possible – Err. No. 743 *Local display:* S: 0-ADJ. FAIL CH1 ϟ: # 743	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	*Cause:* The medium velocity has exceeded a value of 0.1 m/s. *Remedy:* Check whether all prerequisites for carrying out a zero point adjustment have been met.
		Transducer_Error = No Error	OUT. SUBSTATUS = Non specific	
744	*Device status message (FF):* Zero point adjustment CH2 is not possible – Err. No. 744 *Local display:* S: 0-ADJ. FAIL CH2 ϟ: # 744	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	
		Transducer_Error = No Error	OUT. SUBSTATUS = Non specific	
–	No communication to amplifier	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* Communication error. No communication with measuring amplifier. *Remedy:* 1. Switch power supply off and on again. 2. Check whether the electronics boards are correctly inserted in their holders
		Transducer_Error = General Error	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	

9.2.2 List of process error messages

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages	Analog Input Function Block error messages	Cause/remedy (Spare parts → 🖹 109)
* With FOUNDATION Fieldbus, error messages are displayed in the "Diagnosis" Transducer Block (base index: 1600) by means of the "Diag. – Act.Sys.Condition" parameter (manufacturer-specific). P = Process error ϟ = Fault message (with an effect on operation) ! = Notice message (without any effect on operation)				
No. # 4xx → Application error				
469	*Device status message (FF):* Pipe data CH1 – Err. No. 469 *Local display:* P: PIPE DATA? CH1 ϟ: # 469	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	*Cause:* The internal diameter is negative. Remedy: Check the value of the outer diameter, the wall thickness and the liner thickness: ■ FF: – Transducer Block "Transducer_CH1" (base index: 1400) or "Transducer_CH2" (base index: 1500) → Parameter "Pipe Data - Pipe Diameter" (outer diameter), parameter "Pipe Data - Wall Thickness" (wall thickness) and parameter "Pipe Data - Liner Material" (liner thickness) ■ Onsite display: BASIC FUNCTIONS → PROCESS PARAMETER CH1 or CH2 → PIPE DATA → PIPE DIAMETER, WALL THICKNESS and LINER THICKNESS
		Transducer_Error = Config Error	OUT. SUBSTATUS = Non specific	
470	*Device status message (FF):* Pipe data CH2 – Err. No. 470 *Local display:* P: PIPE DATA? K2 ϟ: # 470	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	
		Transducer_Error = Config Error	OUT. SUBSTATUS = Non specific	
492	*Device status message (FF):* Sound velocity CH1 outside the range – Err. No. 492 *Local display:* P: S. V. RANGE CH1 ϟ: # 492	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	*Cause:* The sonic velocity is outside the measuring range. *Remedy:* 1. Check the installation dimensions. 2. If possible, check the sound velocity of the fluid or consult the specialist literature. 3. If the current sound velocity is outside the sound velocity range (min./max.), change the range. – FF: Transducer Block "Transducer_CH1" (base index: 1400) or Transducer Block "Transducer_CH2" (base index: 1500) → Parameter "Liquid Data - Min. Sound Velocity Liquid" and "Liquid Data - Max. Sound Velocity Liquid" – Onsite display: BASIC FUNCTIONS → PROCESS PARAMETER CH1 or CH2 → LIQUID DATA → MIN. FLUID SOUND VELOCITY and MAX. FLUID SOUND VELOCITY
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
493	*Device status message (FF):* Sound velocity CH2 outside the range – Err. No. 493 *Local display:* P: S. V. RANGE CH2 ϟ: # 493	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	

No.	Error messages: FOUNDATION Fieldbus (FF)* (local display)	Transducer Block error messages	Analog Input Function Block error messages	Cause/remedy (Spare parts → 109)
495	*Device status message (FF):* Interference CH1 – Err. No. 495 *Local display:* P: INTERF CH1 ϟ: # 495	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	*Cause:* The wave transmitted in the pipe may superimpose the useful signal. We recommend you alter the sensor configuration in the event of this error message. Caution! If the measuring device displays zero flow or a low flow, the sensor configuration **must** be changed. Remedy: Change the traverses of 2 and 4 to 1 and 3. To do so, proceed as follows: 1. Change the number of traverses in the function accordingly: – FF: Transducer Block "Transducer_CH1" (base index: 1400) or "Transducer_CH2" (base index: 1500) → Parameter "Sensor Param. - Sensor Configuration" – Onsite display: BASIC FUNCTIONS → SENSOR DATA CH1 or CH2 → SENSOR PARAMETERS → SENSOR CONFIGURATION 2. Relocate the sensors accordingly.
		Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	
496	*Device status message (FF):* Interference CH2 – Err. No. 496 *Local display:* P: INTERF CH2 ϟ: # 496	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	
		Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	

9.3 Process errors without messages

Symptoms	Rectification
Note! For troubleshooting, it may be necessary to modify or adapt settings in certain functions of the function matrix. The functions outlined below are described in detail in the "Description of Device Functions" manual.	
Unstable measured value display despite continuous flow.	1. Check the fluid for presence of gas bubbles. 2. Increase the following values: – Analog Input function block → RISING TIME – BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → FLOW DAMPING 3. Increase the value for display damping: HOME → USER INTERFACE → CONTROL → BASIC CONFIG. → 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: BASIC FUNCTION → PROCESS PARAMETER → CONFIGURATION → ON-VALUE LF CUTOFF
The fault cannot be rectified or some other fault not described above has occurred. In instances of this nature, contact your E+H service organization.	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 organization to have a service technician sent out, please be ready with the following information: ■ Brief description of the fault ■ Nameplate specifications: order code and serial number → 7 **Return devices to E+H** You can return a measuring device to Endress+Hauser for repair or calibration. Always enclose the duly completed "Declaration of contamination" form with the flowmeter. You will find a preprinted blank of this form at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective → Order spare part → 109

9.4 Spare parts

The previous sections contain a detailed troubleshooting guide → 📄 96.
The measuring device, more over, provides additional support in the form of continuous self-diagnosis and error messages.
Troubleshooting can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your Endress+Hauser service organization by providing the serial number printed on the transmitter's nameplate → 📄 7.

