



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

## Technical Information

# Proline Prosonic Flow 90U, 90W, 91W, 93C, 93U, 93W

## Ultrasonic Flow Measuring System

Flowrate measurement for standard applications  
with drinking water, wastewater and process water



### Application

The sensors are perfectly suited for bidirectional measurement of pure or slightly contaminated liquids, regardless of the pressure, temperature, conductivity and viscosity.

- Applicable for all homogeneous fluids in acoustically transmissive pipes, even with lining
- For water/wastewater applications
- Ideal for retrofitting
- Installation without process interruption

Approvals for hazardous area:

- ATEX, FM, CSA

Approvals in the food industry/hygiene sector:

- Drinking water approval for Prosonic Flow C

Connection to process control system:

- HART, PROFIBUS PA, FOUNDATION Fieldbus

### Your benefits

Prosonic Flow, the flexible and cost-effective flow measuring system, available as a clamp-on, insertion or inline unit, offers you a tailor-made solution.

The **Proline transmitter concept** comprises:

- Modular device and operating concept resulting in a higher degree of efficiency
- Diagnostic ability and data back-up for increased process quality

The tried-and-tested **Prosonic Flow sensors** offer:

- Easy and safe installation and commissioning guarantee precise measurement
- Insensitivity to vibrations
- No pressure loss
- Optionally available as dual-path version for short inlet runs
- Prosonic Flow C with guaranteed and attestable accuracy

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## Function and system design

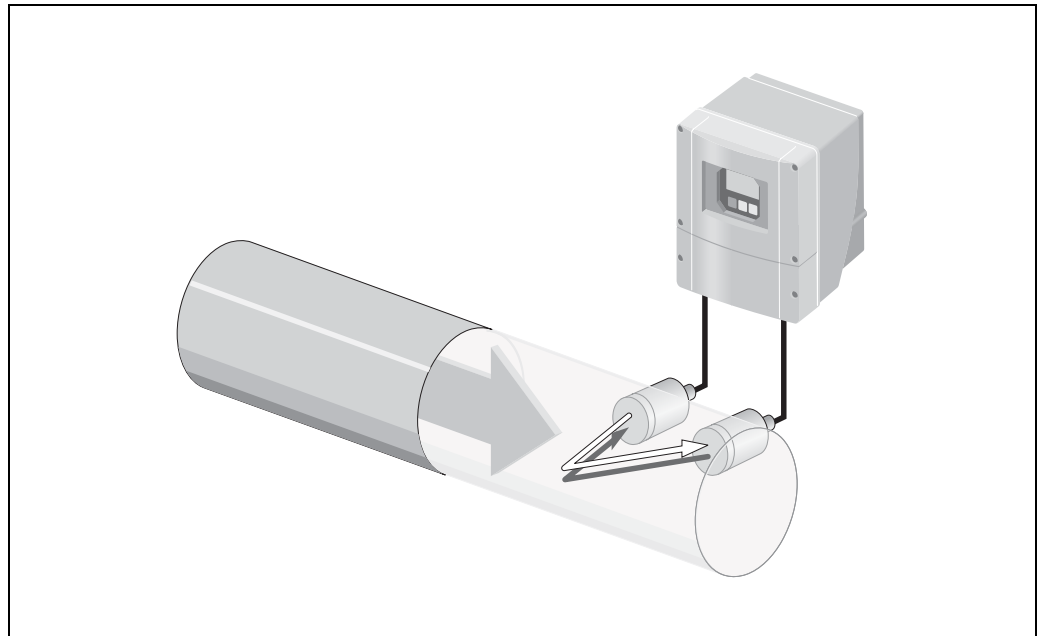
### Measuring principle

Prosonic Flow operates on the principle of transit time difference.

An acoustic (ultrasonic) signal is sent in both directions from one measuring sensor to another.

A transit time difference arises because the signal propagation velocity of the sound waves is greater in the direction of flow than against the direction of flow. This difference is directly proportional to the flow velocity.

Prosonic Flow calculates the flow from the pipe cross-sectional area and the measured transit time difference.



$$v \sim \Delta t$$

$$Q = v \cdot A$$

$v$  = Flow velocity

$\Delta t$  = Transit time difference

$Q$  = Volume flow

$A$  = Pipe cross-sectional area

In addition to the volume flow, the system also always measures the sound velocity of the fluid. The sound velocity can be used to distinguish different fluids or as a measure of fluid quality. Application-specific configuration of the Prosonic Flow can be carried out locally with the aid of the "Quick Setup" menu.

### System design Measuring system

The Prosonic Flow ultrasonic flow measuring system always consists of a transmitter and the related measuring sensors. All components are available in different versions depending on the application requirements.

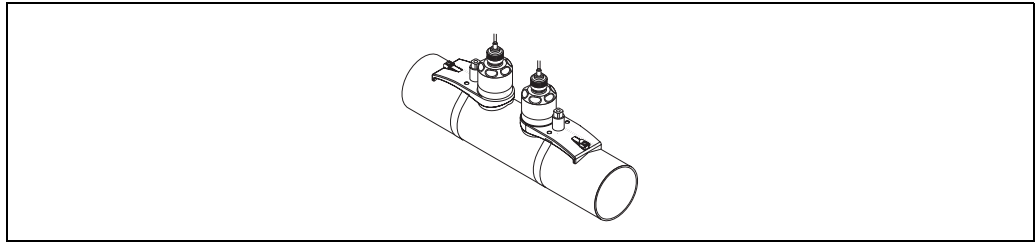
The transmitter is used to actuate the measuring sensors. The electronics and the software in the transmitter are used to prepare, process and evaluate the sensor signals and to convert the measuring signal to the desired output variables.

The measuring sensors work bidirectionally as sound transmitters and sound receivers. The electrical signals of the transmitter are converted to a pressure signal in the measuring sensors and vice versa.

Depending on the design, the different sensor versions of ultrasonic flow measuring devices offer unique possibilities in the application. The properties and benefits of the different versions are explained in detail on the following pages.

## System design Clamp-on sensors

### Prosonic Flow W and U



F06-9xWCOxxx-21-05-00-xx-000

#### Design:

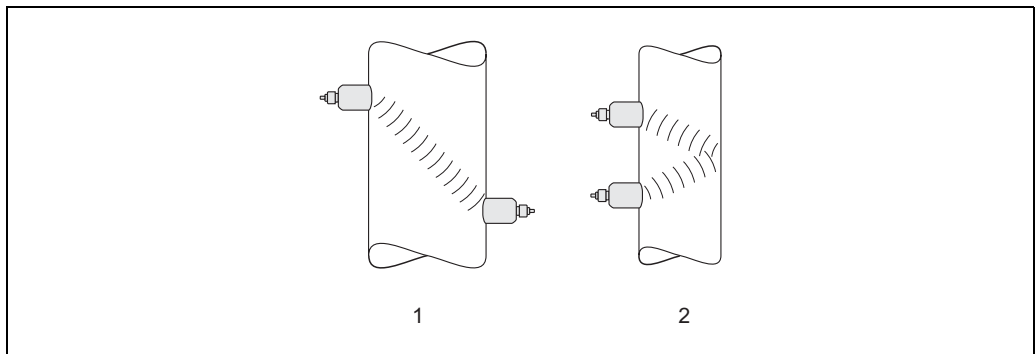
Prosonic Flow clamp-on sensors are mounted on the existing piping from outside.

#### Possibilities and applications:

- Ideal for retrofitting, installation possible without interrupting process.
- Easy, quick and low-cost mounting.
- Suitable for all acoustically transmissive pipes and all pure and slightly contaminated liquids.
- Very large nominal diameter range DN 15 to 4000 (1/2" to 156").

#### Sensor arrangement

The transmitter offers a number of options between 1 and 2 traverses for the type of installation.



A0005728

- 1 1 traverse  
2 2 traverses

#### Recommendations:

Due to their design and properties, the Prosonic Flow sensors are particularly suited to certain nominal diameter ranges and pipe wall thicknesses. For this reason, various sensor types are offered for Prosonic Flow W and U for these different applications.

Recommendations for sensor installation can be found in the following table.

Sensor type	Nominal diameter	Type of mounting
Prosonic Flow U	DN 15 to 100 (1/2" to 4")	2 traverses
Prosonic Flow W	DN 50 to 60 (2" to 2 1/2") DN 80 to 600 (3" to 24") DN 650 to 4000 (26" to 156")	2 (or 1) traverses 2 traverses 1 traverse

#### Note!

- Please note that the signal strength is reduced with each additional reflection point in the pipe. (Example: 2 traverses = 1 reflection point).
- The installation of clamp-on sensors is principally recommended in the 2 traverse type of installation. This type of installation allows the easiest and most comfortable type of mounting and means that a system can also be mounted even if the pipe can only be accessed from one side.

- If the pipe nominal diameter is small (DN 60 / 2 1/2" and smaller), the sensor spacing with Prosonic Flow W can be too small for an installation with 2 traverses. In this case, the 1 traverse type of installation must be used.  
In all other instances, the 2 traverse configuration is the preferred method.
- The use of Prosonic Flow W sensors DN 100 to 4000 (4" to 156") is principally recommended for plastic pipes with a wall thickness > 10 mm (0.40 inch), pipes made of composites such as GRP, pipes with lining, even for nominal diameters < DN 100 (4"). This applies also to applications with media with high acoustic damping. For these applications, we principally recommend mounting the W sensors with 1 traverse configuration.
- In the DN 15 to 50 (1/2" to 2") nominal diameter range, Prosonic Flow U is preferred for use on plastic pipes. Both the Prosonic Flow W and the Prosonic Flow U sensor types can be used in the DN 50 to 100 (2" to 4") nominal diameter range. The use of Prosonic Flow W sensors is principally recommended for applications as of DN 60 (2 1/2").
- If the measuring device displays an insufficient signal strength, reduce the number of the traverses.

### Dual-channel measuring devices

Prosonic Flow 93 has two measuring channels which are independent of one another. In other words, the transmitter supports the simultaneous operation of two sensor pairs at two individual measuring channels. In doing so, the resources of the transmitter are split evenly between the two channels.

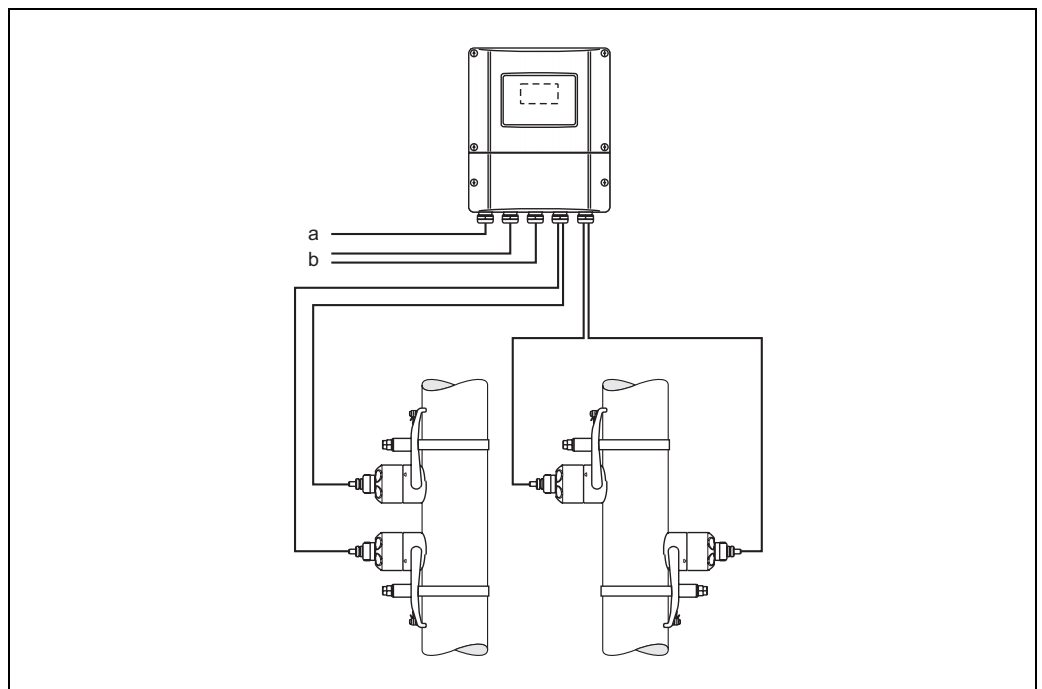
This ability of the transmitter can be used in many different ways:

- For dual-channel measurement
- For dual-path measurement

The transmitter can output the measured values of both channels either individually or arithmetically linked (as total, difference or mean).

### Dual-channel measurement

In the case of dual-channel measurement, the measured values of two independent measuring points are determined and processed by one transmitter.



