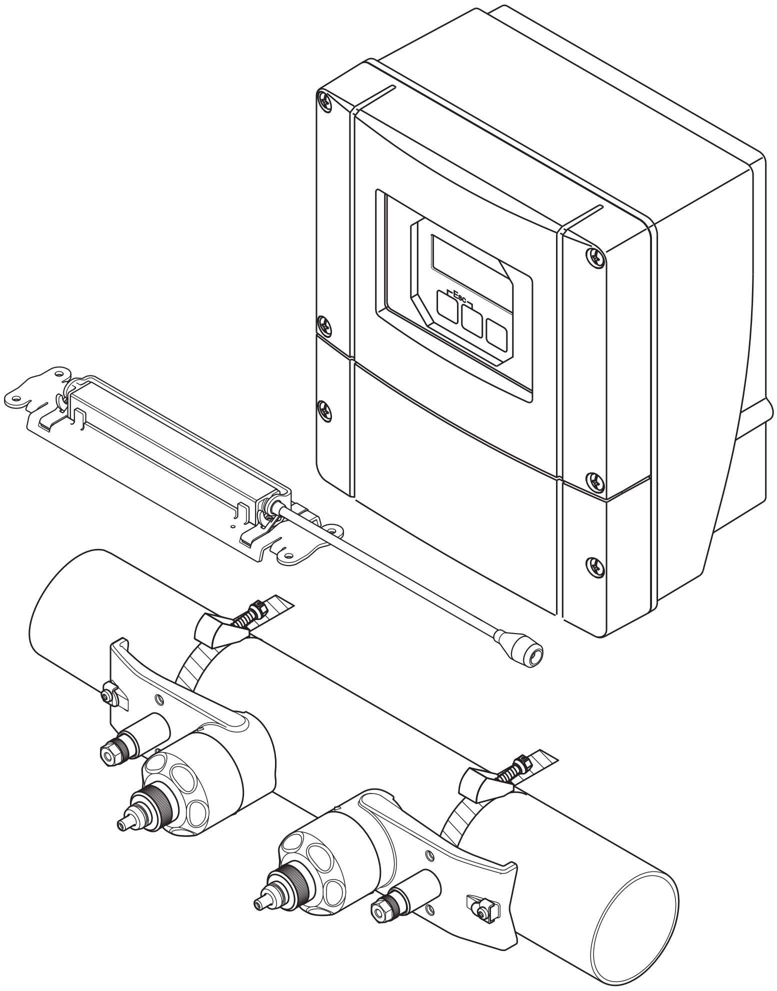
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Prosonic Flow 93 PROFIBUS DP/PA

Ultrasonic flow measuring system



BA00076D/06/EN/14.11
71139005

Valid as of version
PROFIBUS DP
V 3.06.XX (Device software)
PROFIBUS PA
V 3.06.XX (Device software)

Endress+Hauser
People for Process Automation

Table of contents

1 Safety instructions 5

1.1 Designated use 5
1.2 Installation, commissioning and operation 5
1.3 Operational safety 5
1.4 Return 6
1.5 Notes on safety conventions and icons 6

2 Identification 7

2.1 Device designation 7
2.1.1 Nameplate of the transmitter 7
2.1.2 Nameplate of the sensor 8
2.1.3 Nameplate for the connections 9
2.2 Certificates and approvals 10
2.3 Registered trademarks 10

3 Installation 11

3.1 Incoming acceptance, transport and storage 11
3.1.1 Incoming acceptance 11
3.1.2 Transport 11
3.1.3 Storage 11
3.2 Installation conditions 11
3.2.1 Dimensions 11
3.2.2 Mounting location 11
3.2.3 Orientation 12
3.2.4 Inlet and outlet run 12
3.2.5 Sensor selection and arrangement 13
3.3 Two-channel operation 14
3.3.1 Two-channel measurement 14
3.3.2 Two-path measurement 15
3.4 Preparatory steps prior to installation 16
3.5 Determining the necessary installation distances . . 16
3.5.1 Installation distances for Prosonic Flow P or W clamp-on 16
3.5.2 Installation distances for Prosonic Flow W Insertion 16
3.6 Determining values for installation distances 17
3.6.1 Determining installation distances via local operation 17
3.6.2 Determining installation distances via FieldCare 22
3.6.3 Determining installation distances via Applicator 28
3.7 Mechanical preparation 30
3.7.1 Mounting the sensor holder with U-shaped screws 30
3.7.2 Mounting the sensor holder with strapping bands 31
3.7.3 Premounting the strapping bands (medium nominal diameters) 32
3.7.4 Premounting the strapping bands (large nominal diameters) 33
3.7.5 Mounting the welded bolts 34
3.8 Installing Prosonic Flow W and P DN 15 to 65 (½ to 2½") 35
3.8.1 Mounting the sensor 35
3.9 Installing Prosonic Flow P DN 50 to 4000 (2 to 160"), Clamp-on 37
3.9.1 Installation for measurement via one traverse 37
3.9.2 Installation for measurement via two traverses 39
3.10 Installing Prosonic Flow W (Clamp-on) 41
3.10.1 Installation for measurement via one traverse 41
3.10.2 Installation for measurement via two traverses 43
3.11 Installing Prosonic Flow W (Insertion version) 45
3.11.1 Installation for measurement as single-path insertion version 46
3.11.2 Installation for measurement as dual-path insertion version 49
3.12 Installing sensor DDU18 53
3.13 Installing sensor DDU19 54
3.13.1 Version 1 54
3.13.2 Version 2 54
3.14 Installing the wall-mount transmitter housing 55
3.14.1 Direct wall mounting 55
3.14.2 Panel mounting 56
3.14.3 Pipe mounting 56
3.15 Post-installation check 57

4 Wiring 58

4.1 PROFIBUS cable specifications 58
4.1.1 PROFIBUS DP cable specifications 58
4.1.2 PROFIBUS PA cable specifications 60
4.1.3 Shielding and grounding 62
4.2 Sensor/transmitter connecting cable 62
4.2.1 Connecting and grounding Prosonic Flow W and P (DN 50 to 4000 / 2 to 160") Two Single coaxial cables 62
4.2.2 Connecting and Grounding Prosonic Flow W and Prosonic Flow P DN 15 to 65 (½ to 2½") Multicore cable . . 64
4.2.3 Cable specification for connecting cable . . . 64
4.3 Connecting the measuring unit 65
4.3.1 Terminal assignment 65
4.3.2 Connecting the transmitter 66
4.3.3 PROFIBUS DP connection diagram 67
4.3.4 PROFIBUS PA connection diagram 69
4.4 Degree of protection 72
4.5 Post-connection check 73

5 Operation 74

5.1 Quick operation guide 74
5.2 Local display 75
5.2.1 Display and operating elements 75
5.2.2 Display (operating mode) 76
5.2.3 Additional display functions 76
5.2.4 Icons 77

5.3 Brief guide to the function matrix 78
5.3.1 General notes 79
5.3.2 Enabling the programming mode 79
5.3.3 Disabling the programming mode 79
5.4 Error messages 80
5.4.1 Type of error 80
5.4.2 Error message types 80
5.5 Operating options 81
5.5.1 Operating program "FieldCare" 81
5.5.2 Operating program "SIMATIC PDM" 81
5.5.3 Device description files for operating programs 81
5.6 PROFIBUS DP hardware settings 83
5.6.1 Configuring the write protection 83
5.6.2 Configuring the device address 84
5.6.3 Configuring the terminating resistors 85
5.7 PROFIBUS PA hardware settings 86
5.7.1 Configuring the write protection 86
5.7.2 Configuring the device address 87

6 Commissioning 88

6.1 Function check 88
6.2 Switching on the measuring device 88
6.3 Quick Setup 89
6.3.1 Quick Setup "Sensor Installation" 89
6.3.2 Quick Setup "Commissioning" 91
6.3.3 Quick Setup "Communication" 92
6.3.4 Data backup/transmission 94
6.4 Commissioning the PROFIBUS interface 95
6.4.1 PROFIBUS DP commissioning 95
6.4.2 PROFIBUS PA commissioning 98
6.5 PROFIBUS DP/PA system integration 102
6.5.1 Device master file (GSD file) 102
6.5.2 Selecting the GSD file in the measuring device 104
6.5.3 Maximum number of writes 104
6.6 Cyclic data transmission PROFIBUS DP 105
6.6.1 Block model 105
6.6.2 Modules for cyclic data transmission 105
6.6.3 Description of the modules 107
6.6.4 Configuration examples with Simatic S7 HW-Konfig 113
6.7 Cyclic data transmission PROFIBUS PA 116
6.7.1 Block model 116
6.7.2 Modules for cyclic data transmission 116
6.7.3 Description of the modules 118
6.7.4 Configuration examples with Simatic S7 HW-Konfig 124
6.8 Acyclic data transmission PROFIBUS DP/PA 127
6.8.1 Master class 2 acyclic (MS2AC) 127
6.8.2 Master class 1 acyclic (MS1AC) 127
6.9 Adjustment 128
6.10 Memory (HistoROM) 129
6.10.1 HistoROM/T-DAT (transmitter-DAT) . . . 129

7 Maintenance .130

8 Accessories 131

9 Troubleshooting. 135

9.1 Troubleshooting instructions 135
9.2 System error messages 137
9.2.1 Displaying the device status on PROFIBUS DP/PA 137
9.2.2 List of system error messages 138
9.3 Process error messages 143
9.3.1 Displaying the device status on PROFIBUS DP/PA 143
9.3.2 List of process error messages 143
9.4 Process errors without messages 143
9.5 Response of outputs to errors 144
9.6 Spare parts 145
9.6.1 PROFIBUS DP 145
9.6.2 PROFIBUS PA 146
9.6.3 Installing and removing electronics boards 147
9.6.4 Installing and removing the W sensors . . 149
9.6.5 Replacing the device fuse 150
9.7 Return 150
9.8 Disposal 150
9.9 Software history 151

10 Technical data 152

10.1 Quick technical data guide 152
10.1.1 Application 152
10.1.2 Function and system design 152
10.1.3 Input 152
10.1.4 Output 153
10.1.5 Power supply 155
10.1.6 Performance characteristics 156
10.1.7 Operating conditions: installation 158
10.1.8 Operating conditions: environment 158
10.1.9 Operating conditions: process 159
10.1.10 Mechanical construction 160
10.1.11 Human interface 162
10.1.12 Certificates and approvals 162
10.1.13 Accessories 163
10.1.14 Ordering information 163
10.1.15 Documentation 163

Index 164

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.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. 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. Ex Europe, FM USA, SP 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

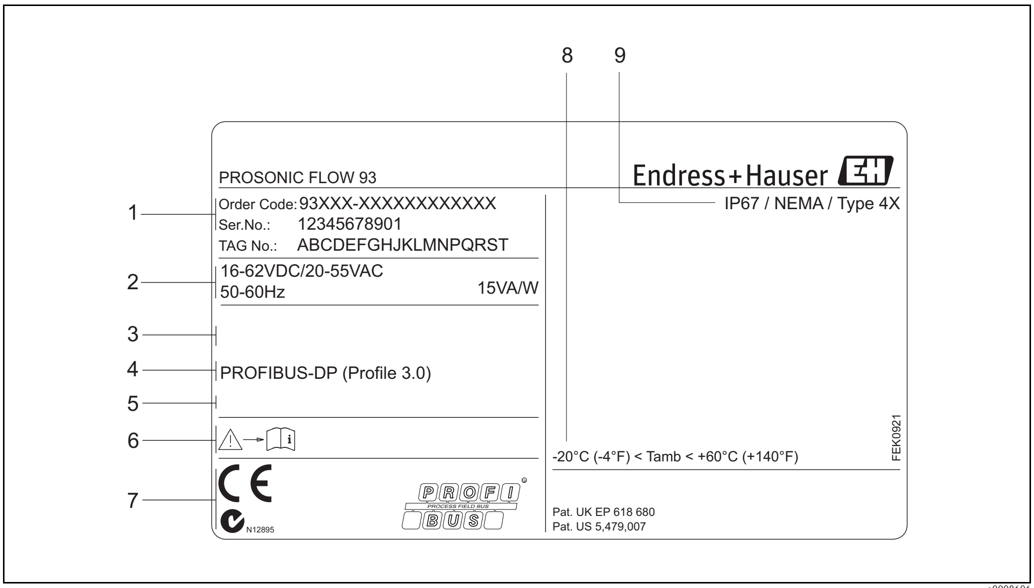
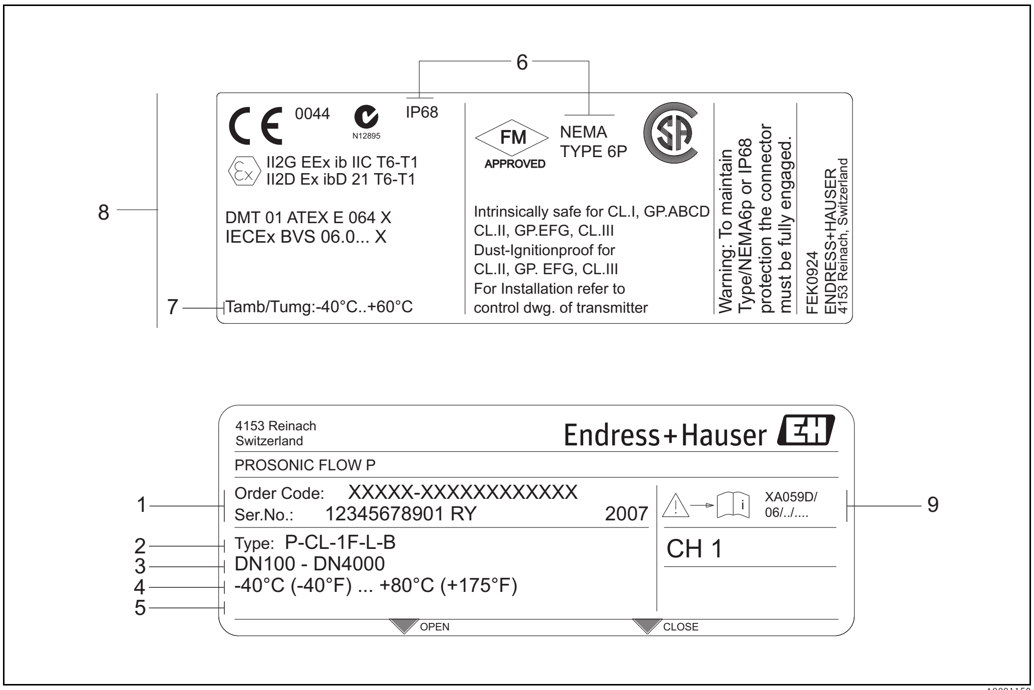


Fig. 1: Nameplate specifications for the "Prosonic Flow 93" transmitter (example)

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 *Additional functions and software*
4 *Available inputs and outputs*
5 *Reserved for information on special products*
6 *Please refer to operating instructions / documentation*
7 *Reserved for certificates, approvals and for additional information on device version*
8 *Ambient temperature range*
9 *Degree of protection*

2.1.2 Nameplate of the sensor



A0001158

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.

2.1.3 Nameplate for the connections

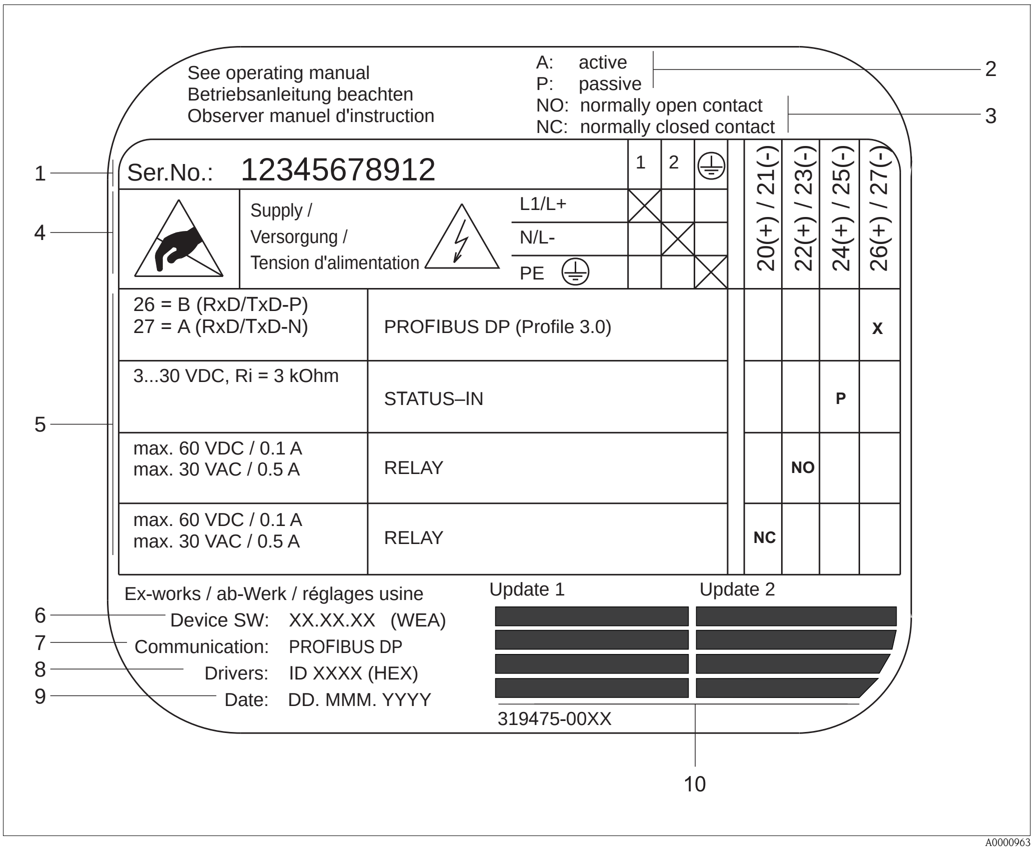


Fig. 3: Nameplate specifications for Proline transmitter (example)

1 *Serial number*
2 *Possible configuration of the current input*
3 *Possible configuration of the relay contacts*
4 *Terminal assignment, 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
5 *Signals present at the inputs and outputs, possible configuration and terminal assignment →* *65*
6 *Version of device software currently installed (including language group)*
7 *Installed communication mode*
8 *PROFIBUS ID No.*
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)".

The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization).

The device thus meets all the requirements of the following specifications:
- Certified to PROFIBUS Specification Profile 3.0 version
  (Device certification number: provided upon request).
- The measuring device can also be operated with certified devices of other manufacturers (interoperability).

2.3 Registered trademarks

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, D

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 (→ 🗎 158).
- 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 → 🗎 163.

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.

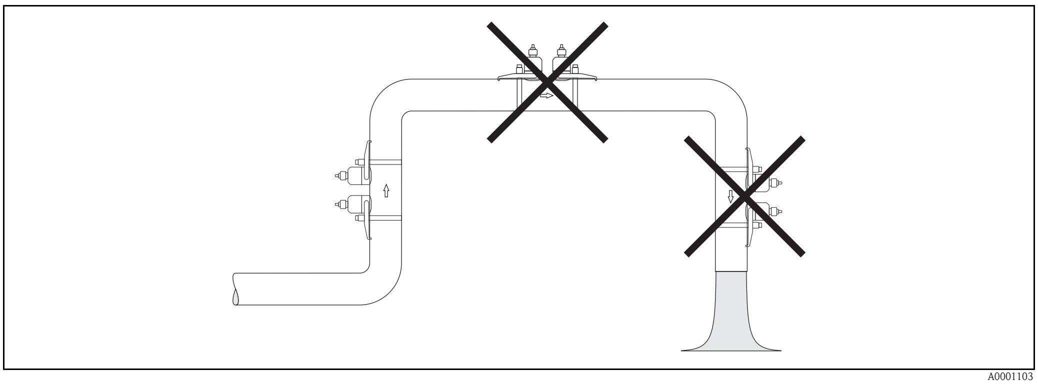


Fig. 4: Mounting location

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.

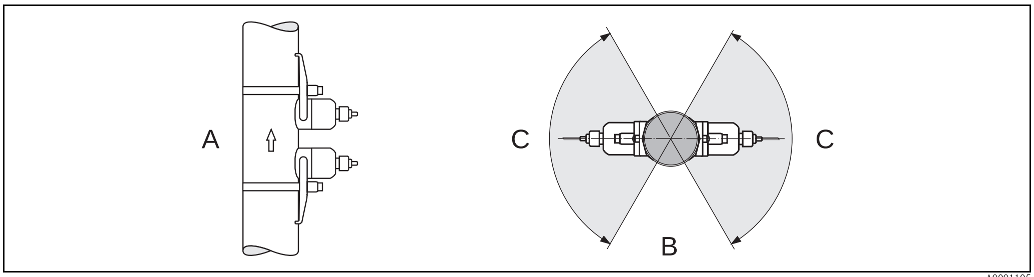


Fig. 5: Recommended orientation and recommended installation range

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.

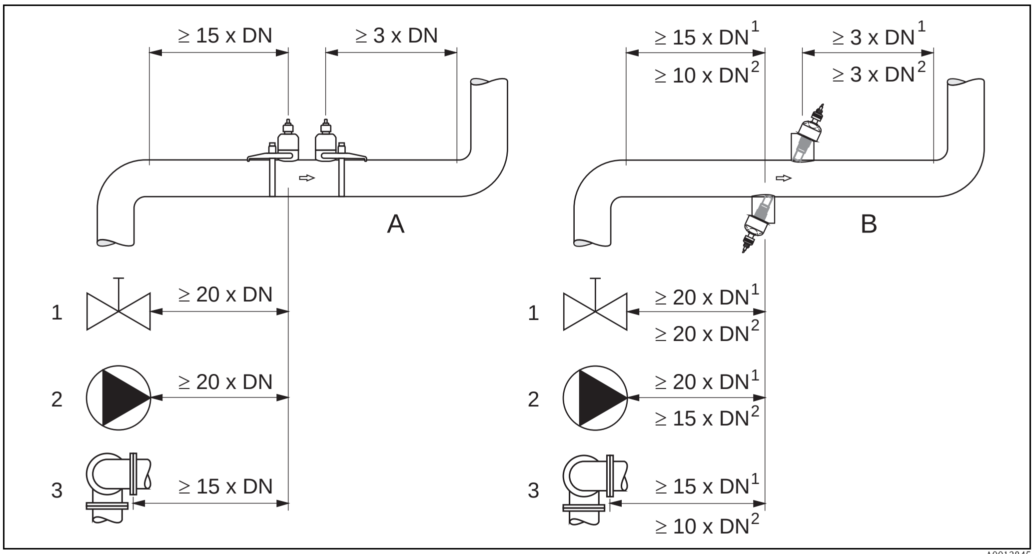


Fig. 6: Recommended inlet and outlet runs to comply with measuring accuracy specifications

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.

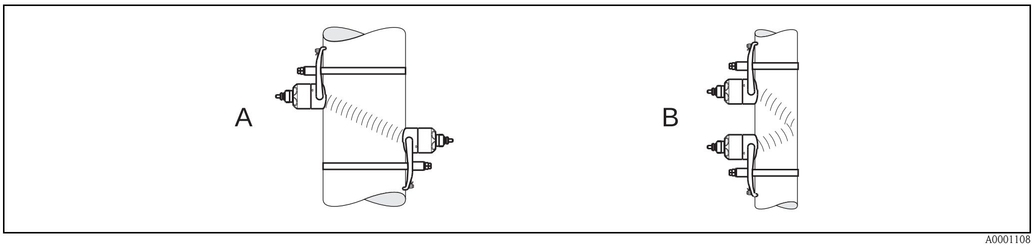


Fig. 7: Sensor mounting arrangement

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.

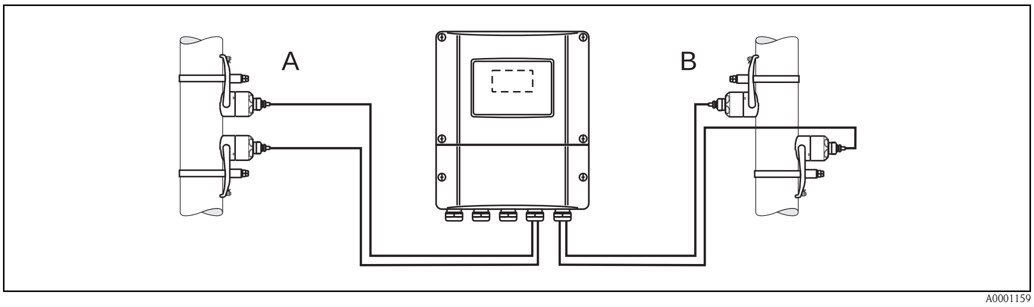


Fig. 8: Two-channel measurement: example of arranging sensor pairs at two separate measuring points

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.

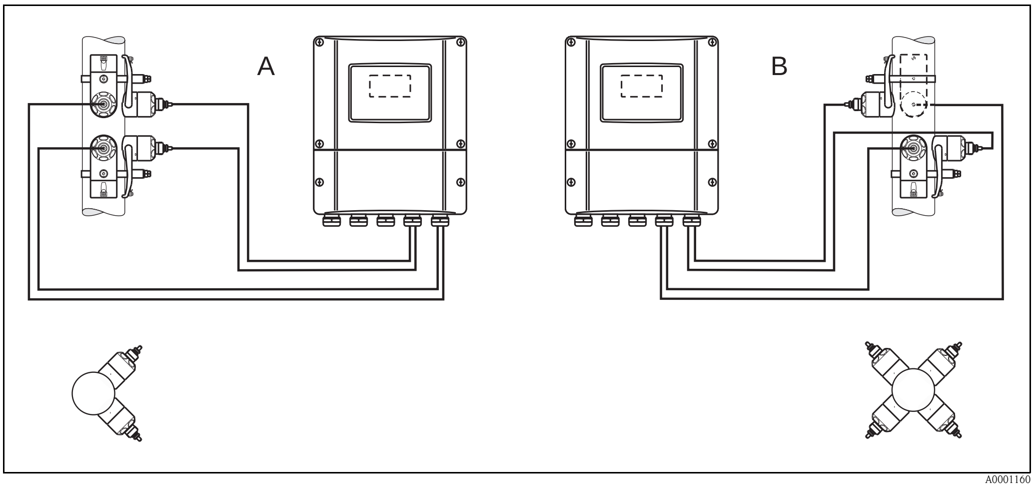


Fig. 9: Two-path measurement: examples of arranging sensor pairs at one measuring point

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 Flow 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 transmitter housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories→ 131)
- Pipe mounting (with separate mounting kit, accessories → 131)

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.

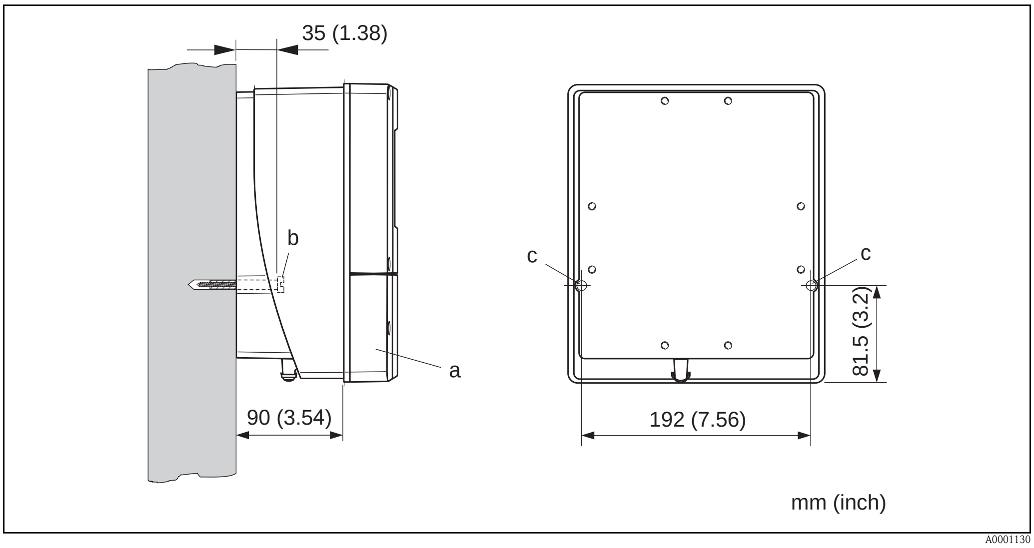


Fig. 10: Direct wall mounting

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.

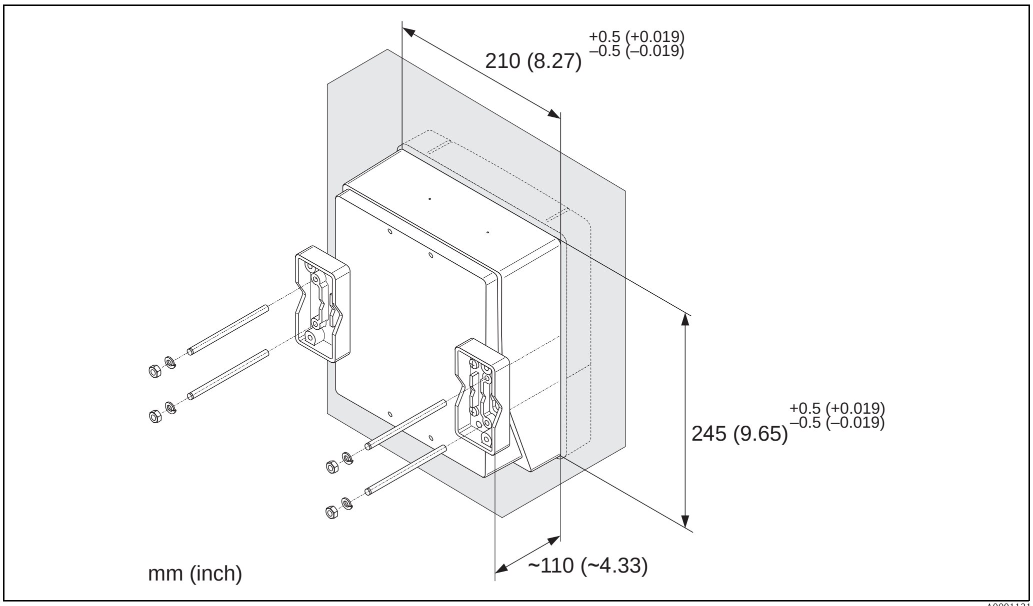


Fig. 11: Panel mounting (wall-mount housing)

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).

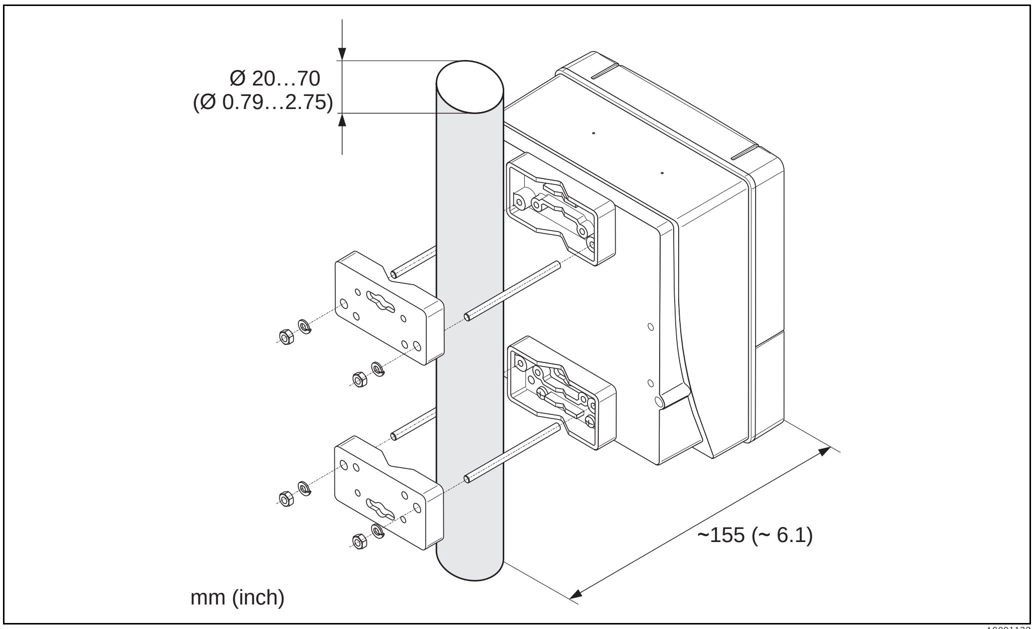


Fig. 12: Pipe mounting (wall-mount housing)

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.

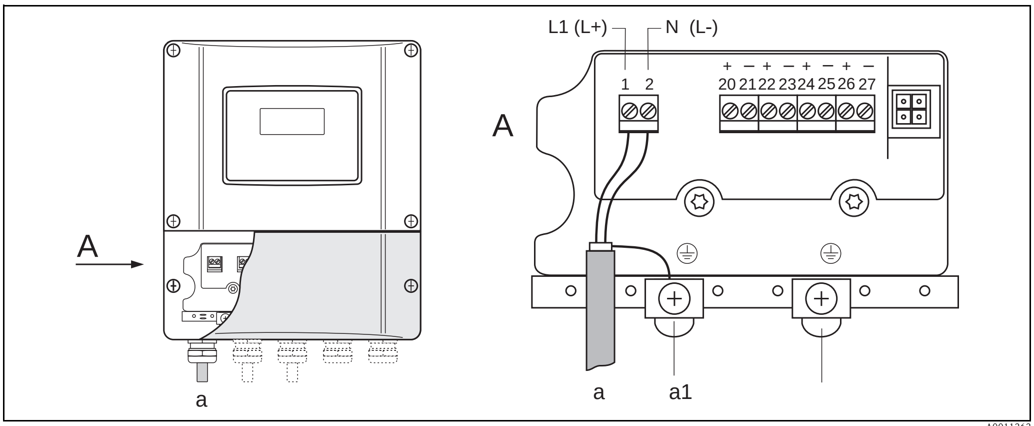


Fig. 13: Connecting the power supply; cable cross-section: max. 2.5 mm² (14 AWG)

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 → 📄 73.
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 → 📄 135.

Running the "Sensor Installation" Quick Setup menu

Note!
- If you are not familiar with the operation of the device → 📄 74.
- 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.

Home position → Quick Setup → Setup sensor

↓

Value		Function		Installation distances for measurement via one traverse:	Installation distances for measurement via two traverses:
		Language			
CH1	→	Channel			
Clamp-on	→	Measurement			
		Sensor type			
1 or 2	→	Sensor configuration	=	Number of traverses	
		Pipe standard			
		Nominal diameter			
		Pipe material			
		Sound velocity pipe			
		Pipe diameter			
		Circumference			
		Wall thickness			
		Liner Material			
		Sound Velocity Liner			
		Liner Thickness			
		Liquid			
		Temperature			
		Sound velocity liquid			
		Position sensor	→	–	
		Wire length	→		–
		Sensor distance	→		
No	→	Other measurement?			
No	→	Other channel?			

↓

Setup sensor

Subsequent procedure

The sensors can be installed once the installation distances have been determined:
- Prosonic Flow P or W (DN 15 to 65 / ½ to 2½)→ 📄 35
- Prosonic Flow P (DN 50 to 4000 / 2 to 160")→ 📄 35
- 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.

Home position → Quick Setup → Setup sensor

↓

Input	Parameter		Installation distances for measurement via one path:	Installation distances for measurement via two paths:
	Language			
CH1 →	Channel			
Insertion →	Measurement			
	Sensor type			
1 or 2 →	Sensor configuration	= Number of paths		
	Pipe standard			
	Nominal diameter			
	Pipe diameter			
	Circumference			
	Wall thickness			
	Liner Material			
	Sound Velocity Liner			
	Liner Thickness			
	Sensor distance	→	(value)	(value)
	Arc length	→	–	(value)
	Path length	→	(value)	–
No →	Other measurement?			
No →	Other channel?			

↓

Setup sensor

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 → 134.

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 transmitter housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories → 131)
- Pipe mounting (with separate mounting kit, accessories → 131)

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.

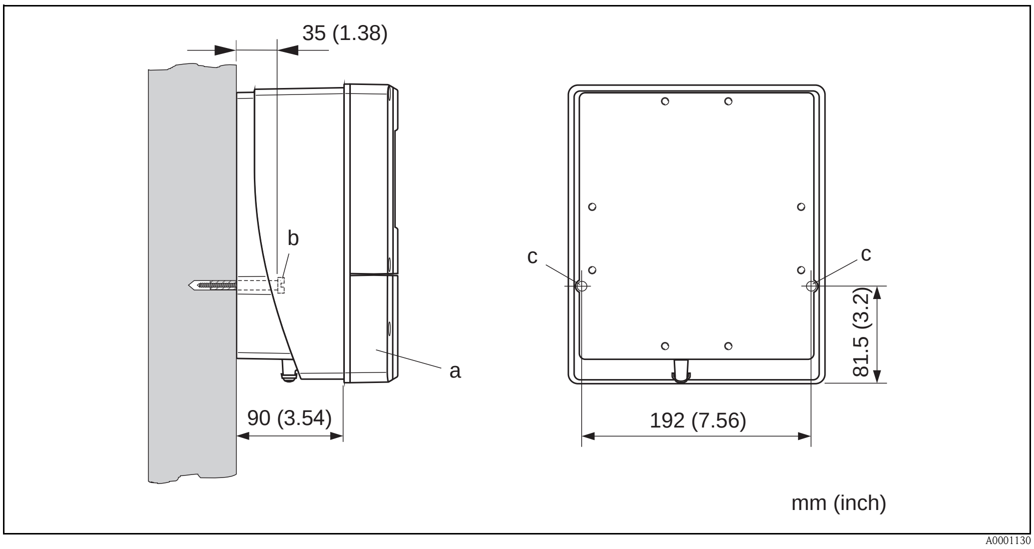


Fig. 14: Direct wall mounting

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.