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

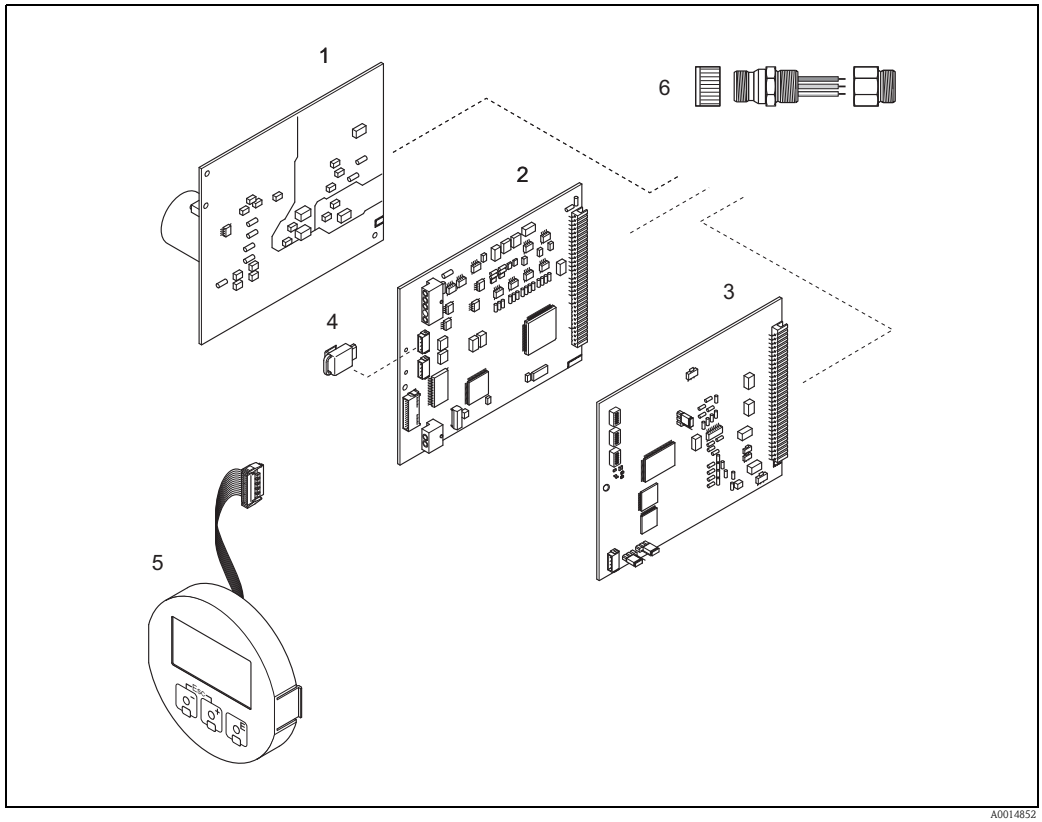


Fig. 83: Spare parts for transmitter (field and wall-mount housings)

1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
2 Amplifier board
3I/O board FOUNDATION Fieldbus (COM module)
4 T-DAT (transmitter data storage device)
5 Display module
6 Fieldbus connector consisting of: protection cap and connector

9.5 Installing and removing electronics boards

Warning!
- Risk of electric shock.
  Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection).
  Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface, 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.

Caution!
Use only original Endress+Hauser parts.

1. Loosen the screws and open the housing cover (1).
2. Loosen 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 connectors from amplifier board (7):
   – Signal cable connector (7.1)
   – Plug of exciting current cable (7.2):
     Gently disconnect the plug, i.e. without moving it back and forward.
   – Ribbon cable plug (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 hole provided (5) for the purpose and pull the board clear of its holder.
6. Installation is the reverse of the removal procedure.