- a Cable for power supply  
b Signal cable (outputs)

If required, the measured values of measuring channel 1 and measuring channel 2 can be arithmetically linked together. The following possibilities for outputting measured values are suitable for dual-channel measurement:

- Individual output of measured values from channel 1 and 2
- Total of measured values from channel 1 and 2
- Difference of measured values from channel 1 and 2

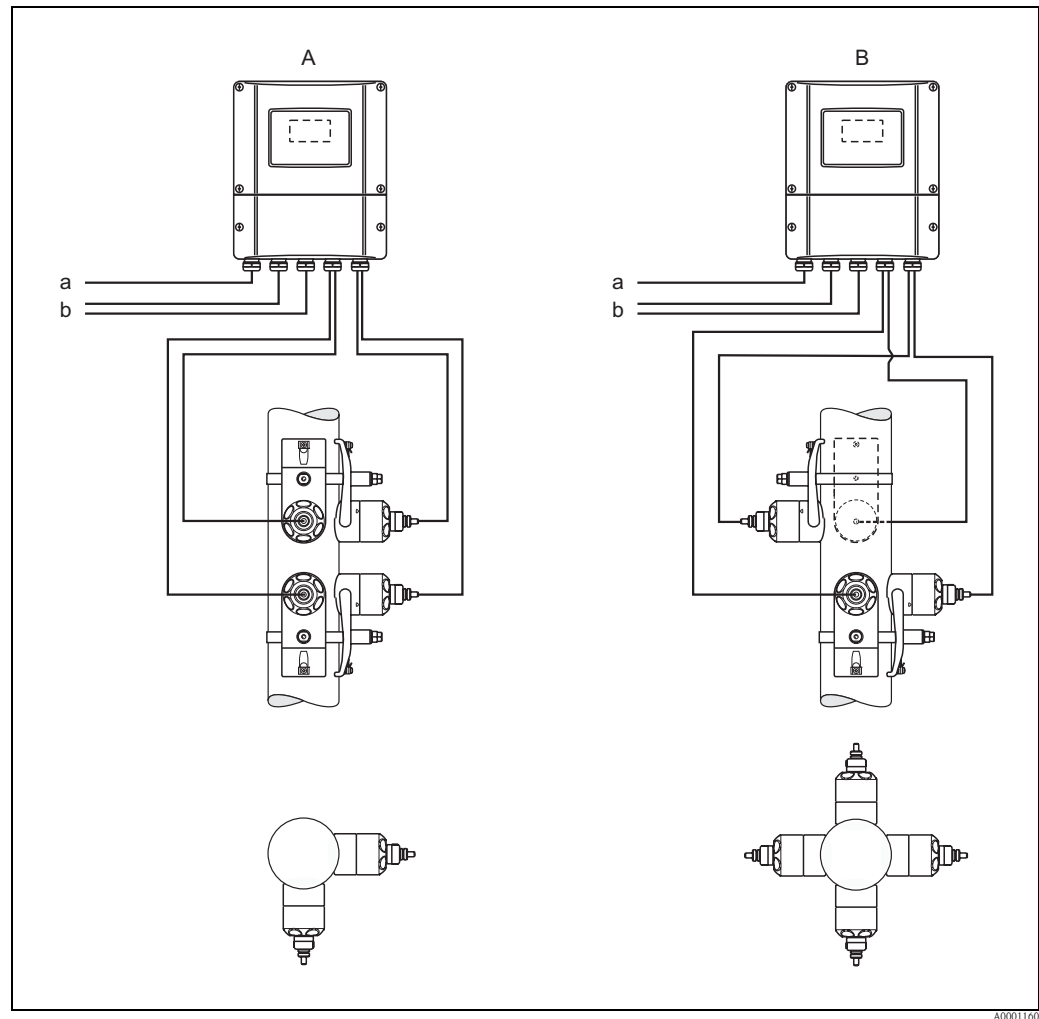
The measuring device supports the individual configuration of the measuring channels and the independent setting of the display and outputs. As a result, the sensor type and type of installation, for example, can be selected and configured separately for both channels.

**Note!**

Pay particular attention to the recommendations on installation in the “Mounting location” section, Page 26, the “Orientation” section, Page 27, the “Inlet and outlet run” section, Page 30 and the recommendations on the type of installation in the “Sensor arrangement” section, Page 4.

### Dual-path measurement

In dual-path measurement, the transmitter is used to operate two sensor pairs which are installed on the same pipe. Different applications can necessitate different types of installation.



a Cable for power supply  
b Signal cable (outputs)

**Note!**

Observe the recommendations in the “Sensor arrangement” section, Page 4.

The following possibilities for outputting measured values are suitable for dual-path measurement:

- Individual output of measured values from channel 1 and 2
- Arithmetic mean of the measured values from channel 1 and 2 ( $CH1 + CH2 / 2$ )

The possibility of obtaining the mean value in dual-path measurement provides the advantage of a more stable measured value. A measured value that is generated from two independent measuring signals is generally less sensitive to irregularities and faults in the application.

As a result, if conditions are not ideal, for example, the dual-path system means that the different flow components within the flow can be better determined thanks to the fact that the measured values are determined independently on two levels. Differences are then balanced out when the two measured values are

subsequently averaged to form one process variable. This often results in a more stable and more accurate measured value than would be the case with single-path measurement.

The measuring device supports the individual configuration of the measuring channels.

#### Caution!

Pay particular attention to the recommendations on installation in the "Mounting location" section, Page 26, the "Orientation" section, Page 27, the "Inlet and outlet run" section, Page 30 and the recommendations on the type of installation in the "Sensor arrangement" section, Page 4.

### Accessories for commissioning

If mounting and commissioning a clamp-on measuring point, you require information on the liquid to be measured and the pipe material used, as well as the exact pipe dimensions. The data of the most common liquids and pipe and lining materials are pre-programmed into the program of the Prosonic Flow 90 and 93 transmitters.

#### For liquids:

WATER – SEA WATER – DISTILLED WATER – AMMONIA – ALCOHOL – BENZENE – BROMIDE – ETHANOL – GLYCOL – KEROSENE – MILK – METHANOL – TOLUOL – LUBRICATING OIL – FUEL OIL – PETROL

#### For pipe material:

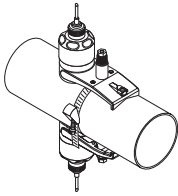
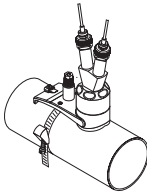
STAINLESS STEEL – SS ANSI 304 – SS ANSI 316 – SS ANSI 347 – SS ANSI 410 – SS ANSI 430 – ALLOY C – PVC – PE – LDPE – HDPE – GRP – PVDF – PA – PP – PTFE – GLASS PYREX – ASBESTOS CEMENT – CARBON STEEL – DUCTILE IRON

#### Lining:

CEMENT – RUBBER – TAR EPOXY

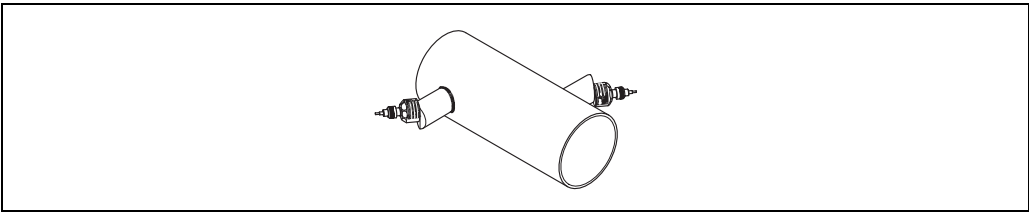
### Additional accessories

If your liquid or pipe material is not included in the pre-programmed options, and if these data are not known, they can be determined with the aid of the sound velocity measuring sensors DDU 18 and the wall thickness measuring sensor DDU 19. These are only available for Prosonic Flow 93 transmitters.

<p><b>DDU 18</b> <b>Sound velocity measuring sensors</b></p>  <p>F06-9xDDU18x-21-05-06-xx-001</p>	<ul style="list-style-type: none"> <li>■ Sound velocity measuring sensors for Prosonic Flow 93</li> <li>■ Sensor pair for measuring the sound velocity of the fluid. Only required for commissioning the clamp-on version unless the sound velocity in the fluid is known.</li> <li>■ DN 50 to 3000 (2" to 120")</li> <li>■ Temperature range -40 to +80 °C (-40 to +176 °F)</li> <li>■ Degree of protection IP 68</li> <li>■ Sensor holder made of stainless steel</li> </ul>
<p><b>DDU 19</b> <b>Wall thickness measuring sensors</b></p>  <p>F06-9xDDU19x-21-05-06-xx-001</p>	<ul style="list-style-type: none"> <li>■ Wall thickness measuring sensor for Prosonic Flow 93</li> <li>■ Sensor for measuring the pipe wall thickness. Only required for commissioning the clamp-on version.</li> <li>■ Wall thickness measuring range: 2 to 50 mm (0.08" to 1.97") for steel pipes 4 to 15 mm (0.16" to 0.60") for plastic pipes (suited to a certain extent for use on PTFE or PE pipes)</li> <li>■ Temperature range 0 to +60 °C (+32 to +140 °F)</li> <li>■ Degree of protection IP 67</li> <li>■ Sensor holder made of stainless steel</li> </ul>

System design  
Insertion sensors

Prosonic Flow W Insertion



F06-9xWxxxx-21-05-06-xx-000

**Design:**  
Prosonic Flow W Insertion sensors are mounted on the existing piping with the aid of welding sockets. One or two measuring paths can be implemented in the pipe.

- Possibilities and applications:**
- Can be used for applications with water and wastewater
  - Simple mounting, specially suited for retrofitting on all weldable pipes with or without lining.
  - Dual-path measurement with 2 sensor pairs makes it possible to reduce the necessary inlet runs.

**Sensor arrangement**

The Prosonic Flow W Insertion sensors are mounted on the existing piping with the aid of welding sockets. For this, boreholes are required in the pipe into which the supports for the flowrate measuring sensors are welded. In a second step, the flowrate measuring sensors are screwed into the sensor supports. Prosonic Flow W Insertion is available as a single-path or dual-path version (only for Prosonic Flow 93 transmitters). Two sensor pairs are mounted in the pipe in the dual-path version. The dual-path version is available for pipes in the nominal diameter range DN 400 to 4000 (16" to 156"). It offers the following advantages over the single-path version:

- Short inlet run of only 10 x nominal diameter.
- Increased tolerance towards turbulence (swirl).
- Improved linearity of measurement.

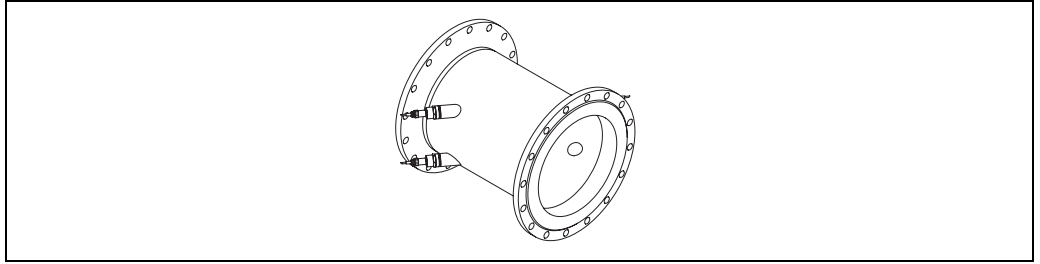
Please refer also to the "Installation" and "Technical data" sections.

Single-path measurement DN 200 to 4000 (8" to 156")	Dual-path measurement DN 400 to 4000 (16" to 156")
<p>F06-9xWxxxx-16-05-xx-xx-001</p>	<p>F06-9xWxxxx-16-05-xx-xx-000</p>



## System design Inline sensors

### Prosonic Flow C Inline



F00-9xCxxxxx-21-05-06-xx-000

#### Design:

The Prosonic Flow C Inline sensor consists of a measuring pipe which is integrated into the pipe system of the application by means of process flanges.

Prosonic Flow C is a dual-path system and has two pairs of W insertion sensors.

#### Possibilities and applications:

- High accuracy
- Traceably calibrated
- Suitable for applications with water and wastewater.

The measuring pipe is not an active part of the measuring system and is therefore not required for the measuring function. However, in contrast to the clamp-on and Insertion systems, which are installed on site, it allows the calibration to be transferred from the factory to the place of use. This has the advantage that a 93 C Inline measuring system measures with guaranteed and verifiable accuracy. Prosonic Flow C Inline makes it possible to achieve high accuracy of the ultrasonic flow measuring system and also offers traceable calibration.

The C Inline sensor is available specific to the application in two versions with different linings:

- For drinking water: epoxy coating with approval for drinking water
- For wastewater: epoxy coating for wastewater

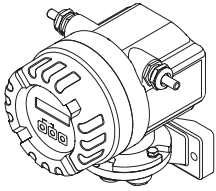
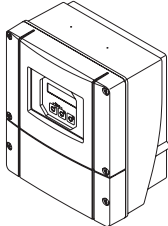
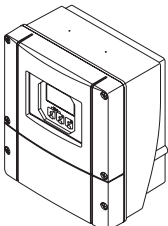
The Prosonic Flow 93 C Inline measuring system always consists of a combination of a Prosonic Flow 93 transmitter in a wall-mount housing and an optimized version of the Prosonic Flow W Insertion sensors integrated in the measuring pipe. Prosonic Flow 93 C Inline is only available as a remote version with 2 sensor pairs. This dual-path version offers the following advantages over the single-path version:

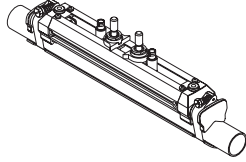
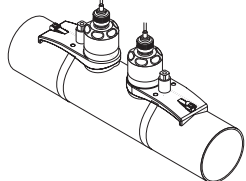
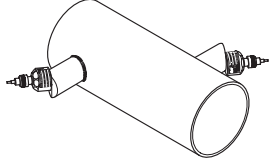
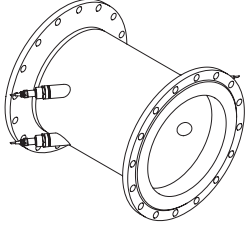
- Short inlet run of only 10 x DN.
- Increased tolerance towards turbulence (swirl).
- Improved linearity of measurement.