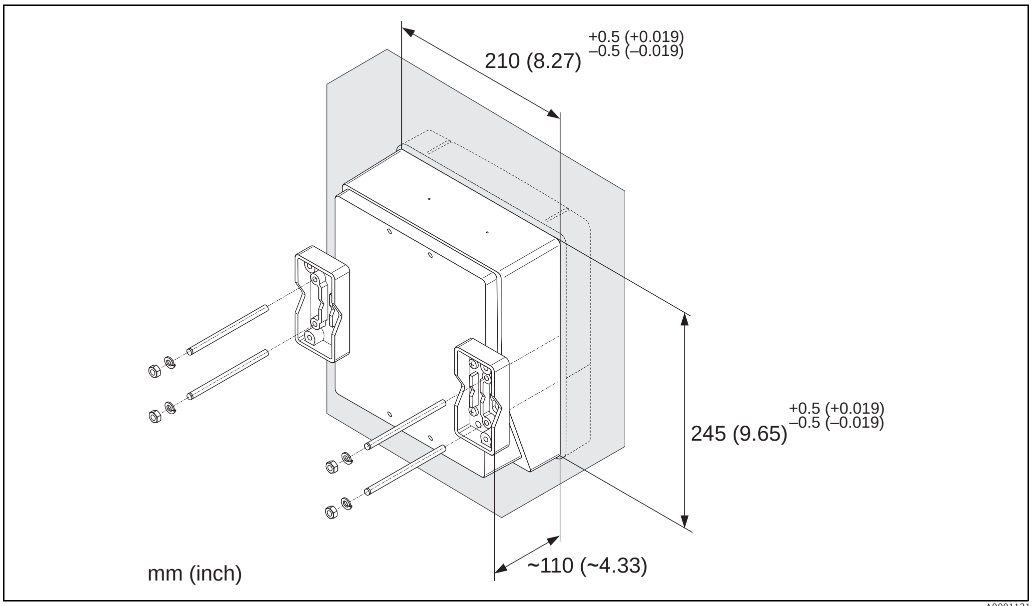


Fig. 15: Panel mounting (wall-mount housing)

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).

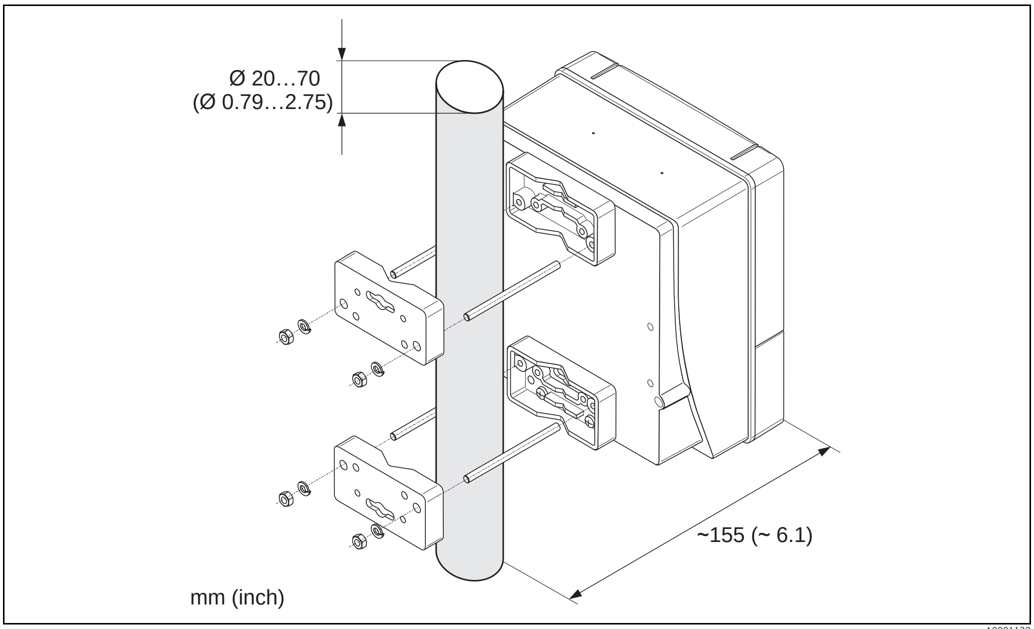


Fig. 16: Pipe mounting (wall-mount housing)

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.

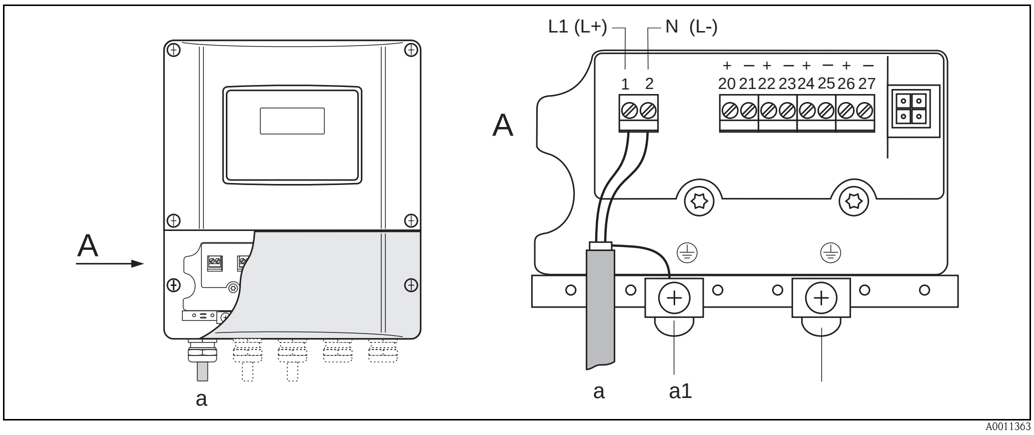


Fig. 17: Connecting the power supply; cable cross-section: max. 2.5 mm² (14 AWG)

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.

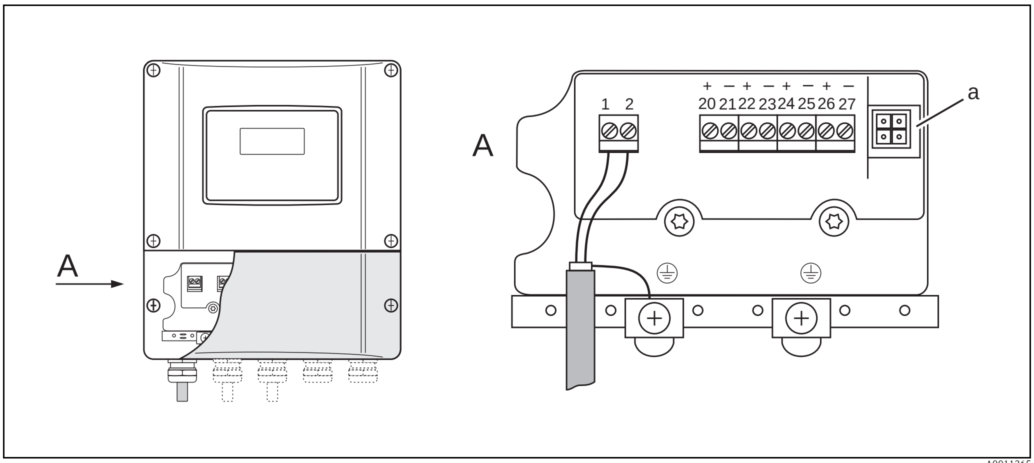


Fig. 18: Connecting a PC with the FieldCare operating software

a Service adapter for connecting service interface FXA193

Switching on the measuring device

1. Perform the post-connection check as specified in the checklist → 🗎 73.
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 → 🗎 135.

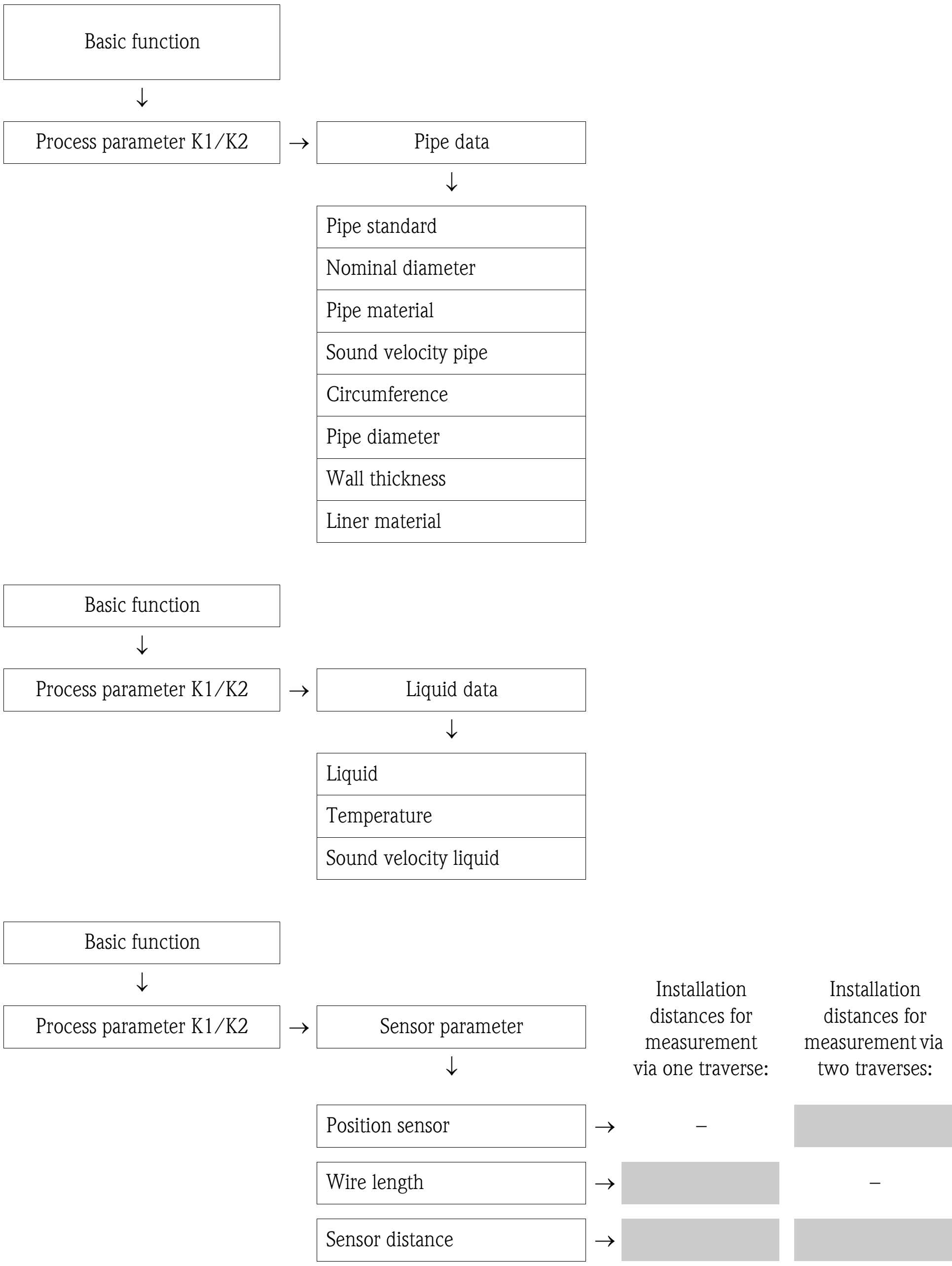
Reading off the installation distances via FieldCare

✎ 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.

Basic function
↓
Sensor data K1/K2 → Sensor parameter
↓
Clamp-on → Measurement
Sensor type
1 or 2 → Sensor configuration = Number of traverses



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.

Basic function
↓
Sensor data K1/K2 → Sensor parameter
↓

Insertion →	Measurement	
	Sensor type	
Single-path or dual-path →	Sensor configuration	= Number of paths

Basic function
↓
Process parameter K1/K2 → Pipe data
↓

- Pipe standard
- Nominal diameter
- Circumference
- Pipe diameter
- Wall thickness

Basic function
↓
Process parameter K1/K2 → Sensor parameter
↓

	Installation distances for measurement via one traverse:	Installation distances for measurement via two traverses:
Sensor distance →		
Arc length →	–	
Path length →		–

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 → 🗎 134.
- 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 or 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.

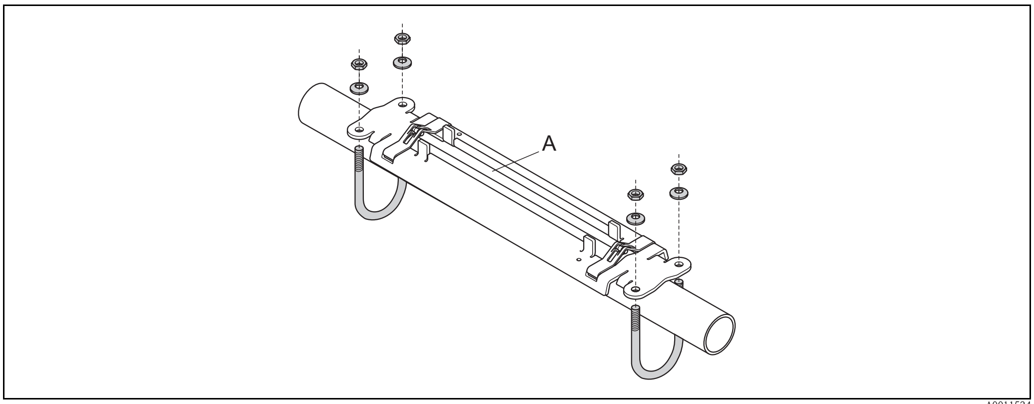


Fig. 19: Mounting the Prosonic Flow P sensor holder (DN 15 to 65 / ½ to 2½") with U-shaped screws

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 or 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.

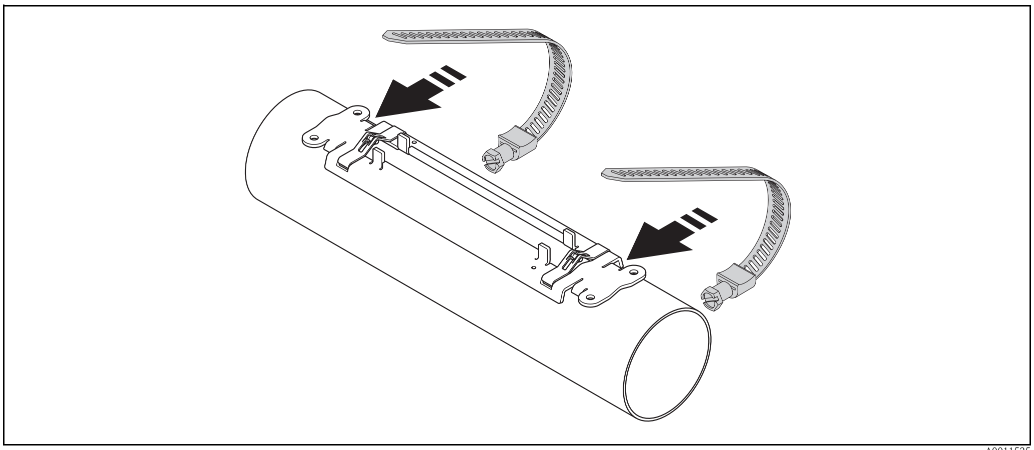

A0011525

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

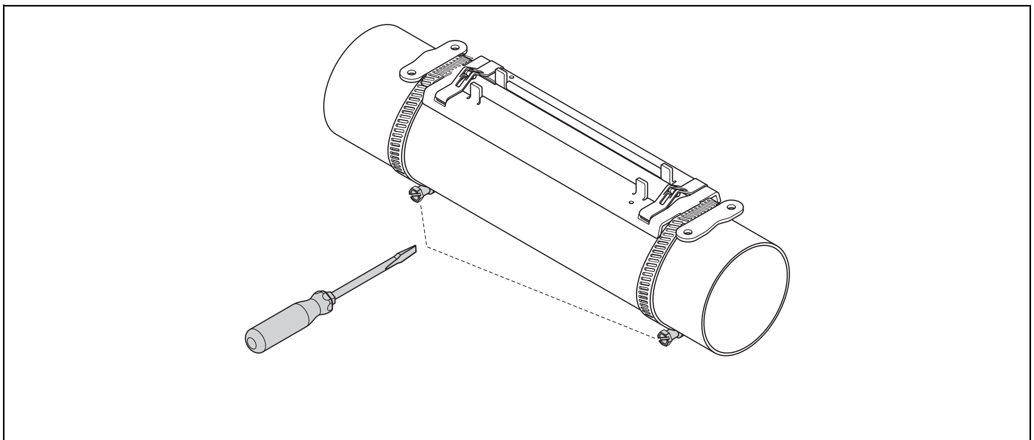

A0011526

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.

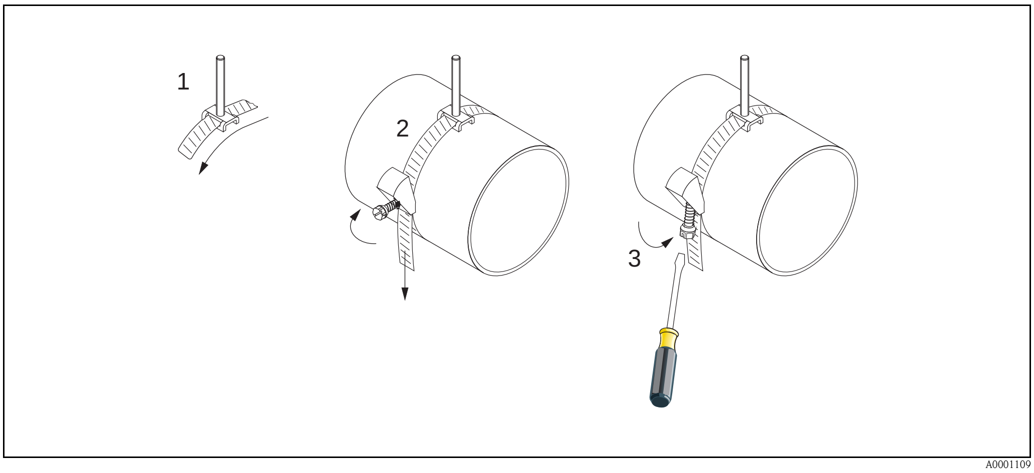


Fig. 22: Premounting strapping bands for pipe diameters DN ≤ 200 (8")

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.

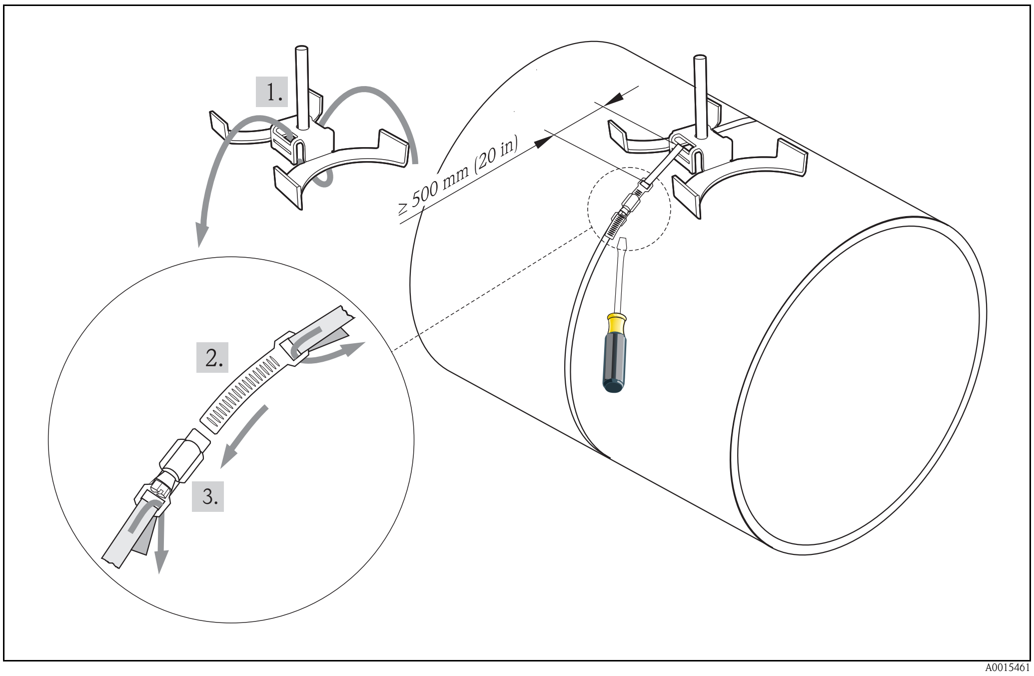


Fig. 23: Premounting strapping bands for pipe diameters DN > 600 (24 ")

*1 Mounting bolt with guide**
*2 Strapping band**
3 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).

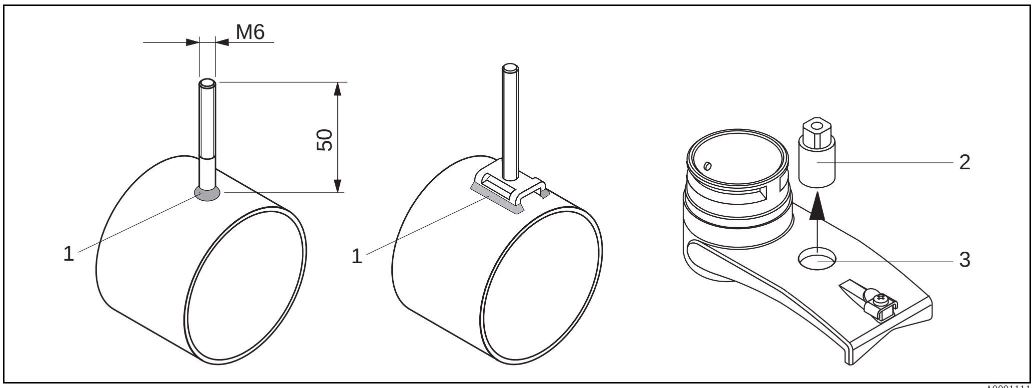


Fig. 24: Use of welded bolts

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.

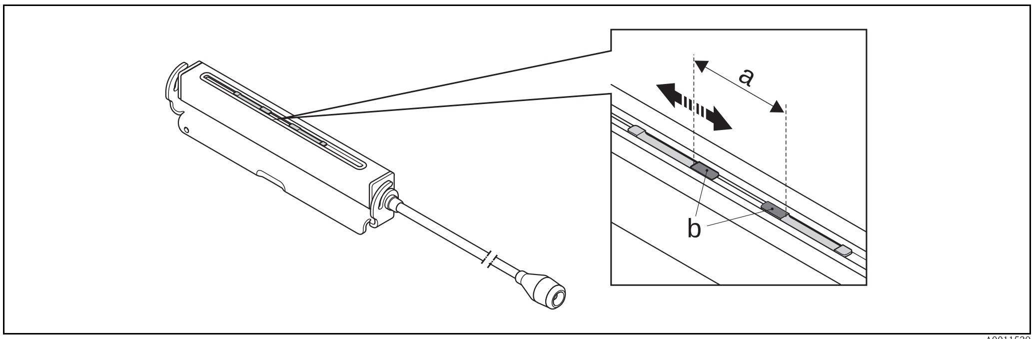


Fig. 25: Setting the distance between the sensors as per the value for the sensor distance

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.

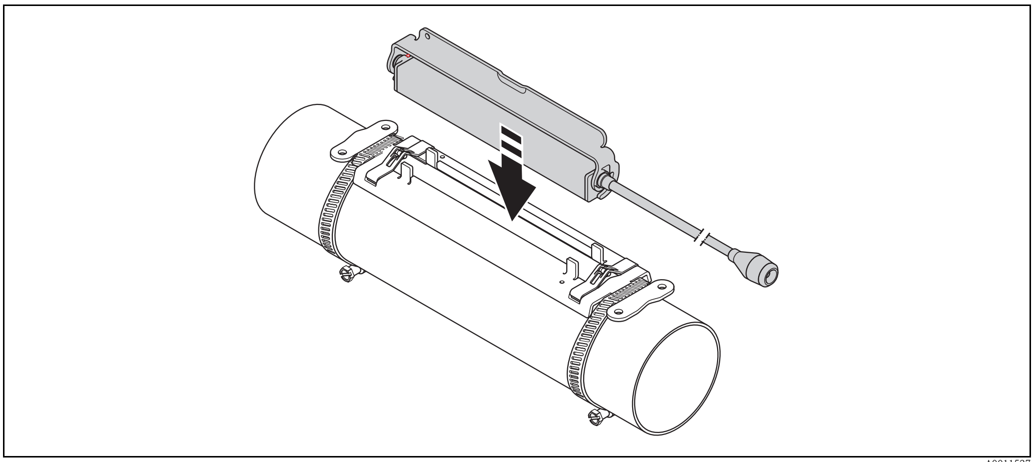


Fig. 26: Fitting the sensor housing

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.

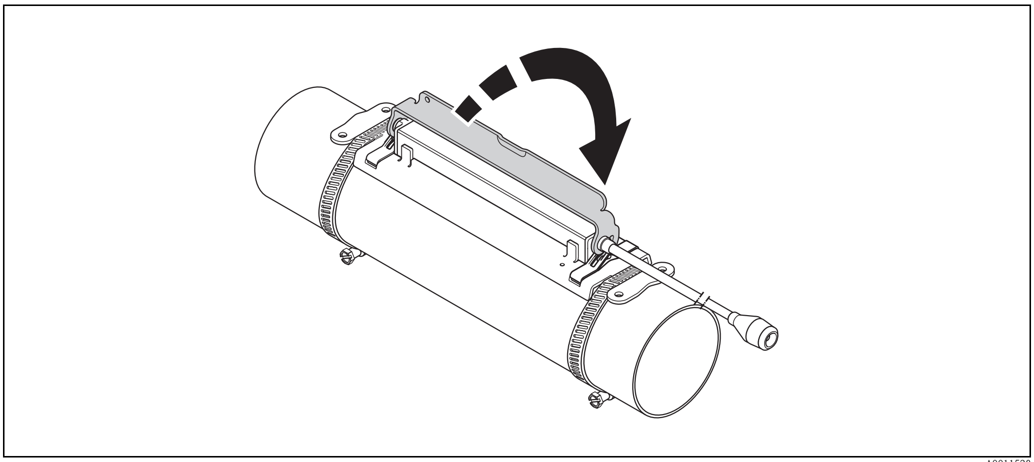


Fig. 27: Fixing the sensor housing

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 → 🗎 62.

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

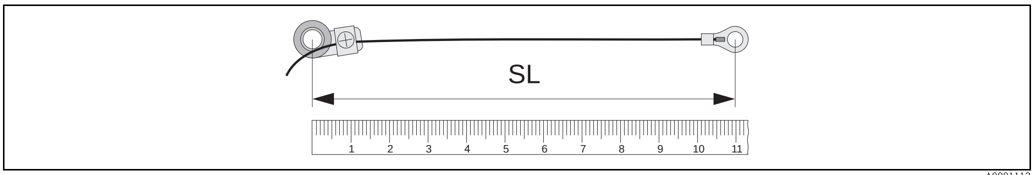
- The installation distances (sensor distance and wire length) are known → 🗎 16.
- The strapping bands are already mounted → 🗎 30.

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

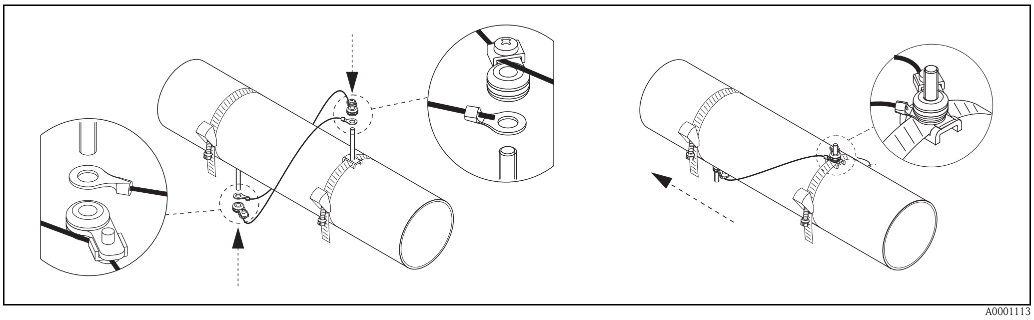
1. Prepare the two measuring wires:
   – Arrange the cable lugs and fixer such that the distance they are apart corresponds to the wire length (SL).
   – Screw the fixer onto the measuring wire.



A0001112

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

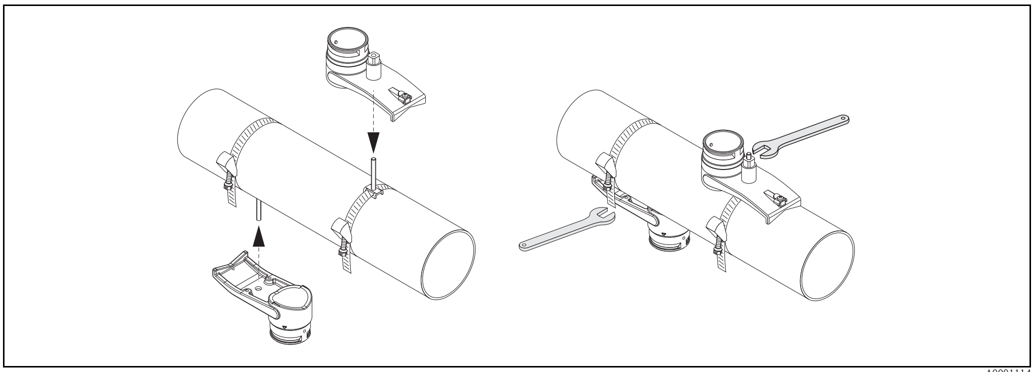
2. With the first measuring wire:
   – Fit the fixer over the mounting bolt of the strapping band that is already securely mounted.
   – Run the measuring wire **clockwise** around the pipe.
   – Fit the cable lug over the mounting bolt of the strapping band that can still be moved.
3. With the second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



A0001113

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

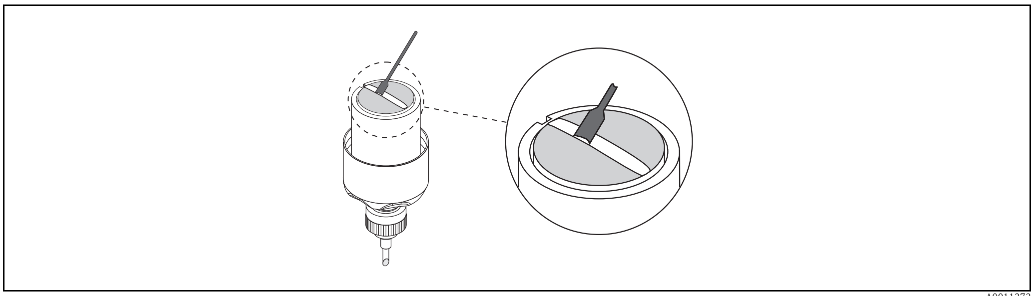
5. Loosen the screws of the fixers on the measuring wires and remove the measuring wires from the mounting bolt.
6. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.



A0001114

Fig. 30: Mounting the sensor holders

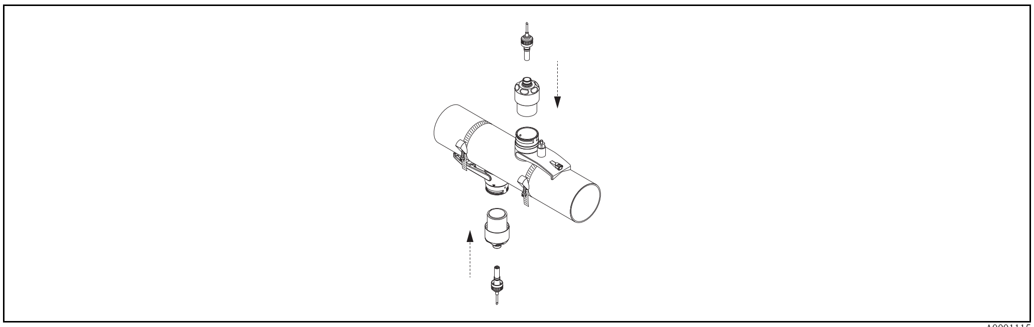
7. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.



A0011373

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.



A0001115

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 → 🗎 62.

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.

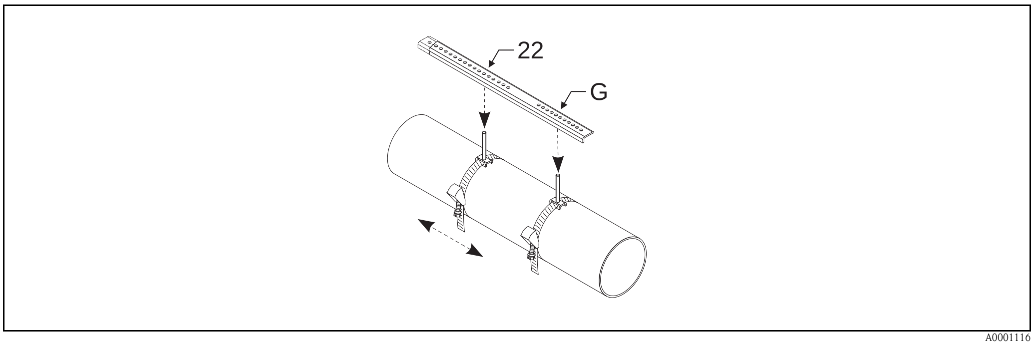
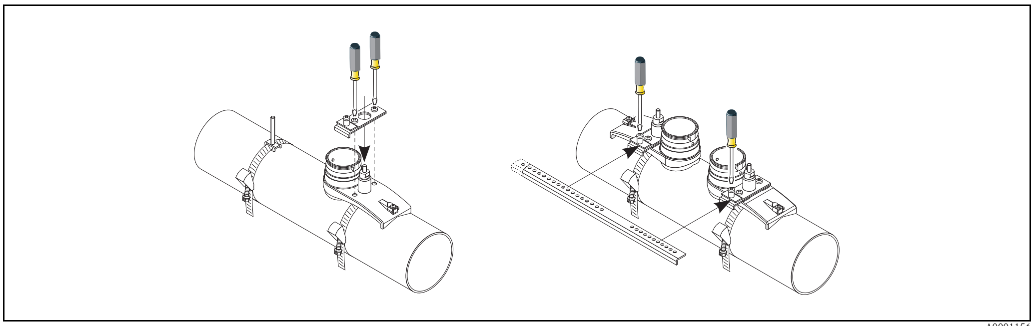


Fig. 33: Determining the distance in accordance with the mounting rail (e.g. POSITION SENSOR G22)

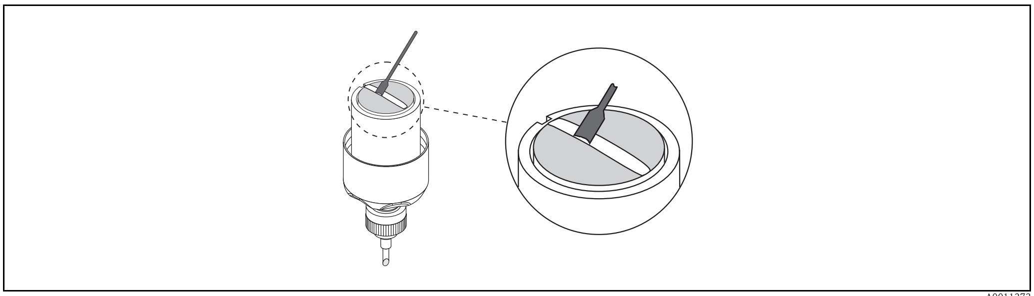
2. Tighten the strapping band so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.
5. Screw the retainers of the mounting rail onto the sensor holder in question.
6. Screw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



A0001156

Fig. 34: Mounting the sensor holders and mounting rail

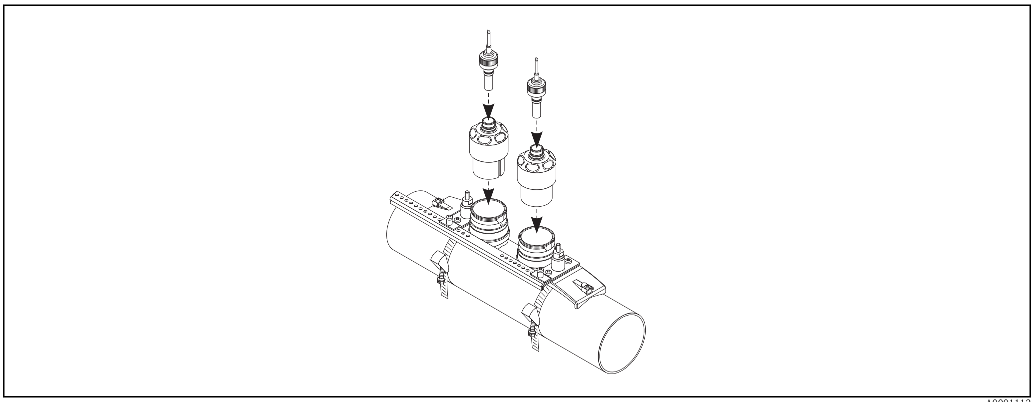
7. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.



A0011373

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.



A0001112

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 → 🗎 62.

3.10 Installing Prosonic Flow W (Clamp-on)

3.10.1 Installation for measurement via one traverse

Prerequisites

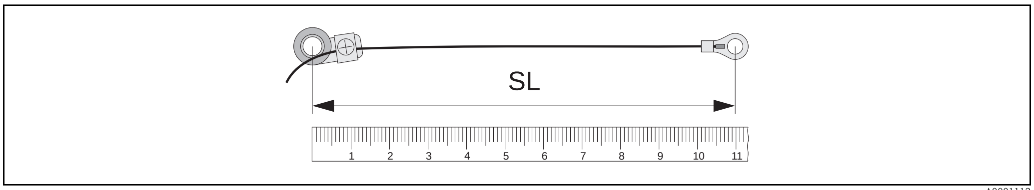
- The installation distances (sensor distance and wire length) are known → 🗎 16.
- The strapping bands are already mounted → 🗎 30.