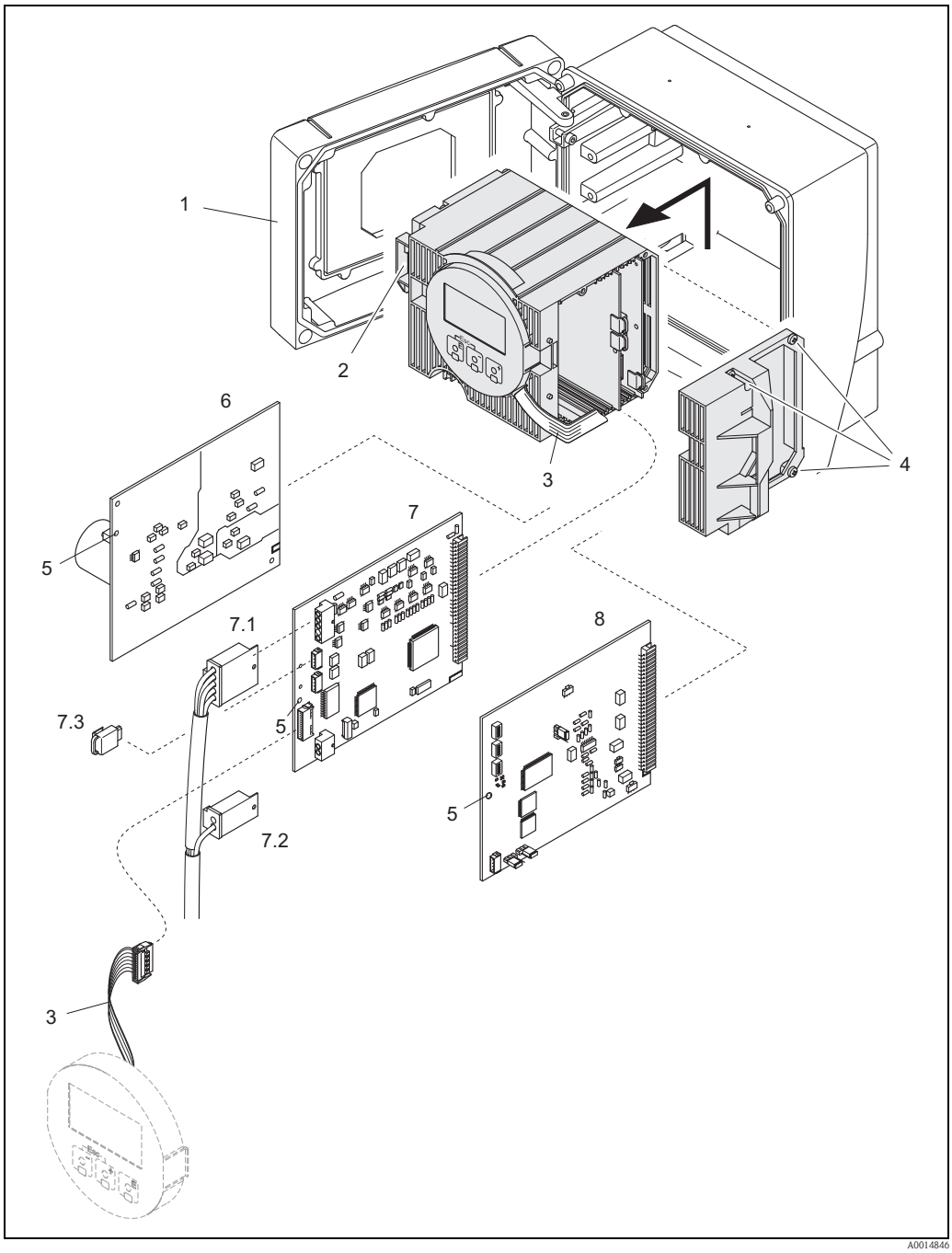


Fig. 84: Wall-mount housing: removing and installing electronics boards

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 Signal cable (sensor)
7.2 Excitation current cable (sensor)
7.3 T-DAT (transmitter data storage device)
8 I/O board (FOUNDATION Fieldbus type)

9.6 Installing and removing the W sensors

The active part of the flowrate measuring sensor W "Insertion version" 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 retainer (8) and replace it with a new one.
7. Installation is the reverse of the removal procedure.

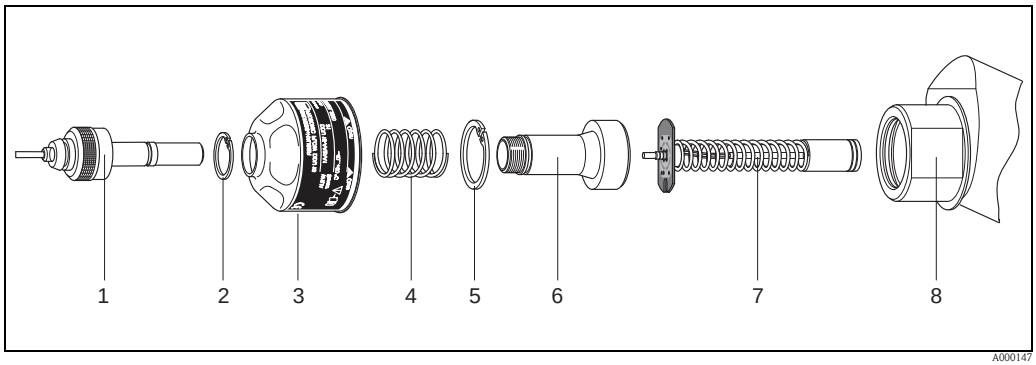


Fig. 85: Flowrate measuring sensor W "Insertion version"

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

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 main fuse is on the power unit board → 86.
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove power unit board → 110.
3. Remove cap (1) and replace the device fuse (2).
   Only use the following fuse type:
   – 20 to 55 V AC / 16 to 62 V DC → 2.0 A slow-blow / 250 V; 5.2 x 20 mm
   – Power supply 85 to 260 V AC → 0.8 A slow-blow / 250 V; 5.2 x 20 mm
   – Ex-rated devices → see the Ex documentation
4. Installation is the reverse of the removal procedure.

Caution!
Use only original Endress+Hauser parts.