Please refer also to the “Installation” and “Technical data” sections.

**Measuring system**

The measuring system consists of the following transmitters and measuring sensors.

<b>Transmitter</b>	
<p><b>Prosonic Flow 91</b></p>  <p>A0006022</p>	<ul style="list-style-type: none"> <li>■ For mounting in non-hazardous areas.</li> <li>■ Two-line LCD display</li> <li>■ Configuration with keys</li> <li>■ Sensor setup</li> <li>■ All outputs are galvanically isolated from the power supply, measuring circuit and each other.</li> <li>■ Volume measurement</li> <li>■ Designed for single-channel measurement as standard</li> <li>■ Degree of protection IP 67</li> </ul>
<p><b>Prosonic Flow 90</b></p>  <p>F06-x0xxxxxx-21-03-06-xx-002</p>	<ul style="list-style-type: none"> <li>■ For mounting in non-hazardous areas.</li> <li>■ Two-line LCD display</li> <li>■ Configuration with keys</li> <li>■ Quick Setup</li> <li>■ All outputs are galvanically isolated from the power supply, measuring circuit and each other.</li> <li>■ Volume and sound velocity measurement</li> <li>■ Designed for single-channel measurement as standard</li> <li>■ Degree of protection IP 67</li> </ul>
<p><b>Prosonic Flow 93</b></p>  <p>F06-x3xxxxxx-21-03-06-xx-002</p>	<ul style="list-style-type: none"> <li>■ For mounting in non-hazardous areas and in Ex Zone II.</li> <li>■ Four-line LCD display</li> <li>■ Configuration with Touch Control</li> <li>■ Application-specific Quick Setup</li> <li>■ All outputs are galvanically isolated from the power supply, measuring circuit and each other.</li> <li>■ Volume and sound velocity measurement</li> <li>■ Designed for wall thickness measurement as standard.</li> <li>■ Designed for dual-channel measurement at one or two different measuring points as standard.</li> <li>■ Degree of protection IP 67</li> </ul>

Measuring sensors	
<p><b>Prosonic Flow U</b> "Clamp-on" version</p>  <p>F06-9xUxxxxx-21-05-06-xx-001</p>	<ul style="list-style-type: none"> <li>■ Clamp-on flowrate measuring sensors for small pipe nominal diameters</li> <li>■ Sensor pair for measuring the flow and the sound velocity of the fluid during operation.</li> <li>■ 1 sensor type for DN 15 to 100 (1/2" to 4")</li> <li>■ Temperature range -20 to +80 °C (-4 to +176 °F)</li> <li>■ Degree of protection IP 54</li> <li>■ Sensor unit made of plastic, stainless cast steel and aluminum</li> </ul>
<p><b>Prosonic Flow W</b> "Clamp-on" version</p>  <p>F06-9xWCOxxx-21-05-06-xx-000</p>	<ul style="list-style-type: none"> <li>■ Clamp-on flowrate measuring sensors</li> <li>■ Sensor pair for measuring the flow and the sound velocity of the fluid during operation.</li> <li>■ 2 sensor types for DN 50 to 4000 (2" to 156")</li> <li>■ Temperature range -20 to +80 °C / -4 to +176 °F (optional 0 to +130 °C / +32 to +266 °F)</li> <li>■ Degree of protection IP 67, IP 68 optional</li> <li>■ Sensor holder made of stainless steel</li> </ul>
<p><b>Prosonic Flow W</b> "Insertion" version</p>  <p>F06-9xWINxxx-21-05-06-xx-000</p>	<ul style="list-style-type: none"> <li>■ Insertion flowrate measuring sensors</li> <li>■ Sensor pair for measuring the flow and the sound velocity of the fluid during operation.</li> <li>■ DN 200 to 4000 (8" to 156")</li> <li>■ Temperature range -40 to +80 °C (-40 to +176 °F)</li> <li>■ 2 sensor holder types single-channel (DN 200 to 4000 / 8" to 156") or dual-channel (DN 400 to 4000 / 16" to 156")</li> <li>■ Degree of protection IP 68</li> <li>■ Sensor holder made of stainless steel</li> </ul>
<p><b>Prosonic Flow C Inline</b></p>  <p>A0001149</p>	<ul style="list-style-type: none"> <li>■ Calibrated measuring pipe with flowrate measuring sensors</li> <li>■ 2 sensor pairs for measuring the flow and the sound velocity of the fluid during operation.</li> <li>■ 1 sensor type for DN 300 to 2000 (12" to 80")</li> <li>■ Measuring pipe for nominal diameter range DN 300 to 2000 (12" to 80")</li> <li>■ Temperature range -10 to +60 °C (+14 to +140 °F)</li> <li>■ Degree of protection IP 68</li> <li>■ Measuring pipe in ST 37.2 epoxy coated</li> <li>■ Measuring sensors made of stainless steel</li> </ul>

**System overview**

Possible combinations of transmitters and sensors			
	Prosonic Flow 90 Transmitter	Prosonic Flow 91 Transmitter	Prosonic Flow 93 Transmitter
<b>Prosonic Flow W</b> Clamp-on version	✓	✓	✓
<b>Prosonic Flow U</b> Clamp-on version	✓	–	✓
<b>Prosonic Flow W</b> Insertion version	✓	–	✓
<b>Prosonic Flow C Inline</b> Calibrated measuring pipe with Prosonic Flow W sensors	–	–	✓

**Ranges of application:**

Warm and cold water and similar liquids

**Input**

<b>Measured variable</b>	Flow velocity (transit time difference proportional to flow velocity)
<b>Measuring range</b>	Typically $v = 0$ to 15 m/s (0 to 50 ft/s) with the specified measuring accuracy for Prosonic Flow W Typically $v = 0$ to 10 m/s (0 to 33 ft/s) with the specified measuring accuracy for Prosonic Flow U and C
<b>Operable flow range</b>	Over 150 : 1
<b>Input signal</b>	<b>Prosonic Flow 90/93</b> Status input (auxiliary input): $U = 3$ to 30 V DC, $R_i = 5\text{ k}\Omega$ , galvanically isolated. Configurable for: totalizer(s) reset, positive zero return, error message reset.
	<b>Prosonic Flow 91</b> None

**Output**

<b>Output signal</b>	<b>Prosonic Flow 90</b> Current output: Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value adjustable, temperature coefficient: typ. 0.005% o.r./°C; resolution: 0.5 $\mu\text{A}$ . <ul style="list-style-type: none"> <li>■ Active: 0/4 to 20 mA, <math>R_L &lt; 700\ \Omega</math> (for HART: <math>R_L \geq 250\ \Omega</math>)</li> <li>■ Passive: 4 to 20 mA, supply voltage 18 to 30 V DC, <math>R_L &lt; 700\ \Omega</math></li> </ul> Pulse/frequency output: Passive, open collector, 30 V DC, 250 mA, galvanically isolated. <ul style="list-style-type: none"> <li>■ <i>Frequency output</i>: full scale frequency 2 to 1000 Hz (<math>f_{\max} = 1250\text{ Hz}</math>), on/off ratio 1:1, pulse width max. 10 s</li> <li>■ <i>Pulse output</i>: pulse value and pulse polarity selectable, max. pulse width adjustable (0.5 to 2000 ms / 1.6 to 6562 ft/s), max. pulse frequency selectable</li> </ul>
----------------------	---

PROFIBUS PA interface:

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption: 11 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Data transmission rate, supported baudrate: 31.25 kBit/s
- Signal encoding: Manchester II
- Function blocks: 3 x Analog Input (AI), 1 x Totalizer
- Output data: volume flow, sound velocity, flow velocity
- 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

**Prosonic Flow 91**

Current output:

- Galvanically isolated
- Active: 4 to 20 mA,  $R_L < 700 \Omega$  (for HART:  $R_L \geq 250 \Omega$ )
- Full scale value adjustable
- Temperature coefficient: typ.  $2 \mu A/^{\circ}C$ , resolution:  $1.5 \mu A$

Pulse/status output:

- Galvanically isolated
- Passive: 30 V DC/250 mA
- Open collector
- Optionally configurable as:
  - Pulse output: pulse value and pulse polarity selectable, max. pulse width adjustable (5 to 2000 ms / 16 to 6562 ft/s), max. pulse frequency 100 Hz
  - Status output: configurable e.g. for error messages, empty pipe detection, flow direction detection, limit value

**Prosonic Flow 93**

Current output:

- Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value adjustable, temperature coefficient: typ. 0.005% o.r./ $^{\circ}C$ ; resolution:  $0.5 \mu A$
- 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,  $R_L \leq 150 \Omega$

Pulse/frequency output:

- Active/passive selectable, galvanically isolated
- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms),  $R_L > 100 \Omega$
  - Passive: open collector, 30 V DC, 250 mA
  - *Frequency output*: full scale frequency 2 to 10000 Hz ( $f_{max} = 12500$  Hz), 2 to 5000 Hz for EEx ia, 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 / 0.16 to 6562 ft/s), the on/off ratio is 1:1 as of a frequency of 1 / (2 x pulse width)

Note!

The following values of the communication interfaces only apply to **Prosonic Flow W** (clamp-on and Insertion) and to **Prosonic Flow U** (clamp-on)!

PROFIBUS PA interface for Prosonic Flow W and U:

- 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 x Analog Input (AI), 3 x 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 for Prosonic Flow W and U:

- 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 x Analog Input (AI), 1 x Discrete Output, 1 x 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, volume flow difference, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), reset totalizer, zero point adjustment control
- Link Master function (LAS) is supported

Note!

The following values of the communication interfaces only apply to **Prosonic Flow C Inline!**

PROFIBUS PA interface for Prosonic Flow C:

- 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 x Analog Input (AI), 3 x Totalizer
- Output data: average volume flow, average sound velocity, average flow velocity
- 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 for Prosonic Flow C:

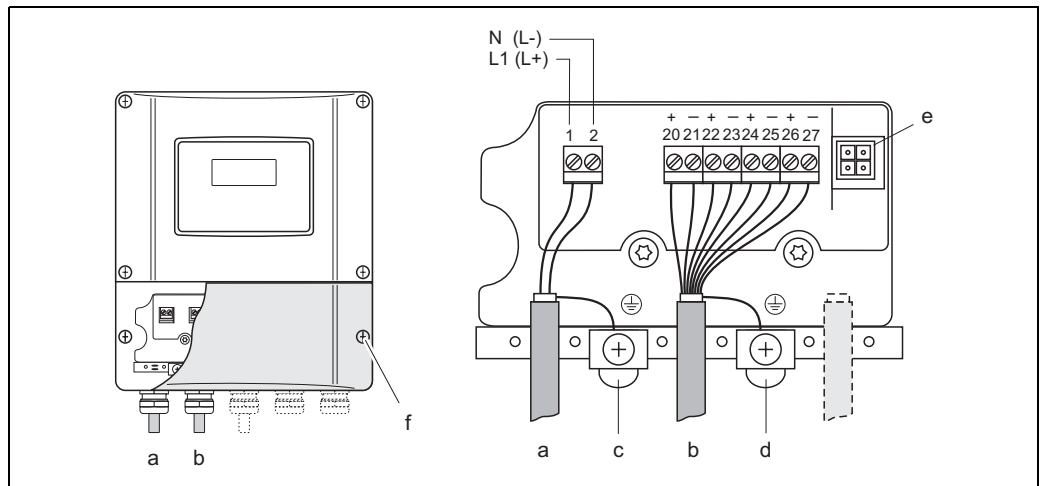
- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Data transmission rate, supported baudrate: 31.25 kBit/s
- Current consumption: 12 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Signal encoding: Manchester II
- Function blocks: 8 x Analog Input (AI), 1 x Discrete Output, 1 x PID
- Output data: average volume flow, average sound velocity, average flow velocity, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), reset totalizer, zero point adjustment control
- Link Master function (LAS) is supported

<b>Signal on alarm</b>	<ul style="list-style-type: none"> <li>■ Current output → failsafe mode selectable</li> <li>■ Pulse/frequency output → failsafe mode selectable</li> <li>■ Status output (Prosonic Flow 90/91) → “nonconductive” in event of error or power supply failure</li> <li>■ Relay output (Prosonic Flow 93) → “voltage-free” in event of error or power supply failure</li> </ul>
<b>Load</b>	See “output signal”
<b>Switching output</b>	<p>Status output (Prosonic Flow 90/91): Open collector, max. 30 V DC / 250 mA, galvanically isolated. Configurable for: error messages, flow direction, limit values.</p> <p>Relay output (Prosonic Flow 93): Normally closed (NC) or normally open (NO) contacts 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.</p>
<b>Low flow cut off</b>	Switching point for the creepage freely selectable
<b>Galvanic isolation</b>	All circuits for inputs, outputs and power supply are galvanically isolated from each other.