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

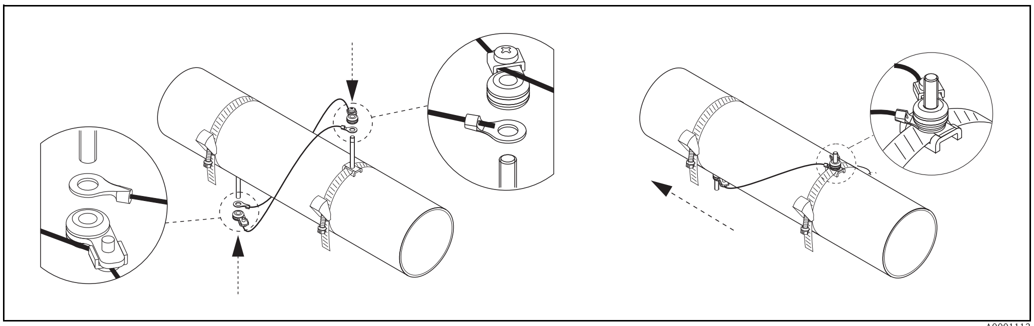
1. Prepare the two measuring wires:
   – Arrange the cable lugs and fixer such that the distance they are apart corresponds to the wire length (SL).
   – Screw the fixer onto the measuring wire.



A0001112

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.



A0001113

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.

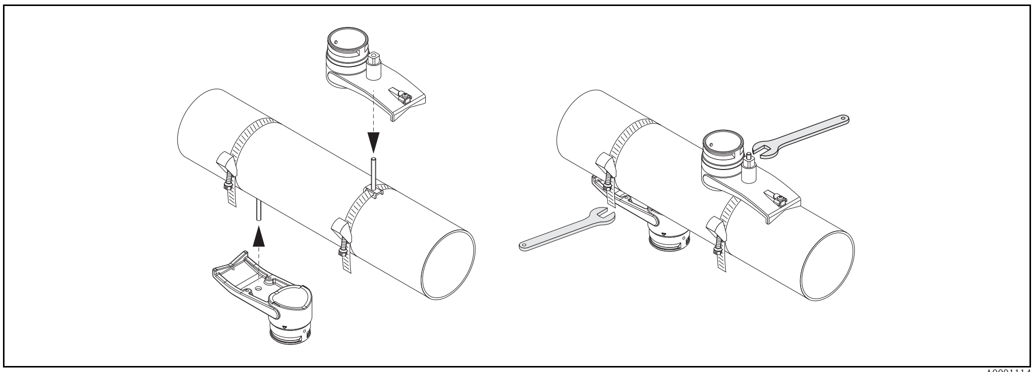


Fig. 39: Mounting the sensor holders

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.

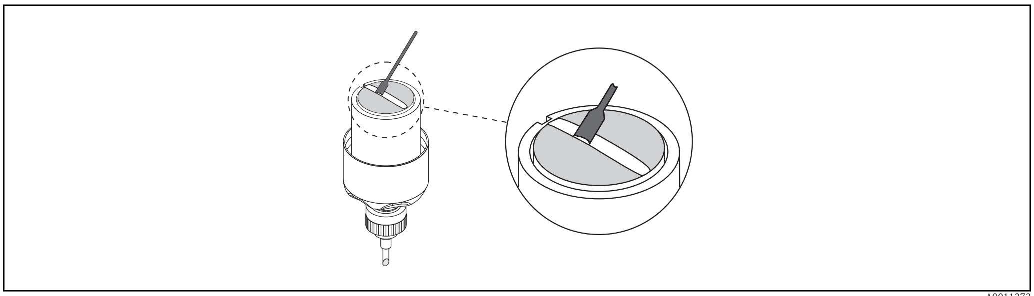


Fig. 40: Coating the contact surfaces of the sensor with coupling fluid

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.

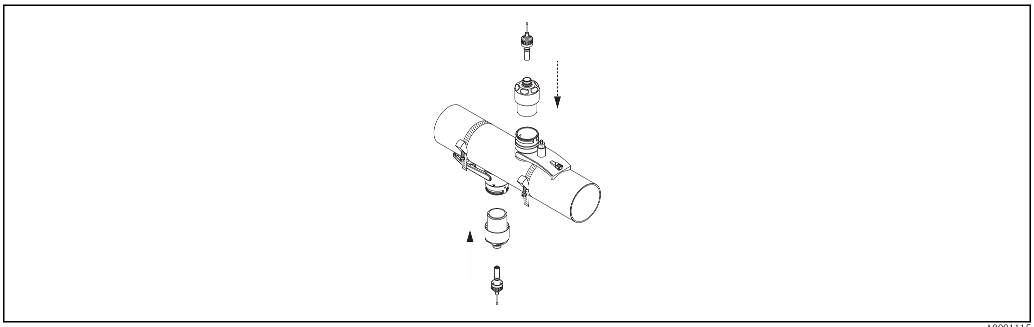


Fig. 41: Mounting the sensor and connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🗎 62.

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.

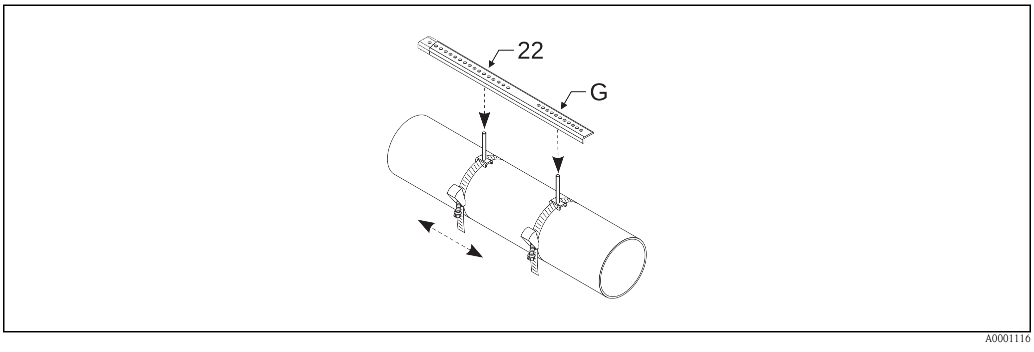
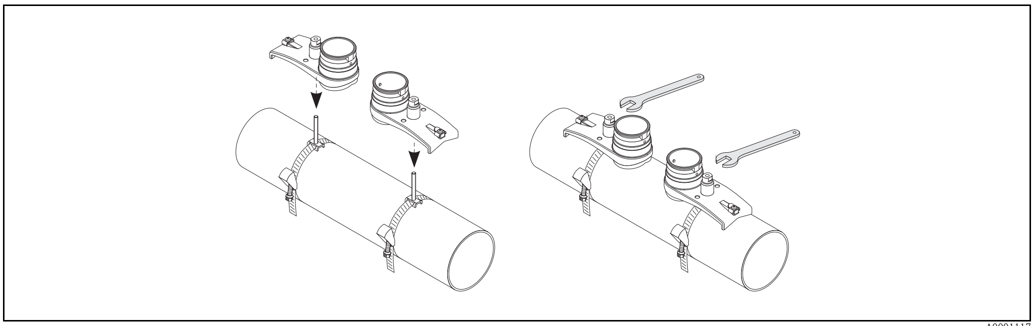


Fig. 42: Determining the distance in accordance with the mounting rail (e.g. POSITION SENSOR G22)

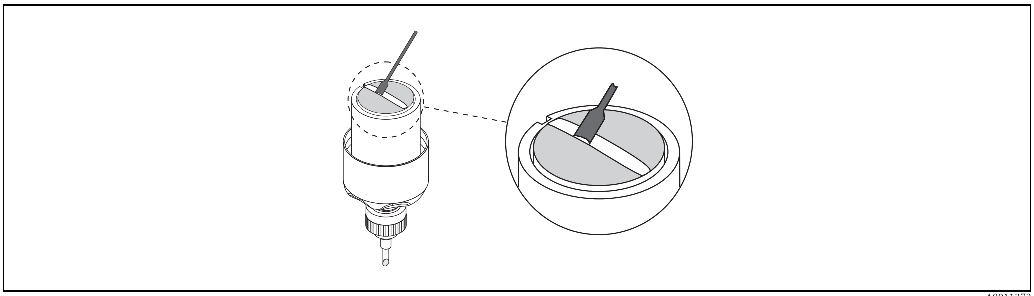
2. Tighten the strapping band so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the retaining nut.



A0001117

Fig. 43: Mounting the sensor

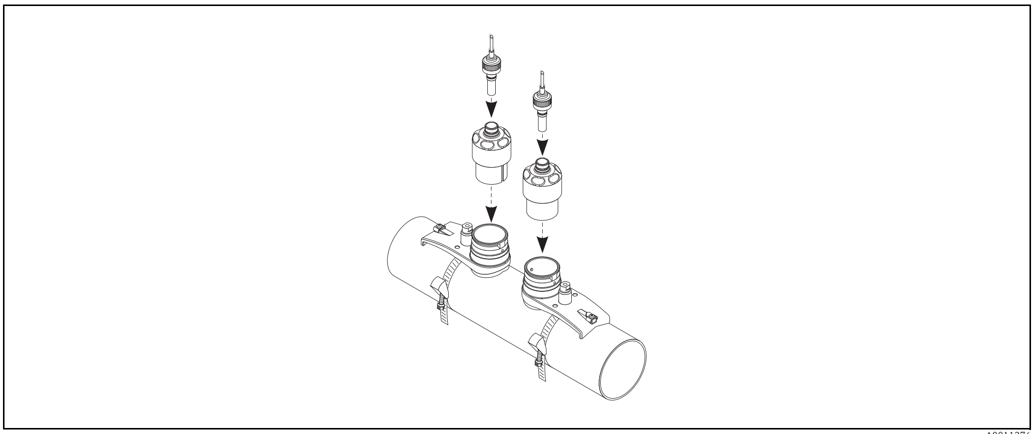
5. Coat the contact surfaces of the sensors with an even layer of coupling fluid approx. 1 mm (0.04") thick, going from the groove through the center to the opposite edge.



A0011373

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.



A0011376

Fig. 45: Connecting the connecting cable

This completes the mounting process. The sensors can now be connected to the transmitter via the connecting cables → 🗎 62.

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).

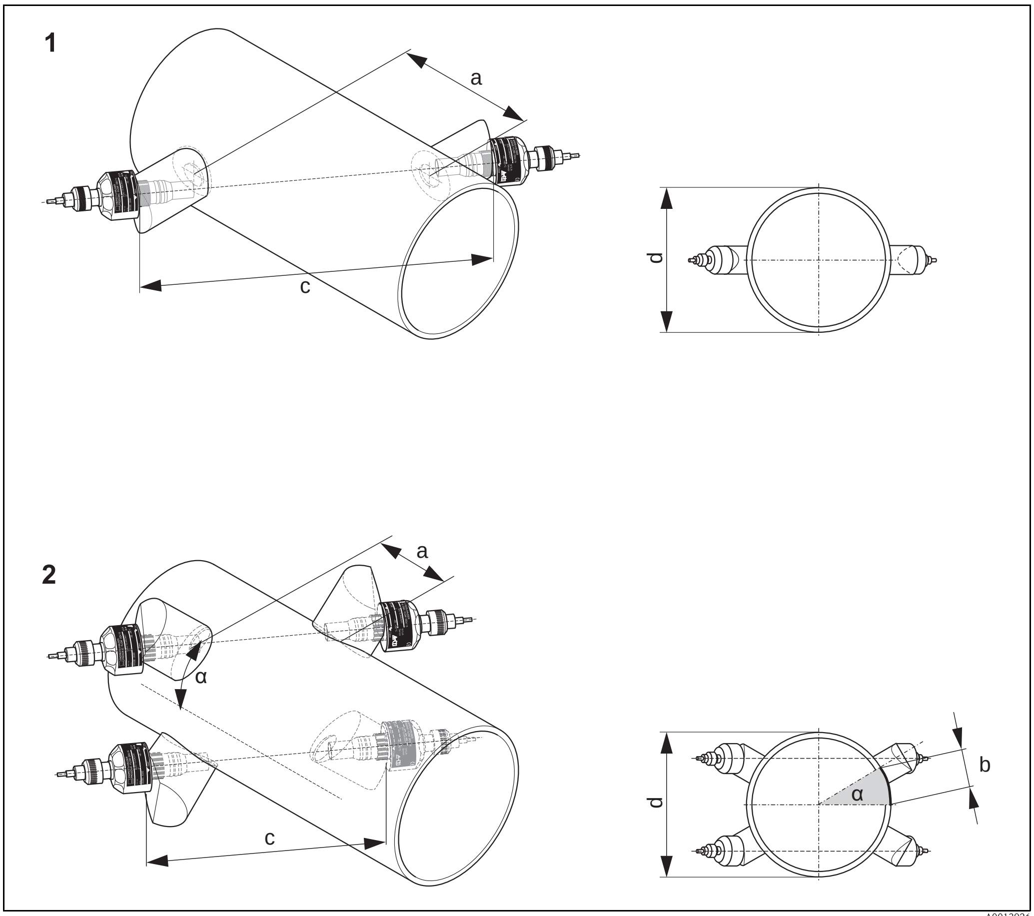


Fig. 46: Explanation of terms

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!

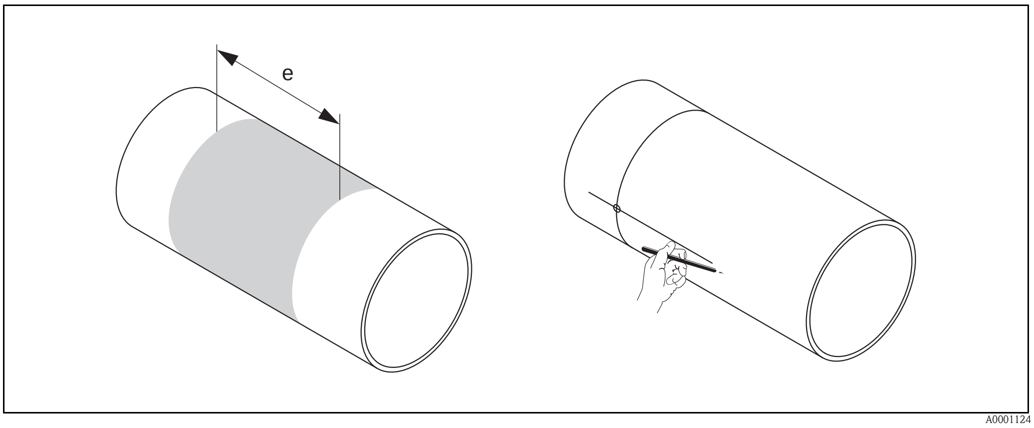


Fig. 47: Installing the measuring sensors, steps 1 and 2

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 → 📄 89. The sensor distance is displayed in the SENSORABSTAND function. The transmitter must be installed and connected to the power supply before you can run the "Sensor Installation" Quick Setup.
   – As explained on → 📄 89 for transmitters without local operation.

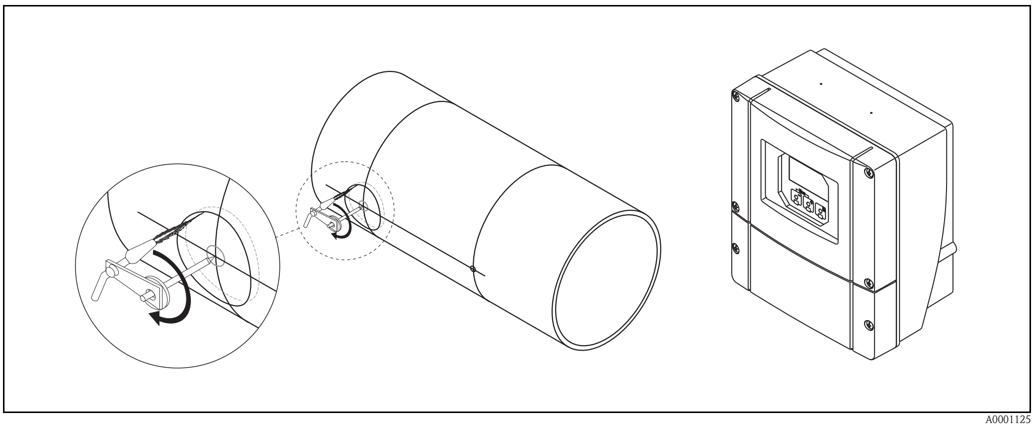
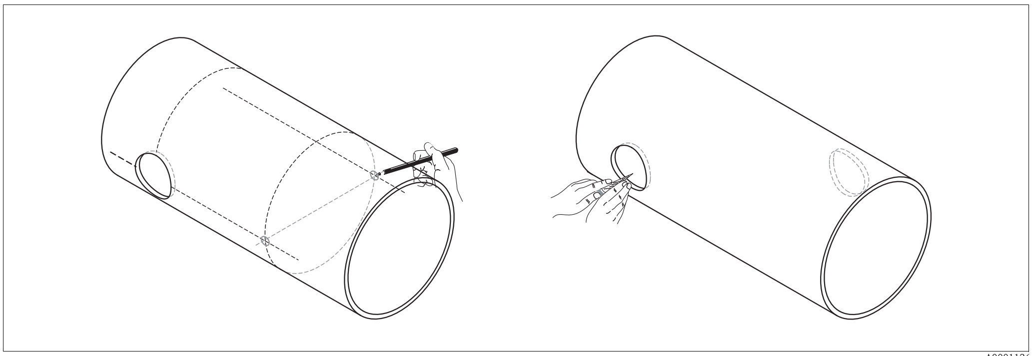


Fig. 48: Installing the measuring sensors, steps 3 and 4

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

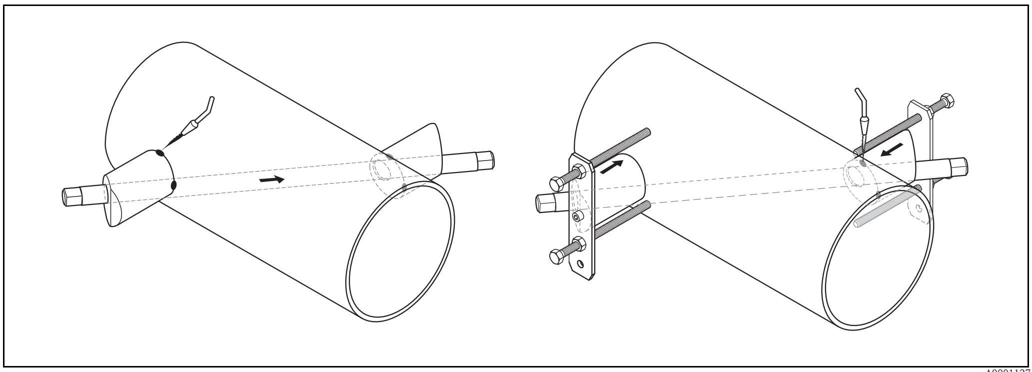
6. Project the middle line to the back of the pipe and draw it on.



A0001126

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.).

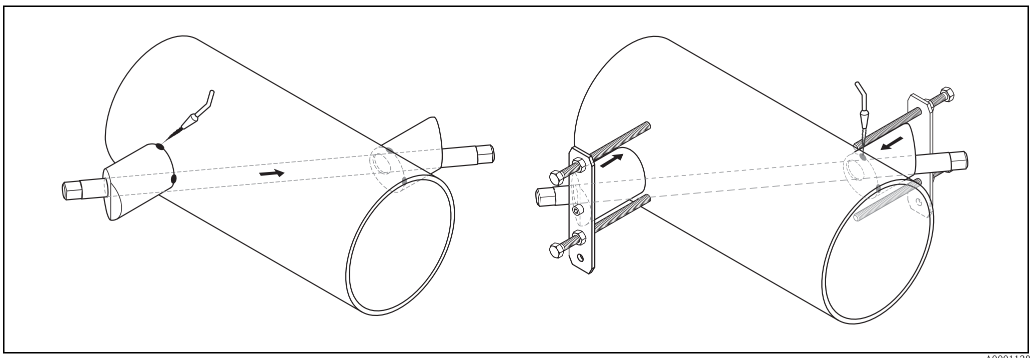


A0001127

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.



A0001128

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 → 89. The path length is displayed in the SPURLÄNGE function. The transmitter must be installed and connected to the power supply before you can run the "Sensor Installation" Quick Setup.
    – As explained on → 89 for transmitters without local operation.
13. Screw the sensors into the sensor holders by hand. If you use a tool, the torque permissible is 30 Nm.
14. Insert the sensor cable connectors into the opening provided and manually tighten the connectors to the stop.

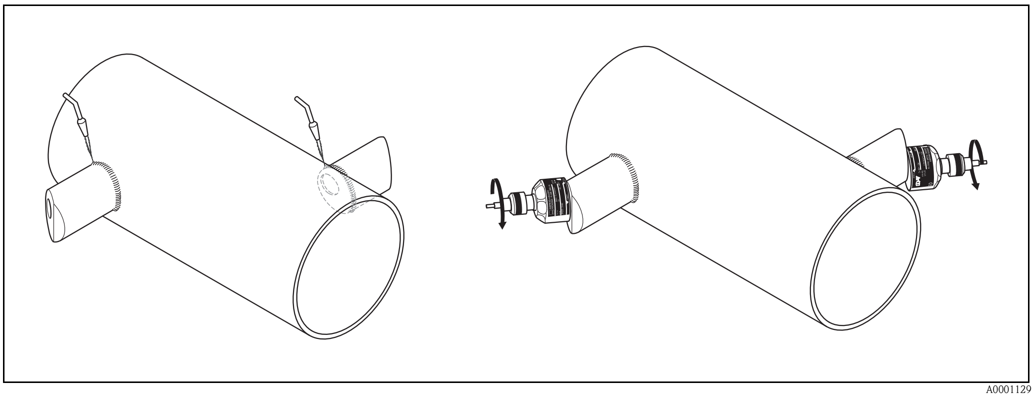
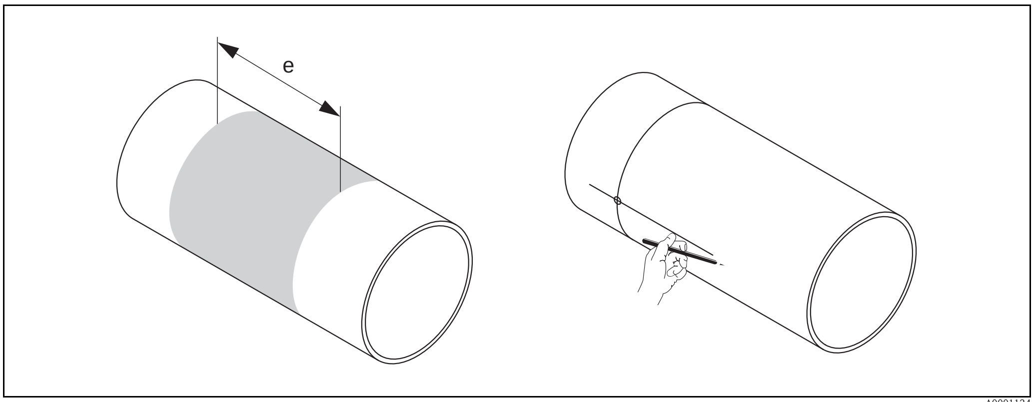


Fig. 52: Installing the measuring sensors, steps 11 to 14

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.

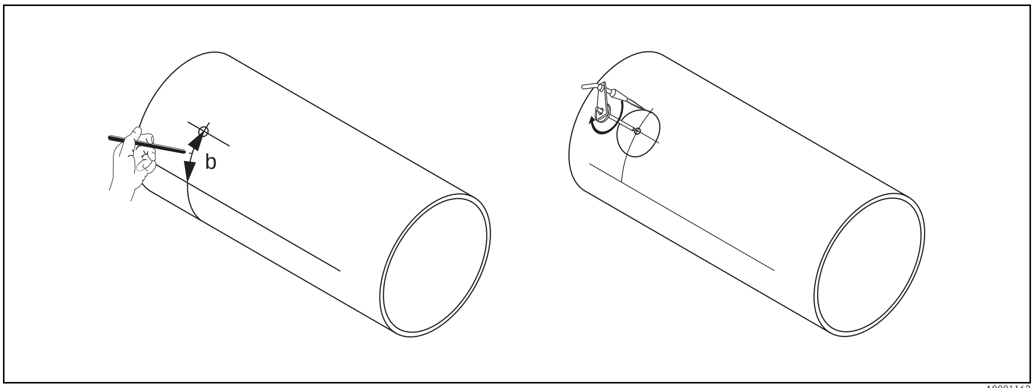


A0001124

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.



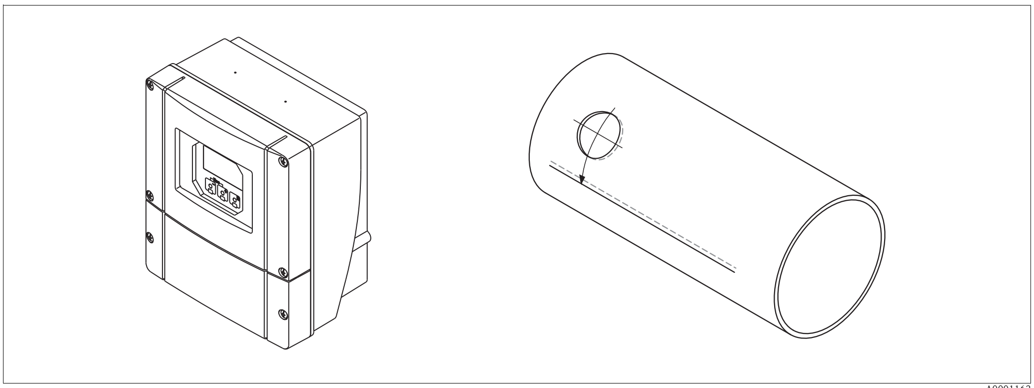
A0001162

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 → 🗎 89. The sensor distance is displayed in the SENSORABSTAND 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 → 🗎 89 for transmitters without local operation.

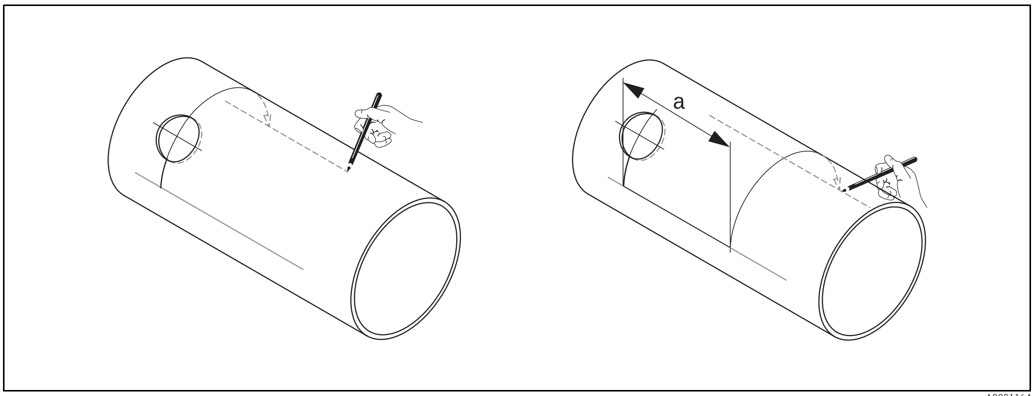
6. You can correct the middle line with the arc length determined.



A0001163

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.

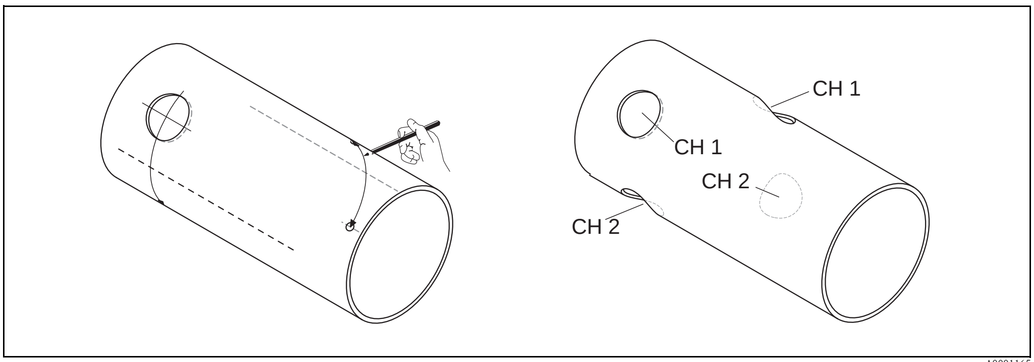


A0001164

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).



A0001165

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.

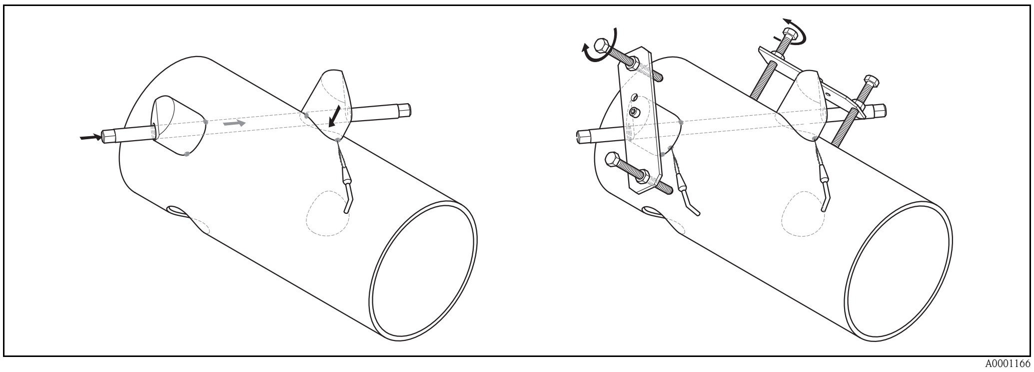


Fig. 58: Installing the dual-path measuring sensors, step 11

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 .

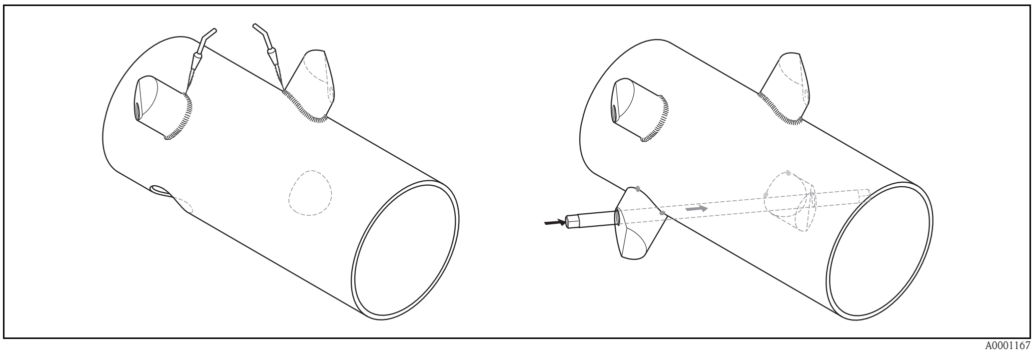


Fig. 59: Installing the dual-path measuring sensors, steps 13 and 14

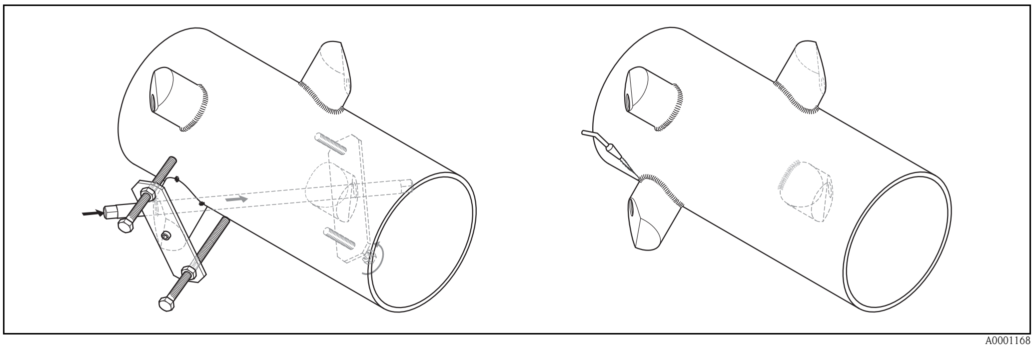


Fig. 60: Installing the dual-path measuring sensors, step 13

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.

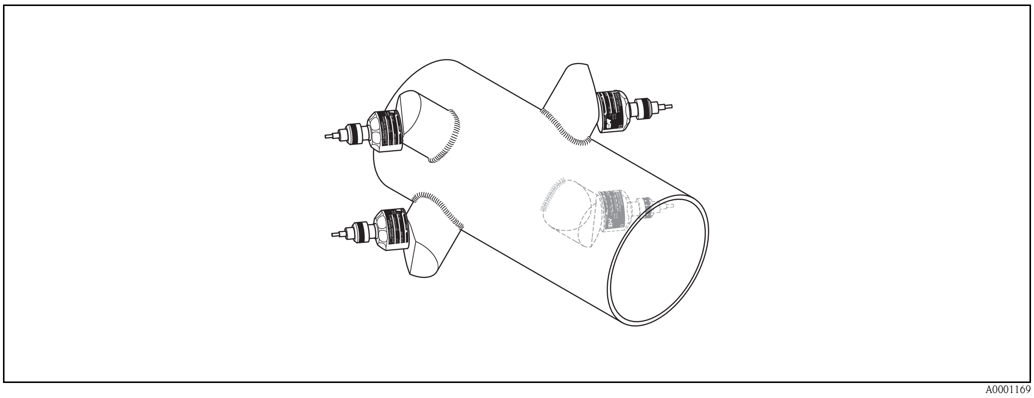


Fig. 61: Installing the dual-path measuring sensors, step 14 and 15

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.

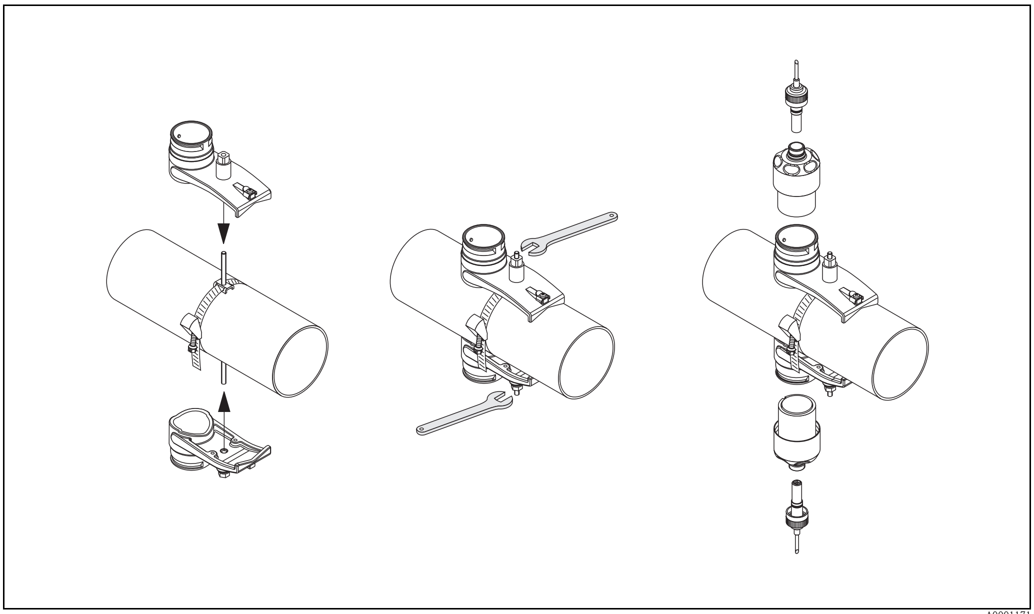


Fig. 62: Steps 1 to 5, installing the sound velocity measuring sensors

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.

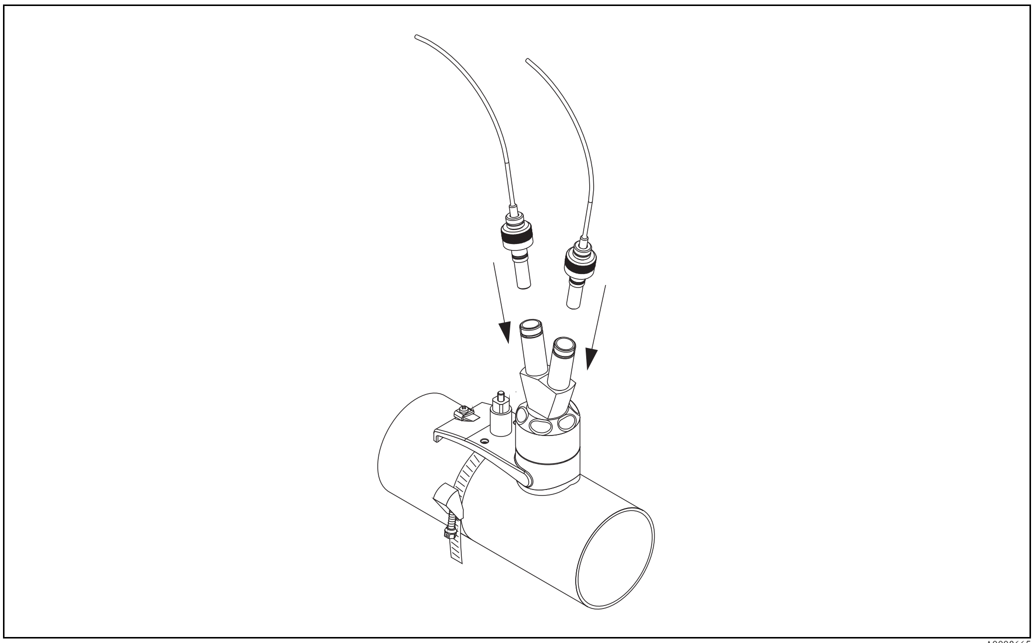


Fig. 63: Installing the wall thickness measuring sensor

3.14 Installing the wall-mount transmitter housing

There are various ways of installing the wall-mount housing:
- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories → 🗎 131)
- Pipe mounting (with separate mounting kit, accessories → 🗎 131)

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.