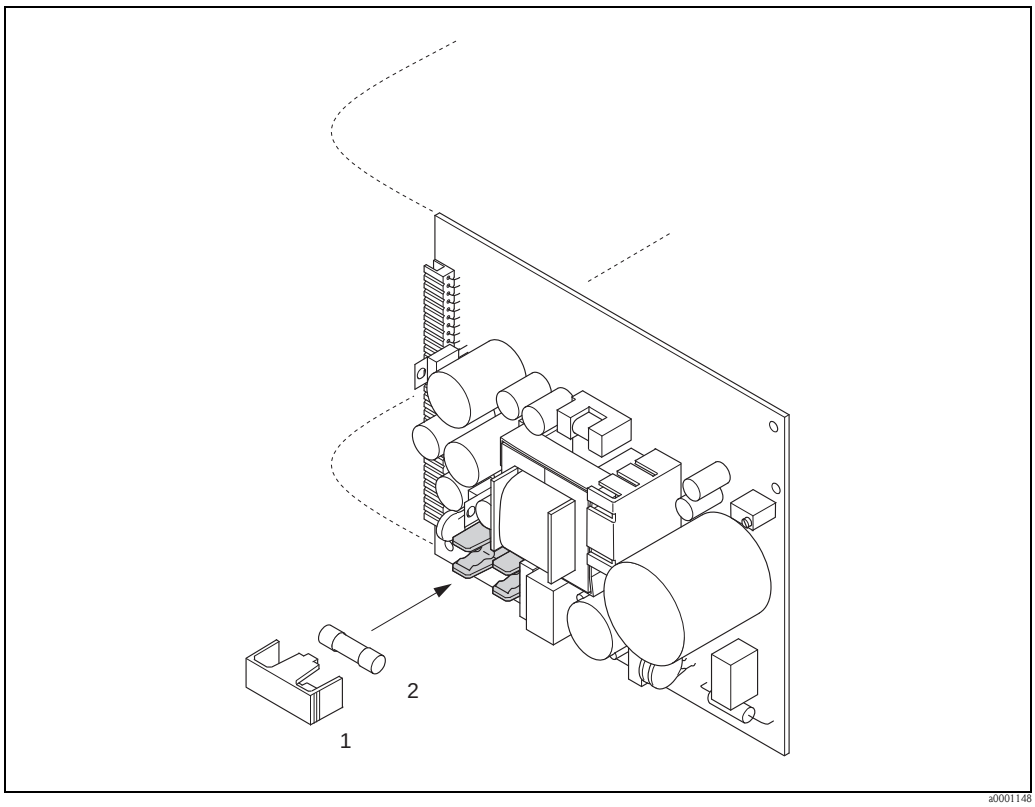


Fig. 86: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse

9.8 Return

→ 6

9.9 Disposal

Observe the regulations applicable in your country!

9.10 Software history

Date	Software version	Changes to software	Operating Instructions
06.2011	2.03.XX	– Prosonic Flow W sensor (DN 15 to 65/½ to 2½") – Liner informaton added to Quick Setup – Additional ANSI pipes added to pipe standard	BA00078D/06/EN/14.10 71139009
06.2009	3.00.XX	Introduction of new FOUNDATION Fieldbus I/O board Shorter execution times: – Analog Input Function Blocks 1 to 8 (each 18 ms) – PID Function Block (25 ms) – Discrete Output Function Block (18 ms) New function blocks: – Arithmetic Function Block (20 ms) – Input Selector Function Block (20 ms) – Signal Characterizer Function Block (20 ms) – Integrator Function Block (18 ms) Software adaptations: – ITK Version: 5.01 – CFF version: 1.8	BA00078D/06/EN/13.10 71121202
01.2007	2.00.XX	Shorter execution times: – Analog Input Function Blocks 1 to 8 (20 ms) – Discrete Output Function Block (20 ms) – PID Function Block (50 ms) Software adaptations: – ITK Version: 5.0 – CFF version: 1.7	BA078D/06/en/01.07 71021607
05.2002	Communication module: 1.01.00	Original software: – Device Revision 1, DD Revision 1 – Certification No. IT 014600 – ITK 4.0 – 1 Resource Block – 6 Transducer Blocks – 8 Analog Input Blocks – 1 Discrete Output Block – 1 PID Block – Output data – Input data – CFF Version: 1.5	-
05.2002	Amplifier: 1.01.XX	Software adaptations: Software supports the following fieldbuses: – PROFIBUS – FOUNDATION Fieldbus	-
06.2001	Amplifier: 1.01.XX	Original software (without fieldbus support)	-

10 Technical data

10.1 Quick technical data guide

10.1.1 Applications

- 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

The measuring system operates on the principle of transit time difference.

Measuring system

The measuring system consists of one transmitter and two sensors. A number of different versions are available:
- Version for installation in the safe zone and for Ex Zone 2.
- Version for installation in Ex Zone 1 (see separate Ex documentation → 127)

Transmitter

Prosonic Flow 93

Sensor

- Prosonic Flow P Clamp-on version (for chemical and process applications), nominal diameters DN 15 to 65 (½ to 2½")
- Prosonic Flow P Clamp-on version (for chemical and process applications), nominal diameters DN 50 to 4000 (2 to 160")
- Prosonic Flow W Clamp-on version (water/wastewater applications), nominal diameters DN 15 to 65 (½ to 2½")
- Prosonic Flow W Clamp-on version (water/wastewater applications), nominal diameters DN 50 to 4000 (2 to 160")
- Prosonic Flow W Insertion version (water/wastewater applications) nominal diameters DN 200 to 4000 (8 to 160")
- Prosonic Flow DDU 18 (sound velocity measurement), nominal diameters DN 50 to 3000 (2 to 120")
- Prosonic Flow DDU 19 (wall thickness measurement),
  – for wall thicknesses from 2 to 50 mm (0.08 to 2") for steel pipes
  – for wall thicknesses from 4 to 15 mm (0.16 to ½") for plastic pipes (only suitable for use with PTFE and PE pipes to a certain extent)

10.1.3 Input

Measured variable

Flow velocity
(transit time difference proportional to flow velocity)

Measuring range

Typically v = 0 to 15 m/s (0 to 50 ft/s)

Operable flow range

Over 150 : 1

Input signal

Status input (auxiliary input):

U = 3 to 30 V DC, R_i = 5 kΩ, galvanically isolated.

Configurable for:
Totalizer(s) reset, positive zero return, error-message reset, zero point adjustment.

10.1.4 Output

Output signal	*Physical data transmission (Physical Layer Type):* ■ Fieldbus interface in accordance with IEC 61158-2 ■ Corresponds to device version type 512 of the FOUNDATION Fieldbus specification: type 512 – standard data transfer (±9 mA, symmetrical), separate supply to field device (4-wire), intrinsically safe version of the FF interface, FISCO ■ With integrated reverse polarity protection
Signal on alarm	Status messages as per FOUNDATION Fieldbus specification
Link Master (LM) support	Yes
Link Master	Factory setting
Basic Device	Selectable
Device basic current	11 mA
Device starting current	<11 mA
Device error current (FDE)	0 mA
Device (lift off) min. voltage	9 V (H1-segment)
Permissible fieldbus supply voltage	9 to 32 V
Integrated reverse polarity protection	Yes
ITK Version	5.01
Number of VCRs (total)	48
Number of link objects in VFD	40
Device capacitance	In accordance with IEC 60079-27, FISCO/FNICO
Galvanic isolation	All circuits for inputs, outputs and power supply are galvanically isolated from each other.
Data transmission speed	31.25 kbit/s, voltage mode
Signal coding	Manchester II