## Power supply

Electrical connection  
measuring unit for  
Prosonic Flow 90/93  
(standard version)

### Connecting power supply and signal cables in the connection compartment



A0001135

Connecting the transmitter (wall-mount housing). Cable cross-section: max. 2.5 mm<sup>2</sup>

- a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC; power consumption: 18 VA / 10 W  
Terminal **No. 1**: L1 for AC, L+ for DC  
Terminal **No. 2**: N for AC, L- for DC
- b Terminals **No. 20-27**: signal cable
- c Ground terminal for protective earth
- d Ground terminal for signal cable shield
- e Service connector
- f Bolts on connection compartment housing

**Terminal assignment Prosonic Flow 90**

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
90***_*****W	–	–	–	HART current output
90***_*****A	–	–	Frequency output	HART current output
90***_*****D	Status input	Status input	Frequency output	HART current output
90***_*****H	–	–	–	PROFIBUS PA

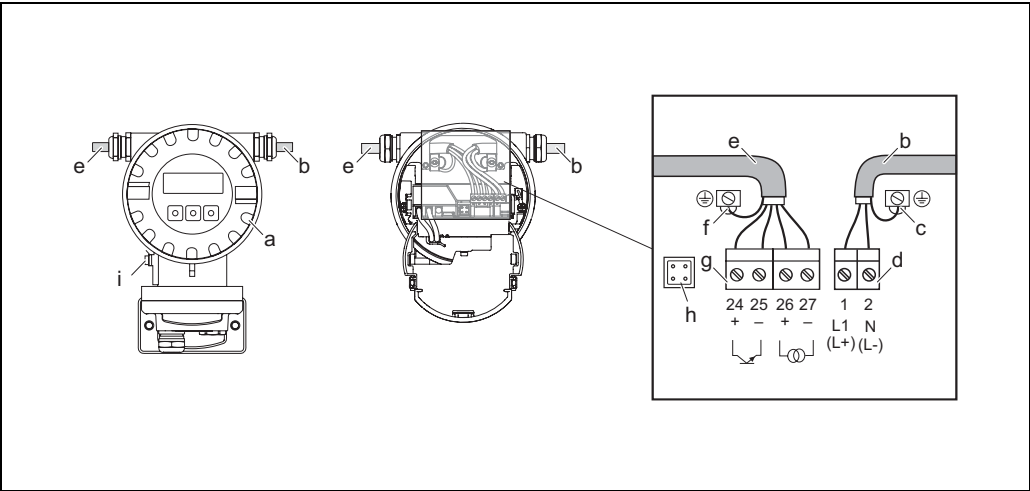
**Terminal assignment Prosonic Flow 93**

Depending on the version ordered, the inputs/outputs on the communication board can be either permanently assigned (fixed) or variable (flexible) (see Table). Plug-in point modules which are faulty or need to be replaced can be ordered as accessories.

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
Fixed communication boards (fixed assignment)				
93***_*****A	–	–	Frequency output	HART current output
93***_*****B	Relay output	Relay output	Frequency output	HART current output
93***_*****H	–	–	–	PROFIBUS PA
93***_*****K	–	–	–	FOUNDATION Fieldbus
Flexible communication boards				
93***_*****C	Relay output	Relay output	Frequency output	HART current output
93***_*****4	Frequency output	Frequency output	Current output	HART current output
93***_*****D	Status input	Relay output	Frequency output	HART current output
93***_*****6	Relay output	Relay output	Current output	HART current output
93***_*****L	Status input	Relay output	Relay output	HART current output
93***_*****M	Status input	Frequency output	Frequency output	HART current output
93***_*****W	Relay output	Current output	Current output	HART current output
93***_*****2	Relay output	Current output	Frequency output	HART current output



**Electrical connection  
measuring unit  
Prosonic Flow 91  
(standard version)**



Connecting the transmitter (aluminum field housing), max. cable cross-section 2.5 mm<sup>2</sup>

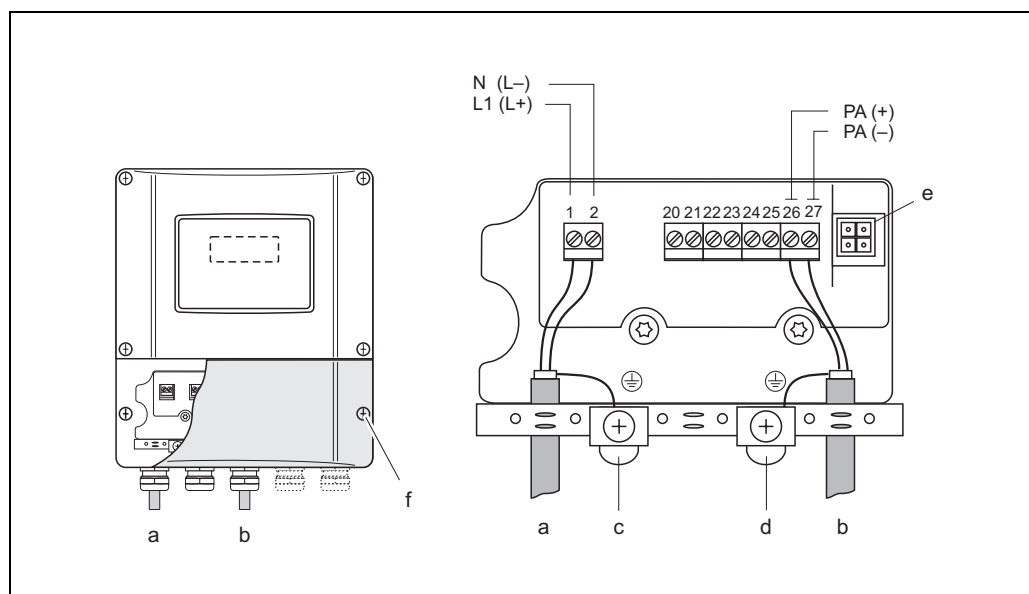
- a* Electronics compartment cover
- b* Cable for power supply: 85 to 250 V AC, 11 to 40 V DC, 20 to 28 V AC
- c* Ground terminal for power supply cable
- d* Terminal connector for power supply: No. 1–2 (terminal assignment)
- e* Signal cable
- f* Ground terminal for signal cable
- g* Terminal connector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

**Terminal assignment Prosonic Flow 91**

Order version	Terminal No. (inputs/outputs)		
	24 (+) / 25 (-)	26 (+) / 27 (-)	1 (L1/L+) / 2 (N/L-)
91***_*****A	Pulse output	HART current output	Power supply
Functional values	See “output signal”		see “Supply voltage”

# Electrical connection measuring unit for Prosonic Flow 90 (PROFIBUS PA)

## Connecting power supply and bus cables in the connection compartment



A0001316

Connecting the transmitter (wall-mount housing), max. cable cross-section 2.5 mm<sup>2</sup>

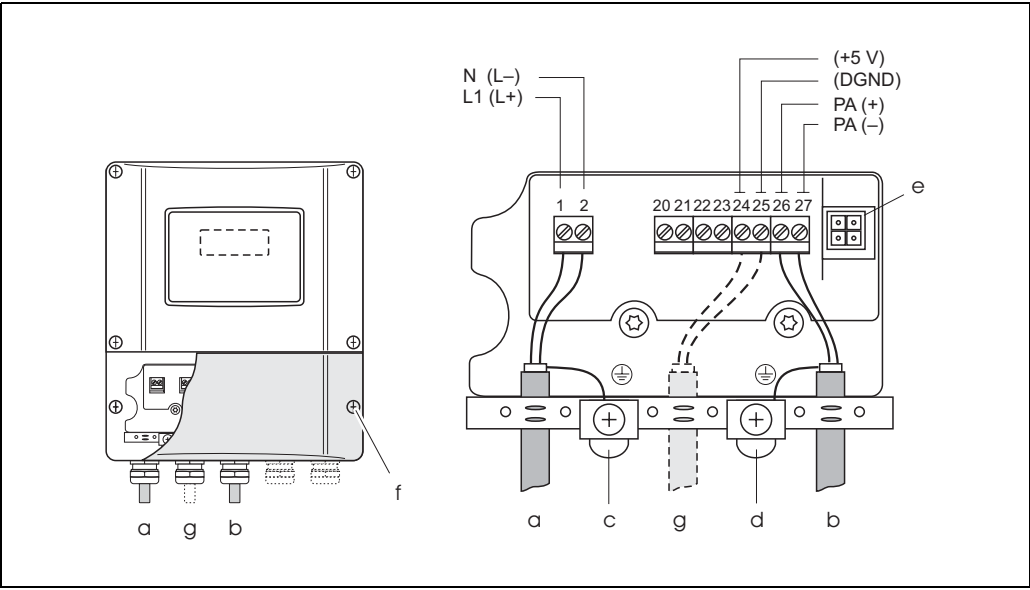
- a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC  
Terminal **No. 1**: L1 for AC, L+ for DC  
Terminal **No. 2**: N for AC, L- for DC
- b PROFIBUS PA line:  
Terminal **No. 26**: PA+  
Terminal **No. 27**: PA-
- c Ground terminal for protective earth
- d Ground terminal for signal cable shield
- e Service connector for connecting service interface FXA193 (Fieldcheck, ToF Tool - Fieldtool Package)
- f Connection compartment cover

## Terminal assignment Prosonic Flow 90 PROFIBUS PA

Order version	Terminal No. (inputs/outputs)
	<b>26</b> : PA+ <b>27</b> : PA-
90***_*****H	PROFIBUS PA (non Ex)
Connection values PROFIBUS PA	
PROFIBUS PA: Power supply: 9 to 32 V DC Current consumption: 11 mA	

Electrical connection  
measuring unit for  
Prosonic Flow 93  
(PROFIBUS PA)

Connecting power supply and bus cables in the connection compartment



A0000061

Connecting the transmitter (wall-mount housing), max. cable cross-section 2.5 mm<sup>2</sup>

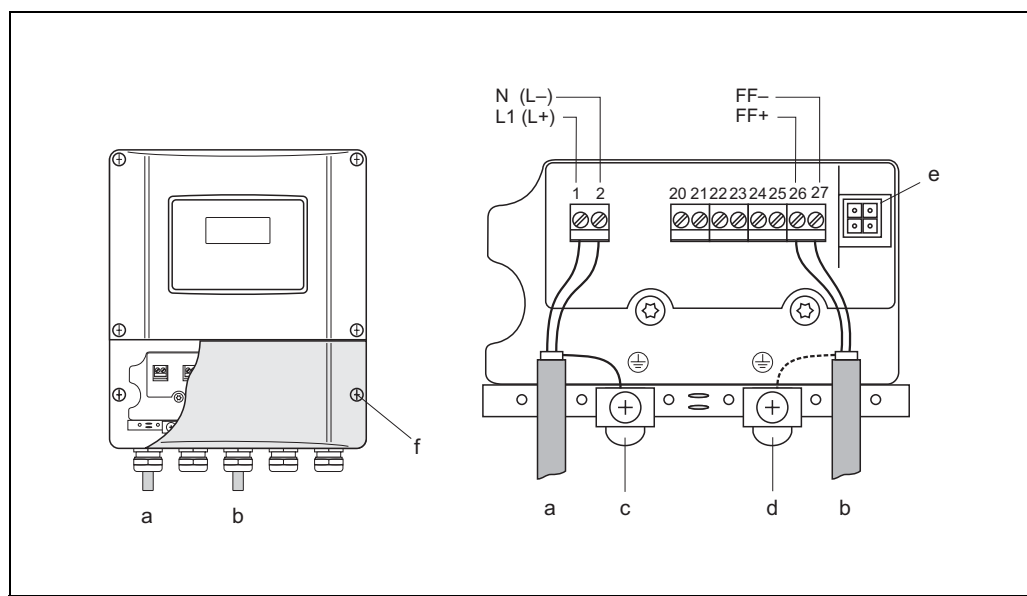
- a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC  
Terminal **No. 1**: L1 for AC, L+ for DC  
Terminal **No. 2**: N for AC, L- for DC
- b PROFIBUS PA line:  
Terminal **No. 26**: PA+  
Terminal **No. 27**: PA-
- c Ground terminal for protective earth
- d Ground terminal for signal cable shield
- e Service connector for connecting service interface FXA193 (Fieldcheck, ToF Tool - Fieldtool Package)
- f Connection compartment cover
- g Cable for external termination:  
Terminal **No. 24**: DGND  
Terminal **No. 25**: +5V

Terminal assignment Prosonic Flow 93 PROFIBUS/PA

Order version	Terminal No. (inputs/outputs)
	<b>26</b> : PA+ <b>27</b> : PA-
93***_*****H	PROFIBUS PA
Connection values PROFIBUS PA	
PROFIBUS PA: Power supply: 9 to 32 V DC Current consumption: 11 mA	

Electrical connection  
measuring unit for  
Prosonic Flow 93  
(FOUNDATION Fieldbus)

Connecting power supply and bus cables in the connection compartment



A0006030

Connecting the transmitter (wall-mount housing), max. cable cross-section 2.5 mm<sup>2</sup>