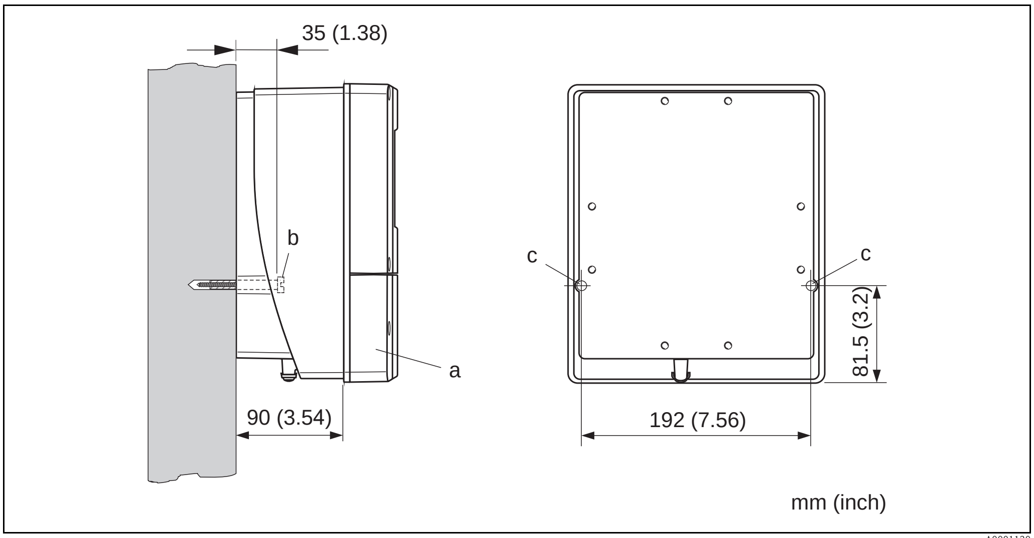


Fig. 64: Direct wall mounting

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.

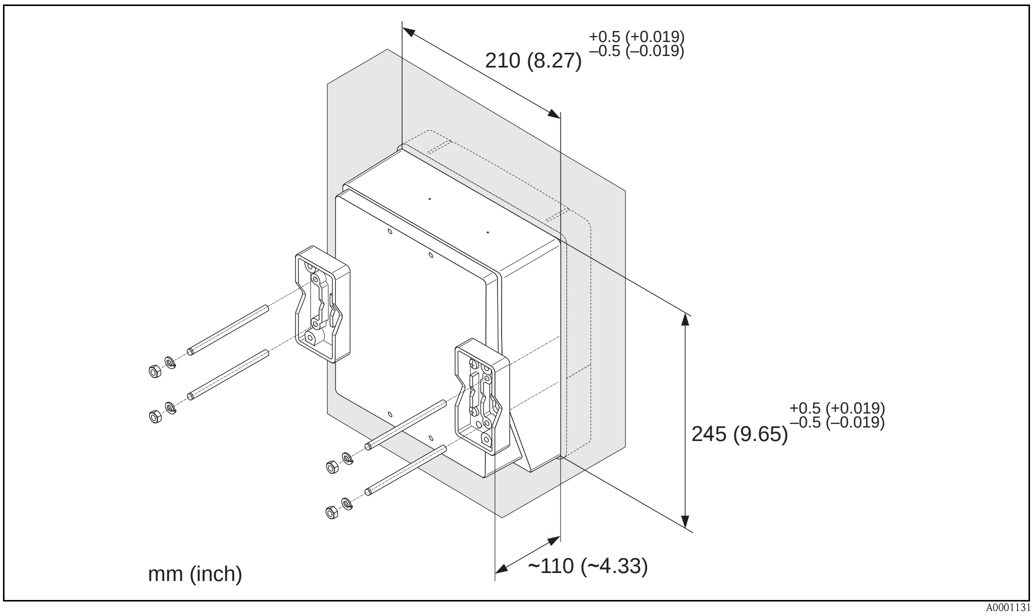


Fig. 65: Panel mounting (wall-mount housing)

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).

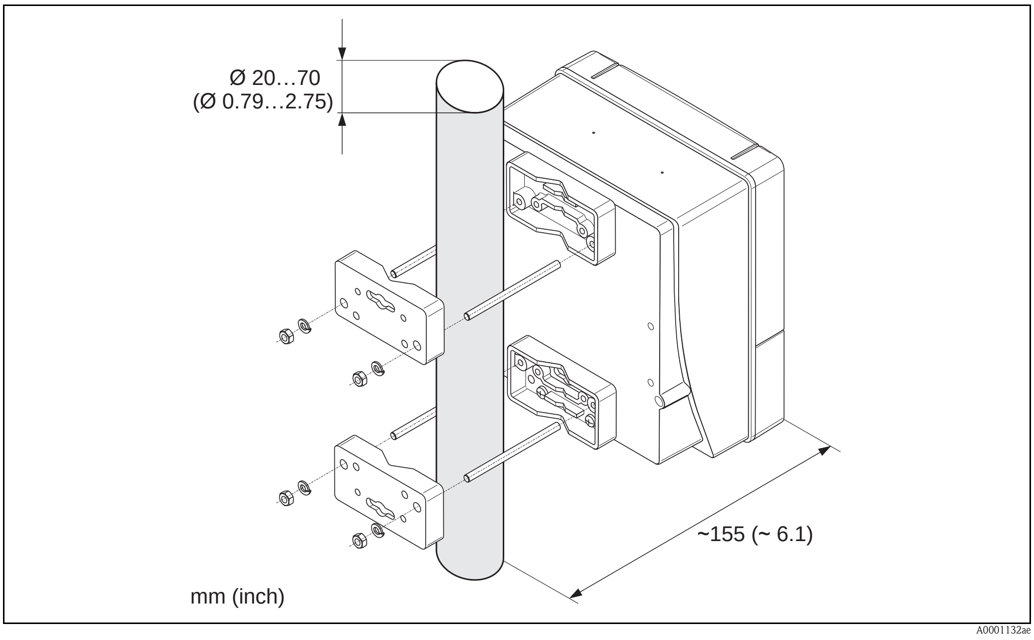


Fig. 66: Pipe mounting (wall-mount housing)

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.?	→ 🗎 158
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 PROFIBUS cable specifications

4.1.1 PROFIBUS DP cable specifications

Cable type

Two versions of the bus line are specified in IEC 61158. Cable type A can be used for all transmission rates up to 12 Mbit/s. Please refer to the table for the cable parameters:

Cable type A	
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Core cross-section	>0.34 mm^2, corresponds to AWG 22
Cable type	Twisted in pairs, 1 x 2, 2 x 2 or 1 x 4 wire
Loop-resistance	110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable section
Shielding	Copper braided shielding or braided shielding and foil shielding

Bus structure

Note the following points:
- The maximum line length (segment length) depends on the transmission rate.
  For cable type A, the maximum line length (segment length) is as follows:

Transmission rate	Line length	
[kBit/s]	[m]	[ft]
9.6 to 93.75	1200	4000
187.5	1000	3300
500	400	1300
1500	200	650
3000 to 12000	100	330

- A maximum of 32 users are permitted per segment.
- Each segment is terminated at either end with a terminating resistor.
- The bus length or the number of users can be increased by introducing a repeater.
- The first and last segment can comprise max. 31 devices.
  The segments between the repeaters can comprise max. 30 stations.
- The maximum distance between two bus users can be calculated as follows:
  (NO_REP + 1) x segment length

  Note!
  NO_REP = maximum number of repeaters that may be switched in series depending on the repeater in question.

Example

In accordance with manufacturer specifications, 9 repeaters can be switched in series when using a standard line. The maximum distance between two bus users at a transmission rate of 1.5 MBit/s can be calculated as follows:
(9 + 1) x 200 m (660 ft) = 2000 m (6600 ft).

Spurs

Note the following points:
- Length of spurs < 6.6 m (21.7 ft) (at max.1.5 MBit/s)
- No spurs should be used for transmission rates >1.5 MBit/s.
  The line between the connector and the bus driver is described as a spur. Experience has shown that you should proceed with caution when configuring spurs. For this reason, you cannot presume that the sum of all spurs at 1.5 MBit/s may be 6.6 m (21.7 ft).
  This is affected greatly by the arrangement of the field devices. Therefore, we recommend you do not use any spurs, if possible, at transmission rates >1.5 MBit/s.
- If you cannot avoid using spurs, then they may not include any bus terminators.

Bus termination

It is important to terminate the RS485 line correctly at the start and end of the bus segment since impedance mismatch results in reflections on the line which can cause faulty communication transmission → 🗎 85.

Further information

General information and further notes regarding the wiring are contained in BA034S/04: "Guidelines for planning and commissioning, PROFIBUS DP/PA, field communication."

4.1.2 PROFIBUS PA cable specifications

Cable type

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

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

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

	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 (6200 ft)	1200 m (4000 ft)

* Not specified

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

Maximum overall cable length

The maximum network expansion depends on the type of protection and the cable specifications. The overall cable length combines 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:

Type A	1900 m	6200 ft
Type B	1200 m	4000 ft

- If repeaters are used, the maximum permissible cable length is doubled. A maximum of three repeaters are permitted between user and master.

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 to 12	13 to 14	15 to 18	19 to 24	25 to 32
Max. length per spur	[m]	120	90	60	30	1
	[ft]	393	295	196	98	3.28

Number of field devices

In systems that meet FISCO with EEx ia type of protection, the line length is limited to max. 1000 m (3300 ft). A maximum of 32 users per segment in non-Ex areas or a maximum of 10 users in an Ex-area (EEx ia IIC) is possible. The actual number of users must be determined during configuration.

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.

Further information

General information and further notes regarding the wiring are contained in BA034S/04: "Guidelines for planning and commissioning, PROFIBUS DP/PA, field communication."

4.1.3 Shielding and grounding

When planning the shielding and grounding for a fieldbus system, there are three important points to consider:

- Electromagnetic compatibility (EMC)
- Explosion protection
- Safety of the personnel

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

Caution!
The legal EMC requirements are fulfilled **only** when the cable shield is grounded on both sides!

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 → 🗎 63

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 → 🗎 64.

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.

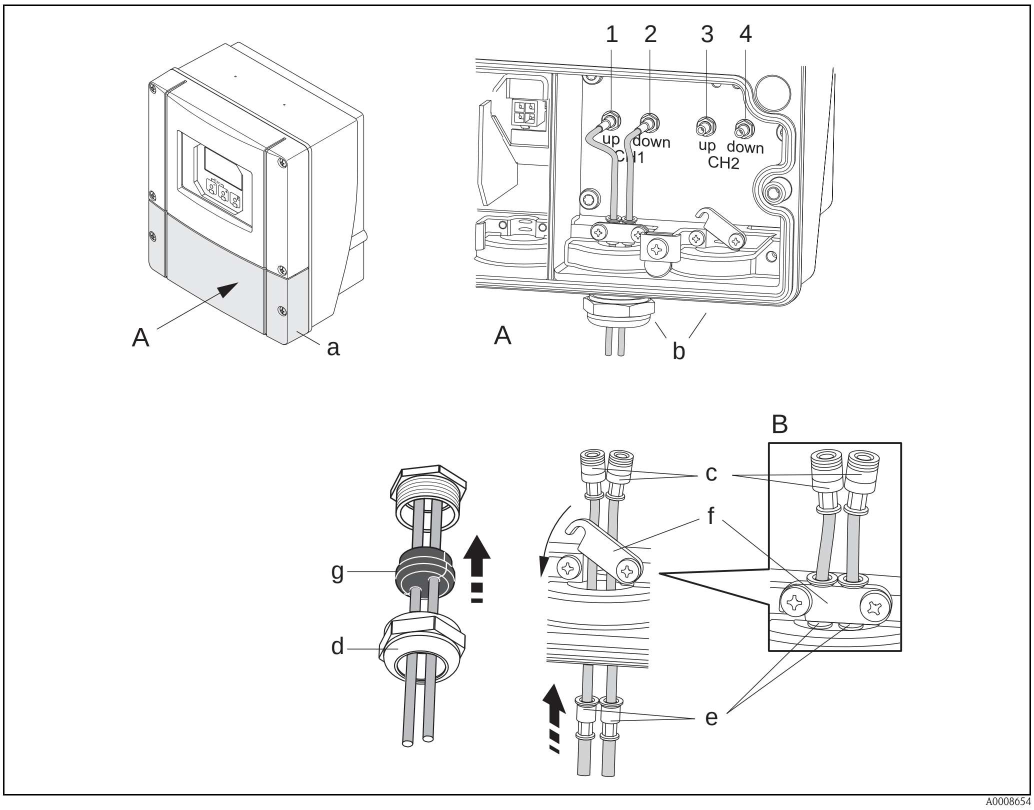


Fig. 67: Connecting the connecting cable for sensor/transmitter (with cable gland for two connecting cables per cable entry)

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.

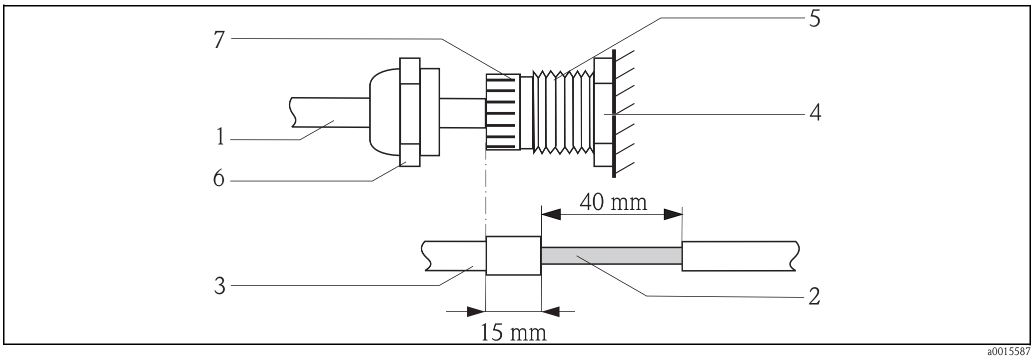


Fig. 68: Connecting and grounding the measuring system

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 → 🗎 131.

For the cable specifications, see → 🗎 155.

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

4.3.1 Terminal assignment

Electrical values for:
- Inputs → 152
- Outputs → 153

PROFIBUS DP

Caution!
Only certain combinations of submodules (see Table) on the I/O board are permissible. The individual slots are marked and assigned to the following terminals in the connection compartment of the transmitter:
- "INPUT / OUTPUT 3" slot = terminals 22 / 23
- "INPUT / OUTPUT 4" slot = terminals 20 / 21

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–) Submodule on slot No. 4	22 (+) / 23 (–) Submodule on slot No. 3	24 (+) / 25 (–) Fixed on I/O board	26 = B (RxD/TxD-P) 27 = A (RxD/TxD-N) Fixed on I/O board
93***-***********J	-	-	+5V (power supply for ext. bus terminator)	PROFIBUS DP
93***-***********V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
93***-***********P	Current output	Frequency output	Status input	PROFIBUS DP

PROFIBUS PA

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 = PA + [1)] 27 = PA – [1)]
93***-***********F	-	-	-	PROFIBUS PA, Ex i
93***-***********H	-	-	-	PROFIBUS PA

[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.

Procedure:
- PROFIBUS DP → 69 (→ 67)
- PROFIBUS PA → 71 (→ 69)

1. Unscrew the connection compartment cover (a) from the transmitter housing.
2. Feed the power supply cable (b), the fieldbus cable (d) and the power supply cable for external bus terminator (optional) or signal cable (g) through the appropriate cable entries.
3. Perform wiring in accordance with the respective terminal assignment and the associated wiring diagram.

   Caution!
   - Risk of damaging the fieldbus cable!
     Observe the information about shielding and grounding the fieldbus cable → 62.
   - We recommend that the fieldbus cable not be looped using conventional cable glands. If you later replace even just one measuring device, the bus communication will have to be interrupted.

   Note!
   - The terminals for connecting PROFIBUS PA (26/27) have integrated reverse polarity protection. This ensures correct signal transmission via the fieldbus even if the cables are connected the wrong way round.
   - Cable cross-section: max. 2.5 mm² (0.0039 in², AWG 14).
   - Pay attention to the grounding concept of the plant.
4. Screw the cover of the connection compartment (a) back onto the transmitter housing.

4.3.3 PROFIBUS DP connection diagram

Permanent assignment board
(order version 93*-***********J)**

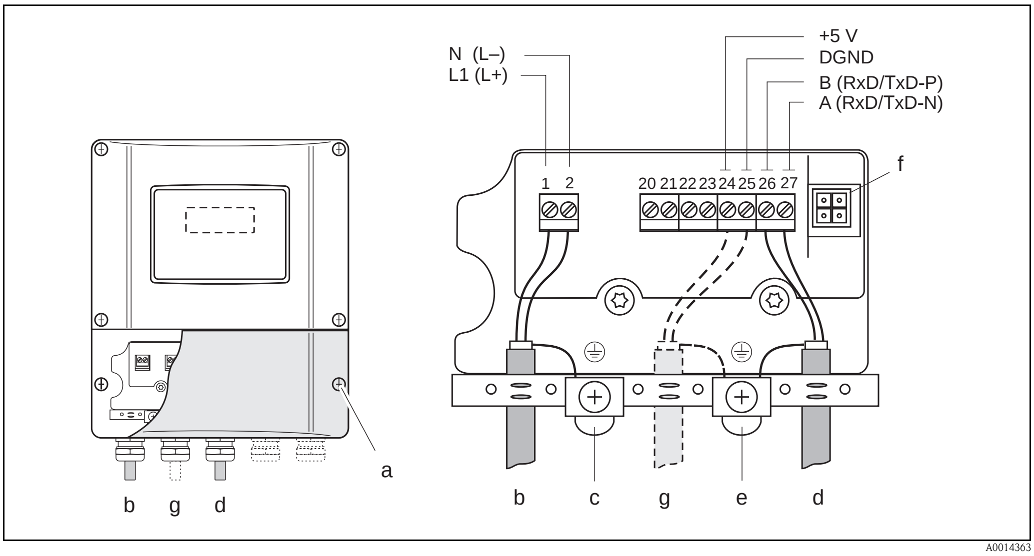


Fig. 69: Connecting the transmitter, cable cross-section max. 2.5 mm² (AWG 14)

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: B (RxD/TxD-P)
Terminal No. 27: A (RxD/TxD-N)
e *Ground terminal for fieldbus cable shield*
Observe the following:
– the shielding and grounding of the fieldbus cable → 62
– 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)*
g *Power supply cable for external bus terminator (optional):*
Terminal No. 24: +5 V
Terminal No. 25: DGND

Flexible assignment boards (order version 93***-***********V and 93***-***********P)

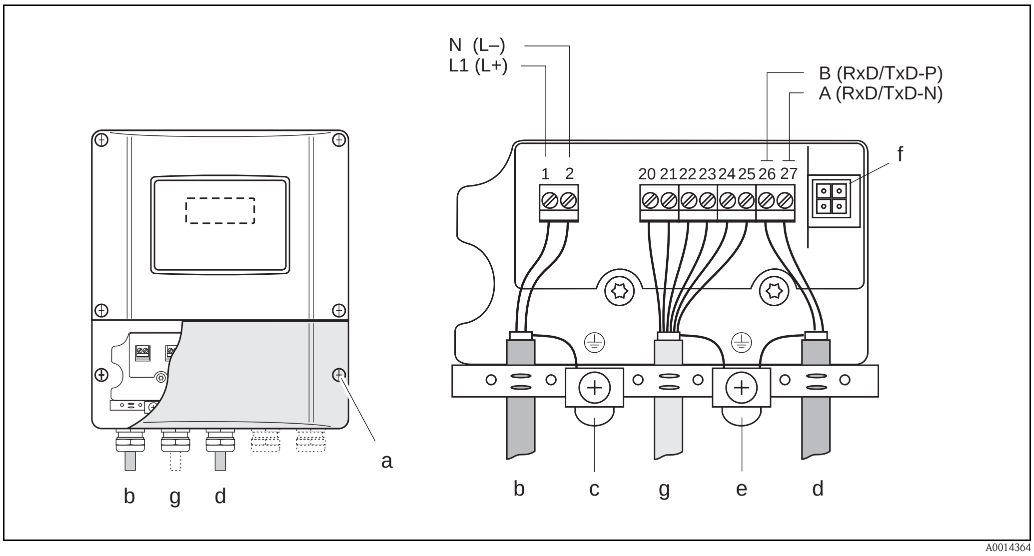
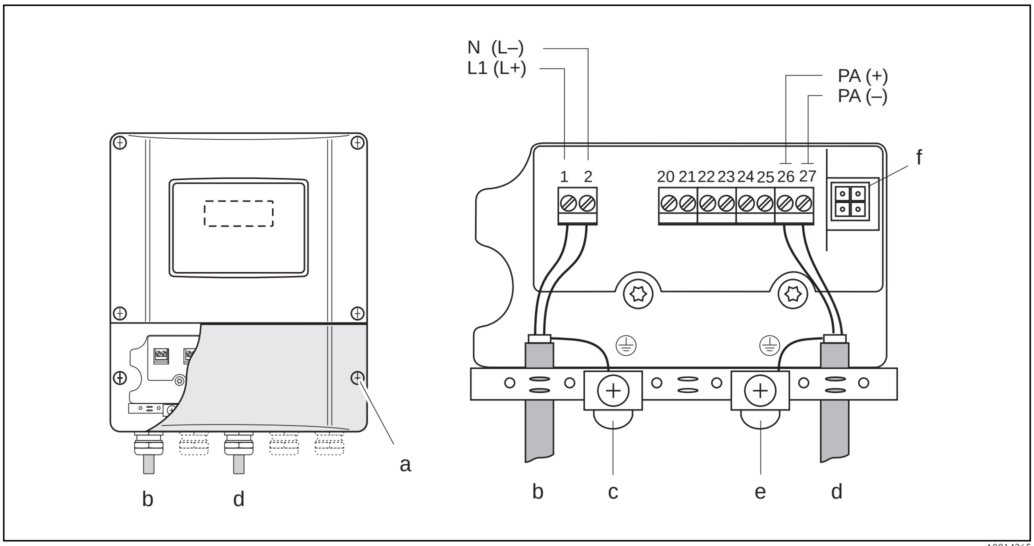


Fig. 70: Connecting the transmitter, cable cross-section: max. 2.5 mm² (AWG 14)

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: B (RxD/TxD-P)
Terminal No. 27: A (RxD/TxD-N)
e Ground terminal for signal cable shield
Observe the following:
– the shielding and grounding of the fieldbus cable → 62
– 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)
g Signal cable: see terminal assignment → 65

4.3.4 PROFIBUS PA connection diagram

Flexible assignment boards
(order version 93*-***********F and 93***-***********H)**



A0014365

Fig. 71: Connecting the transmitter, cable cross-section: max. 2.5 mm² (AWG 14)

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: PA + (with reverse polarity protection)
Terminal No. 27: PA – (with reverse polarity protection)
e *Ground terminal for signal cable shield*
Observe the following:
– the shielding and grounding of the fieldbus cable → 62
– 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)*

Fieldbus connector

Note!
The connector can only be used for PROFIBUS PA devices.

The connection technology of PROFIBUS PA allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, distribution modules 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 → 131.

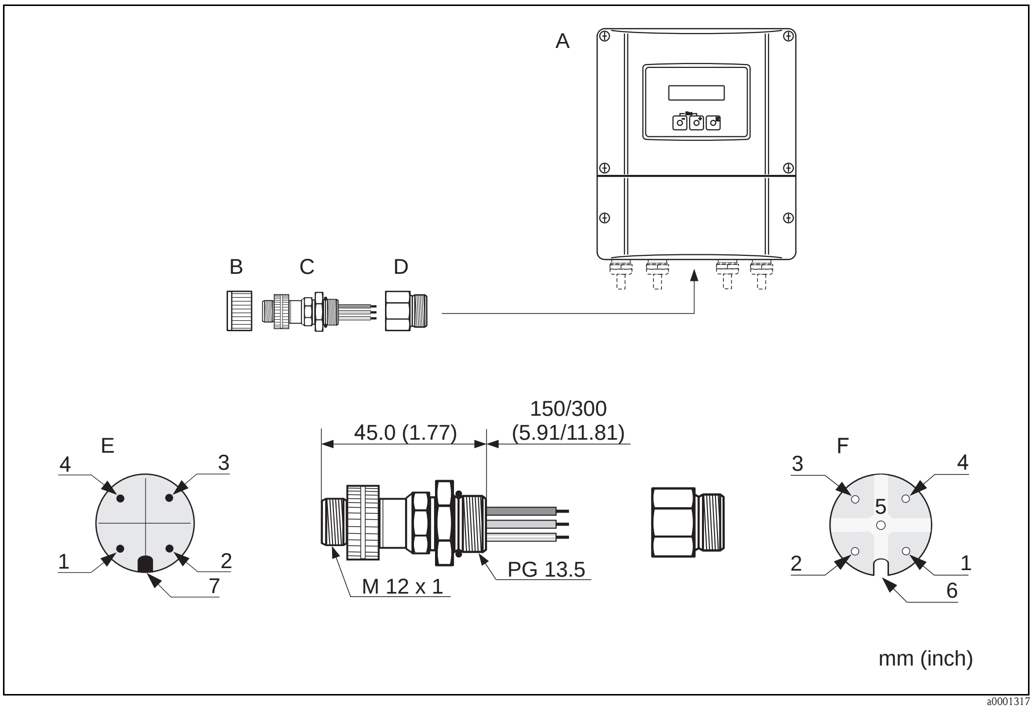


Fig. 72: Connectors for connecting to the PROFIBUS PA

A Wall-mount housing
B Protection cap for connector
C Fieldbus connector
D Adapter PG 13.5 / M 20.5
E Male connector at housing
F Female connector

Pin assignment / color codes:
1 Brown wire : PA + (terminal 26)
2 Not connected
3 Blue wire: PA – (terminal 27)
4 Black wire: ground (instructions for connection → 63, → 65 ff.)
5 Middle female connector not assigned
6 Positioning groove
7 Positioning key

Technical data (fieldbus connector):

Connection cross section	0.75 mm^2 (0.0012 in^2)
Connector thread	PG 13.5
Degree of protection	IP 67 in accordance with DIN 40 050 IEC 529
Contact surface	CuZnAu
Housing material	Cu Zn, surface Ni
Flammability	V - 2 in accordance with UL - 94
Operating temperature	–40 to +85 °C (–40 to +185 °F)
Ambient temperature range	–40 to +150 °C (–40 to +302 °F)
Nominal current per contact	3 A
Nominal voltage	125 to 150 V DC in accordance with the VDE Standard 01 10/ISO Group 10
Resistance to tracking	KC 600
Volume resistance	≤ 8 mΩ in accordance with IEC 512 Part 2
Insulation resistance	≤ 10^{12} Ω in accordance with IEC 512 Part 2

Shielding of the cable connection/T-box

Use cable glands with good EMC properties, with surrounding contact of the cable gland (iris spring). This requires small differences in potential, and possibly potential matching.
- Do not interrupt the shielding of the PA cable.
- Always keep the connection of the shielding as short as possible.

Ideally, cable glands with iris springs should be used for the connection of the shielding. The shield is placed on the T-box via the iris spring that is inside the cable gland. The shielding mesh is located under the iris spring. When the PG thread is screwed closed, the iris spring is pressed onto the shield, making a conductive connection between the shielding and the metal housing.

A junction box or connection is to be considered part of the shielding (Faraday cage). This is particularly true for offset boxes when these are connected to a PROFIBUS PA measuring device using a plug-in cable. In such a case, use a metallic plug in which the cable shielding is attached to the plug housing (such as prefabricated cables).

4.4 Degree of protection

Transmitter (wall-mount housing)

The transmitter fulfills all the requirements for IP 67.

Achtung!
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 → 🗎 72.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

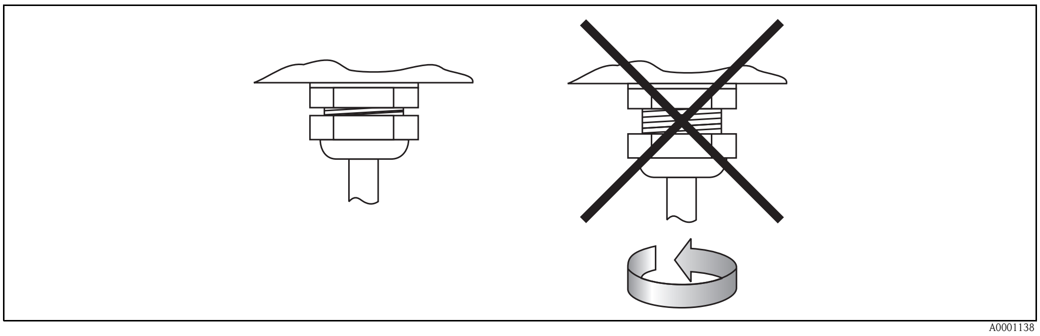


Fig. 73: Installation instructions for cable entries on the transmitter housing

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 → 🗎 72 (1).

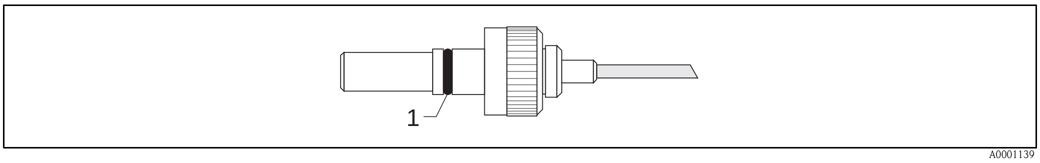


Fig. 74: Cable connector

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?	PROFIBUS DP→ 🗎 58 PROFIBUS PA→ 🗎 60 Sensor cable → 🗎 64
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?	→ 🗎 72
Are all the housing covers installed and tightened?	-
Electrical connection of PROFIBUS DP/PA	**Notes**
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	-
Has each fieldbus segment been terminated at both ends with a bus terminator?	PROFIBUS DP → 🗎 85
Has the max. length of the fieldbus cable been observed in accordance with the PROFIBUS specifications?	PROFIBUS DP → 🗎 58 PROFIBUS PA → 🗎 60
Has the max. length of the spurs been observed in accordance with the PROFIBUS specifications?	PROFIBUS DP → 🗎 59 PROFIBUS PA → 🗎 61
Is the fieldbus cable fully shielded and correctly grounded?	→ 🗎 62

5 Operation

5.1 Quick operation guide

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

1. **Local display (option)** → 🗎 75
   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** → 🗎 81
   The configuration of profile and device-specific parameters is primarily done via the PROFIBUS interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.
3. **Jumpers/miniature switches for hardware settings**
   – PROFIBUS DP → 🗎 83
   – PROFIBUS PA → 🗎 86
   You can make the following hardware settings using a jumper or miniature switches on the I/O board:
   - Address mode configuration (select software or hardware addressing)
   - Device bus address configuration (for hardware addressing)
   - Hardware write protection enabling/disabling

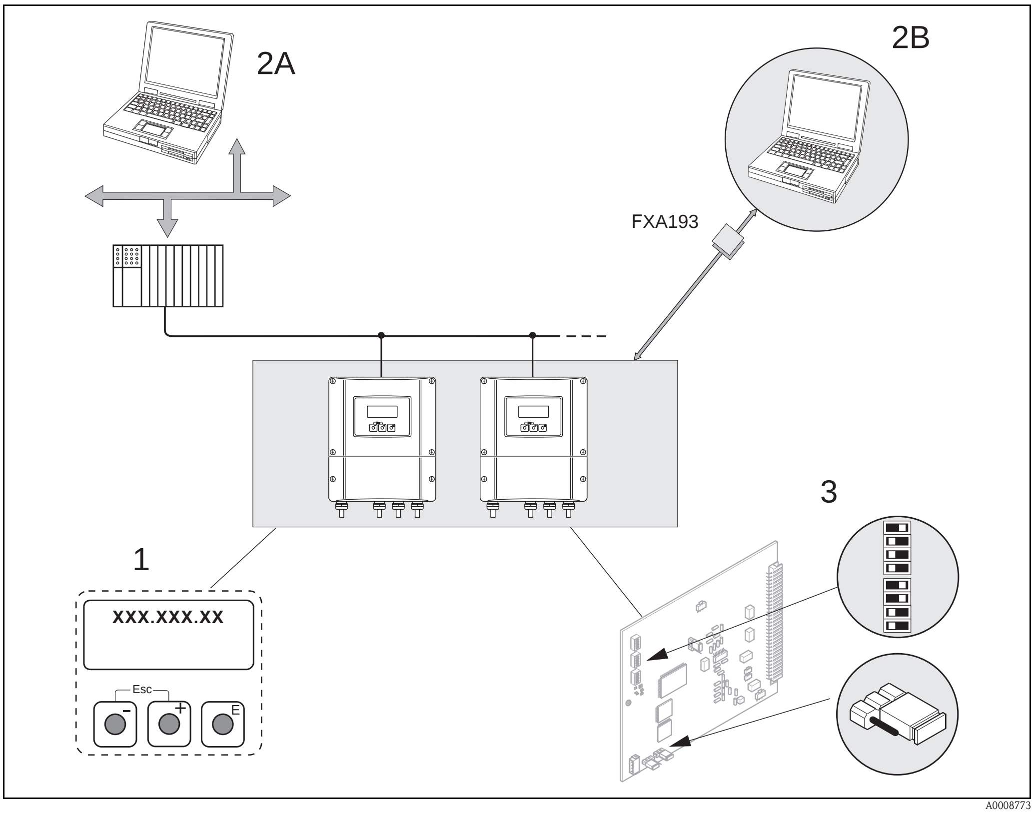


Fig. 75: Methods of operating PROFIBUS PA/DP

1 Local display for device operation in the field (option)
2A Configuration/operating programs (e.g. FieldCare) for operation via PROFIBUS DP/PA
2B Configuration/operating program for operation via the FXA193 service interface (e.g. FieldCare)
3 Jumper/miniature switches for hardware settings (write protection, device address, address 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).