Bus times

Min. idle time between two telegrams:
MIN_INTER_PDU_DELAY = 6 octet time (transfer time per octet)

Block information, execution time

Block	Base index	Execution time [ms]	Functionality
Resource Block	400	–	Enhanced
Transducer Block "Flow Channel 1"	1400	–	Vendor specific
Transducer Block "Flow Channel 2"	1500	–	Vendor specific
"Diagnosis" Transducer Block	1600	–	Vendor specific
Transducer Block "Service"	1700	–	Vendor specific
"Display" Transducer Block	1800	–	Vendor specific
"Totalizer" Transducer Block	1900	–	Vendor specific
Analog Input function block 1	500	18	Standard
Analog Input function block 2	550	18	Standard
Analog Input function block 3	600	18	Standard
Analog Input function block 4	650	18	Standard
Analog Input function block 5	700	18	Standard
Analog Input function block 6	750	18	Standard
Analog Input function block 7	800	18	Standard
Analog Input function block 8	850	18	Standard
Discrete Output Function Block (DO)	900	18	Standard
PID Function Block (PID)	1000	25	Standard
Arithmetic Function Block (ARTH)	1100	20	Standard
Input Selector Function Block (ISEL)	1150	20	Standard
Signal Characterizer Function Block (CHAR)	1200	20	Standard
Integrator Function Block (INTG)	1250	18	Standard

Output data

Transducer Blocks / Analog Input Function Blocks

Block	Process variable	Channel parameter (AI Block)
Transducer Block "CH1"	Volume flow channel 1	2
	Sound velocity channel 1	21
	Flow velocity channel 1	23
	Average volume flow	25
	Volume flow sum	26
	Volume flow difference	27
	Average sound velocity	28
	Average flow velocity	29
	Signal strength channel 1	30
Transducer Block "CH2"	Volume flow channel 2	20
	Sound velocity channel 2	22
	Flow velocity channel 2	24
	Signal strength channel 2	31
"Totalizer" Transducer Block	Totalizer 1	7
	Totalizer 2	8
	Totalizer 3	9

Input data

Discrete Output Function Block (channel 16)

Status change	Action
Discrete state 0 → Discrete state 1	reserved
Discrete state 0 → Discrete state 2	Positive zero return channel 1 ON
Discrete state 0 → Discrete state 3	Positive zero return channel 1 OFF
Discrete state 0 → Discrete state 4	Zero point adjustment channel 1
Discrete state 0 → Discrete state 5	reserved
Discrete state 0 → Discrete state 6	reserved
Discrete state 0 → Discrete state 7	Reset Totalizer 1, 2, 3
Discrete state 0 → Discrete state 8	Reset Totalizer 1
Discrete state 0 → Discrete state 9	Reset Totalizer 2
Discrete state 0 → Discrete state 10	Reset Totalizer 3
Discrete state 0 → Discrete state 11	reserved
Discrete state 0 → Discrete state 12	reserved
Discrete state 0 → Discrete state 13	reserved
Discrete state 0 → Discrete state 14	reserved
Discrete state 0 → Discrete state 15	reserved
Discrete state 0 → Discrete state 16	Positive zero return channel 2 ON
Discrete state 0 → Discrete state 17	Positive zero return channel 2 OFF
Discrete state 0 → Discrete state 18	Zero point adjustment channel 2
Discrete state 0 → Discrete state 27	Permanent storage: Off
Discrete state 0 → Discrete state 28	Permanent storage: On

VCRs

VCRs (total 48)	Quantity
Permanent Entries	1
Client VCRs	0
Server VCRs	24
Source VCRs	23
Sink VCRs	0
Subscriber VCRs	23
Publisher VCRs	23

10.1.5 Power supply

Measuring unit electrical connection	→ 61
Connecting the connecting cable	→ 61
Supply voltage	*Transmitter* Current output / HART ■ 85 to 260 V AC, 45 to 65 Hz ■ 20 to 55 V AC, 45 to 65 Hz ■ 16 to 62 V DC *Sensor* ■ Powered by the transmitter
Cable entry	*Power supply and signal cables (inputs/outputs)* ■ Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47") ■ Cable gland for cables, 6 to 12 mm (0.24 to 0.47") ■ Thread for cable entry ½" NPT, G ½" *Connecting cable (sensor/transmitter)* Prosonic Flow P/W Sensor DN 15 to 65 (½ to 2½") Cable gland for one multi core connecting cable (1 × Ø 8 mm /0.31 in) per cable entry ■ Cable gland M20 × 1.5 ■ Thread for cable entry ½" NPT, G ½" Prosonic Flow P/W Sensor DN 50 to 4000 (2 to 160") Cable gland for two single core connecting cables (2 × Ø 4 mm /0.16 in) per cable entry ■ Cable gland M20 × 1.5 ■ Thread for cable entry ½" NPT, G ½"

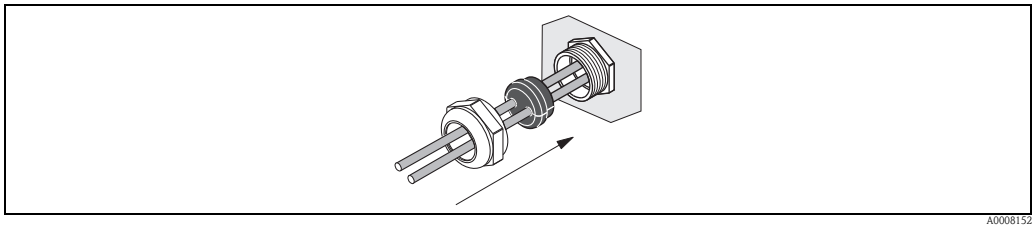


Fig. 87: Cable gland for two connecting cables (2 × Ø 4 mm / 0.16 in) per cable entry