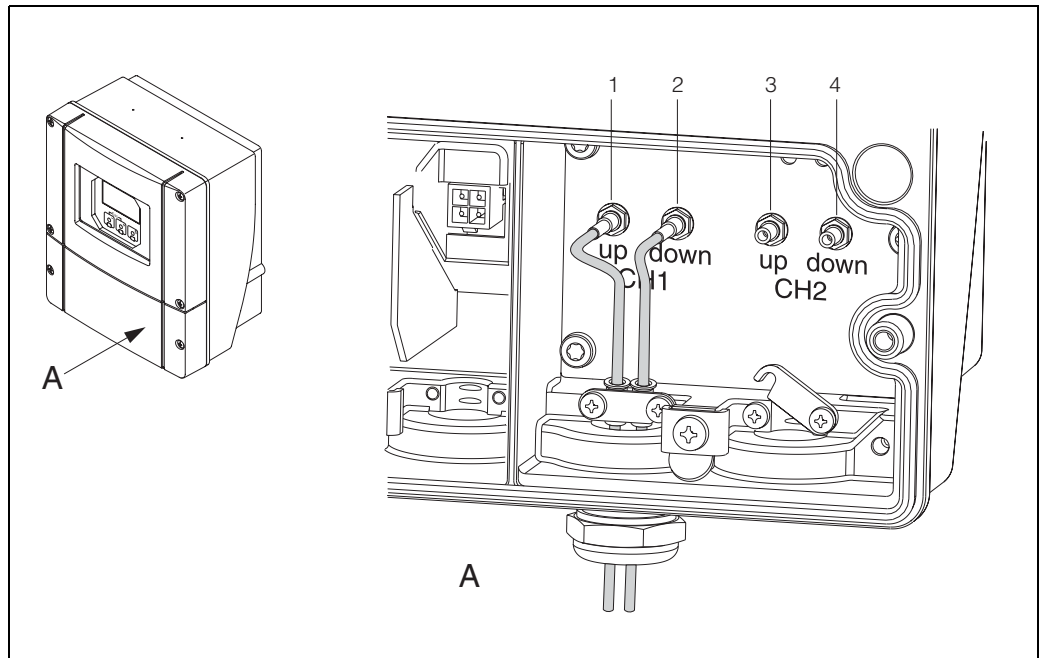
- a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC  
Terminal **No. 1**: L1 for AC, L+ for DC  
Terminal **No. 2**: N for AC, L- for DC
- b Fieldbus cable:  
Terminal **No. 26**: FF+ (with integrated reverse polarity protection)  
Terminal **No. 27**: FF- (with integrated reverse polarity protection)
- c Ground terminal for protective earth
- d Ground terminal for fieldbus cable shield
- e Service connector for connecting service interface FXA193 (Fieldcheck, ToF Tool - Fieldtool Package)
- f Connection compartment cover

Terminal assignment Prosonic Flow 93 FOUNDATION Fieldbus

Order version	Terminal No. (inputs/outputs)
	<b>26</b> : FF+ <b>27</b> : FF-
93***_*****K	FOUNDATION Fieldbus
Connection values FOUNDATION Fieldbus	
FOUNDATION Fieldbus: Power supply: 9 to 32 V DC Current consumption: 12 mA	

**Electrical connection  
sensor connecting cable  
Prosonic Flow 90/93**

**Connecting power sensor cables in the connection compartment**



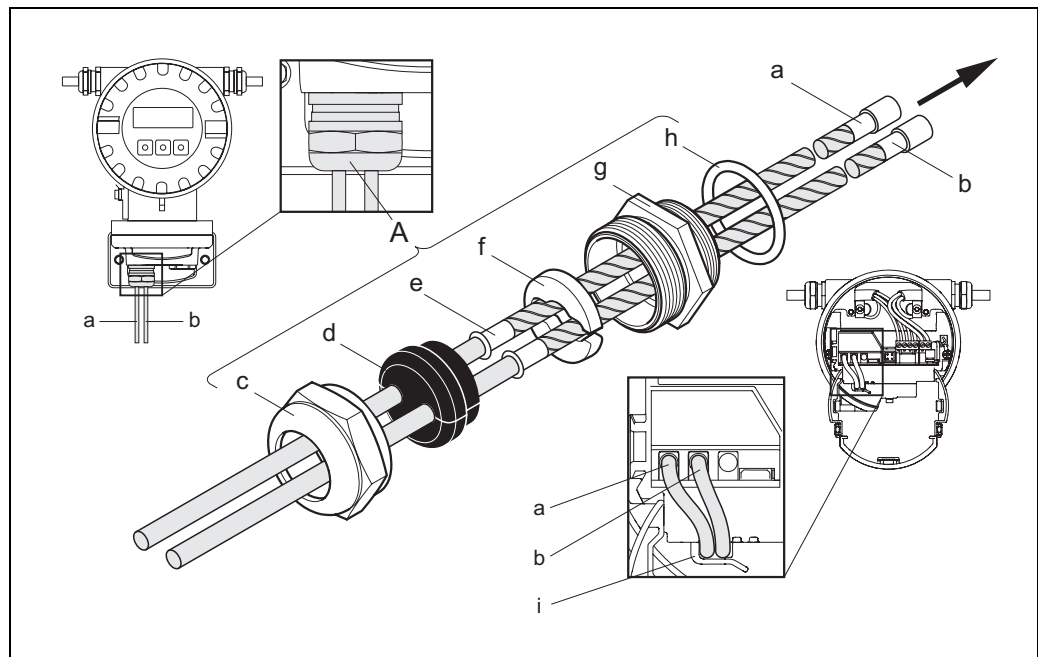
F06-9xxxxxxx-04-06-06-xx-000

*A = View A (wall-mount housing; non-hazardous areas, Ex Zone 2)*

- 1 Channel 1 upstream*
- 2 Channel 1 downstream*
- 3 Channel 2 upstream*
- 4 Channel 2 downstream*

## Electrical connection sensor connecting cable Prosonic Flow 91

### Connecting power sensor cables in the connection compartment



A0005843

#### Connecting the measuring system

- a, b Sensor connecting cables
- c Cover of cable gland
- d Rubber seal
- e Cable retaining sleeves
- f Ground disk
- g Cable gland holder
- h Seal
- i Cable holder

### Supply voltage (power supply)

#### Transmitter:

- 85 to 260 V AC, 45 to 65 Hz
- 20 to 55 V AC, 45 to 65 Hz
- 16 to 62 V DC

#### Measuring sensors:

- Powered by the transmitter

### Cable entry

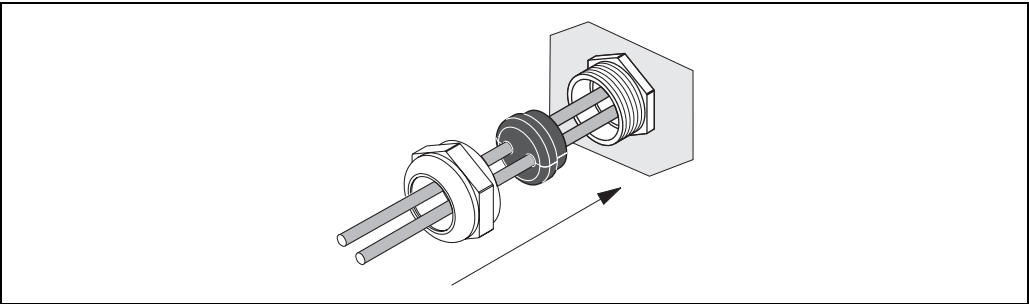
#### Power supply and signal cables (inputs/outputs):

- Cable entry M20 x 1.5 (8 to 12 mm / 0.31" to 0.47")
- or
- Cable gland for cables with  $\varnothing$  6 to 12 mm (0.24" to 0.47")
- Threaded adapter 1/2" NPT, G 1/2"

#### Sensor connecting cable:

A special cable gland allows you to insert both sensor cables (per channel) into the connection compartment simultaneously.

- Cable gland M20 x 1.5 for 2 x  $\varnothing$  4 mm (0.08" x  $\varnothing$  0.16")
- or
- Threaded adapter 1/2" NPT, G 1/2"



F06-9xxxxxx-17-11-06-xx-000

Special cable gland of sensor connecting cables on transmitter side

<b>Cable specifications</b>	<p>Sensor cable:</p> <ul style="list-style-type: none"><li>■ Use the ready-to-use cables supplied by Endress+Hauser with each sensor pair.</li><li>■ The following cable lengths are available: 5 m, 10 m, 15 m, 30 m, 60 m and 100 m 16 ft, 33 ft, 49 ft, 98 ft, 197 ft and 328 ft</li><li>■ You can choose between PTFE and PVC cable material.</li></ul> <p>Operation in zones of severe electrical interference: The measuring system meets the general safety requirements as per EN 61010 and the EMC requirements as per EN 61326/A1 (IEC 1326) “Emission as per requirements for class A” as well as NAMUR recommendation NE 21.</p> <p>Signal and power cable:</p> <p>Caution! Grounding is by means of the ground terminals provided for this purpose inside the connection housing. Keep the stripped and twisted lengths of cable shield to the terminals as short as possible.</p>
<b>Power consumption</b>	<p><b>Prosonic Flow 90/93</b></p> <p>AC: &lt;18 VA (incl. sensor) DC: &lt;10 W (incl. sensor)</p> <p><b>Prosonic Flow 91</b></p> <p>85 to 250 V AC: &lt;12 VA (incl. sensor) 20 to 28 V AC: &lt;7 VA (incl. sensor) 11 to 40 V DC: &lt;5 W (incl. sensor)</p>
<b>Power supply failure</b>	<p>Bridging of min. 1 cycle frequency: EEPROM (Prosonic Flow 90) or HistoROM/T-DAT (Prosonic Flow 91 and 93) save measuring system data if power supply fails</p>
<b>Potential equalization</b>	<p>For potential equalization, no special measures are necessary.</p> <p>Note! For instruments for use in hazardous areas, observe the corresponding guidelines in the specific Ex documentation.</p>

## Performance characteristics

### Reference operating conditions

- Medium temperature range:  $+28\text{ °C} \pm 2\text{ K}$
- Ambient temperature range:  $+22\text{ °C} \pm 2\text{ K}$
- Warm-up period: 30 minutes

#### Installation:

- Inlet run  $>10 \times \text{DN}$
- Outlet run  $> 5 \times \text{DN}$
- Measuring sensors and transmitter are grounded.
- The measuring sensors are properly mounted.

### Maximum measured error

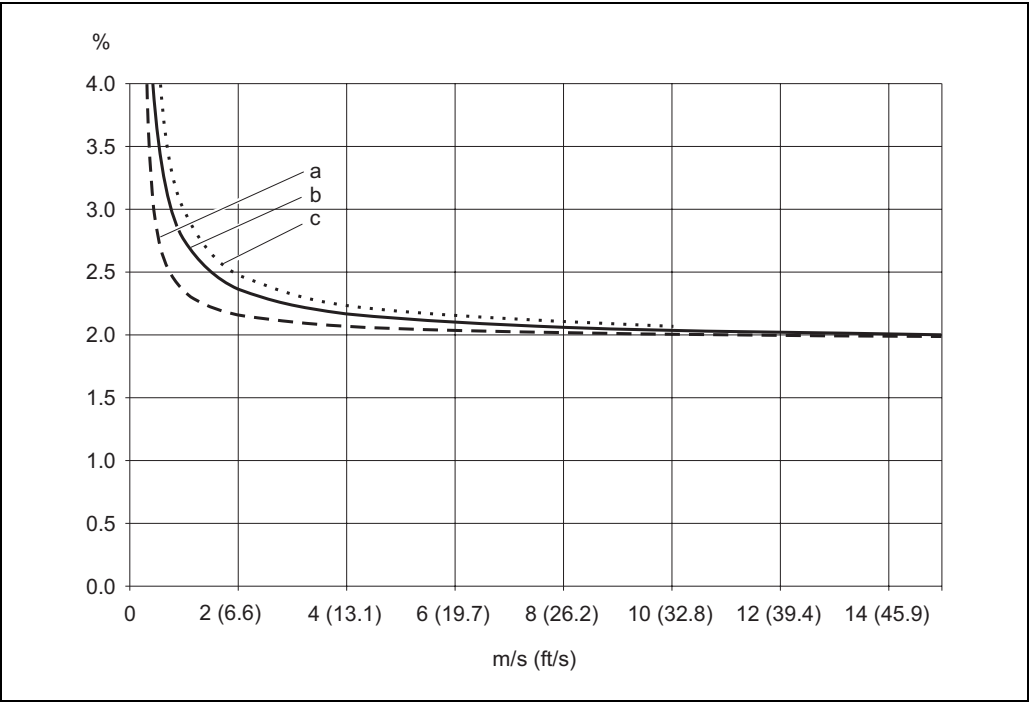
For flow velocities of  $> 0.3\text{ m/s}$  ( $> 0.98\text{ ft/s}$ ) and a Reynolds number of  $>10000$ , the system accuracy is:

Version	Guaranteed error limits		Report
Prosonic Flow W and U: – Clamp-on – Insertion	$< \text{DN } 50$ ( $<2''$ ) <sup>(5)</sup> $\text{DN } 50$ to $200$ ( $2''$ to $8''$ ) $> \text{DN } 200$ ( $>8''$ )	$\pm 2.0\%$ o.r. plus $\pm 0.1\%$ o.f.s. <sup>(4)</sup> $\pm 2.0\%$ o.r. plus $\pm 0.05\%$ o.f.s. <sup>(3)</sup> $\pm 2.0\%$ o.r. plus $\pm 0.02\%$ o.f.s. <sup>(3)</sup> See note <sup>(1)</sup>	A report is not issued. The value given are typical values.
Prosonic Flow W and U: – Clamp-on	U W	$\pm 0.5\%$ o.r. plus $\pm 0.1\%$ o.f.s. <sup>(4)</sup> $\pm 0.5\%$ o.r. plus $\pm 0.05\%$ o.f.s. <sup>(3)</sup>	Verification of accuracy <sup>(2)</sup>
Prosonic Flow W: – Insertion		$\pm 0.5\%$ o.r. plus $\pm 0.02\%$ o.f.s. <sup>(3)</sup>	Verification of accuracy <sup>(2)</sup>
Prosonic Flow C Inline		$\pm 1.5\%$ o.r. plus $\pm 0.02\%$ o.f.s. <sup>(4)</sup>	Calibration confirmation
Prosonic Flow C Inline		$\pm 0.5\%$ o.r. plus $\pm 0.02\%$ o.f.s. <sup>(4)</sup>	Calibration report
o.r. = of reading o.f.s. = of full scale value			