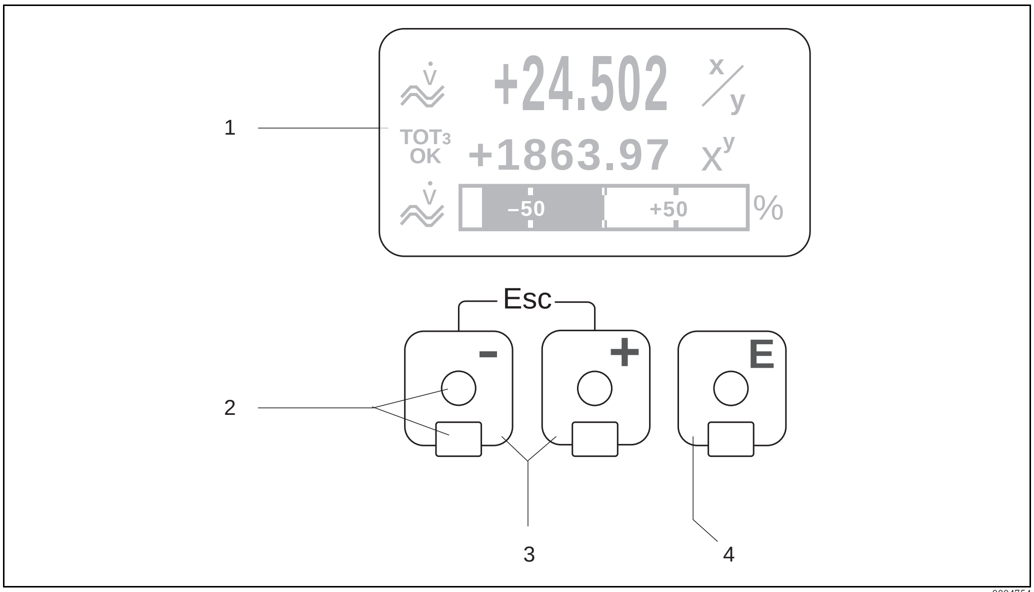


Fig. 76: Display and operating elements

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 *E 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 → 📄 80

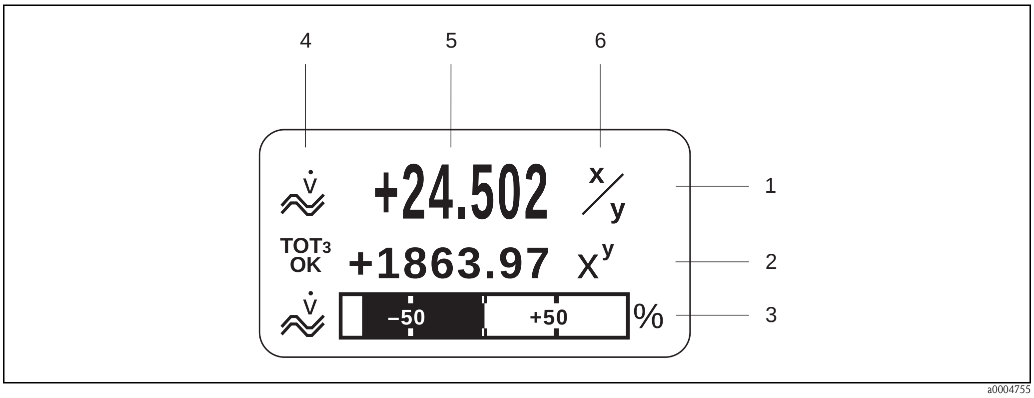


Fig. 77: Typical display for standard operating mode (HOME position)

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.
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

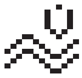
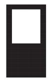
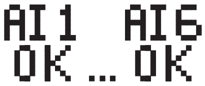
5.2.3 Additional display functions

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

+/- → Scan of individual values within the Info Menu
Esc (-/+) (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 (with effect on outputs)	!	Notice message (without effect on outputs)
 a0001188	Volume flow	 a0001206	Acyclic communication via PROFIBUS active (e.g. via the operating program "FieldCare")
← → (scrolling display)	Cyclic communication via PROFIBUS active, for example via PLC (Class 1 master)	 a0002322	Display value (module DISPLAY_VALUE) with status GOOD
 a0002321	Display value (module DISPLAY_VALUE) with status UNC = uncertain	 a0002320	Display value (module DISPLAY_VALUE) with status BAD
 a0002324	Output value OUT, Analog Input 1 to 6 (AI module) with status GOOD	 a0002325	Output value OUT, Totalizer 1 to 3 (TOTAL module) with status GOOD
 a0002326	Output value OUT, Analog Input 1 to 6 (AI module) with status UNC = uncertain	 a0002327	Output value OUT, Totalizer 1 to 3 (TOTAL module) with status UNC = uncertain
 a0002328	Output value OUT, Analog Input 1 to 6 (AI module) with status BAD	 a0002329	Output value OUT, Totalizer 1 to 3 (TOTAL module) with status BAD

5.3 Brief guide to the function matrix

Note!
- See the general notes → 79
- Function descriptions → see the "Description of Device Functions" manual"

1. HOME position → E → Entry into the function matrix
2. + / − → Select a block (e.g. USER INTERFACE) → E)
3. + / − → Select a group (e.g. CONTROL) → E
4. + / − → Select a function group (e.g. BASIC CONFIG.) → E
5. Select a function (e.g. LANGUAGE)
   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 for longer than 3 seconds → HOME position
   – Repeatedly press Esc key → Return step-by-step to HOME position

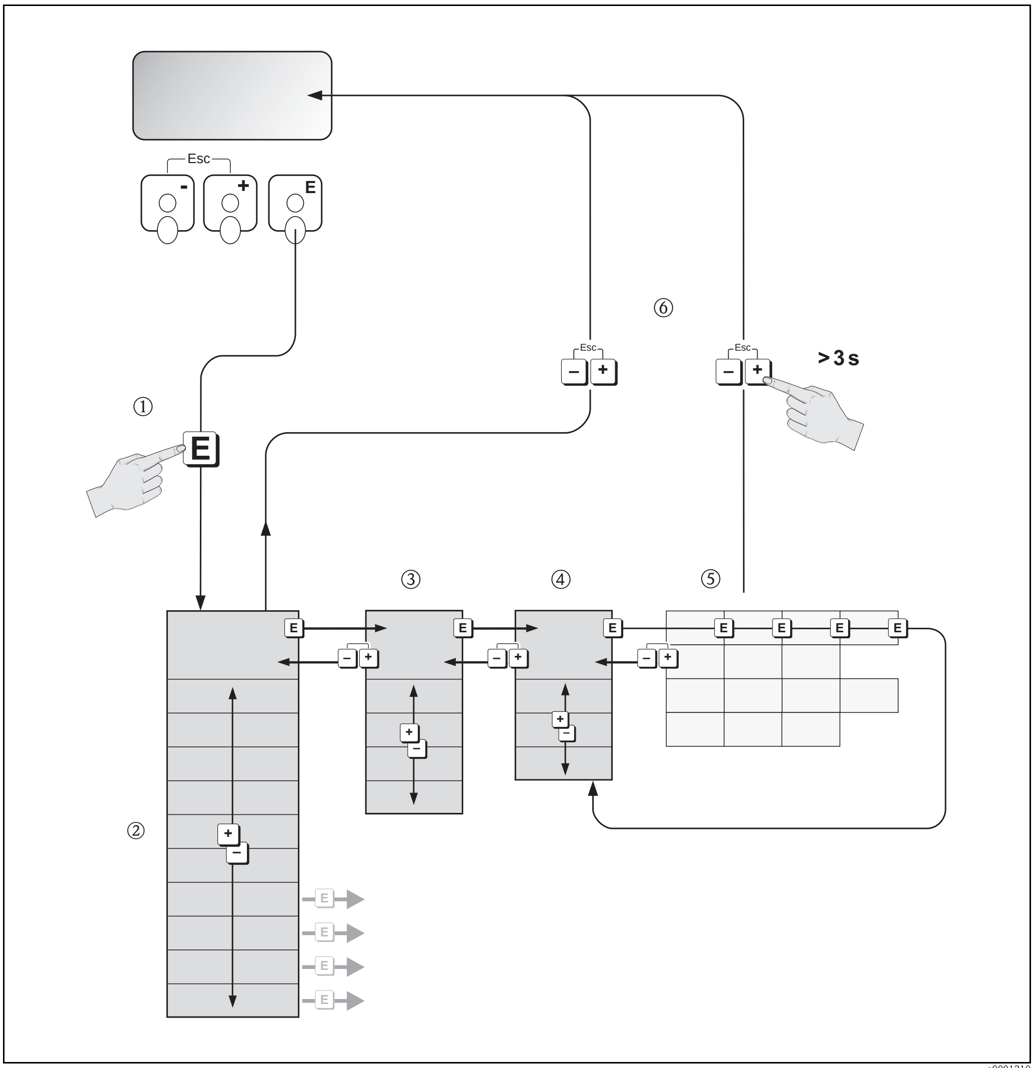


Fig. 78: Selecting functions and configuring parameters (function matrix)

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 → 78. Each cell in the function matrix is identified by a numerical or letter code on the display.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press +- to select "SURE [YES]" and press E 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.

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 error:* this group includes all device errors, for example communication errors, hardware errors, etc. → 🗎 137
- *Process error:* This group includes all application errors, e.g. fluid not homogeneous, etc. → 🗎 143

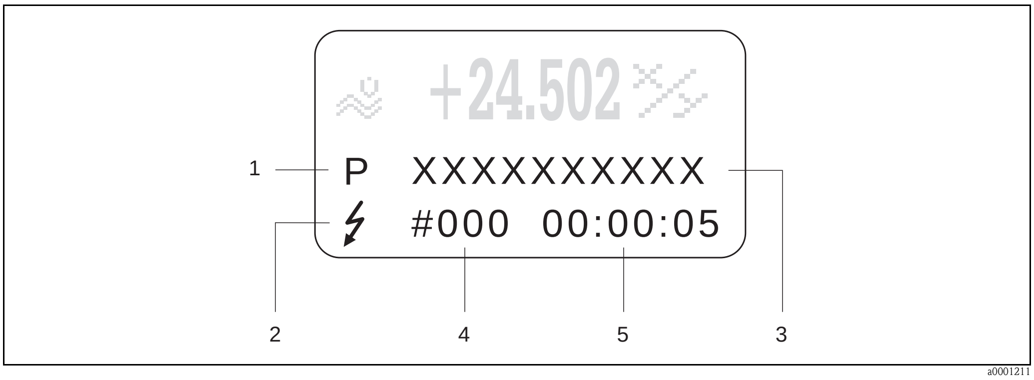


Fig. 79: Error messages on the display (example)

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 → 🗎 135 ff.
Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)
- The error in question has no effect on the current measuring operation.
- Displayed as → Exclamation mark (!), type of error (S: system error, P: process error)
- Displaying the device status on PROFIBUS DP/PA → 🗎 137

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)
- Displaying the device status on PROFIBUS DP/PA → 🗎 137

Note!
- Error conditions can be output via fieldbus communication.
- If an error message occurs, an upper or lower signal level for the breakdown information according to NAMUR NE 43 can be output via the current output.

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 program "SIMATIC PDM"

SIMATIC PDM is a standardized, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

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.

PROFIBUS DP

Valid for device software:	3.06.XX	→ DEVICE SOFTWARE function (8100)
Device data PROFIBUS DP: Profile Version: Prosonic Flow 93 ID No.: Profile ID No.:	 3.0 1531 (Hex) 9741 (Hex)	 → PROFILE VERSION function (6160) → DEVICE ID function (6162)
GSD file information: Prosonic Flow 93 GSD file:	Extended Format (recommended): Standard Format: Note! Before configuring the PROFIBUS network, read and follow the information for using the GSD file → 102 ff.	eh3x1531.gsd eh3_1531.gsd
Bitmaps:	EH_1531_d.bmp/.dib EH_1531_n.bmp/.dib EH_1531_s.bmp/.dib	
Profile GSD file:	PA039741.gsd	
Software release:	06.2010	

Operating program/device description:	Sources for obtaining device descriptions/program updates:
Prosonic Flow 93 GSD file	▪ www.endress.com → Download ▪ www.profibus.com ▪ CD–ROM (Endress+Hauser order number: 56003894)
FieldCare/DTM	▪ www.endress.com → Download ▪ CD–ROM (Endress+Hauser order number: 56004088) ▪ DVD (Endress+Hauser order number: 70100690)
SIMATIC PDM	▪ www.endress.com → Download

Tester/simulator:	How to acquire:
Fieldcheck	▪ Update via FieldCare with Flow Communication FXA193/291 DTM in 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.

PROFIBUS PA

Valid for device software:	3.06.XX	→ DEVICE SOFTWARE function (8100)
Device data PROFIBUS PA: Profile Version: Prosonic Flow 93 ID No.: Profile ID No.:	 3.0 1530 (Hex) 9741 (Hex)	 → PROFILE VERSION function (6160) → DEVICE ID function (6162)
GSD file information: Prosonic Flow 93 GSD file:	Extended Format (recommended): Standard Format:	eh3x1530.gsd eh3_1530.gsd
	✎ Note! Before configuring the PROFIBUS network, read and follow the information for using the GSD file → 🗎 102 ff.	
Bitmaps:	EH_1530_d.bmp/.dib EH_1530_n.bmp/.dib EH_1530_s.bmp/.dib	
Profile GSD file:	PA039741.gsd	
Software release:	06.2010	

Operating program/device description:	Sources for obtaining device descriptions/program updates:
Prosonic Flow 93 GSD file	■ www.endress.com → Download ■ www.profibus.com ■ CD–ROM (Endress+Hauser order number: 56003894)
FieldCare/DTM	■ www.endress.com → Download ■ CD–ROM (Endress+Hauser order number: 56004088) ■ DVD (Endress+Hauser order number: 70100690)
SIMATIC PDM	■ www.endress.com → Download

Tester/simulator:	How to acquire:
Fieldcheck	■ Update via FieldCare with Flow Communication FXA193/291 DTM in 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 PROFIBUS DP hardware settings

5.6.1 Configuring the write protection

A jumper on the I/O board provides the means of switching hardware write protection on or off. When hardware write protection is switched on, it is **not** possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare")..

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.
3. Configure the hardware write protection accordingly with the aid of the jumpers (see Figure).
4. Installation is the reverse of the removal procedure.

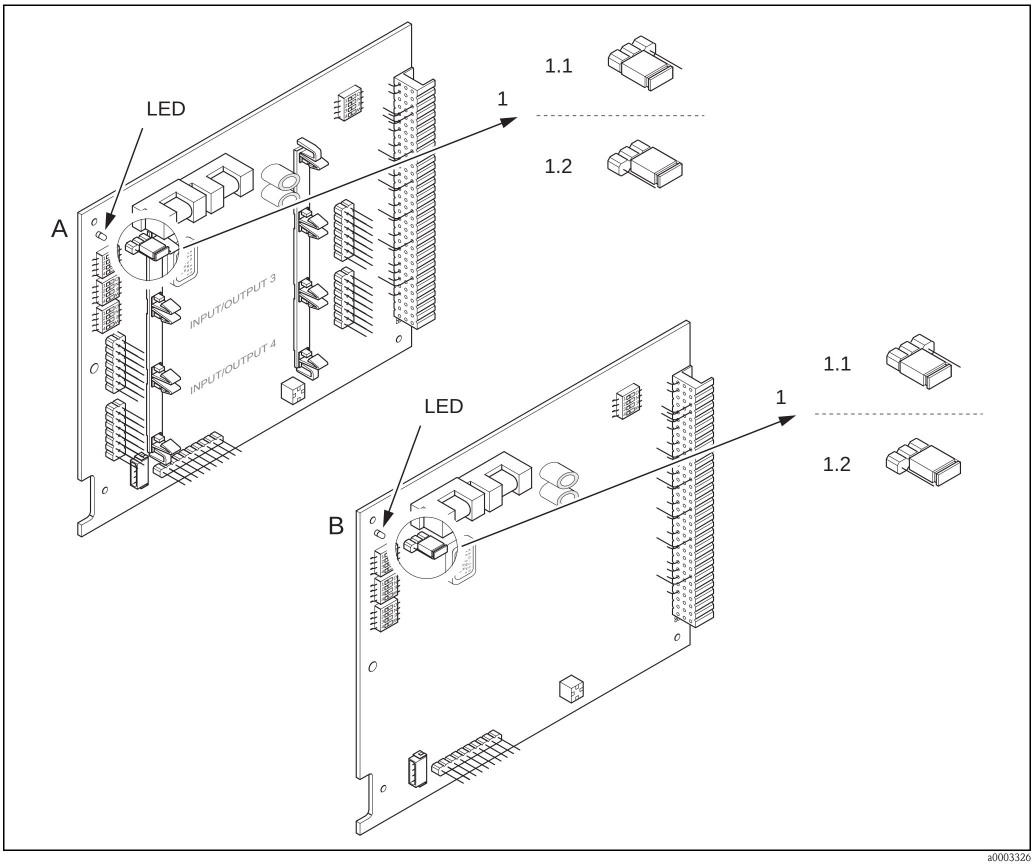


Fig. 80: Switching write protection on and off with the aid of a jumper on the I/O board

A Flexible assignment board
B Permanent assignment board

1 Jumper for switching write protection on and off
1.1 Write protection switched on = it is ***not*** *possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare")*
1.2 Write protection switched off (factory setting) = it is possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare")

LED Overview of LED states:
- *Lit continuously → Ready for operation*
- *Not lit → Not ready for operation*
- *Flashing → System or process error present →* *135 ff.*

5.6.2 Configuring the device address

The address must always be configured for a PROFIBUS DP/PA device. Valid device addresses are in the range 1 to 126. Any address can only be allocated once in a PROFIBUS DP/PA network. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the address 126 and with software addressing.

Addressing via local operation/operating program

Addressing takes place in the FIELDBUS ADDRESS function (6101) → see the "Description of Device Functions" manual.

Addressing via miniature switches

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

1. Loosen the Allen screw (3 mm) of the securing clamp.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Remove the local display (if present) by loosening the set screws of the display module.
4. Set the position of the miniature switches on the I/O board using a sharp pointed object.
5. Installation is the reverse of the removal procedure.

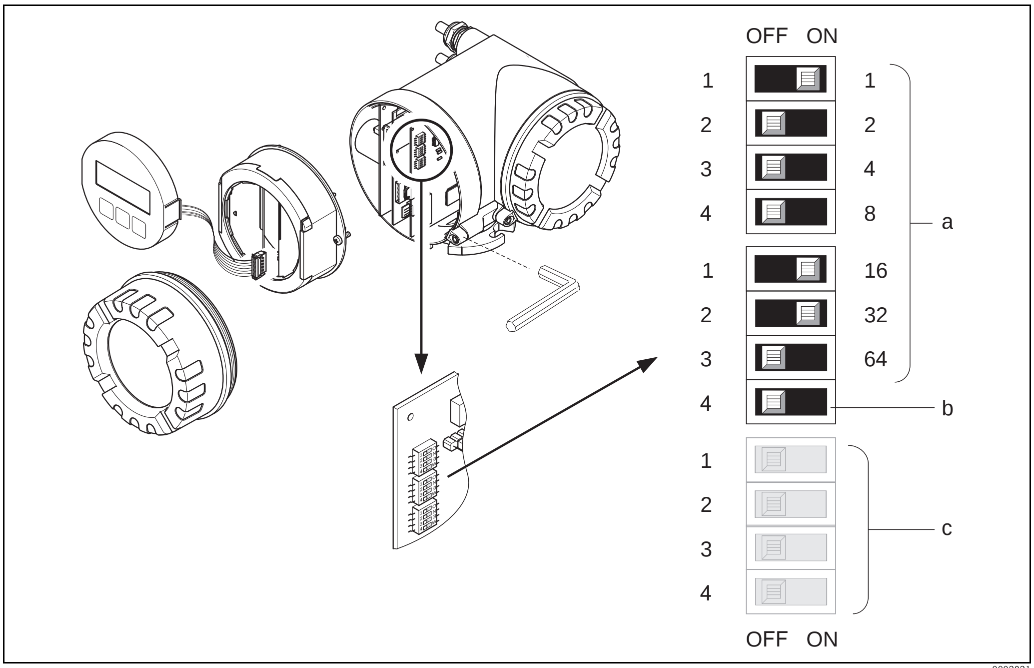


Fig. 81: Addressing with the aid of miniature switches on the I/O board

a Miniature switches for setting the device address (illustrated: 1 + 16 + 32 = device address 49)
b Miniature switches for the address mode (method of addressing):
OFF = software addressing via local operation/operating program (factory setting)
ON = hardware addressing via miniature switches
c Miniature switches not assigned

5.6.3 Configuring the terminating resistors

Note!
It is important to terminate the RS485 line correctly at the start and end of the bus segment since impedance mismatch results in reflections on the line which can cause faulty communication transmission.

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.

- For baudrates up to 1.5 MBaud, the termination is set via the terminating switch SW 1 for the last transmitter on the bus: ON – ON – ON – ON.
- Device is operated with a baud rate >1.5 MBaud: due to the capacitive load of the user and the resulting line reflection, make sure that an external bus terminator is used.
  In addition, the signal lines have to be shielded and grounded for flexible assignment boards → 68.

The miniature switch for termination is located on the I/O board (see Figure):

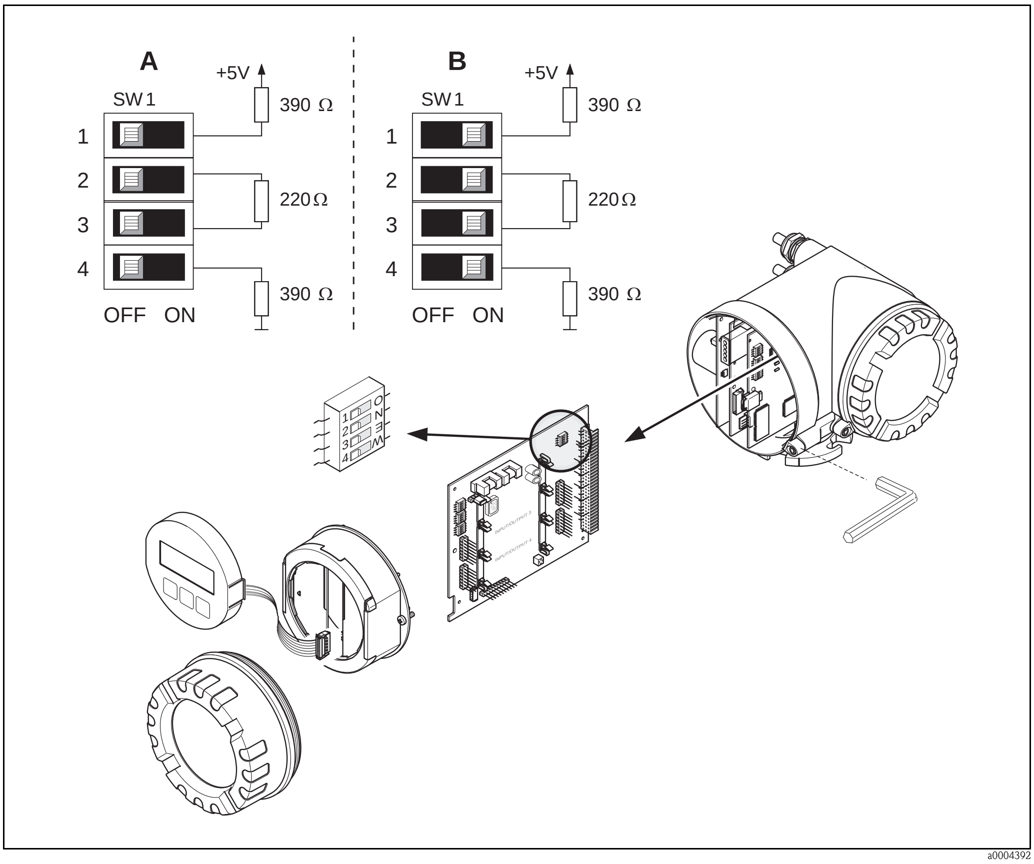


Fig. 82: Configuring the terminating resistors (for baud rates < 1.5 MBaud)

A = Factory setting
B = Setting at the last transmitter

Note!
It is generally recommended to use an external bus terminator since if a device that is terminated internally is defect, this can result in the failure of the entire segment.

5.7 PROFIBUS PA hardware settings

5.7.1 Configuring the write protection

A jumper on the I/O board provides the means of switching hardware write protection on or off. When hardware write protection is switched on, it is **not** possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

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.
3. Configure the hardware write protection accordingly with the aid of the jumpers (see Figure).
4. Installation is the reverse of the removal procedure.

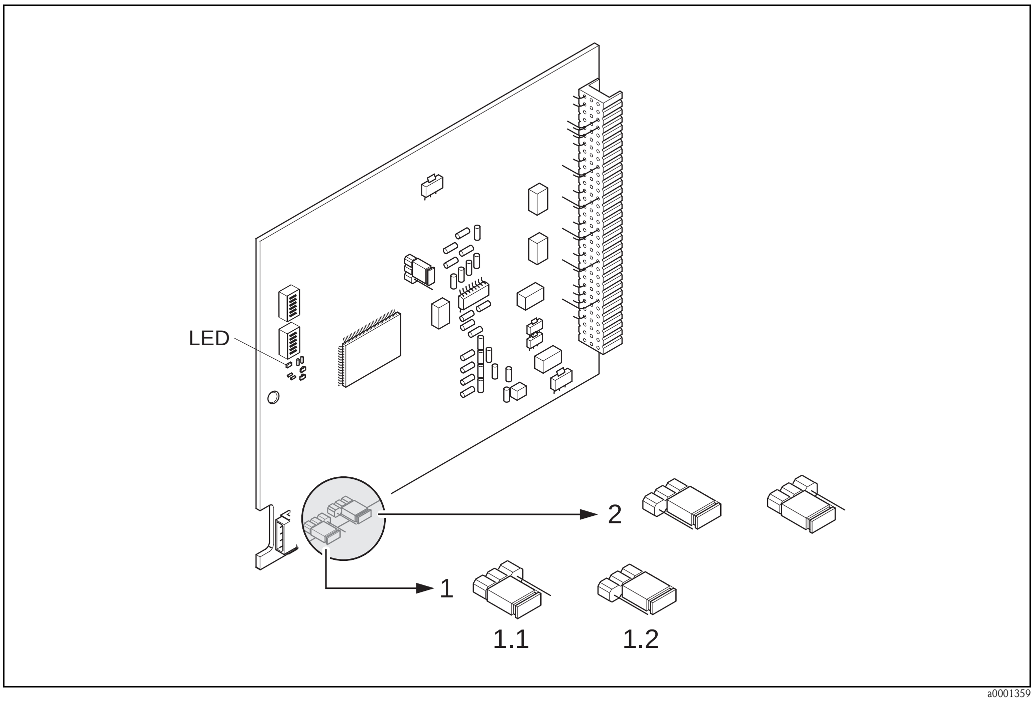


Fig. 83: Switching write protection on and off with the aid of a jumper on the I/O board

1 Jumper for switching write protection on and off
*1.1 Write protection switched on = it is **not** possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare)*
1.2 Write protection switched off (factory setting) = it is possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare)

2 Jumper without function

LED Overview of LED states:
– Lit continuously → Ready for operation
– Not lit → Not ready for operation
– Flashing → System or process error present → *135*

5.7.2 Configuring the device address

The address must always be configured for a PROFIBUS PA device. Valid device addresses are in the range 1 to 126. Any address can only be allocated once in a PROFIBUS network. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the address 126 and with software addressing.

Addressing via local operation/operating program

Addressing takes place in the FIELDBUS ADDRESS function (6101) → see the "Description of Device Functions" manual.

Addressing via miniature switches

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

1. Loosen the screws and open the housing cover (a).
2. Loosen the screws securing the electronics module (b). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Remove the ribbon cable connector (c) of the display module.
4. Remove the cover (d) from the electronics compartment by loosening the screws.
5. Remove the I/O board (e):
   Insert a thin pin into the hole provided for the purpose and pull the board clear of its holder.
6. Set the position of the miniature switches on the I/O board using a sharp pointed object.
7. Installation is the reverse of the removal procedure.

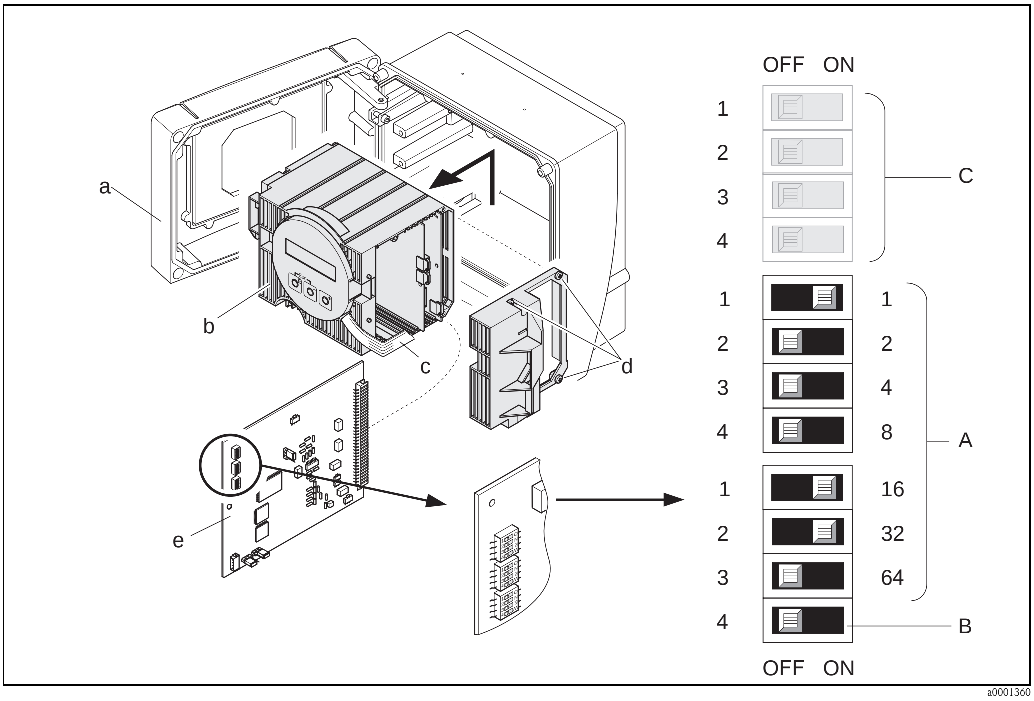


Fig. 84: Addressing with the aid of miniature switches on the I/O board

a Miniature switches for setting the device address (illustrated: 1 + 16 + 32 = device address 49)
b Miniature switches for the address mode (method of addressing)
– OFF = software addressing via local operation/operating program (factory setting)
– ON = hardware addressing via miniature switches
c Miniature switches not assigned

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" → 73

Note!
When using PROFIBUS PA, please note the following:
- The PROFIBUS 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.

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:

Messages: PROFIBUS DP		Messages: PROFIBUS PA
PROSONIC FLOW 93 **START-UP** **RUNNING**	Startup message	**PROSONIC FLOW 93** **START-UP** **RUNNING**
▼		▼
PROSONIC FLOW 93 **DEVICE SOFTWARE** **V XX.XX.XX**	Current software version Software	**PROSONIC FLOW 93** **DEVICE SOFTWARE** **V XX.XX.XX**
▼		▼
PROFIBUS DP **RELAY OUTPUT 1** **RELAY OUTPUT 2** **STATUS INPUT 1**	Existing input/output modules Input/output modules	**PROFIBUS PA**
▼		▼
SYSTEM OK **→ OPERATION**	Beginning of normal measuring mode	**SYSTEM OK** **→ OPERATION**

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 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.

6.3.1 Quick Setup "Sensor Installation"

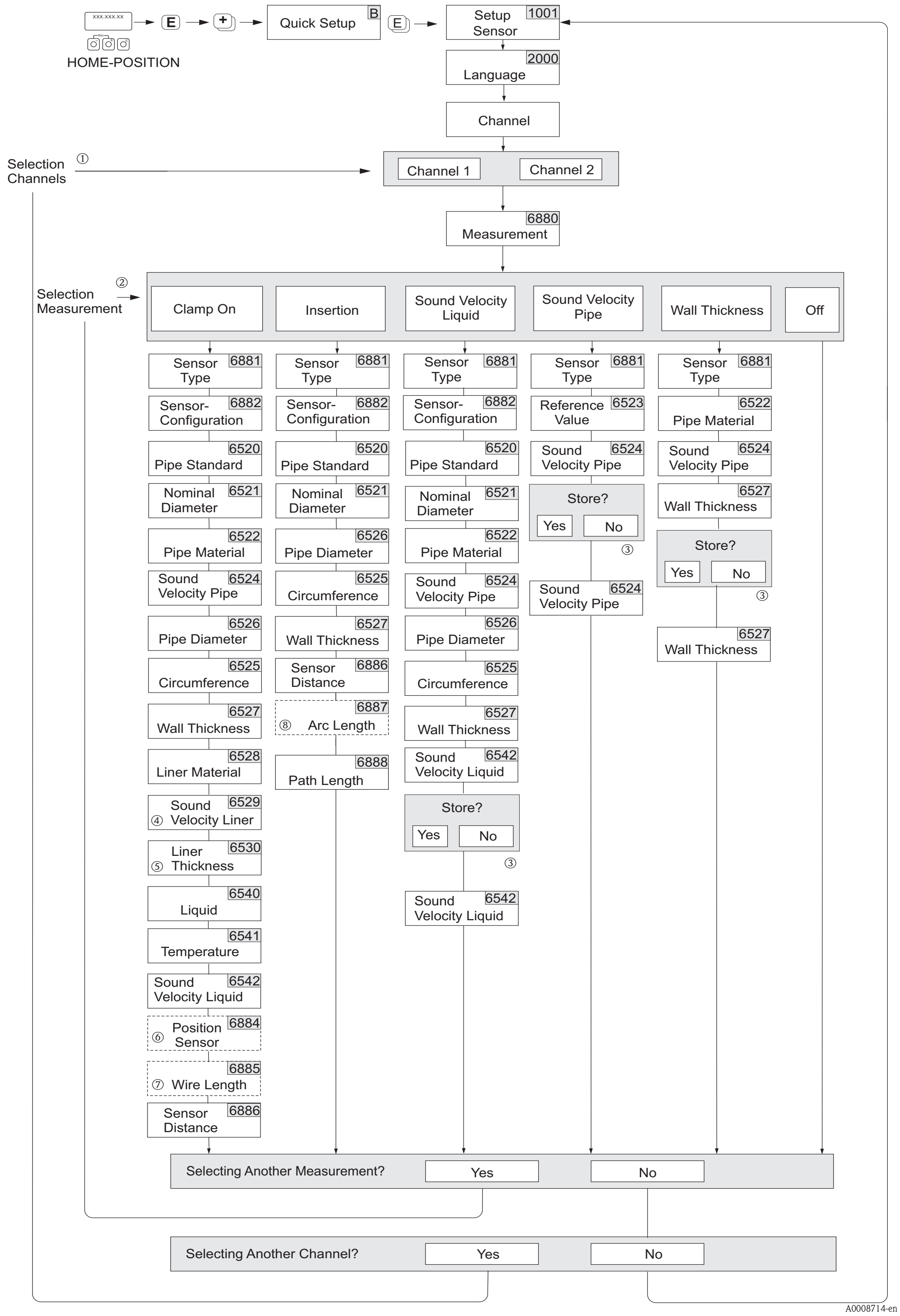


Fig. 85: Quick Setup for sensor mounting

✎ 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 MESURE 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 MESURE 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 MESURE function (6880)

and
- The INSERTION option is selected in the MESURE function (6880)

6.3.2 Quick Setup "Commissioning"

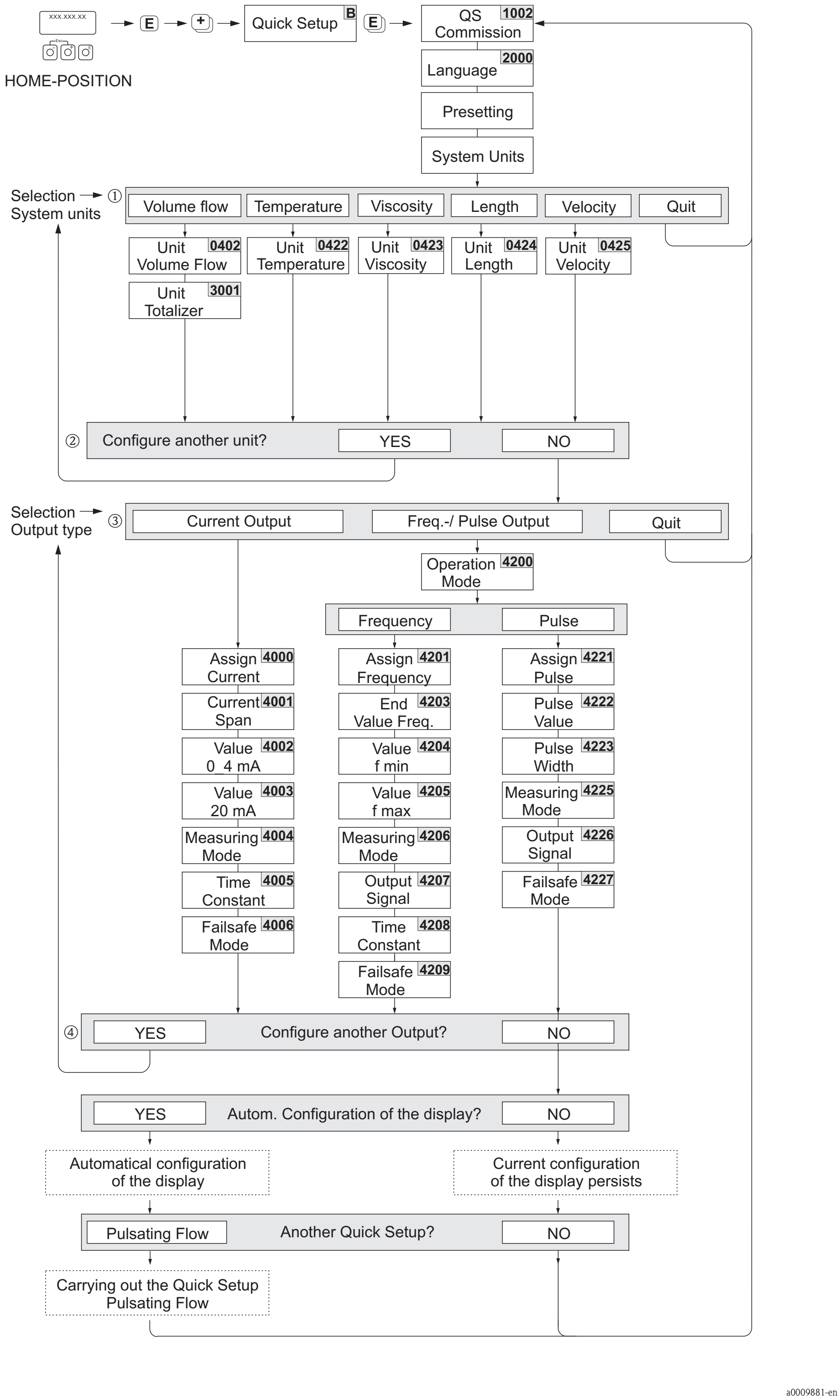


Fig. 86: Quick Setup "Commissioning"

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 = mass 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.

6.3.3 Quick Setup "Communication"

To establish cyclic data transfer, various arrangements between the PROFIBUS master (Class 1) and the measuring device (slave) are required which have to be taken into consideration when configuring various functions. These functions can be configured quickly and easily by means of the "Communication" Quick Setup. The following table explains the parameter configuration options in more detail.

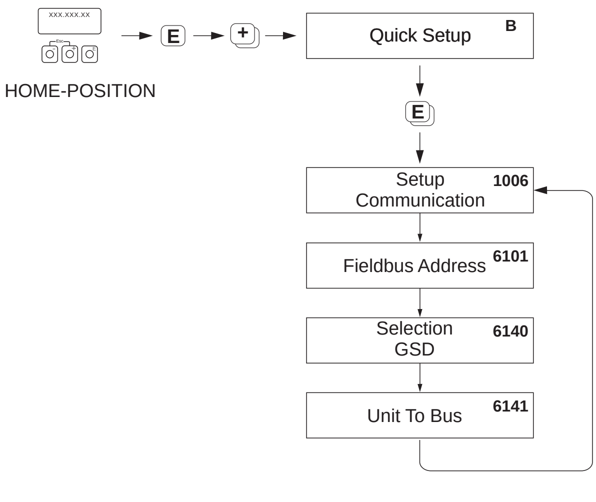


Fig. 87: Quick Setup communication

Quick Setup "Communication"		
HOME position → E → MEASURED VARIABLE (A) MEASURED VARIABLE → + → QUICK SETUP (B) QUICK SETUP → E → QUICK SETUP COMMUNICATION (1006)		
Function No.	Function name	Setting to be selected (+) (to next function with E)
1006	QUICK SETUP COMMUNICATION	YES → After E is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.