Cable specifications	Only use the connecting cables supplied by Endress+Hauser. Different versions of the connecting cables are available → 92. *Prosonic Flow P* ■ Cable material: – Prosonic Flow 93P (DN 50 to 4000 / 2 to 160"): PVC (standard) or PTFE (for higher temperatures) – Prosonic Flow 93P (DN 15 to 65 / ½ to 2½"): TPE-V ■ Cable length: – For use in a non-hazardous zone: 5 to 60 m (16.4 to 196.8 ft) – For use in a hazardous zone: 5 to 30 m (16.4 to 98.4 ft)

Prosonic Flow W

- Cable material made of PVC (standard) or PTFE (for higher temperatures)
- Cable length: 5 to 60 m (16.4 to 196.8 ft)

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

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 power cycle
HistoROM/T-DAT (Prosonic Flow 93) saves measuring system data if the power supply fails.

Potential equalization

For potential equalization, no special measures are necessary.

10.1.6 Performance characteristics

Reference operating conditions

- Fluid temperature: +20 to +30 °C
- Ambient temperature: +22 °C ± 2 K
- Warm-up period: 30 minutes

Installation:
- Sensors and transmitter are grounded.
- The measuring sensors are correctly installed.

Maximum measured error

Measured error clamp-on version

The measured error depends on a number of factors. A distinction is made between the measured error of the device (Prosonic Flow 93 = 0.5 % of the measured value) and an additional installation-specific measured error (typically 1.5 % of the measured value) that is independent of the device. The installation-specific measured error depends on the installation conditions on site, such as the nominal diameter, wall thickness, real pipe geometry, fluid, etc.
The sum of the two measured errors is the measured error at the measuring point.

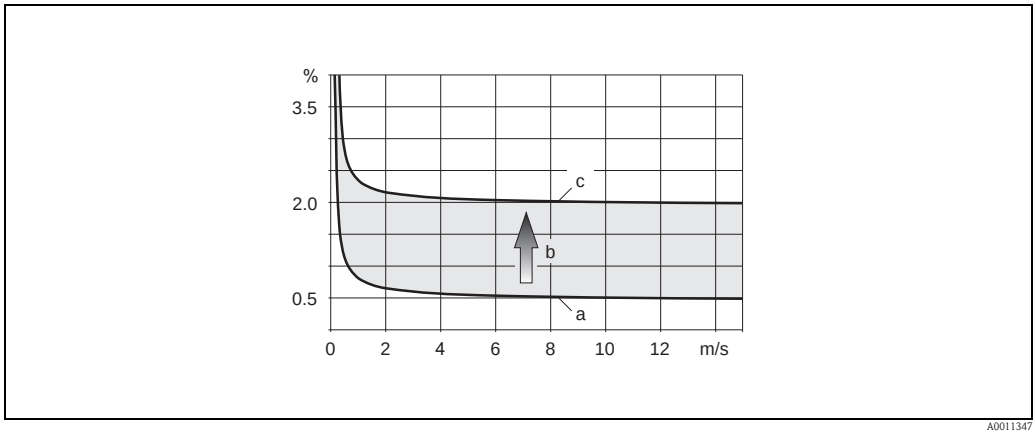


Fig. 88: Example of the measured error in a pipe with a nominal diameter DN > 200 (8")

a Measured error of the device (0.5 % o.r. ± 3 mm/s)
b Measured error due to installation conditions (typically 1.5 % o.r.)
c Measured error at the measuring point: 0.5 % o.r. ± 3 mm/s + 1.5 % o.r. = 2 % o.r. ± 3 mm/s

Measured error at the measuring point

The measured error at the measuring point is made up of the measured error of the device (0.5 % o.r.) and the measured error resulting from the installation conditions on site. Given a flow velocity > 0.3 m/s (1 ft/s) and a Reynolds number > 10000, the following are typical error limits:

Sensor	Nominal diameter	Device error limits	+	Installation-specific error limits (typical)	→	Error limits at the measuring point (typical)
Prosonic P	DN 15 (½")	±0.5 % o.r. ± 5 mm/s	+	±2.5 % o.r.	→	±3 % o.r. ± 5 mm/s
	DN 25 to 200 (1 to 8")	±0.5 % o.r. ± 7.5 mm/s	+	±1.5 % o.r.	→	±2 % o.r. ± 7.5 mm/s
	> DN 200 (8")	±0.5 % o.r. ± 3 mm/s	+	±1.5 % o.r.	→	±2 % o.r. ± 3 mm/s
Prosonic W	DN 15 (½")	±0,5 % v.M. ± 5 mm/s	+	±2.5 % v.M.	→	±3 % v.M. ± 5 mm/s
	DN 50 to 200 (2 to 8")	±0.5 % o.r. ± 7.5 mm/s	+	±1.5 % o.r.	→	±2 % o.r. ± 7.5 mm/s
	> DN 200 (8")	±0.5 % o.r. ± 3 mm/s	+	±1.5 % o.r.	→	±2 % o.r. ± 3 mm/s

o.r. = of reading

Measurement Report

If required, the device can be supplied with a measurement report. To certify the performance of the device, a measurement is performed under reference conditions. Here, the sensors are mounted on a pipe with a nominal diameter of DN 15 (½"), DN 25 (1"), DN 40 (1½"), DN 50 (2") or DN 100 (4") respectively.