- <sup>(1)</sup> The basic accuracy of the measuring system is 0.5%.  
The dry calibration represents additional uncertainty due to mounting and actual pipe properties.  
This additional uncertainty is better than 1.5% typically.
- <sup>(2)</sup> Accuracy verification is carried out on a DN 50 or DN 100 (2" or 4") pipe for the clamp-on version, on a DN 250 (10") pipe for the Insertion version (single-path version) and on a DN 400 (16") pipe for the Insertion version (dual-path version). The verification applies under reference operating conditions.
- <sup>(3)</sup> Maximum full scale value: 15 m/s (49.2 ft/s)
- <sup>(4)</sup> Maximum full scale value: 10 m/s (32.8 ft/s)
- <sup>(5)</sup> Only when used on plastic pipes

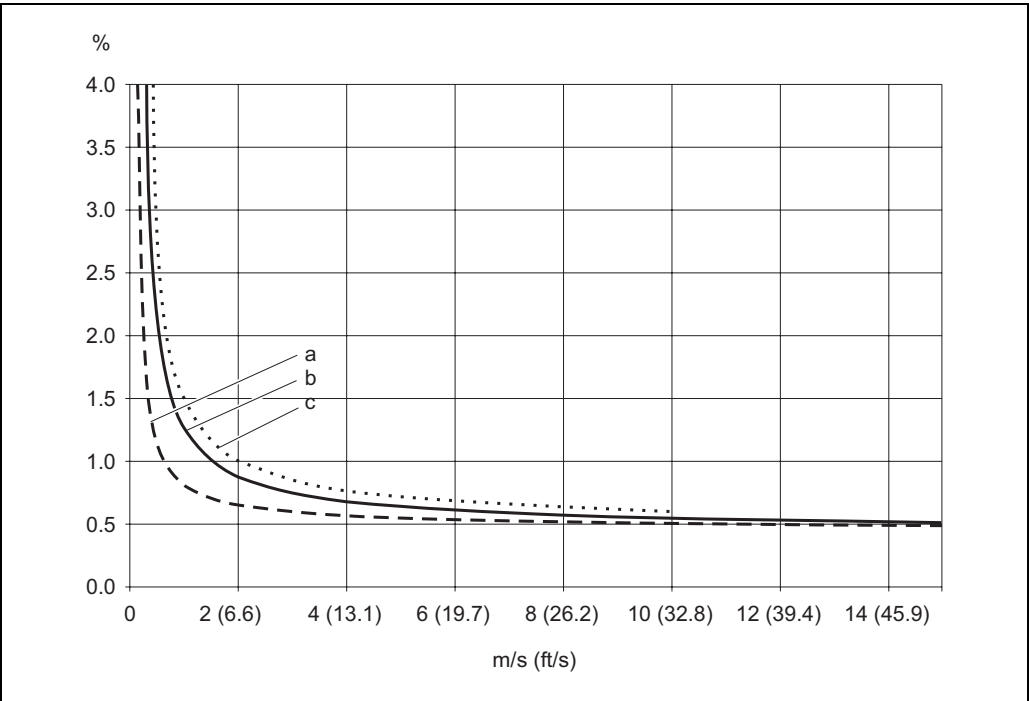


Max. measured error for dry calibration in % of reading



- a Pipe diameter > DN 200 (> 8")
- b Pipe diameter > DN 50 < DN 200 (> 2" < 8")
- c Pipe diameter < DN 50 (> 2")

Max. measured error for wet calibration and verification of accuracy in % of reading



- a Pipe diameter > DN 200 (> 8")
- b Pipe diameter > DN 50 < DN 200 (> 2" < 8")
- c Pipe diameter < DN 50 (> 2")

**Repeatability** ± 0.3% for flow velocities > 0.3 m/s (0.98 ft/s)

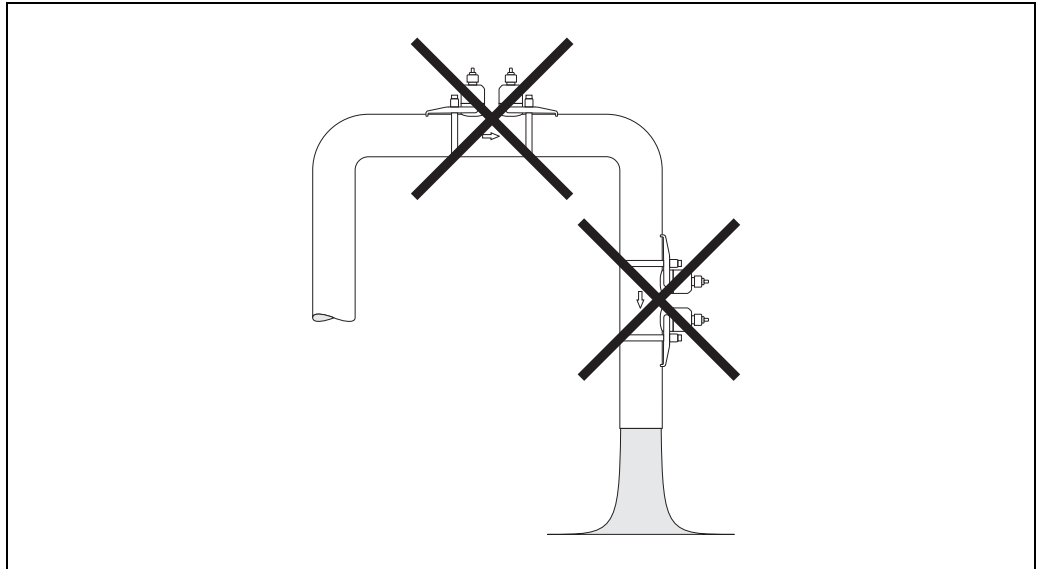
## Operating conditions: Installation

### Installation instructions

#### Mounting location

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

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

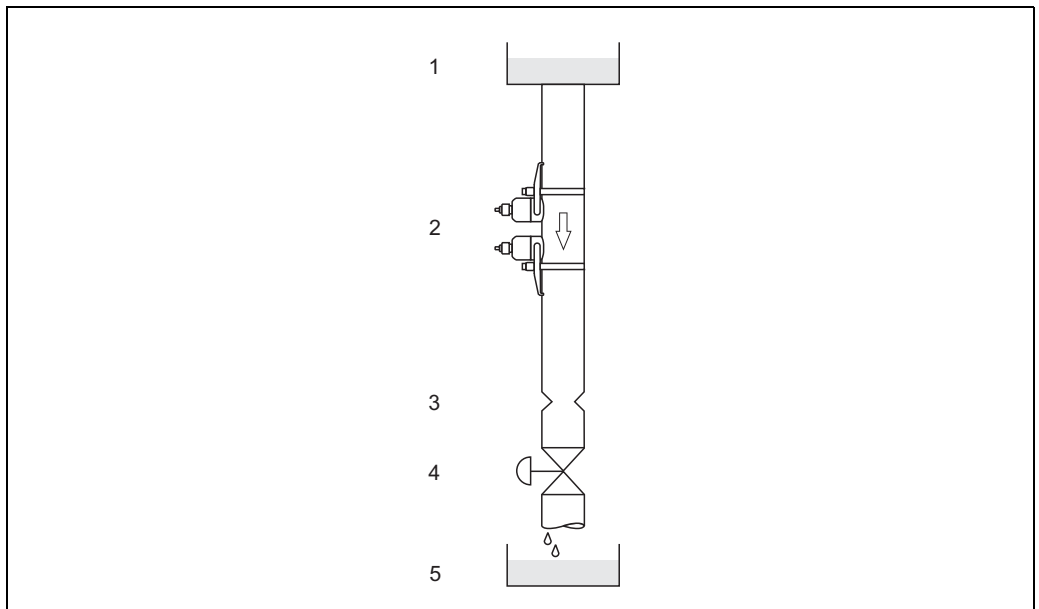


A0001103

*(Applies to all sensor versions)*

#### Down pipes

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



A0001104

*Installation in a down pipe (applies to all sensor versions)*

- 1 Storage tank
- 2 Measuring sensors
- 3 Orifice plate, pipe constriction
- 4 Valve
- 5 Filling tank

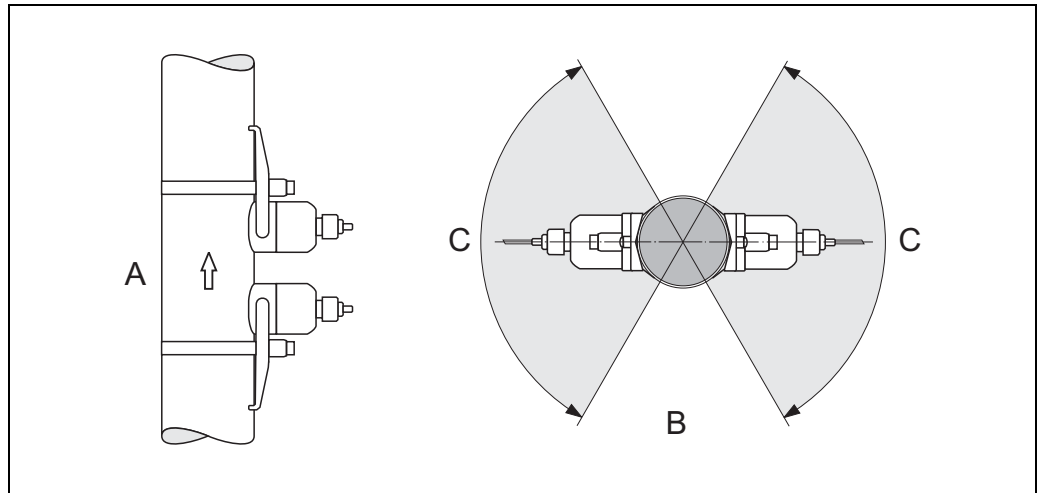
## Orientation

### Vertical

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

### Horizontal

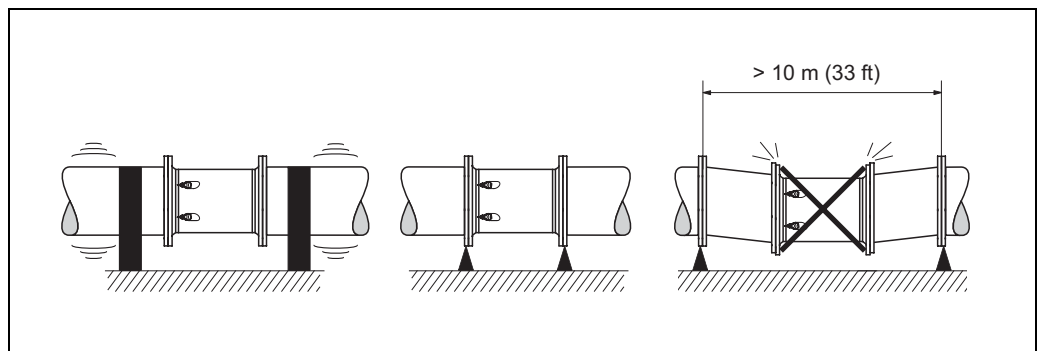
In the recommended installation range in a horizontal installation position (View B), gas and air accumulation at the pipe cover and problematic build-ups at the bottom of the pipe have a minor influence on the measurement.



C = Recommended installation range max. 120° (applies to all sensor versions)

## Vibrations

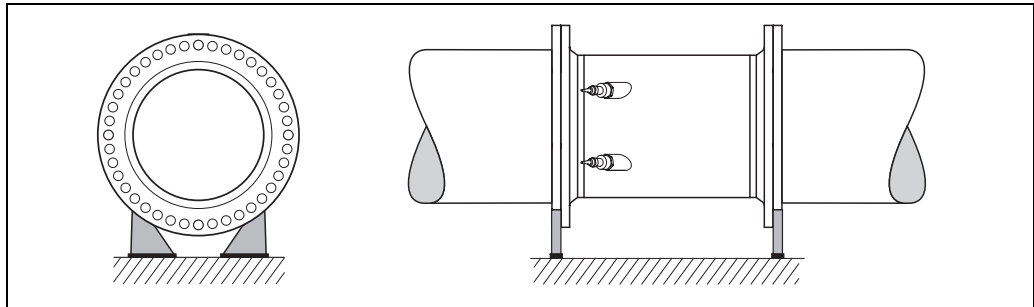
Secure the piping and the Prosonic Flow C Inline sensor if vibration is severe. Information on resistance to vibration and shock can be found on Page 31



A0006103-ae

**Foundations, supports**

For all nominal diameters, mount the sensor on a foundation of adequate load-bearing strength. The foundation/supports must work on the pipe flanges and not on the measuring pipe flanges of Prosonic Flow C.