Quick Setup "Communication"		
6101	FIELDBUS ADDRESS	Enter the device address (permitted address range: 1 to 126) **Factory setting:** 126
6140	SELECTION GSD	Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master. Options: MANUFACT. SPEC. → The measuring device is operated in the manufacturer-specific mode. PROFILE-GSD → The measuring device is operated in the PROFIBUS Profile mode. **Factory setting:** MANUFACT. SPEC. Note! For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 102 ff.
6141	UNIT TO BUS	If this function is executed, the measured variables are transmitted cyclically to the PROFIBUS master (Class 1) with the system units set in the measuring device. **Options:** OFF SET UNITS (Transmission is started by pressing the E key) Caution! Activating this function can cause a sudden change of the measured variables transmitted to the PROFIBUS master (Class 1); this, in turn, can affect subsequent control routines.
▼		
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 → Exit the function matrix step by step		

6.3.4 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 → 145 ff.

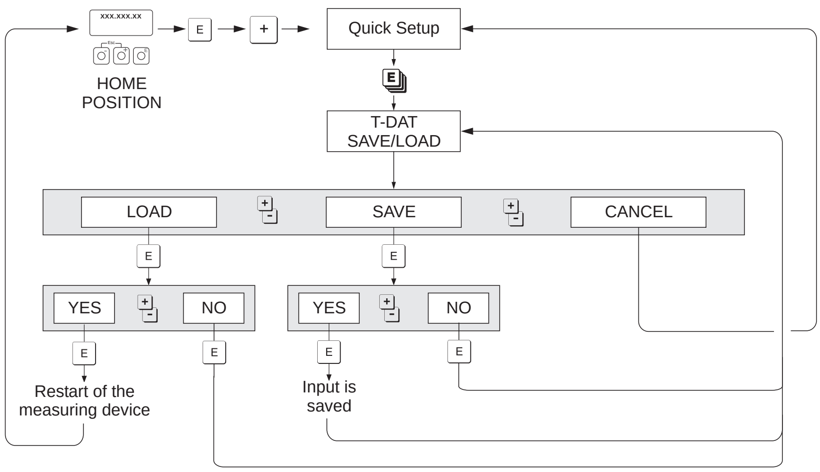


Fig. 88: Data backup/transmission with T-DAT SAVE/LOAD function

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

6.4 Commissioning the PROFIBUS interface

✎ Note!
- All functions required for commissioning are described in detail in the "Description of Device Functions" manual which is a separate part of these Operating Instructions.
- A code (factory setting: 93) must be entered to change device functions, numerical values or factory settings → 🗎 79.

6.4.1 PROFIBUS DP commissioning

The following steps must be carried out in the sequence specified:

1. **Check the hardware write protection:**
   The WRITE PROTECT (6102) parameter indicates whether it is possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

   ✎ Note!
   This check is not needed if operating via the local display.

   BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION (610) →
   WRITE PROTECT (6102) → Display of one of the following options:
   – OFF (factory setting) = write access via PROFIBUS possible
   – ON = write access via PROFIBUS not possible

   Deactivate the write protection if necessary → 🗎 86
2. **Enter the tag name (optional):**
   BASIC FUNCTION (G) → PROFIBUS DP (GBA) →CONFIGURATION(610) →
   TAG NAME (6100)
3. **Configuring the fieldbus address:**
   Software addressing using the local display or an operating program:
   BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION (610) →
   FIELDBUS ADDRESS (6101)

   Hardware addressing via miniature switches → 🗎 87
4. **Select the system unit:**
   a. Determine the units by means of the system units group:
      MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) →
      UNIT MASS FLOW (0400) / UNIT MASS (0401) / UNIT
      VOLUME FLOW (0402) / …
   b. In the function UNIT TO BUS (6141), select the option SET UNITS, so that the measured variables transmitted cyclically to the PROFIBUS master (Class 1) are transmitted with the system units set in the measuring device:
      BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) →
      UNIT TO BUS (6141)

   ✎ Note!
   - The configuration of the system units for the totalizer is described separately → see step 7
   - If the system unit of a measured variable is changed by means of the local operation or an operating program, this initially does not have any effect on the unit that is used to transmit the measured variable to the PROFIBUS master (Class 1). Changed system units of the measured variables are not transmitted to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the function BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) → UNIT TO BUS (6141).

5. **Configuration of the Analog Input function blocks 1 to 8:**
The measuring device has eight Analog Input function blocks (AI modules) via which the various measured variables can be cyclically transmitted to the PROFIBUS master (Class 1). The assignment of a measured variable to the Analog Input function block is shown below using the example of Analog Input function block 1 (AI module, slot 1).

Using the CHANNEL function (6123), you can determine the measured variable (e.g. VOLUME FLOW
CHANNEL 1) to be cyclically transmitted to the PROFIBUS master (Class 1):

a. Select BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTIONBLOCKS (612) → BLOCK SELECTION (6120).
b. Select the option ANALOG INPUT 1.
c. Select the function CHANNEL (6123).
d. Select the option VOLUME FLOW CHANNEL 1.

Possible settings

Measured variable	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting AI function block 1)	273
SOUND VELOCITY CHANNEL 1 (factory setting AI function block 2)	293
FLOW VELOCITY CHANNEL 1 (factory setting AI function block 3)	309
VOLUME FLOW CHANNEL 2 (factory setting AI function block 4)	529
SOUND VELOCITY CHANNEL 2 (factory setting AI function block 5)	549
FLOW VELOCITY CHANNEL 2 (factory setting AI function block 6)	565
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
SIGNAL STRENGTH CHANNEL 1	310
SIGNAL STRENGTH CHANNEL 2	566
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
AVERAGE FLOW VELOCITY	571

Note!
If, when performing the PROFIBUS network configuration, the AI module was integrated in slot 1 to 8, the measured variable selected in the CHANNEL function for the respective Analog Input function block 1 to 8 is transmitted cyclically to the PROFIBUS master (Class 1) → 108 ff.

6. **Setting the measuring mode:**
In the function MEASURING MODE (6601), select the flow portions to be measured by the measuring device.

BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601) → Selection of one of the following options:
– UNIDIRECTIONAL (factory setting) = only the positive flow portions
– BIDIRECTIONAL = the positive and negative flow components

7. **Configuration of totalizers 1 to 3:**
The measuring device has three totalizers. The following example describes the configuration of the totalizer using totalizer 1 as an example.

- Using the CHANNEL function (6133), you can determine the measured variable (e.g. mass flow) to be transmitted to the PROFIBUS master (Class 1) as a totalizer value:
  a. Select BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) → SELECT TOTALIZER (6130).
  b. Select the option TOTALIZER 1.
  c. Go to the function CHANNEL (6133).
  d. Select the option VOLUME FLOW.

  Possible settings → see following table.

- Enter the desired unit for the totalizer:
  BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
  UNIT TOTALIZER (6134)
- Configure totalizer status (e.g. totalize):
  BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
  SET TOTALIZER (6135) → Select the option TOTALIZE
- Set the totalizer mode:
  BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
  TOTALIZER MODE (6137) → Selection of one of the following options:
  – BALANCE (factory setting): calculates the positive and negative flow portions
  – POSITIVE: calculates the positive flow portions
  – NEGATIVE: calculates the negative flow portions
  – HOLD VALUE: The totalizer remains at the last value

  ✎ Note!
  For the calculation of the positive and negative flow portions (BALANCE) or the negative flow portions (NEGATIVE) to be carried out correctly, the selection BIDIRECTIONAL must be active in the function BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601).

Possible settings

Totalizer value/measured variable (channel 1 = active)	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
OFF	0
Totalizer value/measured variable (channel 1 + channel 2 = active)	**ID for CHANNEL function**
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
VOLUME FLOW CHANNEL 2	529
AVERAGE VOLUME FLOW	567
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
OFF	0

✎ Note!
If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).

8. **Select the operating mode:**
   Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master (Class 1).

   BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) →
   SELECTION GSD (6140) → Options:
   – MANUFACT. SPEC. (factory setting): the complete device functionality is available.
   – PROFILE GSD: Prosonic Flow 93 is operated in the PROFIBUS Profile mode.

   ✎ Note!
   For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 🗎 102 ff.

9. **Configuration of cyclic data transmission in the PROFIBUS master**
   A detailed description of the system integration can be found on → 🗎 102.

6.4.2 PROFIBUS PA commissioning

The following steps must be carried out in the sequence specified:

1. **Check the hardware write protection:**
   The WRITE PROTECT (6102) parameter indicates whether it is possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

   ✎ Note!
   This check is not needed if operating via the local display.

   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →
   WRITE PROTECT (6102) → Display of one of the following options:
   – OFF (factory setting) = write access via PROFIBUS possible
   – ON = write access via PROFIBUS not possible

   Deactivate the write protection if necessary → 🗎 86.

2. **Enter the tag name (optional):**
   BASIC FUNCTION (G) → PROFIBUS PA (GCA) →CONFIGURATION(610) →
   TAG NAME (6100)

3. **Configuring the fieldbus address:**
   Software addressing using the local display or an operating program:
   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →
   FIELDBUS ADDRESS (6101)

   Hardware addressing via miniature switches → 🗎 87

4. **Select the system unit:**
   a. Determine the units by means of the system units group:
      MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) →
      UNIT MASS FLOW (0400) / UNIT MASS (0401) / UNIT
      VOLUME FLOW (0402) / …
   b. In the function UNIT TO BUS (6141), select the option SET UNITS, so that the measured variables transmitted cyclically to the PROFIBUS master (Class 1) are transmitted with the system units set in the measuring device:
      BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) →
      UNIT TO BUS)

✎ Note!
- The configuration of the system units for the totalizer is described separately → see step 7
- If the system unit of a measured variable is changed by means of the local operation or an operating program, this initially does not have any effect on the unit that is used to transmit the measured variable to the PROFIBUS master (Class 1). Changed system units of the measured variables are not transmitted to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the function BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) → UNIT TO BUS (6141).

5. **Configuration of the Analog Input function blocks 1 to 8:**
   The measuring device has eight Analog Input function blocks (AI modules) via which the various measured variables can be cyclically transmitted to the PROFIBUS master (Class 1). The assignment of a measured variable to the Analog Input function block is shown below using the example of Analog Input function block 1 (AI module, slot 1).

   Using the CHANNEL function (6123), you can determine the measured variable (e.g. VOLUME FLOW CHANNEL 1) to be cyclically transmitted to the PROFIBUS master (Class 1):
   a. Select BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTIONBLOCKS (612) → BLOCK SELECTION (6120).
   b. Select the option ANALOG INPUT 1.
   c. Select the function CHANNEL (6123).
   d. Select the option VOLUME FLOW CHANNEL 1.

Possible settings

Measured variable	**ID for CHANNEL function**
VOLUME FLOW CHANNEL 1 (factory setting AI function block 1)	273
SOUND VELOCITY CHANNEL 1 (factory setting AI function block 2)	293
FLOW VELOCITY CHANNEL 1 (factory setting AI function block 3)	309
VOLUME FLOW CHANNEL 2 (factory setting AI function block 4)	529
SOUND VELOCITY CHANNEL 2 (factory setting AI function block 5)	549
FLOW VELOCITY CHANNEL 2 (factory setting AI function block 6)	565
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
SIGNAL STRENGTH CHANNEL 1	310
SIGNAL STRENGTH CHANNEL 2	566
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
AVERAGE FLOW VELOCITY	571
✎ Note! If, when performing the PROFIBUS network configuration, the AI module was integrated in slot 1 to 8, the measured variable selected in the CHANNEL function for the respective Analog Input function block 1 to 8 is transmitted cyclically to the PROFIBUS master (Class 1) → 🗎 108 ff.	

6. **Setting the measuring mode:**
   In the function MEASURING MODE (6601), select the flow portions to be measured by the measuring device.

BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601) → Selection of one of the following options:
– UNIDIRECTIONAL (factory setting) = only the positive flow portions
– BIDIRECTIONAL = the positive and negative flow components

7. **Configuration of totalizers 1 to 3:**
The measuring device has three totalizers. The following example describes the configuration of the totalizer using totalizer 1 as an example.

- Using the CHANNEL function (6133), you can determine the measured variable (e.g. mass flow) to be transmitted to the PROFIBUS master (Class 1) as a totalizer value:
  a. Select BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → SELECT TOTALIZER (6130).
  b. Select the option TOTALIZER 1.
  c. Go to the function CHANNEL (6133).
  d. Select the option VOLUME FLOW.

  Possible settings → see following table.

- Enter the desired unit for the totalizer:
  BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → UNIT TOTALIZER (6134)
- Configure totalizer status (e.g. totalize):
  BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → SET TOTALIZER (6135) → Select the option TOTALIZE
- Set the totalizer mode:
  BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → TOTALIZER MODE (6137) → Selection of one of the following options:
  – BALANCE (factory setting): calculates the positive and negative flow portions
  – POSITIVE: calculates the positive flow portions
  – NEGATIVE: calculates the negative flow portions
  – HOLD VALUE: The totalizer remains at the last value

  ✎ Note!
  For the calculation of the positive and negative flow portions (BALANCE) or the negative flow portions (NEGATIVE) to be carried out correctly, the selection BIDIRECTIONAL must be active in the function BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601).

Possible settings

Totalizer value/measured variable (channel 1 = active)	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
OFF	0
Totalizer value/measured variable (channel 1 + channel 2 = active)	**ID for CHANNEL function**
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
VOLUME FLOW CHANNEL 2	529
AVERAGE VOLUME FLOW	567
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
OFF	0

✎ Note!
If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).

8. **Select the operating mode:**
   Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master (Class 1).

   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) →
   SELECTION GSD (6140) → Options:
   – MANUFACT. SPEC. (factory setting): the complete device functionality is available.
   – PROFILE GSD: Prosonic Flow 93 is operated in the PROFIBUS Profile mode.

   ✎ Note!
   For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 🗎 102 ff.

9. **Configuration of cyclic data transmission in the PROFIBUS master**
   A detailed description of the system integration can be found on → 🗎 102.

6.5 PROFIBUS DP/PA system integration

6.5.1 Device master file (GSD file)

For PROFIBUS network configuration, the device master file (GSD file) is needed for every bus user (PROFIBUS slave). The GSD file contains a description of the properties of a PROFIBUS device, such as supported data transmission rate and number of input and output data.
Before configuration takes place, a decision should be made as to which GSD file should be used to operate the measuring device in the PROFIBUS DP/PA master system.

The measuring device supports the following GSD files:
- Prosonic Flow 93 GSD file (manufacturer-specific GSD file, complete device functionality)
- PROFIBUS Profile GSD file

Below you will find a detailed description of the GSD files supported.

Prosonic Flow 93 GSD file (manufacturer-specific GSD file, complete device functionality)

Use this GSD file to access the complete functionality of the measuring device. In this way, device-specific measured variables and functionalities are thus completely available in the PROFIBUS master system. An overview of the modules available (input and output data) is contained on the following pages:
PROFIBUS DP → 🗎 105
PROFIBUS PA → 🗎 116

GSD file with standard or extended format

The GSD file with either the standard or the extended format must be used depending on the configuration software used. When installing the GSD file, the GSD file with the extended format (EH3**x**15xx.gsd) should always be used first.
However, if the installation or the configuration of the measuring device fails with this format, then use the standard GSD (EH3_15xx.gsd). This differentiation is the result of different implementation of the GSD formats in the master systems. Note the specifications of the configuration software.

Name of the Prosonic Flow 93 GSD file

	ID No.	GSD file		Type file	Bitmaps
PROFIBUS DP	1531 (Hex)	Extended Format (recommended): Standard Format:	EH3x1531.gsd EH3_1531.gsd	EH_1531.200	EH_1531_d.bmp/.dib EH_1531_n.bmp/.dib EH_1531_s.bmp/.dib
PROFIBUS PA	1530 (Hex)	Extended Format (recommended): Standard Format:	EH3x1530.gsd EH3_1530.gsd	EH_1530.200	EH_1530_d.bmp/.dib EH_1530_n.bmp/.dib EH_1530_s.bmp/.dib

How to acquire

- Internet (Endress+Hauser) → www.endress.com → Download
- CD-ROM with all GSD files for Endress+Hauser devices → Order No.: 56003894

Contents of the download file from the Internet and the CD-ROM:

- All Endress+Hauser GSD files (standard and extended format)
- Endress+Hauser type files
- Endress+Hauser bitmap files
- Information on the devices

PROFIBUS Profile GSD file

The function scope of the profile GSD file is defined by the PROFIBUS Profile Specification 3.0. The function scope is restricted compared to the manufacturer-specific GSD file (complete device functionality). However, similar devices from different manufacturers can be interchanged with the profile GSD file without the need to reconfigure (interchangeability).

Profile GSD (multivariable) with ID number 9760 (hex): This GSD contains all the function blocks such as AI, DO, DI etc. Prosonic Flow does not support this GSD.

Note!
- Before configuration takes place, a decision should be made as to which GSD file should be used to operate the system.
- This setting can be changed via the local display or via a Class 2 master. For configuring via the local display, see → Page 95.

Supported GSD files: → 81

The Profibus User Organization (PNO) gives each device an identification number (ID No.). The name of the GSD file is derived from this number.
For Endress+Hauser, this ID No. starts with the manufacturer ID 15xx.
To clarify the assignment of the GSD files, the GSD names (apart from the Type files) at Endress+Hauser are as follows:

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

Name of the PROFIBUS Profile GSD file

	ID No.	Profile GSD file
PROFIBUS DP	9741 (Hex)	PA139741.gsd
PROFIBUS PA	9741 (Hex)	PA139741.gsd

Source

Internet (GSD library of the PROFIBUS User Organization) → www.PROFIBUS.com

6.5.2 Selecting the GSD file in the measuring device

Depending on which GSD file is used in the PROFIBUS master system, the corresponding GSD file has to be configured in the device by means of the SELECTION GSD function.

BASIC FUNCTION (G) → PROFIBUS DP/PA (GBA/GCA) → OPERATION (614) → SELECTION GSD (6140)

Prosonic Flow 93 GSD file	→	Select: MANUFACT. SPEC. (factory setting)
Profile GSD file	→	Select: PROFILE-GSD

Example

Before configuration takes place, a decision should be made as to which GSD file should be used to configure the measuring device in the PROFIBUS master system. Below, the use of the manufacturer-specific GSD file (complete device functionality) is shown using **PROFIBUS PA** as an example:

Select the manufacturer-specific GSD file in the measuring device by means of the SELECTION GSD function.

BASIC FUNCTION (G)→ PROFIBUS PA (GCA) → OPERATION (614) → SELECTION GSD (6140) → Select: MANUFACT. SPEC. (factory setting)

1. Before configuring the network, load the corresponding GSD file into the configuration system/master system.

   ✎ Note!
   When installing the GSD file, always first use the GSD file with the extended format (EH3x1530.gsd). However, if the installation or the configuration of the device fails with this format, then use the standard GSD (EH3_1530.gsd).

   Example for the configuration software Siemens STEP 7 of the Siemens PLC family S7-300/400:
   Use the GSD file with the extended format (EH3x1530.gsd). Copy the file to the subdirectory "...\siemens\step7\s7data\gsd". The GSD files also include bitmap files. These bitmap files are used to display the measuring points in image form. The bitmap files must be saved to the directory "...\siemens\step7\s7data\nsbmp".

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

2. The measuring device is a modular PROFIBUS slave, i.e. the desired module configuration (input and output data) must be performed in the next step. This can be done directly by means of the configuration software. A detailed description of the modules supported by the measuring device is provided on the pages indicated:
   PROFIBUS DP → 🗎 105 ff.
   PROFIBUS PA → 🗎 116 ff.

6.5.3 Maximum number of writes

If a nonvolatile device parameter is modified via the cyclic or acyclic data transmission, this change is saved in the EEPROM of the measuring device.
The number of writes to the EEPROM is technically restricted to a maximum of 1 million. Attention must be paid to this limit since, if exceeded, it results in data loss and measuring device failure. For this reason, avoid constantly writing nonvolatile device parameters via the PROFIBUS!

6.6 Cyclic data transmission PROFIBUS DP

Below is a description of the cyclic data transmission when using the Prosonic Flow 93 GSD file (complete device functionality).

6.6.1 Block model

The block model illustrated shows which input and output data Prosonic Flow 93 provides for cyclic data exchange via PROFIBUS DP.

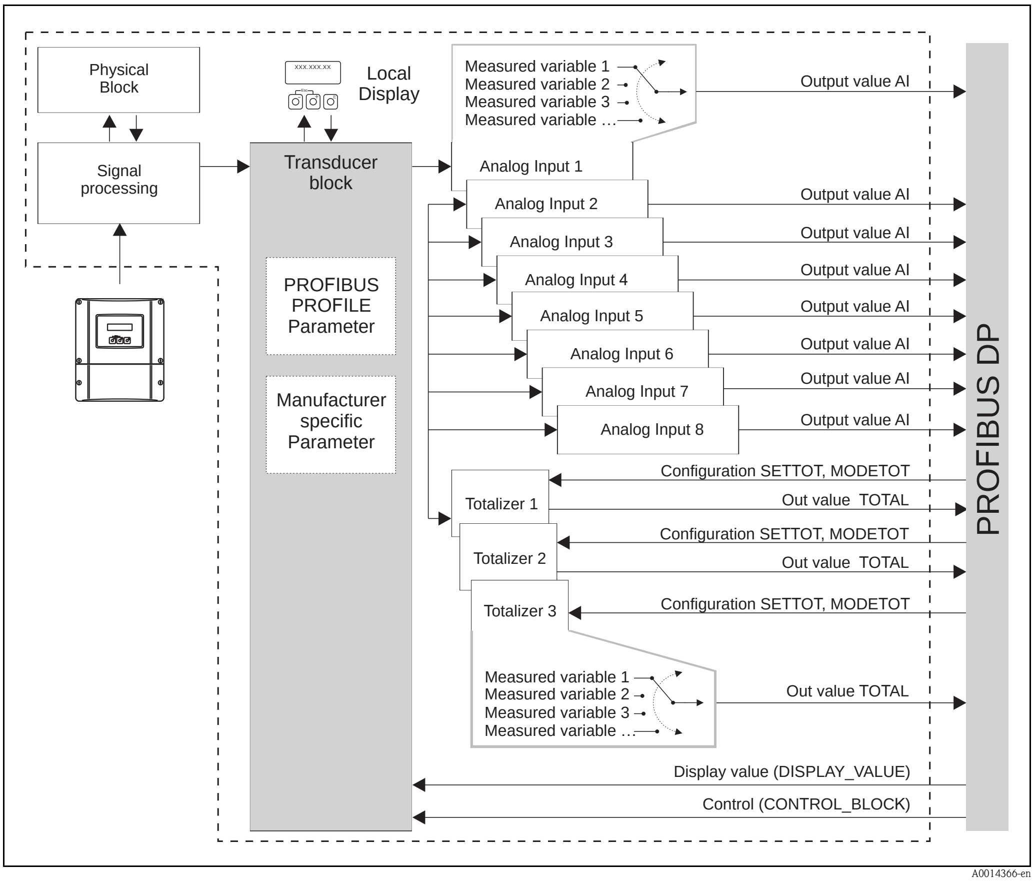


Fig. 89: Block model for Prosonic Flow 93 PROFIBUS DP Profile 3.0

6.6.2 Modules for cyclic data transmission

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the EMPTY_MODULE module.
To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

It is essential to adhere to the following sequence/assignment when configuring the modules in the PROFIBUS master system:

Slot sequence	Module	Description
1	AI	**Analog Input function block 1** Output variable → volume flow channel 1 (factory setting)
2	AI	**Analog Input function block 2** Output variable → sound velocity channel 1 (factory setting)
3	AI	**Analog Input function block 3** Output variable → flow velocity channel 1 (factory setting)
4	AI	**Analog Input function block 4** Output variable → volume flow channel 2 (factory setting)
5	AI	**Analog Input function block 5** Output variable → sound velocity channel 2 (factory setting)
6	AI	**Analog Input function block 6** Output variable → flow velocity channel 2 (factory setting)
7	AI	**Analog Input function block 7** Output variable → average volume flow (factory setting)
8	AI	**Analog Input function block 8** Output variable → average sound velocity (factory setting)
9	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	**Totalizer function block 1** TOTAL → output variable = totalized volume (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
10		**Totalizer function block 2** TOTAL → output variable = totalized volume (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
11		**Totalizer function block 3** TOTAL → output variable = totalized volume (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	Default value for local display
13	CONTROL_BLOCK	Control of device functions

Note!
- The assignment of the measured variables for the Analog Input function blocks (1 to 8) and the Totalizer function blocks (1 to 3) can be changed by means of the CHANNEL function. A detailed description of the individual modules is contained in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system. This can be effected as follows:
  – By means of the local display
  – By means of an operating program (e.g. FieldCare)
  – By switching the supply voltage off and on again.

6.6.3 Description of the modules

AI module (Analog Input)

The corresponding measured variable, including the status, is cyclically transmitted to the PROFIBUS master (Class 1) by means of the AI module (slots 1 to 8). The measured variable is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the measured variable.
Further information on the device status → 137

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
measured variable (IEEE 754 floating point number)				Status

Assignment of the measured variables to the AI module

The AI module can transmit different measured variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Analog Input function blocks 1 to 8 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) →
BLOCK SELECTION (6120): Selection of an Analog Input function block →
CHANNEL (6123): Selection of a measured variable

Possible settings

Measured variable	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting AI function block 1)	273
SOUND VELOCITY CHANNEL 1 (factory setting AI function block 2)	293
FLOW VELOCITY CHANNEL 1 (factory setting AI function block 3)	309
VOLUME FLOW CHANNEL 2 (factory setting AI function block 4)	529
SOUND VELOCITY CHANNEL 2 (factory setting AI function block 5)	549
FLOW VELOCITY CHANNEL 2 (factory setting AI function block 6)	565
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
SIGNAL STRENGTH CHANNEL	310
SIGNAL STRENGTH CHANNEL 2	566
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
AVERAGE FLOW VELOCITY	571
Note! The measured variables for the software options (concentration measurement, viscosity, batching, adv. diagnosis) are only available if the appropriate additional software is installed in the device. If the measured variable is selected even if the additional software is not installed, the value "0" is transmitted to the PROFIBUS master (Class 1) for the measured variable.	

Factory setting:

Module	Analog Input function block	Measured variable	Unit	ID for CHANNEL function
AI (slot 1)	1	VOLUME FLOW CHANNEL 1	m^3/h	277
AI (slot 2)	2	SOUND VELOCITY CHANNEL 1	m/s	273
AI (slot 3)	3	FLOW VELOCITY CHANNEL 1	m/s	398
AI (slot 4)	4	VOLUME FLOW CHANNEL 2	m^3/h	281
AI (slot 5)	5	SOUND VELOCITY CHANNEL 2	m/s	402
AI (slot 6)	6	FLOW VELOCITY CHANNEL 2	m/s	285
AI (slot 7)	7	AVERAGE VOLUME FLOW	m^3/h	402
AI (slot 8)	8	AVERAGE SOUND VELOCITY	m/s	285

Example:

You want to cyclically transmit the VOLUME FLOW CHANNEL 1 to the PROFIBUS master (Class 1) by means of the Analog Input function block 1 (module AI, slot 1) and the SOUND VELOCITY CHANNEL 1 by means of the Analog Input function block 2 (module AI, slot 2).

1. BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 1, then select CHANNEL (6123) = VOLUME FLOW CHANNEL 1
2. BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 2, then select CHANNEL (6123) = SOUND VELOCITY CHANNEL 1

TOTAL module

The measuring device has three Totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS master (Class 1) via the TOTAL module (slots 9 to 11). The totalizer value is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the totalizer value.
Further information on the device status → 📄 137

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Assignment of the measured variables to the TOTAL module

The TOTAL module can transmit different totalizer variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Totalizer function blocks 1 to 3 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the "CHANNEL" function:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
TOTALIZER selection (6130): Selection of a totalizer →
CHANNEL (6133): Selection of a measured variable

Possible settings

Totalizer value/measured variable (channel 1 = active)	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
OFF	0
Totalizer value/measured variable (channel 1 + channel 2 = active)	**ID for CHANNEL function**
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
VOLUME FLOW CHANNEL 2	529
AVERAGE VOLUME FLOW	567
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
OFF	0
Note! If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).	

Factory setting

Module	Totalizer function block	Totalizer value/measured variable	Unit	ID for CHANNEL function
TOTAL (slot 9)	1	VOLUME FLOW CHANNEL 1	m^3	273
TOTAL (slot 10)	2	VOLUME FLOW CHANNEL 1	m^3	273
TOTAL (slot 11)	3	VOLUME FLOW CHANNEL 1	m^3	273

Example:

You want to cyclically transmit the totalized volume flow as totalizer value 1 to the PROFIBUS master (Class 1) by means of the TOTAL module (slot 7):

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
select TOTALIZER (6130): Select TOTALIZER 1, then select CHANNEL (6133) = VOLUME FLOW

SETTOT_TOTAL module

The module combination SETTOT_TOTAL (slots 9 to 11) consists of the functions SETTOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT)
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

In the SETTOT function, the totalizer can be controlled via control variables.
The following control variables are supported:
- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer preset

Note!
After the totalizer value has been reset to 0 or set to the preset value, the totalizing continues automatically. The control variable does not have to be changed to 0 again to restart totalizing. Stopping totalizing is controlled in the SETTOT_MODETOT_TOTAL module via the MODETOT function → 110.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 🗎 108.

Data structure of the SETTOT_TOTAL module combination

Output data:

SETTOT
Byte 1
Control

Input data:

TOTAL				
Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

SETTOT_MODETOT_TOTAL module

The module combination SETTOT_MODETOT_TOTAL (slots 9 to 11) consists of the functions SETTOT, MODETOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer can be configured via the automation system (MODETOT).
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

For a description of the SETTOT function, refer to SETOT_TOTAL module. → 🗎 109

MODETOT function

In the MODETOT function, the totalizer can be configured via control variables.
The following settings are possible:
- 0 = Balance (factory setting), calculates the positive and negative flow portions
- 1 = calculates the positive flow portions
- 2 = calculates the negative flow portions
- 3 = Totalizing is stopped

✎ Note!
For the calculation of the positive and negative flow portions (control variable 0) or the negative flow portions only (control variable 2) to be carried out correctly, the option BIDIRECTIONAL must be active in the MEASURING MODE (6601) function.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 🗎 108

Data structure of the SETTOT_MODETOT_TOTAL module combination

Output data:

SETTOT	MODETOT
Byte 1	Byte 2
Control	Configuration

Input data:

TOTAL				
Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Example of using the SETTOT_MODETOT_TOTAL module

If the SETTOT function is set to 1 (= reset the totalizer), the value for the aggregated total is reset to 0.
If the aggregated total of the totalizer should constantly retain the value 0, the MODETOT function must first be set to 3 (= totalizing is stopped) and then the SETTOT function must be set to 1 (= reset the totalizer).

DISPLAY_VALUE module

Any value (IEEE 754 floating point number), including status, can be cyclically transmitted via the PROFIBUS master (Class 1) directly to the local display using the DISPLAY_VALUE module (slot 10). Display value assignment to the main line, additional line or info line can be configured via the local display itself or an operating program (e.g. FieldCare).

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Displayed value (IEEE 754 floating point number)				Status

Status

The measuring device interprets the status in accordance with PROFIBUS Profile Specification Version 3.0. The statuses OK, BAD and UNCERTAIN are indicated on the local display by a corresponding symbol → 77.

CONTROL_BLOCK module

By means of the CONTROL_BLOCK module (slot 11), the measuring device is able to process device-specific control variables from the PROFIBUS master (Class 1) in cyclic data transmission (e.g. switching on positive zero return).

Supported control variables of the CONTROL_BLOCK module

The following device-specific control variables can be activated by changing the output byte from 0 → x:

Module	Control variables
CONTROL_BLOCK	0 → 1: Reserved 0 → 2: Positive zero return channel 1 ON 0 → 3: Positive zero return channel 1 OFF 0 → 4: Zero point adjustment channel 1 0 → 5: Reserved 0 → 6: Reserved 0 → 7: Reserved 0 → 8: Channel 1 operation UNIDIRECTIONAL 0 → 9: Channel 1 operation BIDIRECTIONAL 0 → 10 to 15: Reserved 0 → 16: Positive zero return channel 2 ON 0 → 17: Positive zero return channel 2 OFF 0 → 18: Zero point adjustment channel 2 0 → 19 to 21: Reserved 0 → 22: Channel 2 operation UNIDIRECTIONAL 0 → 22: Channel 2 operation BIDIRECTIONAL
Note! The control (e.g. switching on positive zero return) is executed by cyclic data transmission if the output byte switches from "0" to the bit pattern in question. The output byte must always switch from "0". A switchback to "0" does not have any effect.	

Example (change the output byte)

From		To	Result
0	→	2	Positive zero return for channel 1 is switched on.
2	→	0	No effect
0	→	3	Positive zero return for channel 1 is switched off.
3	→	2	No effect

Output data

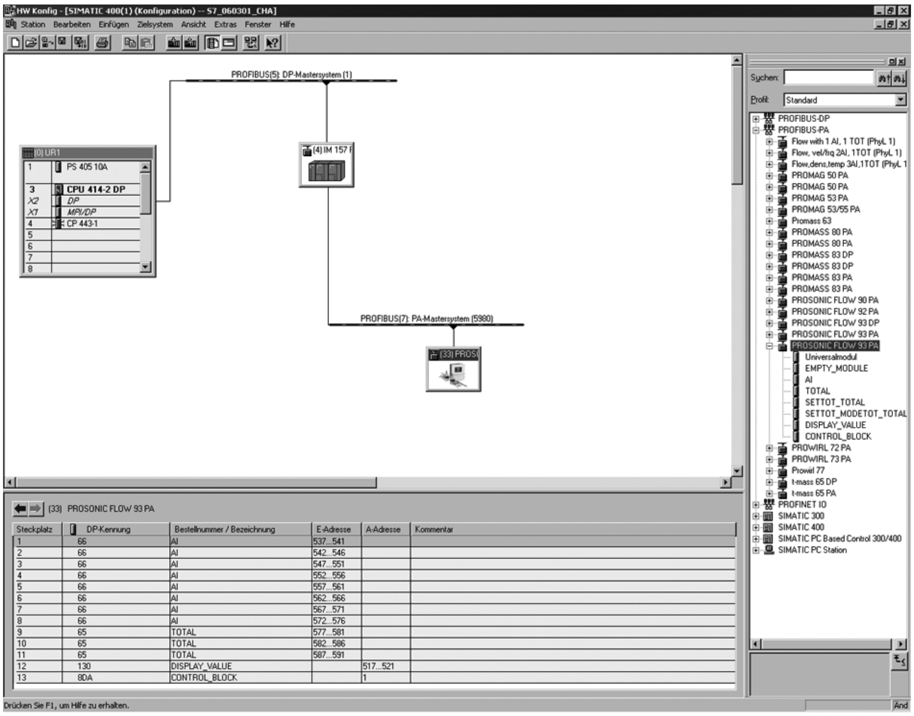
Byte 1
Control

EMPTY_MODULE module

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable - it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules. Gaps between configured modules have to be assigned the EMPTY_MODULE module.
For a more detailed description, see → 🗎 106.

6.6.4 Configuration examples with Simatic S7 HW-Konfig

Example 1:



A0008802

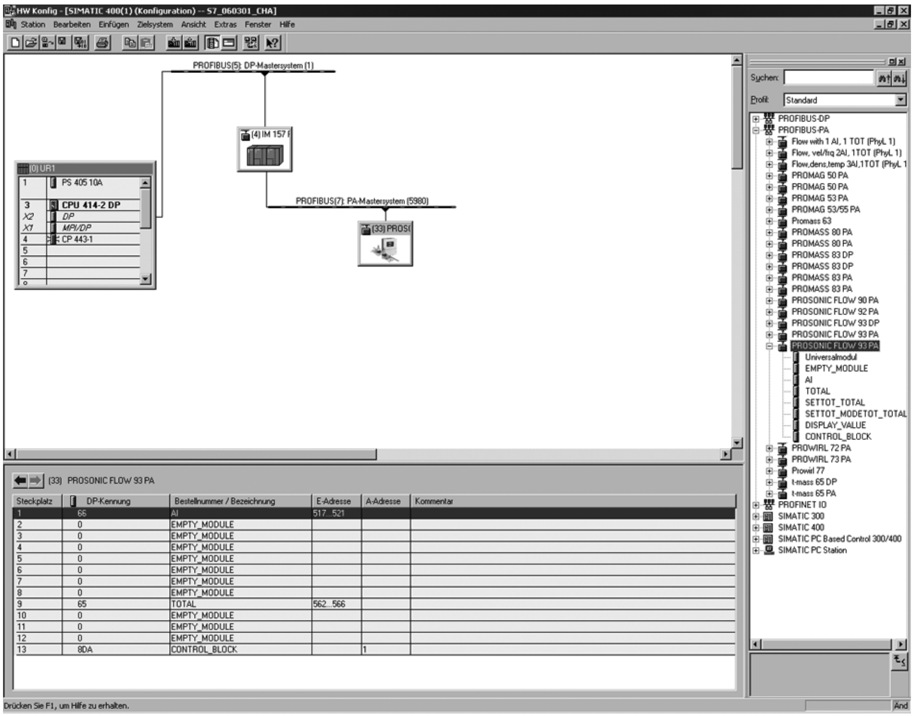
Fig. 90: Complete configuration using the Prosonic Flow 93 GSD file

It is essential to adhere to the following sequence when configuring the modules in the PROFIBUS master (Class 1):

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → (factory setting)
2	AI	5	–	**Analog Input function block 2** Output variable → (factory setting)
3	AI	5	–	**Analog Input function block 3** Output variable → (factory setting)
4	AI	5	–	**Analog Input function block 4** Output variable → (factory setting)
5	AI	5	–	**Analog Input function block 5** Output variable → (factory setting)
6	AI	5	–	**Analog Input function block 6** Output variable → (factory setting)
7	AI	5	–	**Analog Input function block 7** Output variable → (factory setting)
8	AI	5	–	**Analog Input function block 8** Output variable → (factory setting)
9	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 1** TOTAL → output variable = totalized mass flow (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration

Slot sequence	Module	Byte length input data	Byte length output data	Description
10	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 2** TOTAL → output variable = totalized mass flow (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
11	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 3** TOTAL → output variable = totalized mass flow (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	–	5	Default value for local display
13	CONTROL_BLOCK	–	1	Control of device functions

Example 2:



A0008803

Fig. 91: In this configuration example, modules that are not needed are replaced by the module EMPTY_MODULE. The Promass Flow 93 GSD file is used.