The measurement report guarantees the following error limits of the device [at a flow velocity > 0.3 m/s (1 ft/s) and a Reynolds number > 10000]:

Sensor	Nominal diameter	Guaranteed error limits of the device
Prosonic W/P	DN 15 (½"), DN 25 (1"), DN 40 (1½"), DN 50 (2")	±0.5 % o.r. ± 5 mm/s
Prosonic W/P	DN 100 (4")	±0.5 % o.r. ± 7.5 mm/s

o.r. = of reading

Measured error – Insertion system

Nominal diameter	**Device error limits**	**+**	**Installation-specific error limits (typical)**	**→**	**Error limits at the measuring point (typical)**
> DN 200 (8")	±0.5 o.r. ± 3 mm/s	+	±1.5 % o.r.	→	±2 % o.r. ± 3 mm/s

o.r. = of reading

Measurement Report

If required, the device can be supplied with a measurement report. To certify the performance of the device, a measurement is performed under reference conditions. Here, the sensors are mounted on a pipe with a nominal diameter of DN 250 (10") (single path) or DN 400 (16") (dual path).

The measurement report guarantees the following error limits of the device [at a flow velocity > 0.3 m/s (1 ft/s) and a Reynolds number > 10000]:

Sensor	Nominal diameter	Guaranteed error limits of the device
Prosonic W (Insertion)	DN 250 (10"), DN 400 (16")	±0.5 % o.r. ± 3 mm/s

o.r. = of reading

Repeatability ±0.3 % for flow velocities > 0.3 m/s (1 ft/s)

10.1.7 Operating conditions: installation

Installation instructions

Mounting location

→ 📄 11

Orientation

→ 📄 12

Inlet and outlet run

→ 📄 12

Length of connecting cable (sensor/transmitter)

The connecting cable is available in the following lengths:
- 5 m (16.4 ft)
- 10 m (32.8 ft)
- 15 m (49.2 ft)
- 30 m (98.4 ft)

10.1.8 Operating conditions: environment

Ambient temperature range

Transmitter

–20 to +60 °C (–4 to +140 °F)

Sensor P

- Standard: –40 to +80 °C (–40 to +176 °F)
- Optional: 0 to +170 °C (+32 to +338 °F)

Sensor W

- Standard: –20 to +80 °C (–4 to +176 °F)

DDU18 sensor (accessories: sound velocity measurement)

–40 to +80 °C (–40 to +176 °F)

DDU19 sensor (accessories: wall thickness measurement)

–20 to +60 °C (–4 to +140 °F)

Connecting cable (sensor/transmitter)

- Standard (TDE-V): –20 to +80 °C (–4 to +175 °F) (multi core)
- Standard (PVC): –20 to +70 °C (–4 to +158 °F) (single core)
- Optional (PTFE): –40 to +170 °C (–40 to +338 °F) (single core)

Note!
- It is permitted to insulate the sensors mounted on the pipes.
- Mount the transmitter in a shady location and avoid direct sunlight, particularly in warm climatic regions.

Storage temperature

The storage temperature corresponds to the ambient temperature range.

Degree of protection	*Transmitter* IP 67 (NEMA 4X) *Sensor P* IP 68 (NEMA 6P) *Sensor W* IP 67 (NEMA 4X) optional: IP 68 (NEMA 6P) *DDU18 sensor (accessories: sound velocity measurement)* IP 68 (NEMA 6P) *DDU19 sensor (accessories: wall thickness measurement)* IP 67 (NEMA 4X)
Shock resistance	In according with IEC 68-2-31
Vibration resistance	Acceleration up 1g, 10 to 150Hz, following IEC 68-2-6
Electromagnetic compatibility (EMC)	Electromagnetic compatibility (EMC requirements) according to IEC/EN 61326 "Emission to class A requirements" and NAMUR Recommendation NE 21/43.

10.1.9 Operating conditions: process

Medium temperature range	*Prosonic Flow P sensor* Prosonic Flow P (DN 15 to 65 / ½ to 2½") ■ Standard: –40 to +100 °C (–40 to +212 °F) ■ Optional: –40 to +150 °C (–40 to +302 °F) Prosonic Flow P (DN 50 to 4000 / 2 to 160") ■ Standard: –40 to +80 °C (–40 to +176 °F) ■ Optional: 0 to +170 °C (+32 to +338 °F) *Prosonic Flow W sensor* ■ Clamp-on: –20 to +80 °C (–4 to +176 °F) ■ Insertion version: –40 to +80 °C (–40 to +176 °F) *Sensor (accessories)* ■ Prosonic Flow DDU18 (sound velocity measurement): –40 to +80 °C (–40 to +176 °F) ■ Prosonic Flow DDU19 (wall thickness measurement): –0 to +60 °C (–4 to +140 °F)
Medium pressure range (nominal pressure)	Perfect measurement requires that the static fluid pressure is higher than vapor pressure.
Pressure loss	There is no pressure loss.

10.1.10 Mechanical construction

Design / dimensions

The dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document on the device in question. This can be downloaded as a PDF file from www.endress.com.
A list of the "Technical Information" documents available is provided on → 📄 127.

Weight

Transmitter

- Wall-mount housing: 6.0 kg (13.2 lbs)
- Field housing: 6.7 kg (14.8 lbs)

Prosonic Flow P sensor

- Prosonic Flow P DN 15 to 65 (½ to 2½") (incl. mounting material): 1.2 kg (2.65 lbs)
- Prosonic Flow P DN 50 to 4000 (2 to 160") (incl. mounting material): 2.8 kg (6.2 lbs)

Prosonic Flow W sensor

- Prosonic Flow W Clamp-on DN 15 to 65 (½ to 2½") (incl. mounting material): 1.2 kg (2.65 lbs)
- Prosonic Flow W Clamp-on (incl. mounting material): 2.8 kg (6.2 lbs)
- Prosonic Flow W Insertion version (incl. mounting material):
  - Single path version: 4.5 kg (9.92 lbs)
  - Dual path version: 12 kg (26.5 lbs)

Sensor (accessories)

- Prosonic Flow DDU18 (incl. mounting material): 2.4 kg (5.3 lbs)
- Prosonic Flow DDU19 (incl. mounting material): 1.5 kg (3.3 lbs)

Note!
Weight information without packaging material.