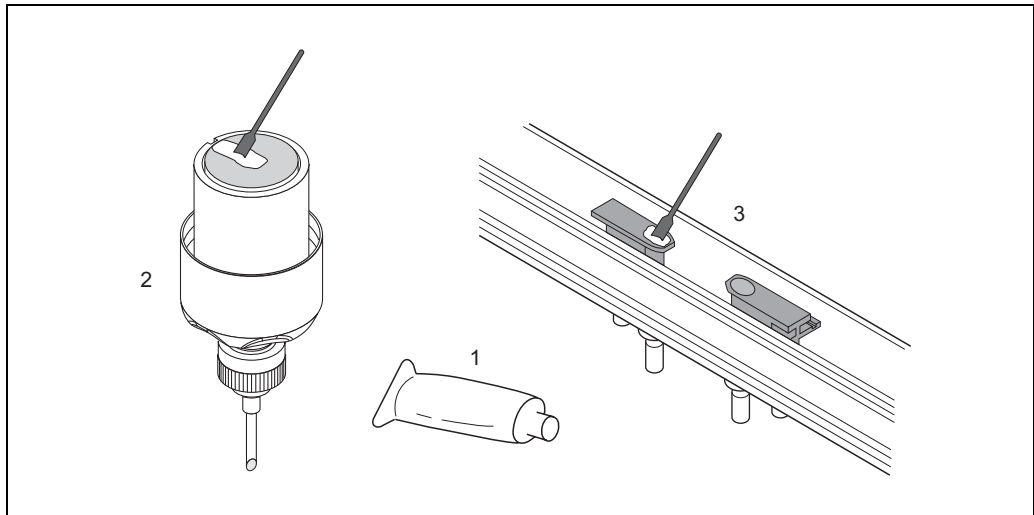


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**Coupling fluid**

A coupling fluid is required to ensure the acoustic link between the sensor (clamp-on version) and the piping. This is applied to the sensor surface during commissioning. Periodic replacement of the coupling fluid is usually not required.

As part of the “Advanced diagnostics” software package, Prosonic Flow 93 offers a coupling fluid monitoring function in which the signal strength can be output as a limit value.

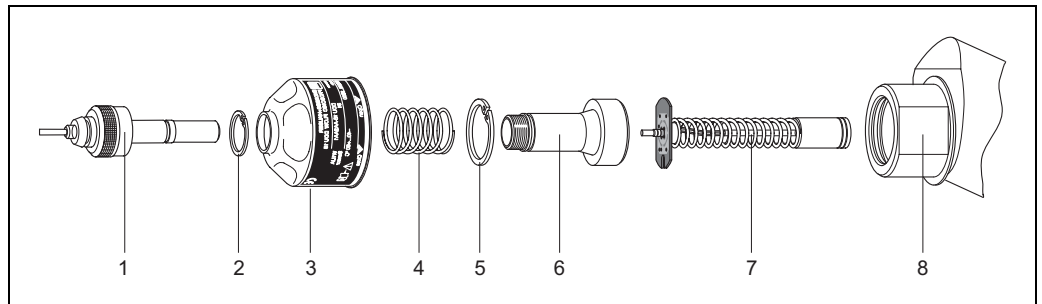


A0001144

- 1 Coupling fluid
- 2 Sensor surface Prosonic Flow W (clamp-on)
- 3 Sensor surface Prosonic Flow U

### Sensor replacement, Prosonic Flow W Insertion

The active part of the sensor can be replaced without interrupting the process.



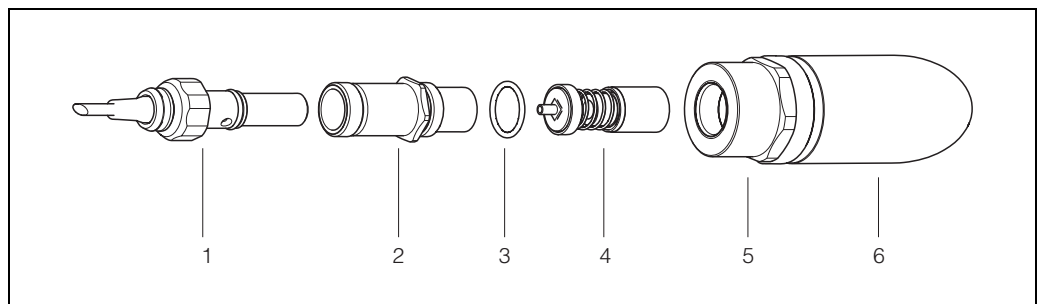
A0001144

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

### Sensor replacement, Prosonic Flow C Inline

The active part of the sensor can be replaced without interrupting the process.

Prosonic Flow C Inline has 2 pairs of Prosonic Flow W Insertion sensors.

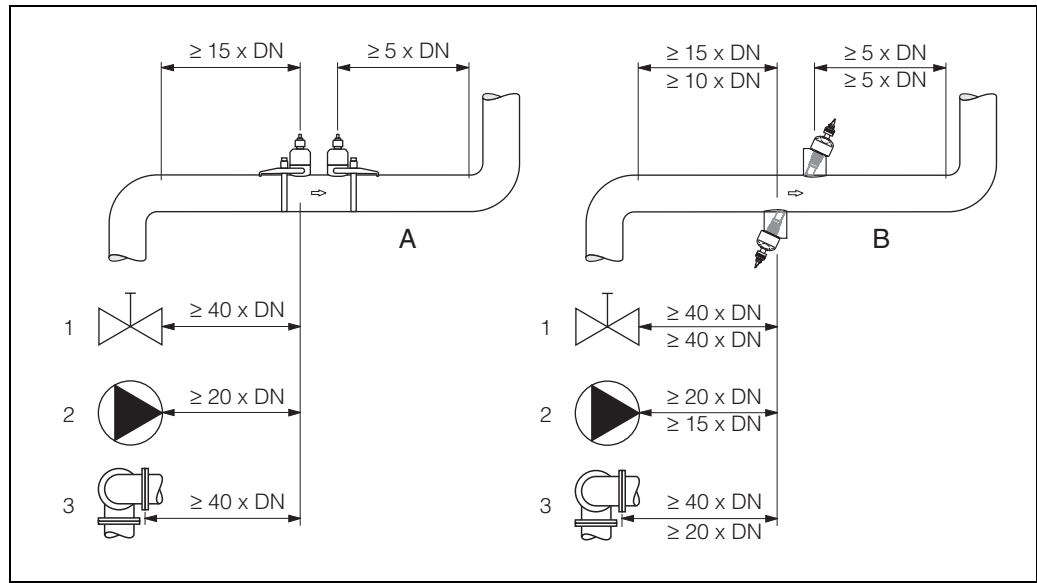


F06-9xWxxxxx-11-05-06-xx-000

- 1 Sensor connector
- 2 Sensor neck
- 3 O-ring
- 4 Sensor element
- 5 Sensor holder
- 6 Sensor support in measuring pipe Prosonic Flow C

**Inlet and outlet run**

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc. Compliance with the following requirements for the inlet and outlet runs is recommended to ensure measuring accuracy:



The figure above illustrates the minimum recommended inlet and outlet runs (DN = pipe diameter).

A Prosonic Flow W and U (clamp-on versions)

B Prosonic Flow W (insertion version) and Prosonic Flow C Inline  
(dimensions above the dimensioning line = single-path version;  
dimensions under the dimensioning line = dual-path version and Prosonic Flow C)

1 Valve

2 Pump

3 Two pipe bends in different directions

**Length of connecting cable**

Shielded cables are offered in the following lengths:

5 m, 10 m, 15 m, 30 m, 60 m and 100 m (applies to all sensor versions)

16 ft, 33 ft, 49 ft, 98 ft, 197 ft and 328 ft

Comply with the following instructions when mounting in order to achieve correct measuring results:  
Route the cable well clear of electrical machines and switching elements.

## Operating conditions: Environment

<b>Ambient temperature range</b>	<ul style="list-style-type: none"> <li>■ Transmitter Prosonic Flow 90/91/93: –20 to +60 °C (–4 to +140 °F)</li> <li>■ Flowrate measuring sensors Prosonic Flow W (clamp-on): –20 to +80 °C (–4 to +176 °F)</li> <li>■ Flowrate measuring sensors Prosonic Flow U (clamp-on): –20 to +60 °C (–4 to +140 °F)</li> <li>■ Flowrate measuring sensors Prosonic Flow W (Insertion): –40 to +80 °C (–40 to +176 °F)</li> <li>■ Prosonic Flow C Inline: Measuring pipe: –10 to +60 °C (+14 to +140 °F) Flowrate measuring sensors Prosonic Flow W (Inline): –40 to +80 °C (–40 to +176 °F)</li> <li>■ Sound velocity measuring sensors DDU 18: –40 to +80 °C (–40 to +176 °F)</li> <li>■ Wall thickness measuring sensor DDU 19: 0 to +60 °C (+32 to +140 °F)</li> <li>■ Sensor cable PTFE –40 to +170 °C (–40 to +338 °F); sensor cable PVC –20 to +70 °C (–4 to +158 °F)</li> <li>■ In heated piping or piping conveying cold fluids, it is always permissible to insulate the piping completely with the mounted ultrasonic sensors.</li> <li>■ Install the transmitter at a shady location. Avoid direct sunlight, particularly in warm climatic regions.</li> </ul>
<b>Storage temperature</b>	The storage temperature corresponds to the ambient temperature range of the measuring transmitter and the relevant measuring sensors and the corresponding sensor cables (see above).
<b>Degree of protection</b>	<ul style="list-style-type: none"> <li>■ Transmitter Prosonic Flow 90/91/93: IP 67 (NEMA 4X)</li> <li>■ Flowrate measuring sensors Prosonic Flow W (clamp-on): IP 67 (NEMA 4X), optional IP 68 (NEMA 6P)</li> <li>■ Flowrate measuring sensors Prosonic Flow U (clamp-on): IP 54</li> <li>■ Flowrate measuring sensors Prosonic Flow W (Insertion): IP 68 (NEMA 6P)</li> <li>■ Flowrate measuring sensors Prosonic Flow W (Inline): IP 68 (NEMA 6P)</li> <li>■ Sound velocity measuring sensors DDU 18: IP 68 (NEMA 6P)</li> <li>■ Wall thickness measuring sensor DDU 19: IP 67 (NEMA 4X)</li> </ul>
<b>Shock and vibration resistance</b>	In accordance with IEC 68-2-6
<b>Electromagnetic compatibility (EMC)</b>	Electromagnetic compatibility (EMC requirements) according to EN 61326/A1 (IEC 1326) “Emission to class A requirements” and NAMUR Recommendation NE 21/43

## Operating conditions: Process

### Medium temperature range

- Flowrate measuring sensors Prosonic Flow W (clamp-on):  
–20 to +80 °C / –4 to +176 °F (optional 0 to +130 °C / +32 to +266 °F)
- Flowrate measuring sensors Prosonic Flow U (clamp-on):  
–20 to +80 °C (–4 to +176 °F)
- Flowrate measuring sensors Prosonic Flow W (Insertion):  
–40 to +80 °C (–40 to +176 °F)
- Prosonic Flow C Inline:  
Measuring pipe: –10 to +60 °C (+14 to +140 °F) (epoxy coated)  
Flowrate measuring sensors Prosonic Flow W (Inline): –40 to +80 °C (–40 to +176 °F)
- Sound velocity measuring sensors DDU 18:  
–40 to +80 °C (–40 to +176 °F)
- Wall thickness measuring sensor DDU 19:  
0 to +60 °C (+32 to +140 °F)

### Medium pressure range (nominal pressure)

- Perfect measurement requires that the static fluid pressure is higher than vapor pressure.
- Max. nominal pressure Prosonic Flow W (insertion): PN 16 (232 psi).

### Pressure loss

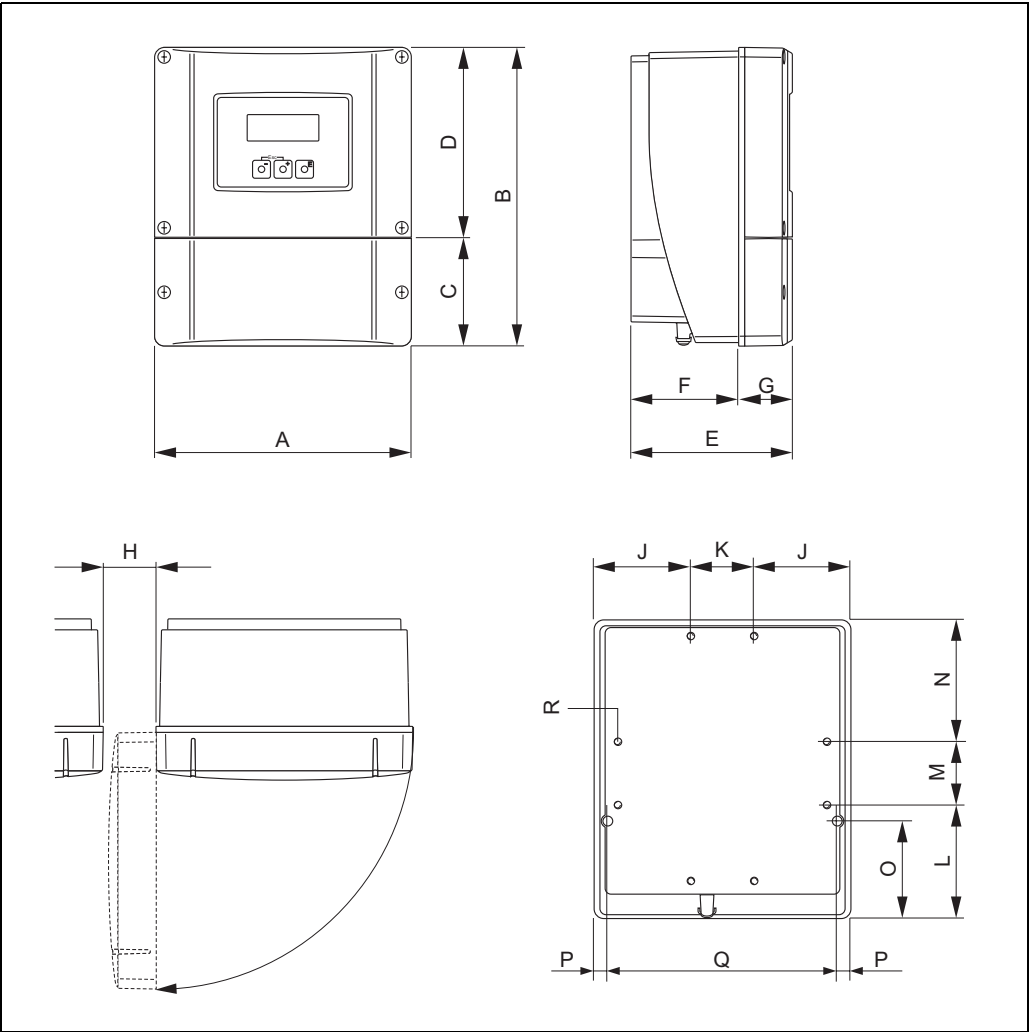
There is no pressure loss.