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 9) and the cyclic control of device functions CONTROL_BLOCK (slot 13) are activated. The mass flow (factory setting) is read out cyclically by the measuring device by means of the Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the mass flow (factory setting) by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → mass flow (factory setting)
2	EMPTY_MODULE	–	–	Empty
3	EMPTY_MODULE	–	–	Empty
4	EMPTY_MODULE	–	–	Empty
5	EMPTY_MODULE	–	–	Empty
6	EMPTY_MODULE	–	–	Empty
7	EMPTY_MODULE	–	–	Empty
8	EMPTY_MODULE	–	–	Empty
9	TOTAL	5	–	**Totalizer function block 1** TOTAL → output variable = totalized mass flow (factory setting)
10	EMPTY_MODULE	–	–	Empty
11	EMPTY_MODULE	–	–	Empty
12	EMPTY_MODULE	–	–	Empty
13	CONTROL_BLOCK	–	1	Control of device functions

6.7 Cyclic data transmission PROFIBUS PA

Below is a description of the cyclic data transmission when using the Prosonic Flow 93 GSD file (complete device functionality).

6.7.1 Block model

The block model illustrated shows which input and output data Prosonic Flow 93 provides for cyclic data exchange via PROFIBUS PA.

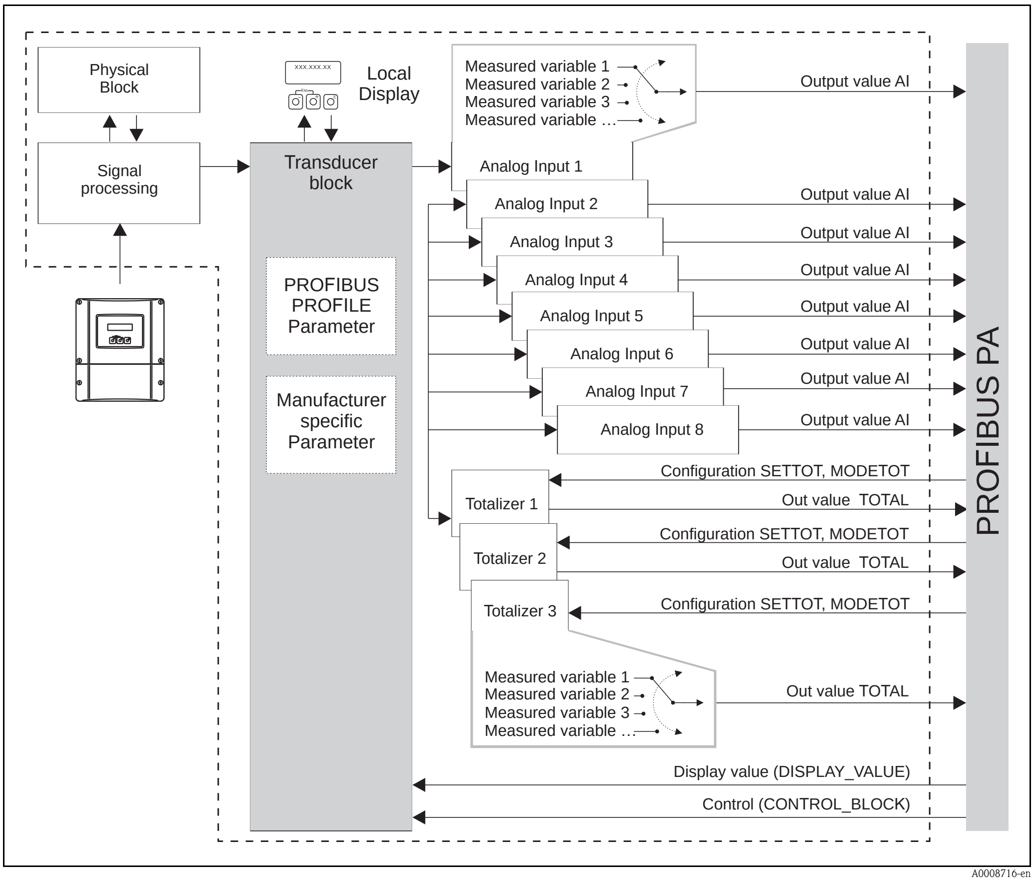


Fig. 92: Block model for Prosonic Flow 93 PROFIBUS PA Profile 3.0

6.7.2 Modules for cyclic data transmission

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable - it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the EMPTY_MODULE module.
To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

It is essential to adhere to the following sequence/assignment when configuring the modules in the PROFIBUS master system:

Slot sequence	Module	Description
1	AI	**Analog Input function block 1** Output variable → volume flow channel 1 (factory setting)
2	AI	**Analog Input function block 2** Output variable → sound velocity channel 1 (factory setting)
3	AI	**Analog Input function block 3** Output variable → flow velocity channel 1 (factory setting)
4	AI	**Analog Input function block 4** Output variable → volume flow channel 2 (factory setting)
5	AI	**Analog Input function block 5** Output variable → sound velocity channel 2 (factory setting)
6	AI	**Analog Input function block 6** Output variable → flow velocity channel 2 (factory setting)
7	AI	**Analog Input function block 7** Output variable → average volume flow (factory setting)
8	AI	**Analog Input function block 8** Output variable → average sound velocity (factory setting)
9		**Totalizer function block 1** TOTAL → output variable = totalized volume (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
10	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	**Totalizer function block 2** TOTAL → output variable = totalized volume (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
11		**Totalizer function block 3** TOTAL → output variable = totalized volume (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	Default value for local display
13	CONTROL_BLOCK	Control of device functions

✎ Note!

- The assignment of the measured variables for the Analog Input function blocks (1 to 8) and the Totalizer function blocks (1 to 3) can be changed by means of the CHANNEL function. A detailed description of the individual modules is contained in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system. This can be effected as follows:
  – By means of the local display
  – By means of an operating program (e.g. FieldCare)
  – By switching the supply voltage off and on again.

6.7.3 Description of the modules

AI module (Analog Input)

The corresponding measured variable, including the status, is cyclically transmitted to the PROFIBUS master (Class 1) by means of the AI module (slots 1 to 8). The measured variable is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the measured variable.
Further information on the device status → 137

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
measured variable (IEEE 754 floating point number)				Status

Assignment of the measured variables to the AI module

The AI module can transmit different measured variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Analog Input function blocks 1 to 8 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) →
BLOCK SELECTION (6120): Selection of an Analog Input function block →
CHANNEL (6123): Selection of a measured variable

Possible settings

Measured variable	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting AI function block 1)	273
SOUND VELOCITY CHANNEL 1 (factory setting AI function block 2)	293
FLOW VELOCITY CHANNEL 1 (factory setting AI function block 3)	309
VOLUME FLOW CHANNEL 2 (factory setting AI function block 4)	529
SOUND VELOCITY CHANNEL 2 (factory setting AI function block 5)	549
FLOW VELOCITY CHANNEL 2 (factory setting AI function block 6)	565
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
SIGNAL STRENGTH CHANNEL	310
SIGNAL STRENGTH CHANNEL 2	566
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
AVERAGE FLOW VELOCITY	571
Note! The measured variables for the software options (concentration measurement, viscosity, batching, adv. diagnosis) are only available if the appropriate additional software is installed in the device. If the measured variable is selected even if the additional software is not installed, the value "0" is transmitted to the PROFIBUS master (Class 1) for the measured variable.	

Factory setting:

Module	Analog Input function block	Measured variable	Unit	ID for CHANNEL function
AI (slot 1)	1	VOLUME FLOW CHANNEL 1	m^3/h	277
AI (slot 2)	2	SOUND VELOCITY CHANNEL 1	m/s	273
AI (slot 3)	3	FLOW VELOCITY CHANNEL 1	m/s	398
AI (slot 4)	4	VOLUME FLOW CHANNEL 2	m^3/h	281
AI (slot 5)	5	SOUND VELOCITY CHANNEL 2	m/s	402
AI (slot 6)	6	FLOW VELOCITY CHANNEL 2	m/s	285
AI (slot 7)	7	AVERAGE VOLUME FLOW	m^3/h	402
AI (slot 8)	8	AVERAGE SOUND VELOCITY	m/s	285

Example:

You want to cyclically transmit the VOLUME FLOW CHANNEL 1 to the PROFIBUS master (Class 1) by means of the Analog Input function block 1 (module AI, slot 1) and the SOUND VELOCITY CHANNEL 1 by means of the Analog Input function block 2 (module AI, slot 2).

1. BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 1, then select CHANNEL (6123) = VOLUME FLOW CHANNEL 1
2. BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 2, then select CHANNEL (6123) = SOUND VELOCITY CHANNEL 1

TOTAL module

The measuring device has three Totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS master (Class 1) via the TOTAL module (slots 9 to 11). The totalizer value is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the totalizer value.
Further information on the device status → 137

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Assignment of the measured variables to the TOTAL module

The TOTAL module can transmit different totalizer variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Totalizer function blocks 1 to 3 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the "CHANNEL" function:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
Select TOTALIZER (6130): Selection of a totalizer →
CHANNEL (6133): Selection of measured variable

Possible settings

Totalizer value/measured variable (channel 1 = active)	ID for CHANNEL function
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
OFF	0
Totalizer value/measured variable (channel 1 + channel 2 = active)	**ID for CHANNEL function**
VOLUME FLOW CHANNEL 1 (factory setting totalizer 1 to 3)	273
VOLUME FLOW CHANNEL 2	529
AVERAGE VOLUME FLOW	567
VOLUME FLOW SUM	568
VOLUME FLOW DIFFERENCE	569
OFF	0
✎ Note! If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).	

Factory setting

Module	Totalizer function block	Totalizer value/measured variable	Unit	ID for CHANNEL function
TOTAL (slot 9)	1	VOLUME FLOW CHANNEL 1	m^3	273
TOTAL (slot 10)	2	VOLUME FLOW CHANNEL 1	m^3	273
TOTAL (slot 11)	3	VOLUME FLOW CHANNEL 1	m^3	273

Example:

You want to cyclically transmit the totalized volume flow as totalizer value 1 to the PROFIBUS master (Class 1) by means of the TOTAL module (slot 7):

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
select TOTALIZER (6130): Select TOTALIZER 1, then select CHANNEL (6133) = VOLUME FLOW

SETTOT_TOTAL module

The module combination SETTOT_TOTAL (slots 9 to 11) consists of the functions SETTOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

In the SETTOT function, the totalizer can be controlled via control variables.
The following control variables are supported:
- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer preset

✎ Note!
After the totalizer value has been reset to 0 or set to the preset value, the totalizing continues automatically. The control variable does not have to be changed to 0 again to restart totalizing. Stopping totalizing is controlled in the SETTOT_MODETOT_TOTAL module via the MODETOT function → 110.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 108.

Data structure of the SETTOT_TOTAL module combination

Output data	Input data				
SETTOT	**TOTAL**				
Byte 1	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**
Control	Totalizer value (IEEE 754 floating point number)				Status

SETTOT_MODETOT_TOTAL module

The module combination SETTOT_MODETOT_TOTAL (slots 9 to 11) consists of the functions SETTOT, MODETOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT)
- The totalizer can be configured via the automation system (MODETOT)
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

For a description of the SETTOT function, refer to SETOT_TOTAL module → 109.

MODETOT function

In the MODETOT function, the totalizer can be configured via control variables.
The following settings are possible:
- 0 = Balance (factory setting), calculates the positive and negative flow portions
- 1 = calculates the positive flow portions
- 2 = calculates the negative flow portions
- 3 = Totalizing is stopped

Note!
For the calculation of the positive and negative flow portions (control variable 0) or the negative flow portions only (control variable 2) to be carried out correctly, the option BIDIRECTIONAL must be active in the MEASURING MODE (6601) function.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 108.

Data structure of the SETTOT_MODETOT_TOTAL module combination

Output data		Input data				
SETTOT	**MODETOT**	**TOTAL**				
Byte 1	**Byte 2**	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**
Control	Configuration	Totalizer value (IEEE 754 floating point number)				Status

Example of using the SETTOT_MODETOT_TOTAL module

If the SETTOT function is set to 1 (= reset the totalizer), the value for the aggregated total is reset to 0.
If the aggregated total of the totalizer should constantly retain the value 0, the MODETOT function must first be set to 3 (= totalizing is stopped) and then the SETTOT function must be set to 1 (= reset the totalizer).

DISPLAY_VALUE module

Any value (IEEE 754 floating point number), including status, can be cyclically transmitted via the PROFIBUS master (Class 1) directly to the local display using the DISPLAY_VALUE module (slot 10). Display value assignment to the main line, additional line or info line can be configured via the local display itself or an operating program (e.g. FieldCare).

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Displayed value (IEEE 754 floating point number)				Status

Status

The measuring device interprets the status in accordance with PROFIBUS Profile Specification Version 3.0. The statuses OK, BAD and UNCERTAIN are indicated on the local display by a corresponding symbol → 📄 77.

CONTROL_BLOCK module

By means of the CONTROL_BLOCK module (slot 11), the measuring device is able to process device-specific control variables from the PROFIBUS master (Class 1) in cyclic data transmission (e.g. switching on positive zero return).

Supported control variables of the CONTROL_BLOCK module

The following device-specific control variables can be activated by changing the output byte from 0 → x:

Module	Control variables
CONTROL_BLOCK	0 → 1: Reserved 0 → 2: Positive zero return channel 1 ON 0 → 3: Positive zero return channel 1 OFF 0 → 4: Zero point adjustment channel 1 0 → 5: Reserved 0 → 6: Reserved 0 → 7: Reserved 0 → 8: Channel 1 operation UNIDIRECTIONAL 0 → 9: Channel 1 operation BIDIRECTIONAL 0 → 10 to 15: Reserved 0 → 16: Positive zero return channel 2 ON 0 → 17: Positive zero return channel 2 OFF 0 → 18: Zero point adjustment channel 2 0 → 19 to 21: Reserved 0 → 22: Channel 2 operation UNIDIRECTIONAL 0 → 22: Channel 2 operation BIDIRECTIONAL
✎ Note! The control (e.g. switching on positive zero return) is executed by cyclic data transmission if the output byte switches from "0" to the bit pattern in question. The output byte must always switch from "0". A switchback to "0" does not have any effect.	

Example (change the output byte)

From		To	Result
0	→	2	Positive zero return for channel 1 is switched on.
2	→	0	No effect
0	→	3	Positive zero return for channel 1 is switched off.
3	→	2	No effect

Output data

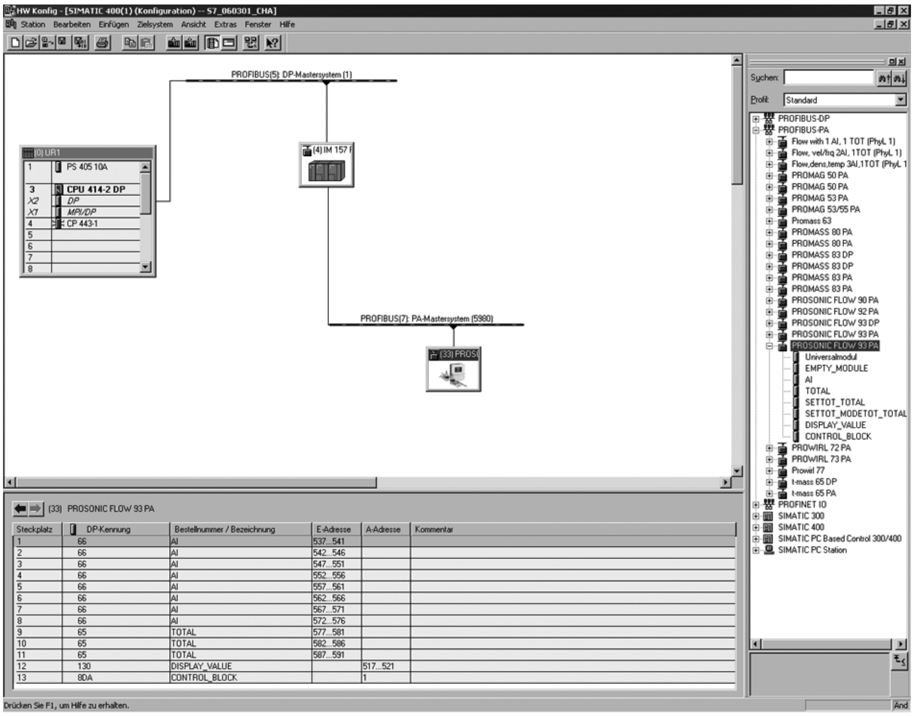
Byte 1
Control

EMPTY_MODULE module

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules. Gaps between configured modules have to be assigned the EMPTY_MODULE module.
For a more detailed description, see → 🗎 106.

6.7.4 Configuration examples with Simatic S7 HW-Konfig

Example 1:



A0008802

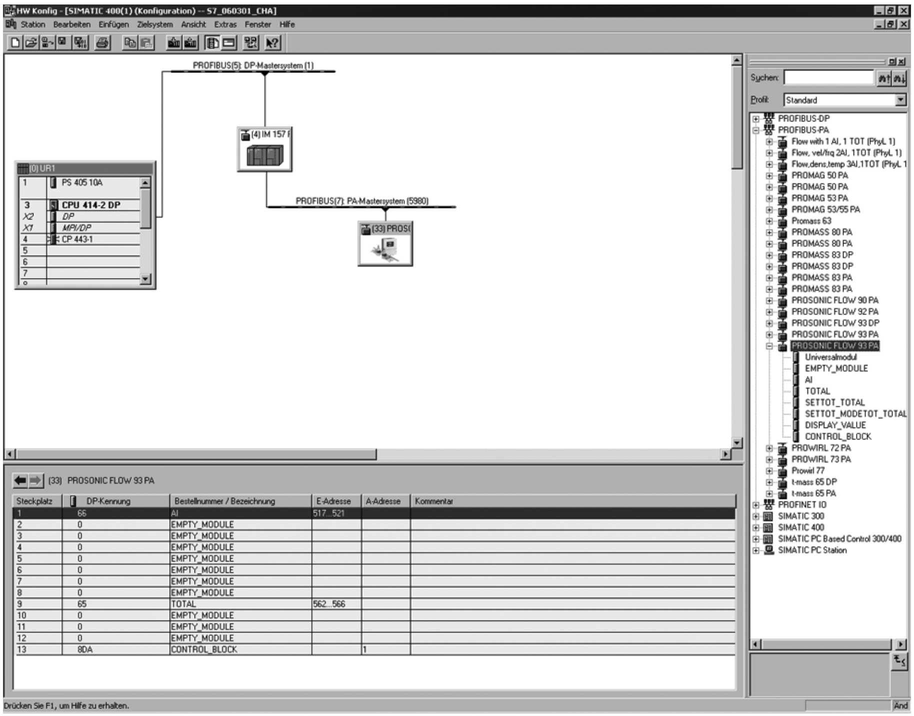
Fig. 93: Complete configuration using the Prosonic Flow 93 GSD file

It is essential to adhere to the following sequence when configuring the modules in the PROFIBUS master (Class 1):

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → (factory setting)
2	AI	5	–	**Analog Input function block 2** Output variable → (factory setting)
3	AI	5	–	**Analog Input function block 3** Output variable → (factory setting)
4	AI	5	–	**Analog Input function block 4** Output variable → (factory setting)
5	AI	5	–	**Analog Input function block 5** Output variable → (factory setting)
6	AI	5	–	**Analog Input function block 6** Output variable → (factory setting)
7	AI	5	–	**Analog Input function block 7** Output variable → (factory setting)
8	AI	5	–	**Analog Input function block 8** Output variable → (factory setting)
9	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 1** TOTAL → output variable = totalized mass flow (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration

Slot sequence	Module	Byte length input data	Byte length output data	Description
10	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 2** TOTAL → output variable = totalized mass flow (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
11	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 3** TOTAL → output variable = totalized mass flow (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	–	5	Default value for local display
13	CONTROL_BLOCK	–	1	Control of device functions

Example 2:



A0008803

Fig. 94: In this configuration example, modules that are not needed are replaced by the module EMPTY_MODULE. The Promass Flow 93 GSD file is used.

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 9) and the cyclic control of device functions CONTROL_BLOCK (slot 13) are activated. The mass flow (factory setting) is read out cyclically by the measuring device by means of the Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the mass flow (factory setting) by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → mass flow (factory setting)
2	EMPTY_MODULE	–	–	Empty
3	EMPTY_MODULE	–	–	Empty
4	EMPTY_MODULE	–	–	Empty
5	EMPTY_MODULE	–	–	Empty
6	EMPTY_MODULE	–	–	Empty
7	EMPTY_MODULE	–	–	Empty
8	EMPTY_MODULE	–	–	Empty
9	TOTAL	5	–	**Totalizer function block 1** TOTAL → output variable = totalized mass flow (factory setting)
10	EMPTY_MODULE	–	–	Empty
11	EMPTY_MODULE	–	–	Empty
12	EMPTY_MODULE	–	–	Empty
13	CONTROL_BLOCK	–	1	Control of device functions

6.8 Acyclic data transmission PROFIBUS DP/PA

Acyclic data transmission is used to transmit parameters during commissioning or maintenance, or to display additional measured variables that are not included in cyclic data traffic. Thus parameters for identification, control or adjustment in the various blocks (Physical Block, Transducer Block, function block) can be changed while the device is in the process of cyclic data transmission with a PLC.

The measuring device supports the two basic types of acyclic data transmission:
- MS2AC communication with 2 available SAPs
- MS1AC communication

6.8.1 Master class 2 acyclic (MS2AC)

MS2AC is acyclic data transmission between a field device and a Class 2 master (e.g. FieldCare, Siemens PDM etc. → 81). During this process, the master opens a communication channel via an SAP (Service Access Point) to access the device.
All parameters to be exchanged with a device via PROFIBUS must be made known to a Class 2 master. This assignment to each individual parameter takes place either in a device description (DD), a DTM (Device Type Manager), or inside a software component in the master via slot and index addressing.

When using MS2AC communication, note the following:
- As described above, a Class 2 master accesses a device via special SAPs.
  Therefore, the number of Class 2 masters that can communicate with a device simultaneously is limited to the number of SAPs available for this data transmission.
- The use of a Class 2 master increases the cycle time of the bus system. This must be taken into account when programming the control system used.

6.8.2 Master class 1 acyclic (MS1AC)

In MS1AC, a cyclic master, that is already reading the cyclic data from the device or writing to the device opens the communication channel via the SAP 0x33 (special Service Access Point for MS1AC) and can then read or write a parameter acyclically like a Class 2 master via the slot and the index (if supported).
When using MS1AC communication, note the following:
- Currently, few PROFIBUS masters on the market support this data transmission.
- MS1AC is not supported by all PROFIBUS devices.
- In the user program, note that constant writing of parameters (for example, at every cycle of the program) can drastically reduce the service life of a device. Acyclically written parameters are written to voltage-resistant memory modules (EEPROM, Flash etc.). These memory modules are designed for a limited number of write operations. In normal operation without MS1AC (during parameter configuration), the number of write operations does not even come close to this number. If programming is incorrect, this maximum number can be reached quickly, drastically reducing a device's service life.

  ✎ Note!
  The memory module of the measuring device is designed for one million writes.

6.9 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 → 🗎 156 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

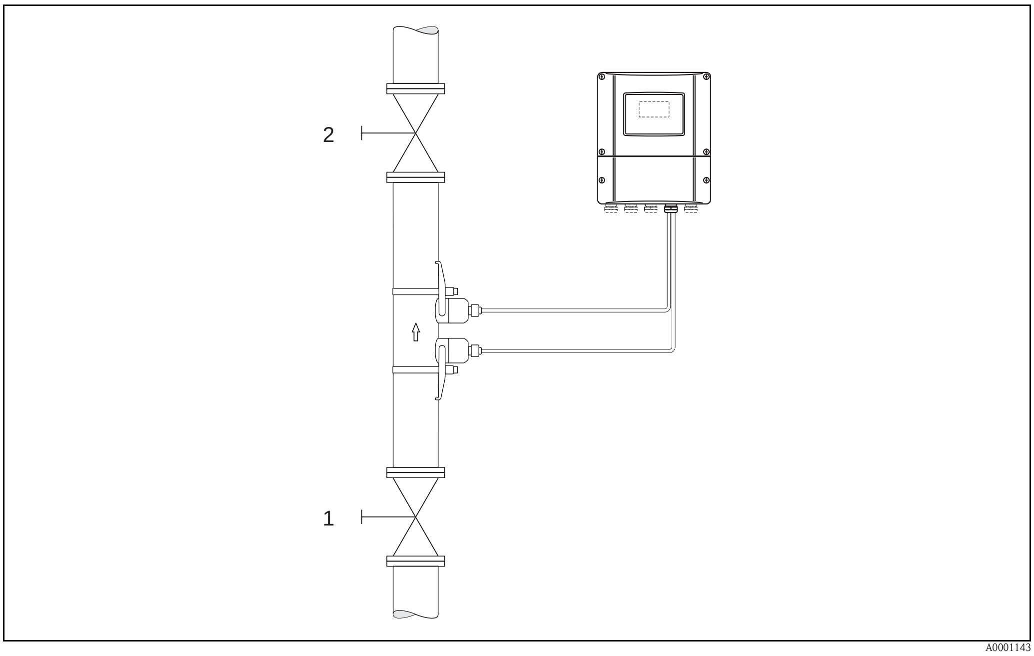


Fig. 95: Zero point adjustment and shutoff valves

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 E. Acknowledge the security prompt with YES and confirm again with E. 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 (- +).

6.10 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.

6.10.1 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 94 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

Accessory	Description	Order code
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
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.

<table>
<tr><th colspan="2">Check the display</th></tr>
<tr><td>No display visible and no output signals present.</td><td>1. Check the supply voltage → Terminals 1, 2
2. Check device fuse → 🗎 150
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 → 🗎 145</td></tr>
<tr><td>No display visible, but output signals are present.</td><td>1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → 🗎 145 ff.
2. Display module defective → Order spare part → 🗎 145
3. Meter electronics defective → Order spare part → 🗎 145</td></tr>
<tr><td>Display texts are in a foreign language.</td><td>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.</td></tr>
<tr><td colspan="2">▼</td></tr>
<tr><th colspan="2">Error messages on display</th></tr>
<tr><td colspan="2">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 → 🗎 80
▪ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.</td></tr>
<tr><td colspan="2">System error (device error) has occurred → 🗎 137</td></tr>
<tr><td colspan="2">Process error (application error) has occurred → 🗎 143</td></tr>
<tr><td colspan="2">▼</td></tr>
<tr><th colspan="2">Faulty connection to control system</th></tr>
<tr><td colspan="2">No connection can be made between the control system and the device.
Check the following points:</td></tr>
<tr><td>Supply voltage
Transmitter</td><td>Check the supply voltage → Terminals 1/2</td></tr>
<tr><td>Device fuse</td><td>Check device fuse → 🗎 150
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</td></tr>
<tr><td>Fieldbus connection</td><td>PROFIBUS PA: Check data line
Terminal 26 = PA +
Terminal 27 = PA –

PROFIBUS DP: Check data line
Terminal 26 = B (RxD/TxD-P)
Terminal 27 = A (RxD/TxD-N)</td></tr>
<tr><td>Fieldbus connector
(only for PROFIBUS PA)</td><td>▪ Check pin assignment/wiring → 🗎 57
▪ Check connection between connector/fieldbus port.
Is the coupling ring tightened correctly?</td></tr>
</table>

Fieldbus voltage (only for PROFIBUS PA)	Check that a min. bus voltage of 9 V DC is present at terminals 26/27. Permissible range: 9 to 32 V DC
Network structure	Check permissible fieldbus length and number of spurs. → 🗎 58
Basic current (only for PROFIBUS PA)	Is there a basic current of min. 11 mA?
Bus address	Check bus address: make sure there are no double assignments
Bus termination (Termination)	Has the PROFIBUS network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in communication.
Power consumption, permitted feed current (only for PROFIBUS PA)	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply.
▼	
System or process error messages	
System or process errors which occur during commissioning or operation can be displayed via the local display or an operating program (e.g. FieldCare) in the ACTUAL SYSTEM CONDITION function.	
▼	
Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → 🗎 143

9.2 System error messages

Serious system errors are **always** recognized by the instrument as "Fault message" and are shown as a lightning flash (ϟ) on the display! Fault messages immediately affect the outputs. Simulations and positive zero return, on the other hand, are classed and displayed as "Notice messages".

Caution!
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!

Note!
See the information on → 🗎 80

9.2.1 Displaying the device status on PROFIBUS DP/PA

Display in the operating program (acyclic data transmission)

The device status can be queried using an operating program (e.g. FieldCare):
Function block SUPERVISION → SYSTEM → OPERATION → ACTUAL SYSTEM CONDITION

Display in the PROFIBUS master system (cyclic data transmission)

If the AI or TOTAL modules are configured for cyclic data transmission, the device status is coded in accordance with PROFIBUS Profile Specification 3.0 and transmitted with the measured value to the PROFIBUS master (Class 1) by means of the quality byte (byte 5). The quality byte is split into the "quality status", "quality substatus" and "limits" segments.

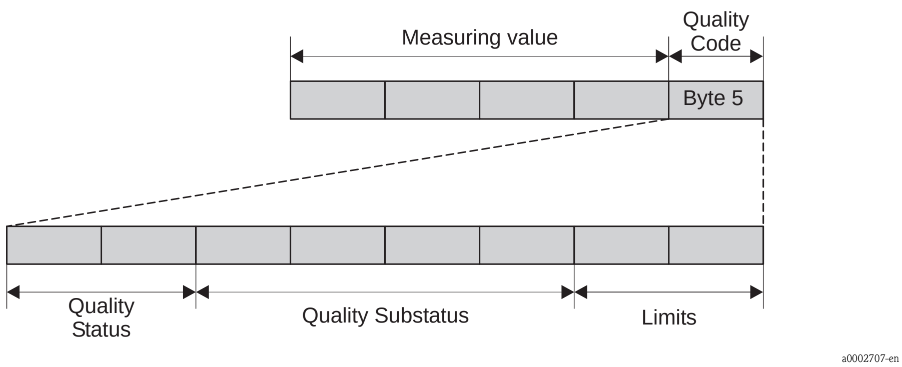


Fig. 96: Structure of the quality byte

The content of the quality byte depends on the failsafe mode error behavior configured in the corresponding Analog Input function block. Depending on which failsafe mode has been set in the FAILSAFE_TYPE function, the following status information is transmitted to the PROFIBUS master (Class 1) via the quality byte:

- For FAILSAFE_TYPE→ FSAFE VALUE:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x48 0x49 0x4A	UNCERTAIN	Substitute set	OK Low High

- For FAILSAFE_TYPE→ LAST GOOD (factory setting):

If a valid output value was available before the failure:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x44 0x45 0x46	UNCERTAIN	Last usable value	OK Low High

If no valid output value was available before the failure:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x4C 0x4D 0x4E	UNCERTAIN	Initial Value	OK Low High

- For FAILSAFE_TYPE → WRONG VALUE:
  For status information, see the table in the following section.

Note!
The FAILSAFE_TYPE function can be configured in the corresponding Analog Input function block 1 to 8 or Totalizer function block 1 to 3 by means of an operating program (e.g. FieldCare).

9.2.2 List of system error messages

No.	Device status message (local display)	PROFIBUS measured value status: Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits	Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part Page 145 ff.)
Depicted on the local display: S = System error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without any effect on the outputs)							
001	S: CRITICAL FAILURE ϟ: # 001	0x0F	BAD	Device Failure	Constant	ROM / RAM failure	*Cause*: ROM/RAM error. Error when accessing the program memory (ROM) or random access memory (RAM) of the processor. *Remedy:* Replace the amplifier board.
011	S: AMP HW EEPROM ϟ: # 011	0x0F	BAD	Device Failure	Constant	Amplifier EEPROM failure	*Cause:* Amplifier with faulty EEPROM *Remedy:* Replace the amplifier board.
012	S: AMP SW EEPROM ϟ: # 012	0x0F	BAD	Device Failure	Constant	Amplifier EEPROM data inconsistent	*Cause:* Error when accessing data of the amplifier EEPROM. *Remedy:* Perform a "warm start" (= start the measuring system without disconnecting main power). *Access:* SUPERVISION → SYSTEM → OPERATION → SYSTEM RESET (→ RESTART)

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part Page 145 ff.)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
041	S: TRANSM. HW-DAT ϟ: # 041	0x0F	BAD	Device Failure	Constant	T-DAT failure	*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 electronics boards if necessary. 4. Plug the T-DAT into the amplifier board.
042	S: TRANSM. SW-DAT ϟ: # 042	0x0F	BAD	Device Failure	Constant	T-DAT data inconsistent	
082	S: SENS. DOWN CH1 ϟ: # 082	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH1	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – Check the cable connection between the sensor and the transmitter. – Check that the sensor connector is fully screwed in. – The sensor may be defective. – Incorrect sensor connected. Change the sensor type specified: *Access:* BASIC FUNCTION → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE
083	S: SENS. DOWN CH2 ϟ: # 083	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH2	
085	S: SENSOR UP CH1 ϟ: # 085	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH1	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – Check the cable connection between the sensor and the transmitter. – Check that the sensor connector is fully screwed in. – The sensor may be defective. – Incorrect sensor connected. Change the sensor type specified: *Access:* BASIC FUNCTION → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE
086	S: SENSOR UP CH2 ϟ: # 086	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH2	

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Device status message (local display)</th><th colspan="4">PROFIBUS measured value status</th><th rowspan="2">Extended diagnostic message in the PROFIBUS master</th><th rowspan="2">Cause/remedy (spare part Page 145 ff.)</th></tr>
<tr><th>Quality code (HEX) Measured value status</th><th>Quality status</th><th>Quality substatus</th><th>Limits</th></tr>
<tr><td>121</td><td>S: A / C COMPATIB.
!: # 121</td><td>0x0F</td><td>BAD</td><td>Device Failure</td><td>Constant</td><td>Amplifier and I/O board only partially compatible</td><td>Cause:
Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality).
Note!
■ This message is only listed in the error history.
■ Nothing is displayed on the display.
Remedy:
Module with lower software version has either to be updated by FieldCare with the required software version or the module has to be replaced.</td></tr>
<tr><td>205</td><td>S: LOAD T-DAT
!: # 205</td><td>0x0F</td><td>BAD</td><td>Device Failure</td><td>Constant</td><td>Save to T-DAT failed</td><td rowspan="2">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. Using the spare part set number, check whether the new, replacement DAT is compatible with the existing measuring electronics.
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 electronics boards if necessary.
4. Plug the T-DAT into the amplifier board.</td></tr>
<tr><td>206</td><td>S: SAVE T-DAT
!: # 206</td><td>0x0F</td><td>BAD</td><td>Device Failure</td><td>Constant</td><td>Restore from T-DAT failed</td></tr>
<tr><td>261</td><td>S: COMMUNICAT. I/O
ϟ: # 261</td><td>0x18
0x19
0x1A</td><td>BAD</td><td>No Communication</td><td>O.K.
Low
High</td><td>Communication failure</td><td>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</td></tr>
<tr><td>392</td><td>S: SIGNAL LOW CH1
ϟ: # 392</td><td rowspan="2">0x0F</td><td rowspan="2">BAD</td><td rowspan="2">Device Failure</td><td rowspan="2">Constant</td><td rowspan="2">Attenuation of acoustic measurement section too high</td><td rowspan="2">Cause:
System error. Attenuation of acoustic measurement section too high.
Remedy:
– Check to see if the coupling fluid must be renewed.
– It is possible that the fluid indicates too much attenuation.
– It is possible that the pipe indicates too much attenuation.
– Check the sensor spacing (Installation dimensions).
– Reduce the number of traverses if possible.</td></tr>
<tr><td>393</td><td>S: SIGNAL LOW CH1
ϟ: # 393</td></tr>
</table>

No.	Device status message (local display)	PROFIBUS measured value status: Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits	Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part Page 145 ff.)
469	S: PIPE DATA CH1 ϟ: # 469	0x0F	BAD	Device Failure	Constant	Pipe data ? CH1	*Cause:* The internal diameter is negative. *Remedy:* In the "PIPE DATA" function group, check the values of the functions "OUTER DIAMETER" and "WALL THICKNESS" or "LINING THICKNESS".
470	S: PIPE DATA CH2 ϟ: # 470					Pipe data ? CH2	
492	S: S. V. RANGE CH1 ϟ: # 492	0x03	BAD	Non specific (uncertain status)	Constant	Sound velocity in CH1 outside the range	*Cause:* Process error. The sound velocity in channel 1 or channel 2 is outside the search range of the transmitter. *Remedy:* – Check the installation dimensions. – If possible, check the sound velocity of the liquid or check the specialist literature. If the current sound velocity is outside the defined search range, the corresponding parameters must be changed in the LIQUID DATA function group. More detailed information on this is provided in the "Description of Device Functions, Prosonic Flow 93" manual (BA 077D/06/en) under the SOUND VELOCITY LIQUID (6542) function (local display)
493	S: S. V. RANGE CH2 ϟ: # 493					Sound velocity in CH2 outside the range	
495	S: INTERFERENCE CH1 ϟ: # 495	0x43	UNCERTAIN	Non specific (uncertain status)	Constant	Interference CH 1	*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! The sensor configuration **must be** changed if the measuring device indicates zero flow or low flow. *Remedy:* In the SENSOR CONFIGURATION function, change the number of traverses from 2 or 4 to 1 or 3 and mount the sensors accordingly.
496	S: INTERFERENCE CH2 ϟ: # 496					Interference CH 2	
501	S: SW.-UPDATE ACT. !: # 501	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	New amplifier software loaded	*Cause:* New amplifier or communication software version is loaded. Currently no other functions are possible. *Remedy:* Wait until process is finished. The device will restart automatically.
502	S: UP-/DOWNLO. ACT. !: # 502					Upload/download of device data active	*Cause:* Up- or downloading the device data via operating program. Currently no other functions are possible. *Remedy:* Wait until process is finished.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part Page 145 ff.)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
602	S: POS.0-RET. CH1 !: # 602	0x53	UNCERTAIN	Sensor conversion not accurate (measured value from sensor not accurate)	Constant	Positive zero return active CH1	*Cause:* System error Positive zero return channel 1 or channel 2 is active. *Remedy:* Switch off positive zero return. *Access:* BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → POS. ZERO RETURN (→ OFF)
603	S: POS.0-RET. CH2 !: # 603					Positive zero return active CH2	
604	S: POS.0-RET. CH1&2 !: # 604	0x53	UNCERTAIN	Sensor conversion not accurate (measured value from sensor not accurate)	Constant	Positive zero return active CH1&2	*Cause:* System error Positive zero return channel 1 and channel 2 are active. *Remedy:* Switch off positive zero return. *Access:* BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → POS. ZERO RETURN (→ OFF)
691	S: SIM. FAILSAFE. !: # 691	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	Simulation failsafe active	*Cause:* Simulation of response to error is active. *Remedy:* Switch off simulation: *Access:* SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
694	S: SIM. MEASUR. CH1 !: # 694	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Simulation of measuring CH1 active	*Cause:* System error Simulation of the volume flow for channel 1 or 2 active *Remedy:* Switch off simulation: *Access:* SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)
695	S: SIM. MEASUR. CH2 !: # 695					Simulation of measuring CH2 active	
696	S: SIM.FAILSAFE CH1 !: # 696	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Simulation failsafe act. CH1	*Cause:* System error Simulation of the failsafe mode for channel 1 or 2 active *Remedy:* Switch off simulation: *Access:* SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
697	S: SIM.FAILSAFE CH2 !: # 697					Simulation failsafe act. CH2	
698	S: DEV. TEST ACT. !: # 698	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Device test via Fieldcheck active	*Cause:* The measuring device is being checked on site via the test and simulation device.