Materials

Transmitter

- Wall-mounted housing: powder-coated die-cast aluminum
- Field housing: powder-coated die-cast aluminum

Prosonic P sensor

- Sensor holder: stainless steel 1.4301 (AISI 304)
- Sensor housing: stainless steel 1.4301 (AISI 304)
- Strapping bands/bracket: stainless steel 1.4301 (AISI 304)
- Sensor contact surfaces: chemically stable plastic

Prosonic W sensor

Prosonic Flow W clamp-on version
- Sensor holder: stainless steel 1.4308/CF-8
- Sensor housing: stainless steel 1.4301 (AISI 304)
- Strapping bands/bracket: textile or stainless steel 1.4301 (AISI 304)
- Sensor contact surfaces: chemically stable plastic

Prosonic Flow W Insertion version
- Sensor holder: stainless steel 1.4308/CF-8
- Sensor housing: stainless steel 1.4301 (AISI 304)
- Weld-in parts: stainless steel 1.4301 (AISI 304)
- Sensor contact surfaces: chemically stable plastic

Sensor (accessories)

Prosonic Flow DDU18; Prosonic Flow P DDU19
- Sensor holder: stainless steel 1.4308/CF-8
- Sensor housing: stainless steel 1.4301 (AISI 304)
- Strapping bands/bracket: textile or stainless steel 1.4301 (AISI 304)
- Sensor contact surfaces: chemically stable plastic

Connecting cable (sensor/transmitter), Prosonic Flow 93P

Prosonic Flow 93P (DN 15 to 65)
- TPE-V connecting cable
  - Cable sheath: TPE-V
  - Cable connector: stainless steel 1.40301

Prosonic Flow 93P (DN 50 to 4000)
- PVC connecting cable
  - Cable sheath: PVC
  - Cable connector: nickeled brass 2.0401
- PTFE connecting cable
  - Cable sheath: PTFE
  - Cable connector: stainless steel 1.4301

Connecting cable (sensor/transmitter), Prosonic Flow 93W

Prosonic Flow 93W (DN 15 to 65)
- TPE-V connecting cable
  - Cable sheath: TPE-V
  - Cable connector: stainless steel 1.40301
- PVC connecting cable
  - Cable sheath: PVC
  - Cable connector: nickeled brass 2.0401
- PTFE connecting cable
  - Cable sheath: PTFE
  - Cable connector: stainless steel 1.4301

10.1.11 Human interface

Display elements

- Liquid crystal display: illuminated, four lines each with 16 characters
- Custom configuration for presenting different measured values and status variables
- 3 totalizers.

Operating elements

- Local operation with three optical keys
- Application specific Quick Setup menus for straightforward commissioning.

Language groups

Language groups available for operation in different countries:

- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe/Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish and Czech.
- South and Eastern Asia (SEA):
  English, Japanese, Indonesian
- China (CN):
  English, Chinese

Note!
You can change the language group via the operating program "FieldCare".

Remote operation

Operation via HART, PROFIBUS DP/PA, FOUNDATION Fieldbus and FieldCare

10.1.12 Certificates and approvals

Ex approval

Information on the currently available Ex-rated versions (ATEX, FM, CSA, IECEx, NEPSI, etc.) can be supplied by your Endress+Hauser Sales Center on request. All information relevant to explosion protection is available in separate documents that you can order as necessary.

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-Tick mark

The measuring system is in conformity with the EMC requirements of the "Australian Communications and Media Authority" (ACMA).

Certification FOUNDATION Fieldbus

The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus Foundation. The device thus meets all the requierements of the following specifications:

- Certified to FOUNDATION Fieldbus specification
- The flowmeter meets all the specifications of the FOUNDATION Fieldbus-H1.
- Interoperability Test Kit (ITK), revision 5.01:
  The device can also be operated with certified devices of other manufacuturers.
- Physical Layer Conformance Test by Fieldbus Foundation

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code).
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use.
- IEC/EN 61326
  "Emission in accordance with Class A requirements".
  Electromagnetic compatibility (EMC requirements).
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment - General Requirements. Pollution Degree 2, Installation Category II.
- CAN/CSA-C22.2 No. 1010.1-92
  Safety Requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution Degree 2, Installation Category II.
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics.

10.1.13 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor → 92.
Your Endress+Hauser service organization can provide detailed information on the order codes in question.

10.1.14 Ordering information

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

10.1.15 Documentation

- Flow measurement (FA005D)
- Technical Information for Promass Flow 93P (TI083D)
- Technical Information for Prosonic Flow 93W (TI084D)
- Description of Device Functions for Prosonic Flow 93 (BA071D)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IEC, NEPSI

Index

W

Z

Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.
Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.
Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System /** *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/ *Prozessdaten*
Temperature / *Temperatur*_____ [°F] _____ [°C]
Pressure / *Druck* _____ [psi] _____ [Pa]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration *Medium /Konzentration*	Identification CAS No.	flammable *entzündlich*	toxic *giftig*	corrosive *ätzend*	harmful/ irritant *gesundheits-schädlich/ reizend*	other * *sonstiges**	harmless *unbedenklich*
Process medium / *Medium im Prozess*								
Medium for process cleaning / *Medium zur Prozessreinigung*								
Returned part cleaned with / *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____

_____

_____

Company data / *Angaben zum Absender*

Company / *Firma* _____

_____

Address / *Adresse*

_____

_____

Phone number of contact person / *Telefon-Nr. Ansprechpartner:*

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

_____ (place, date / *Ort, Datum*)

_____ Name, dept./*Abt.* (please print / *bitte Druckschrift*)

_____ Signature / *Unterschrift*

www.endress.com/worldwide

Endress+Hauser

People for Process Automation

BA00078D/06/EN/14.11
71139009
FM+SGML6.0 ProMoDo