9.3 Process error messages

Note!
See the information on → 80 ff.

9.3.1 Displaying the device status on PROFIBUS DP/PA

Further information → 137

9.3.2 List of process error messages

No.	Device status message (local display)	PROFIBUS measured value status: Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits	Extended diagnostic message in the PROFIBUS master	Cause/remedy
P = Process error ϟ = Fault message (*with* an effect on the outputs) ! = Notice message (*without* any effect on the outputs)							
743	P: 0-ADJ. FAIL CH1 ϟ: # 800	0x40	UNCERT AIN	Non specific (uncertain status)	No limits	Zeropoint adjustment is not possible	*Cause:* The measuring device is being checked on site via the test and simulation device. *Remedy:* Make sure that zero point adjustment is carried out at "zero flow" only (v = 0 m/s) → 128.
744	P: DENS. DEV. LIMIT ϟ: # 801	0x40 0x41 0x42	UNCERT AIN	Non specific (uncertain status)	O.K. Low High	Density outside the limit	

9.4 Process errors without messages

Symptoms	Rectification
Note! You may have to change or correct certain settings of the function matrix in order to rectify faults. The functions outlined below are described in detail in the "Description of Device Functions" manual.	
Measured value reading fluctuates even though flow is steady.	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 these instances, please contact your Endress+Hauser service organization.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service 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 Endress+Hauser** 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 → 145 ff.

9.5 Response of outputs to errors

Note!
The failsafe mode of the current, pulse and frequency outputs can be customized by means of various functions in the function matrix. More detailed information on this is provided in the "Description of Device Functions" manual.

You can use positive zero return to reset the signals of the current, pulse and frequency outputs to their fallback value, or reset measured value transmission via fieldbus to "0", for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions. This function has priority over all other device functions; simulations are suppressed, for example.

Failsafe mode of outputs		
	Process/system error present	Positive zero return activated
Caution! System or process errors defined as "Notice messages" have no effect whatsoever on the outputs. See the information on → Page 80 ff.		
Current output	MIN. CURRENT Depending on the option selected in the CURRENT SPAN function (see "Description of Device Functions" manual), the current output is set to the value of the lower signal on alarm level. MAX. CURRENT Depending on the option selected in the CURRENT SPAN function (see "Description of Device Functions" manual), the current output is set to the value of the upper signal on alarm level. HOLD VALUE Measured value displayed is based on the last measured value saved before the error occurred. ACTUAL VALUE Measured value displayed is based on the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow".
Pulse output	FALLBACK VALUE Signal output → No pulses HOLD VALUE The last valid measured value (before the error occurred) is output. ACTUAL VALUE The fault is ignored, i.e. the measured value is output as normal on the basis of the current flow measurement.	Output signal corresponds to "zero flow".
Frequency output	FALLBACK VALUE Signal output → 0 Hz FAILSAFE LEVEL Output of the frequency specified in the FAILSAFE VALUE function. HOLD VALUE The last valid measured value (before the error occurred) is output. ACTUAL VALUE The fault is ignored, i.e. the measured value is output as normal on the basis of the current flow measurement.	Output signal corresponds to "zero flow".
Relay output	In the event of a fault or power supply failure: Relay → deenergized The "Description of Device Functions" manual contains detailed information on relay switching response for various configurations such as error message, flow direction, limit value, etc.	No effect on the relay output
PROFIBUS	→ 137	–

9.6 Spare parts

The previous sections contain a detailed troubleshooting guide → 135 ff..
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

9.6.1 PROFIBUS DP

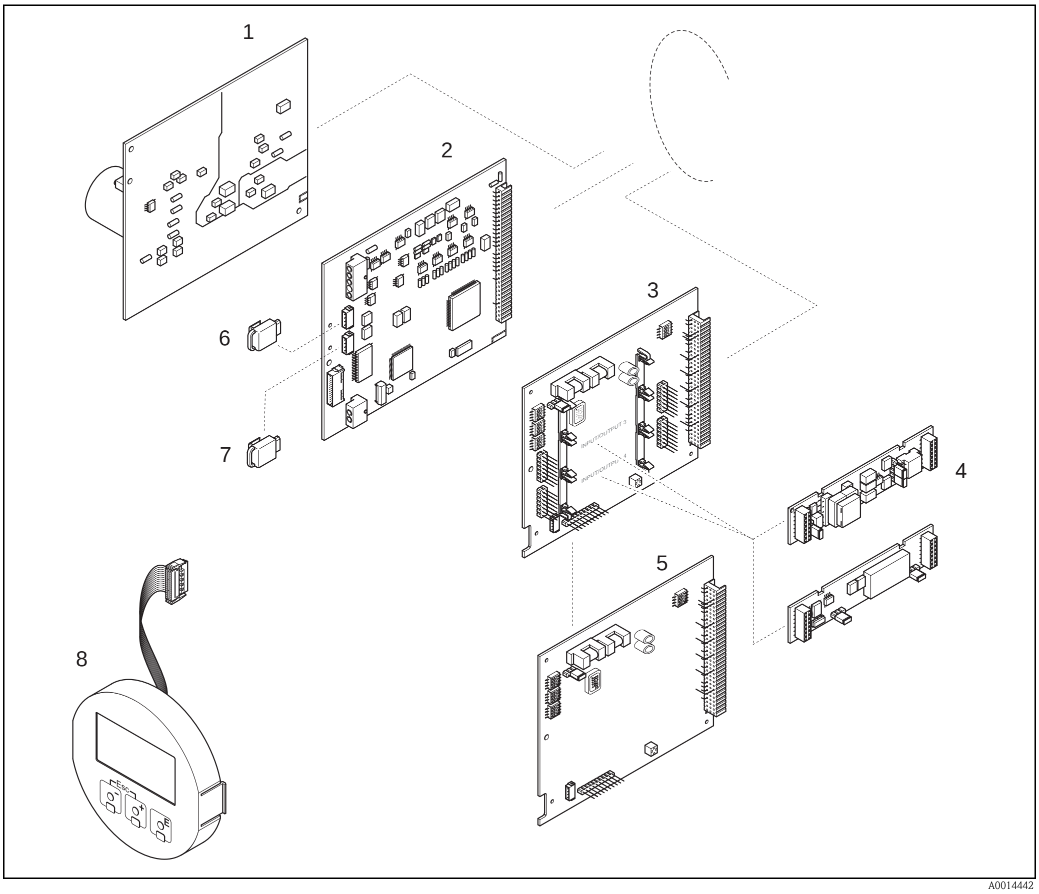
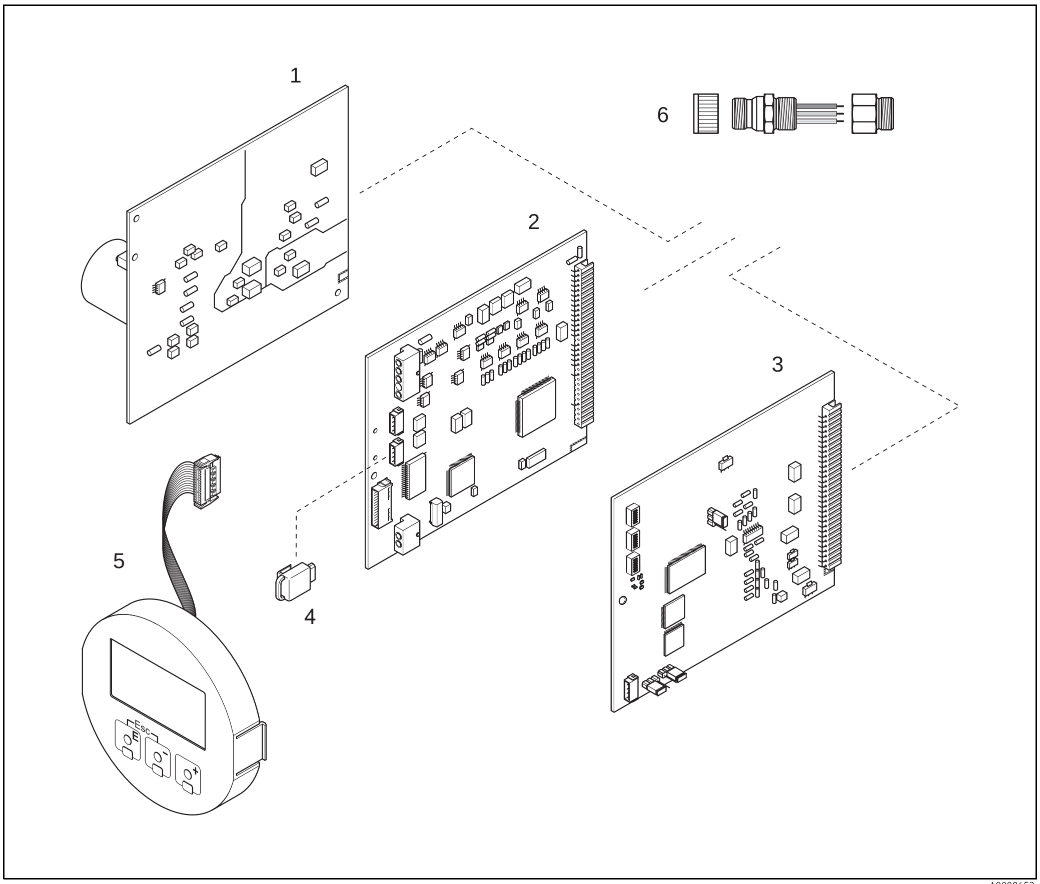


Fig. 97: Spare parts for PROFIBUS DP transmitters (field and wall-mount housing)

1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
2 Amplifier board
3 I/O board (COM module), flexible
4 Pluggable input/output submodules; ordering structure
5 I/O board (COM module), permanent assignment
6 S-DAT (sensor data storage device)
7 T-DAT (transmitter data storage device)
8 Display module

9.6.2 PROFIBUS PA



A0008653

Fig. 98: Spare parts for PROFIBUS PA transmitters (field and wall-mount housing)

1 *Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)*
2 *Amplifier board*
3 *I/O board (COM module), permanent assignment*
4 *T-DAT (transmitter data storage device)*
5 *Display module*
6 *Fieldbus connector consisting of protection cap, connector, adapter PG 13.5/M20.5 (only for PROFIBUS PA, Order No. 50098037)*

9.6.3 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 replacement parts.

Installing and removing printed circuit boards → Fig. 99:

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. Remove submodules (8.2) (optional):
   No tools are required for removing the submodules (outputs) from the I/O board. Installation is also a no-tools operation.

   Caution!
   Only certain combinations of submodules on the I/O board are permissible → 65.
   The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:

   "INPUT / OUTPUT 3" slot = terminals 22/23
   "INPUT / OUTPUT 4" slot = terminals 20/21
7. Installation is the reverse of the removal procedure.

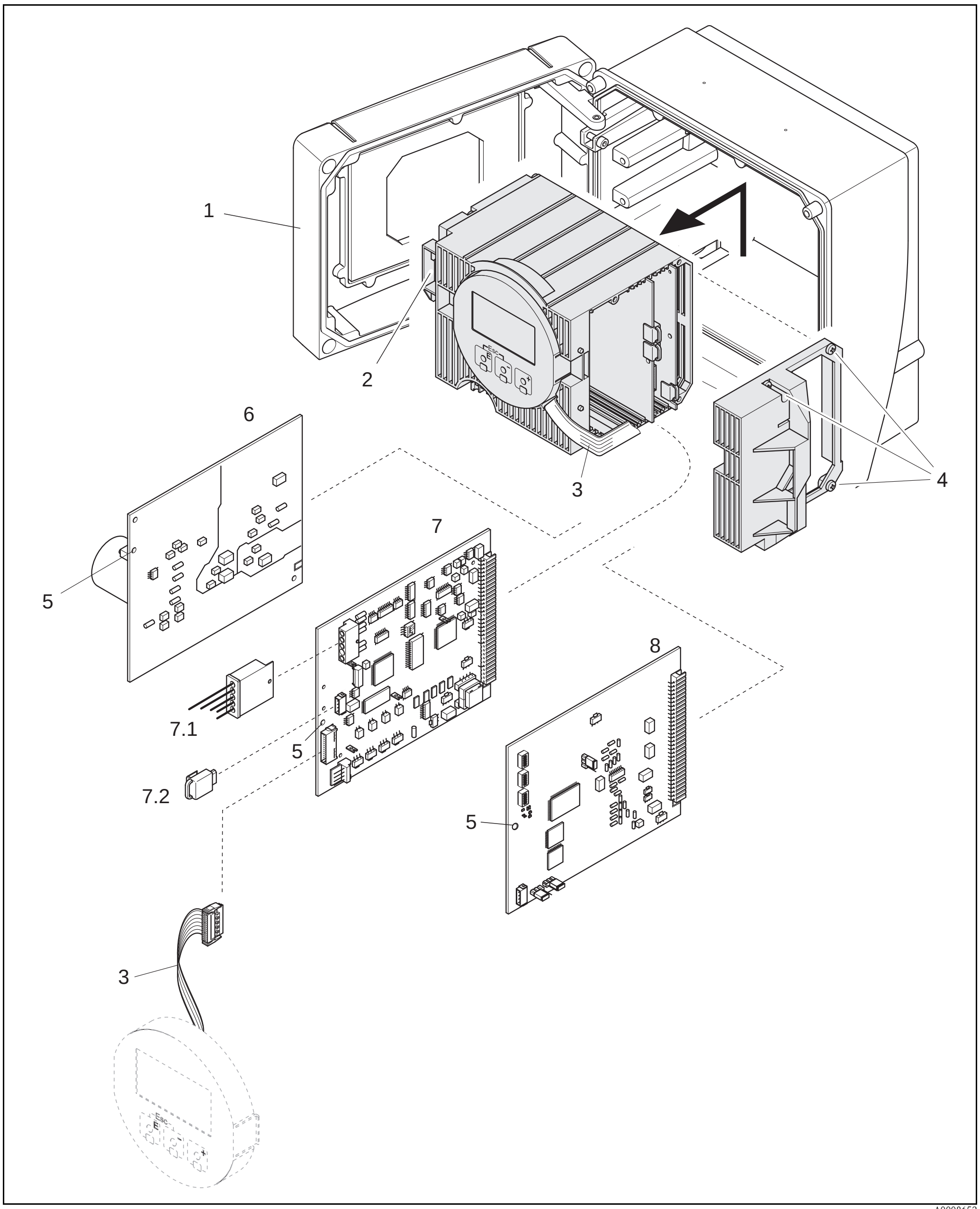


Fig. 99: Wall-mount housing: removing and installing printed circuit boards

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

9.6.4 Installing and removing the W sensors

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

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

Caution!
Use only original Endress+Hauser parts.

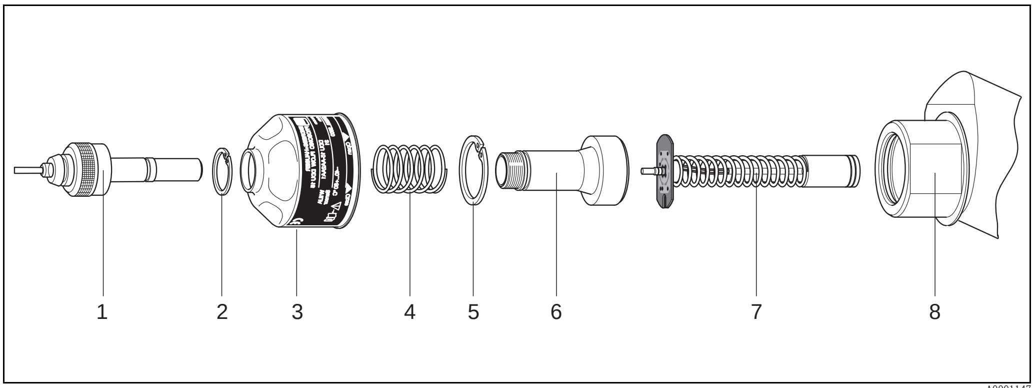


Fig. 100: Flow measuring sensor W "Insertion": installation/removal

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

9.6.5 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 → Fig. 101.
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power unit board.
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.

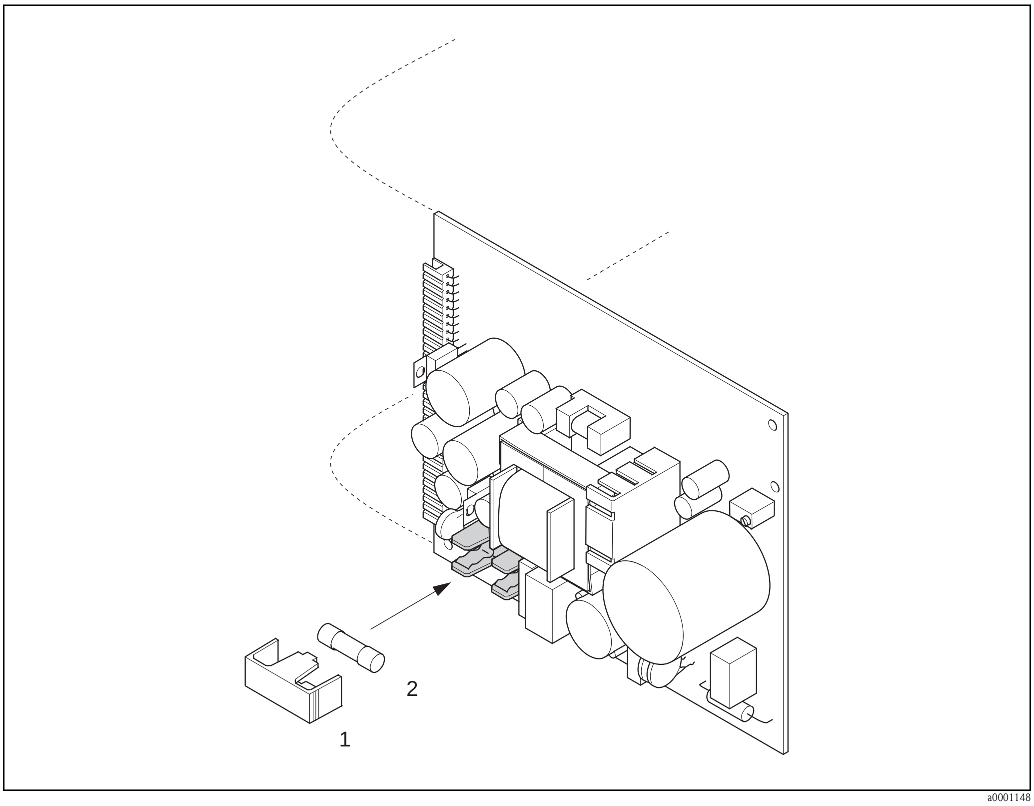


Fig. 101: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse

9.7 Return

→ 6

9.8 Disposal

Observe the regulations applicable in your country!

9.9 Software history

Date	Software version	Changes to software	Operating Instructions
06.2011	PROFIBUS DP/PA 3.06.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	71139005/06.11
06.2010	PROFIBUS DP 3.06.XX	Introduction of a new PROFIBUS DP I/O board	BA00076D/06/EN/13.10 71121236
12.2007	PROFIBUS PA 3.05.XX	Introduction of a new PROFIBUS PA I/O board	BA076D/06/en/12.07 71066298
12.2006	PROFIBUS DP	PROFIBUS DP I/O board phased out	
10.2003	Amplifier: 1.06.XX Communication module: 2.03.XX	Software expansion: – General device functions – Language groups – Simulation function for pulse output – Flow direction of pulse output can be selected New functionalities: – Operation hours counter – Hours of measuring counter – Intensity of background illumination adjustable – Counter for access code – Failsafe mode, channel-separate – Preparation for upload/download via ToF Tool - Fieldtool Package	BA076D/06/en/12.02 50102133

12.2002	Amplifier:
	1.05.00
	Communication module:
	2.02.00
		Software expansion:
		– Prosonic Flow U sensors
		– Prosonic Flow C Inline
		– New error messages
		  – PIPE DATA (CH1 to CH2)
		  – INTERFERENCE (CH1 to CH2)
		– Update Commuwin II Matrix
		– Update GSD
		
		New functionalities:
			BA076D/06/en/05.02
			50102133

05.2002	Amplifier: 1.01.00 Communication module: 2.00.01	Original software Compatible with: – Fieldtool – Commuwin II (version 2.07.02 and higher) – PROFIBUS DP/PA Profile Version 3.0	

10 Technical data

10.1 Quick technical data guide

10.1.1 Application

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

10.1.2 Function and system design

Measuring principle

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 → 163)

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, $R_i = 5\ k\Omega$, galvanically isolated.

Configurable for: totalizer(s) reset, measured-value suppression, error-message reset.

10.1.4 Output

Output signal

Current output

- Galvanically isolated
- Active/passive selectable
  - Active: 0/4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
  - Passive: 4 to 20 mA, max. 30 V DC, $R_i \leq 150\ \Omega$
- Time constant selectable (0.01 to 100 s)
- Full scale value adjustable
- Temperature coefficient: typ. 0.005 % o.r./°C (o.r. = of reading)
- Resolution: 0.5 µA

Pulse/frequency output

- Galvanically isolated
- Active/passive selectable
  - Active: 4 V DC, 25 mA (max. 250 mA during 20 mS), $R_L > 100\ \Omega$
  - Passive: open collector, 30 V DC, 250 mA
- Time constant selectable (0.05 to 100 s)
- Frequency output
  - End frequency: 2 to 10000 Hz (f_{max} = 12500 Hz)
  - End frequency for EEx ia 2 to 5000 Hz
  - On/off ratio 1:1, pulse width max. 10 s
- Pulse output
  - Pulse value and pulse polarity selectable
  - Max. pulse width adjustable (0.05 to 2000 ms)
  - As of a frequency of 1 / (2 × pulse width), the on/off ratio is 1:1

PROFIBUS DP interface

- PROFIBUS DP in accordance with EN 50170 Volume 2
- Profile version 3.0
- Data transmission rate: 9.6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Signal encoding = NRZ Code
- Function blocks: 8 × analog input, 3 × totalizer
- Output data: volume flow channel 1 or channel 2, sound velocity channel 1 or channel 2, flow velocity channel 1 or channel 2, average volume flow, average sound velocity, average flow velocity, volume flow sum, volume flow difference, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), zero point adjustment, measuring mode, totalizer control
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Available output combination → 65

PROFIBUS PA interface

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP)
- Galvanically isolated
- Data transmission rate, supported baudrate: 31.25 kBit/s
- Current consumption = 11 mA
- Error current FDE (fault disconnection electronic) = 0 mA
- Signal encoding = Manchester II
- Function blocks: 8 × Analog Input (AI), 3 × Totalizer
- Output data: volume flow channel 1 or channel 2, sound velocity channel 1 or channel 2, flow velocity channel 1 or channel 2, average volume flow, average sound velocity, average flow velocity, volume flow sum, volume flow difference, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), operation control, totalizer control, zero point adjustment control, display value
- Bus address can be set via DIP switch on device

	FOUNDATION Fieldbus interface ■ FOUNDATION Fieldbus H1, IEC 61158-2 ■ Galvanically isolated ■ Data transmission rate, supported baudrate: 31.25 kBit/s ■ Current consumption = 12 mA ■ Error current FDE (fault disconnection electronic) = 0 mA ■ Signal encoding = Manchester II ■ Function blocks: 8 × Analog Input (AI), 1 × Discrete Output, 1 × PID ■ Output data: volume flow channel 1 or channel 2, sound velocity channel 1 or channel 2, flow velocity channel 1 or channel 2, signal strength channel 1 or 2, average volume flow, average sound velocity, average flow velocity, volume flow sum, difference, volume flow, totalizer 1 to 3 ■ Input data: positive zero return (ON/OFF), reset totalizer, zero point adjustment control ■ Link master function (LAS) is supported
Signal on alarm	■ Current output → failsafe mode selectable. ■ Pulse/frequency output → failsafe mode selectable ■ Relay output → "deenergized" in the event of a fault or if the power supply fails.
Load	→ "Output signal"
Switching output	*Relay output* ■ NC contact or NO contact available Factory setting: relay 1 = NO contact, relay 2 = NC contact ■ Max. 30 V / 0.5 A AC; 60 V / 0.1 A DC ■ Galvanically isolated ■ Configurable for: error messages, flow direction, limit values
Low flow cutoff	Switch points for low flow are selectable
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

10.1.5 Power supply

Measuring unit electrical connection	→ 📄 65
Connecting the connecting cable	→ 📄 62
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"

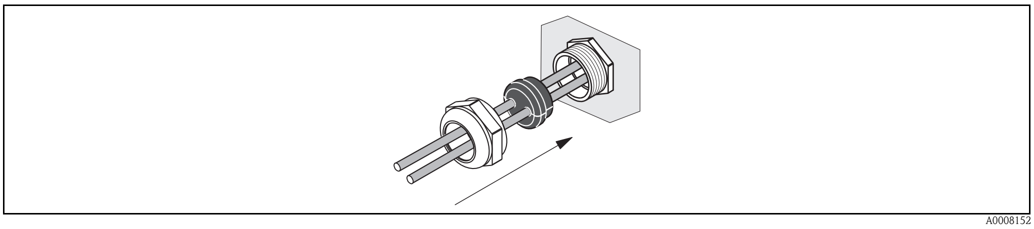


Fig. 102: Cable gland for two connecting cables (2 × Ø 4 mm / 0.16") per cable entry

Cable specifications

Only use the connecting cables supplied by Endress+Hauser.

Different versions of the connecting cables are available → 📄 131.

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.

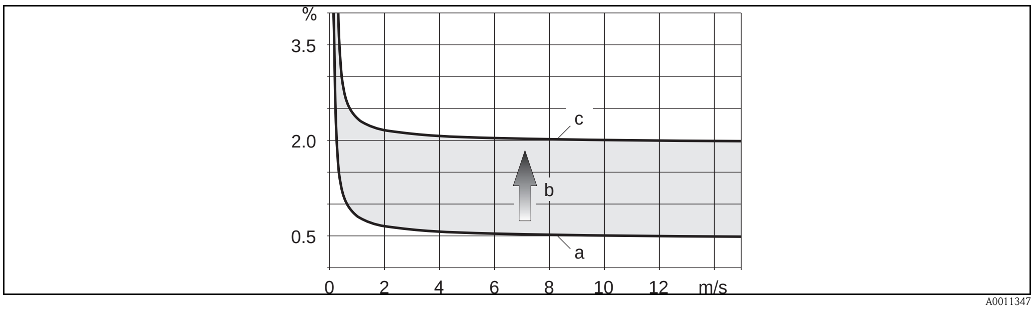


Fig. 103: Example of the measured error in a pipe with a nominal diameter DN > 200 (8")

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 → 163.

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).
PROFIBUS DP/PA certification	The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the equirements of the following specifications: ▪ Certified in accordance with PROFIBUS Profile Version 3.0 (device certification number: available on request) ▪ The measuring device can also be operated with certified devices of other manufacturers (interoperability).
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 → 131.
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

A

Accessories . . . 131
Acyclic data transmission . . . 127
Applications . . . 5
Applicator (selection and configuration software) . . . 134
Approvals . . . 10

B

Block model
  PROFIBUS DP . . . 105
  PROFIBUS PA . . . 116
Blocks . . . 78
Bus structure
  PROFIBUS DP . . . 58

C

Cable entries
  Degree of protection . . . 72
Cable specifications
  PROFIBUS DP . . . 58
  PROFIBUS PA . . . 60
Cable type
  PROFIBUS DP . . . 58
  PROFIBUS PA . . . 60
CE mark (Declaration of Conformity) . . . 10
Certificates . . . 10
Cleaning
  Exterior cleaning . . . 130
Code entry (function matrix) . . . 79
Commissioning
  Quick Setup . . . 89, 91
  Zero point adjustment . . . 128
Commubox FXA 195 (electrical connection) . . . 133
Communication
  Quick Setup . . . 92
Connection
  See Electrical connection
Coupling fluid . . . 130
C-Tick mark . . . 10
Cyclic data exchange
  PROFIBUS DP . . . 105
  PROFIBUS PA . . . 116
Cyclic data transmission PROFIBUS DP
  AI module (Analog Input) . . . 107
  CONTROL_BLOCK . . . 111
  DISPLAY_VALUE module . . . 111
  EMPTY_MODULE . . . 112
  SETTOT_MODETOT_TOTAL module . . . 110
  SETTOT_TOTAL module . . . 109
  TOTAL module . . . 108
Cyclic data transmission PROFIBUS PA
  AI module (Analog Input) . . . 118
  CONTROL_BLOCK . . . 122
  DISPLAY_VALUE module . . . 122
  EMPTY_MODULE . . . 123
  SETTOT_MODETOT_TOTAL module . . . 121
  SETTOT_TOTAL module . . . 120
  TOTAL module . . . 119

D

Data backup . . . 94
Data transmission
  Acyclic . . . 127
  Cyclic PROFIBUS PA . . . 105, 116
Declaration of Conformity (CE mark) . . . 10
Degree of protection
  Wall-mount housing (IP67) . . . 72
Designated use . . . 5
Device address, configuring
  PROFIBUS DP . . . 84
  PROFIBUS PA . . . 87
Device description data
  PROFIBUS DP . . . 81
  PROFIBUS PA . . . 82
Device designation . . . 7
Device functions
  See "Description of Device Functions" manual
Device status, display . . . 137
Display
  Local display . . . 75
Disposal . . . 150

E

Electrical connection
  Degree of protection . . . 72
Error messages
  Confirming error messages . . . 80
  Process error (application error) . . . 143
  System error (device error) . . . 137
Error types (system and process errors) . . . 80
Ex approval . . . 162
Exterior cleaning . . . 130

F

Fault message . . . 80
FieldCare . . . 81, 134
Fieldcheck (tester and simulator) . . . 134
Function check . . . 88
Function description
  See "Description of Device Functions" manual
Function groups . . . 78
Functions . . . 78
Fuse, replacing . . . 149–150
FXA193 . . . 134
FXA195 . . . 133

G

Grounding . . . 62
Groups . . . 78

H

Hardware write protection
  PROFIBUS DP . . . 83

PROFIBUS PA 86
Hazardous substances 6
HOME position (display operating mode) 75

I

Icons. 77
Incoming acceptance 11
Input signal 152
Installation
Panel mounting, wall-mount housing. 56
Pipe mounting, wall-mount housing. 56
Wall-mount housing 55
Installation conditions
Dimensions 11
Inlet and outlet run 12
Mounting location 11
Installation distances
Prosonic Flow P. 16
Prosonic Flow W 16
Installation distances (determining values)
Applicator 28
FieldCare. 22
Local operation 17
Installation/removal
Flow measuring sensors W “Insertion version" 149
IP 67 mounting instructions
See Degree of protection
IP 68 mounting instructions
See Degree of protection

L

Language groups 162
Local display
See Display

M

Materials. 160
Measured value status, display. 137
Measuring sensor installation
Installation distances 16
Mechanical preparation 30
Preparatory steps 16
Prosonic Flow DDU 18 53
Prosonic Flow DDU 19 54
Prosonic Flow P DN 15 to 65. 35
Prosonic Flow P DN 50 to 4000, one traverse 37
Prosonic Flow P DN 50 to 4000, two traverses 39
Prosonic Flow W (general information). 45
Prosonic Flow W (single-path insertion version) 46
Prosonic Flow W Clamp On, one traverse 41
Prosonic Flow W Clamp On, two traverses. 43
Prosonic Flow W Insertion, dual-path. 49
selection and arrangement 13
Measuring system 7
Mechanical preparation
Prosonic Flow P (DN 15 to 65)
Retainer with strapping bands 31
Prosonic Flow P (DN 15 to 65)
Retainer with U-shaped screws 30
Strapping bands (large nominal diameters) 33
Strapping bands (medium nominal diameters). 32
Welded bolts 34
Module
AI (Analog Input)
PROFIBUS DP 107
PROFIBUS PA 118
CONTROL_BLOCK
PROFIBUS DP 111
PROFIBUS PA 122
DISPLAY_VALUE
PROFIBUS DP 111
PROFIBUS PA 122
EMPTY_MODULE
PROFIBUS DP 112
PROFIBUS PA 123
SETTOT_MODETOT_TOTAL
PROFIBUS DP 110
PROFIBUS PA 121
SETTOT_TOTAL
PROFIBUS DP 109
PROFIBUS PA 120
TOTAL
PROFIBUS DP 108
PROFIBUS PA 119
Mounting instructions
IP 67 72
IP 68 72

N

Nameplate
Connections. 9
Sensor 8
Notice message 80

O

Operable flow range 152
Operation
FieldCare 81
Function matrix 78
Operational safety 5
Order code
Accessories 131
Transmitter 7–9
Ordering information 163

P

Position sensor 16
Post-installation check (checklist). 57
Printed circuit boards (installation/removal)
Wall-mount housing. 147
Process error
Definition 80
Process error messages. 143
PROFIBUS DP
Bus structure 58
Cable specifications 58
Cable type 58
Configuration examples 113
Cyclic data exchange 105
Device address, configuring 84

Device description data 81
Hardware write protection 83
Spur 59
Terminal assignment 65
PROFIBUS PA
Cable specifications 60
Cable type 60
Configuration examples 124
Cyclic data exchange 116
Device address, configuring 87
Device description data 82
Hardware write protection 86
Spur 61
Terminal assignment 65
Programming mode
Disabling 79
Enabling 79

Q
Quick Setup
Commissioning 89, 91
Communication 92

R
Registered trademarks 10
Relay output
Technical data 154
Remote operation 162
Repair 6
Returning devices 6

S
Safety icons 6
Safety instructions 5
Sensor distance 16, 49
Serial number 7–9
Service 134
Service interface FXA193. 134
Service-specific accessories 134
Shielding 62
Shielding of the cable connection/T-box 71
Shock resistance 159
Software
Amplifier display 88
Sound velocity measuring sensors DDU 18
Installation. 53–54
Spare parts 145
Spur
PROFIBUS DP 59
PROFIBUS PA 61
Standards, guidelines 162
Status input
Technical data 152
Storage 11
Supplementary Ex documentation 5
System error
Definition 80
System error messages 137

T
T-DAT
Save/load (data back-up, e.g. for replacing devices) . . . 94
T-DAT (HistoROM) 129
Temperature ranges
Storage temperature 158
Terminal assignment
PROFIBUS DP. 65
PROFIBUS PA. 65
Terminating resistors 85
Transmitter
Electrical connection 66
Installing the wall-mount housing 55
Traverse 13
Troubleshooting and remedy. 135
Two-channel measurement. 14
Two-channel operation 14
Two-path measurement 15

V
Vibration resistance. 159
Vibrations, shock and vibration resistance 159

W
Wall-mount housing
Installation 55
Panel mounting. 56
Pipe mounting. 56
Wire length 16
Wiring
See Electrical connection
Writes (max.) 104

Z
Zero point adjustment. 128

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."

P/SF/Konta XIV

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

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

______________________ Signature / *Unterschrift*

www.endress.com/worldwide

Endress+Hauser
People for Process Automation

BA00076D/06/EN/14.11
71139005
FM+SGML6.0 ProMoDo