Mechanical construction

Design, dimensions

Dimensions of wall-mount housing, Prosonic Flow 90/93



A0001150

Metric units [mm]

A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
215	250	90.5	159.5	135	90	45	>50	81	53	95	53	102	81.5	11.5	192	8xM5

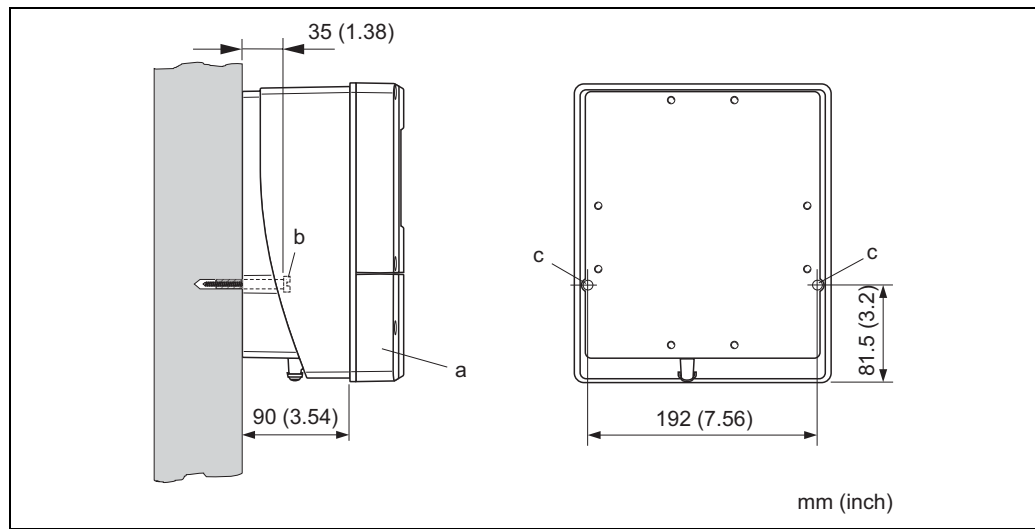
US units [inch]

A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
8.46	9.84	3.56	6.28	5.32	3.54	1.77	>1.97	3.19	2.09	3.74	2.09	4.02	3.21	0.45	7.56	8xM5

Installing the wall-mount housing

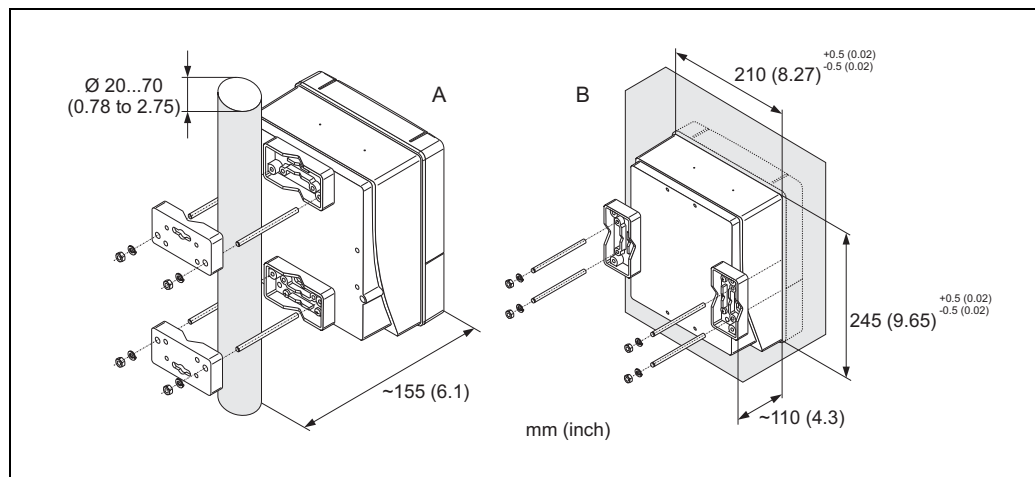
Caution!

- Ensure that the ambient temperature does not exceed or undershoot the permitted range of  $-20\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$  ( $-4$  to  $+140\text{ }^{\circ}\text{F}$ ) or optionally  $-40\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$  ( $-40$  to  $+140\text{ }^{\circ}\text{F}$ ). Install the device at a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries point downwards.

*Mounted directly on the wall*

a0001130-ae

- a* Wall-mount housing  
*b* Retaining bolts (M6): max.  $\varnothing$  6.5 mm (0.25 inch); bolt head: max.  $\varnothing$  10.5 mm (0.41 inch)  
*c* Assembly holes in the housing

*Pipe mounting and panel mounting*

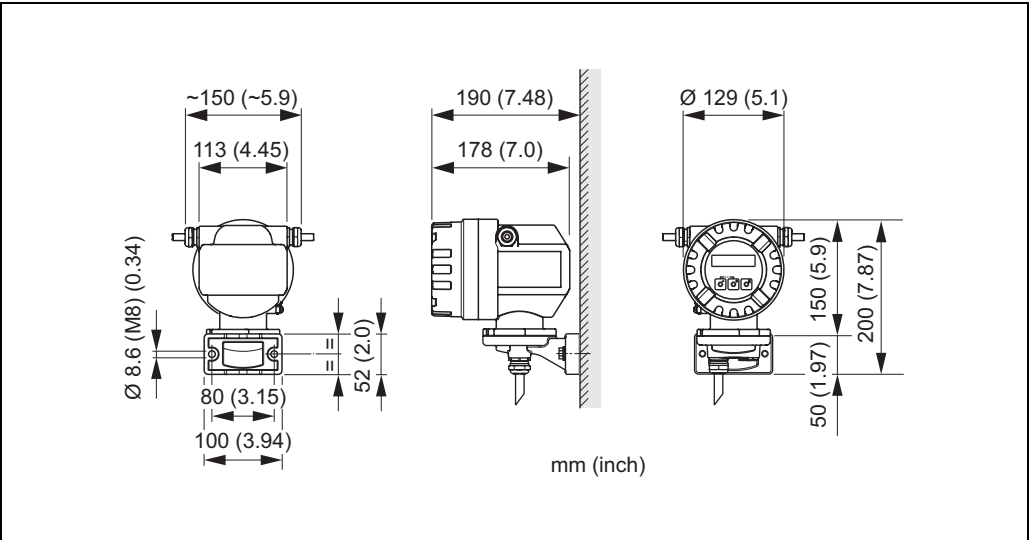
a0005250-ae

- A* Pipe mounting the wall-mount housing  
*B* Installation of the wall-mount housing in a control panel

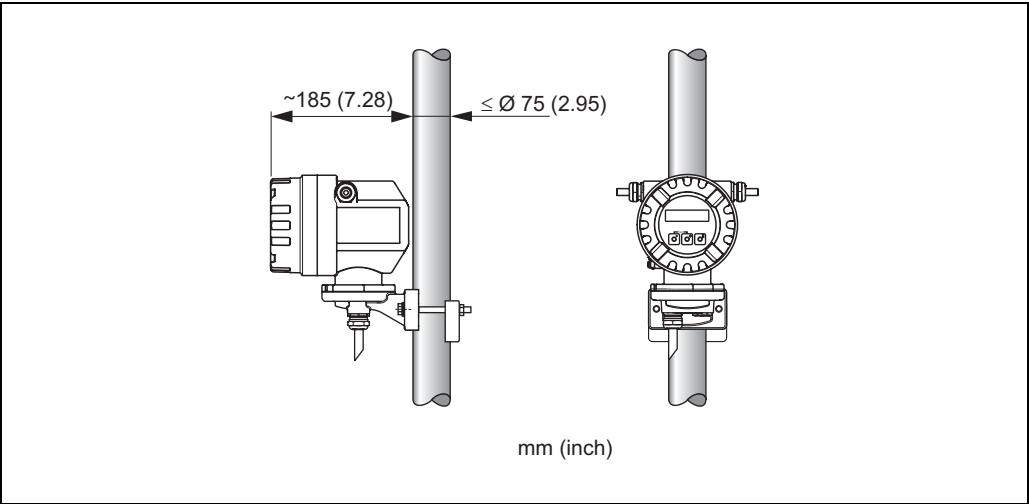
**Caution!**

If a pipe which is heated under normal conditions is used for installation you must ensure that the housing temperature does not exceed the max. permitted value of +60 °C (+140 °F).

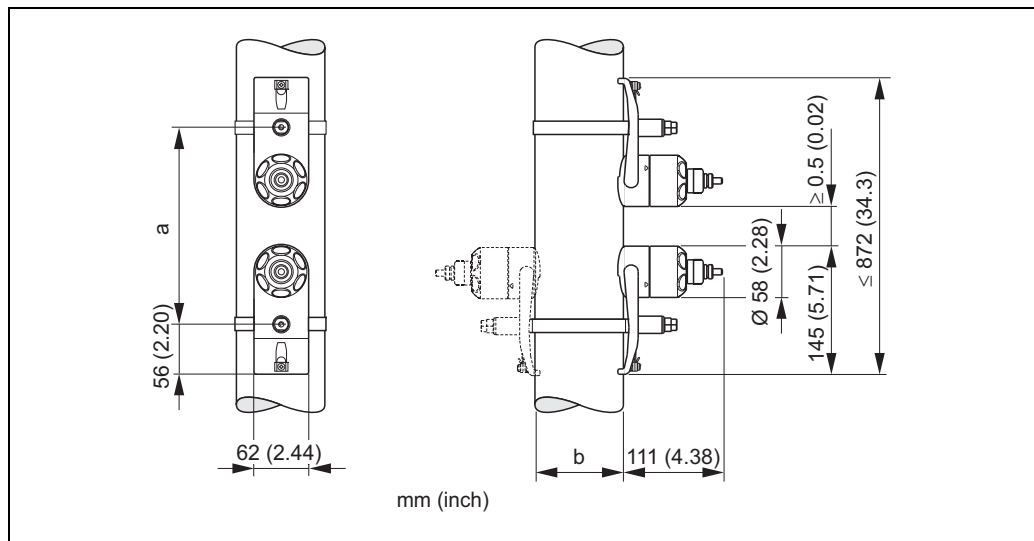
Dimensions of field housing, Prosonic Flow 91



Dimensions of pipe mounting, Prosonic Flow 91



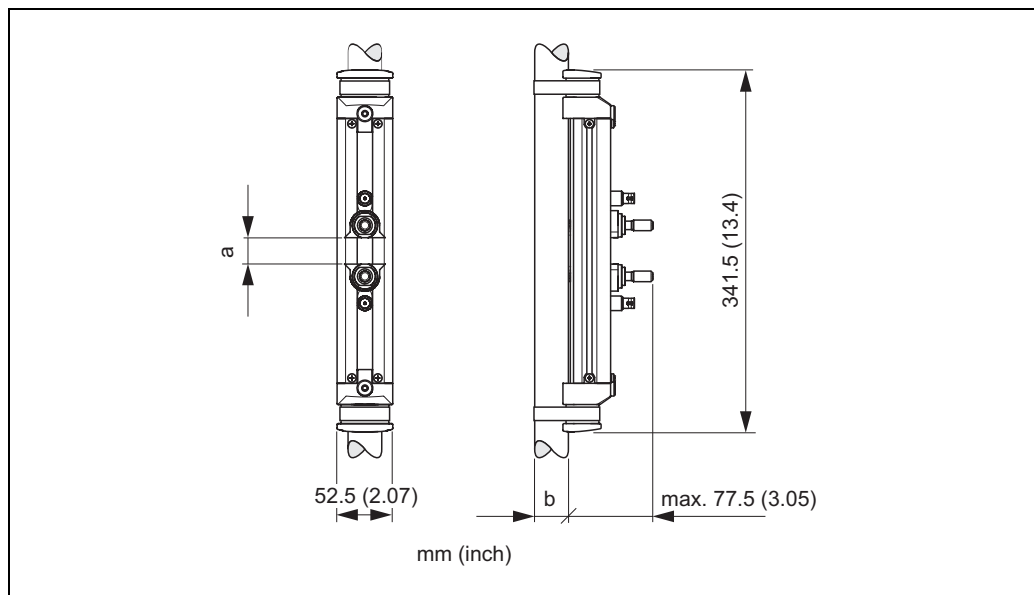
### Prosonic Flow W (clamp-on version)



A0001151-ae

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

### Prosonic Flow U (clamp-on version for small nominal diameters)

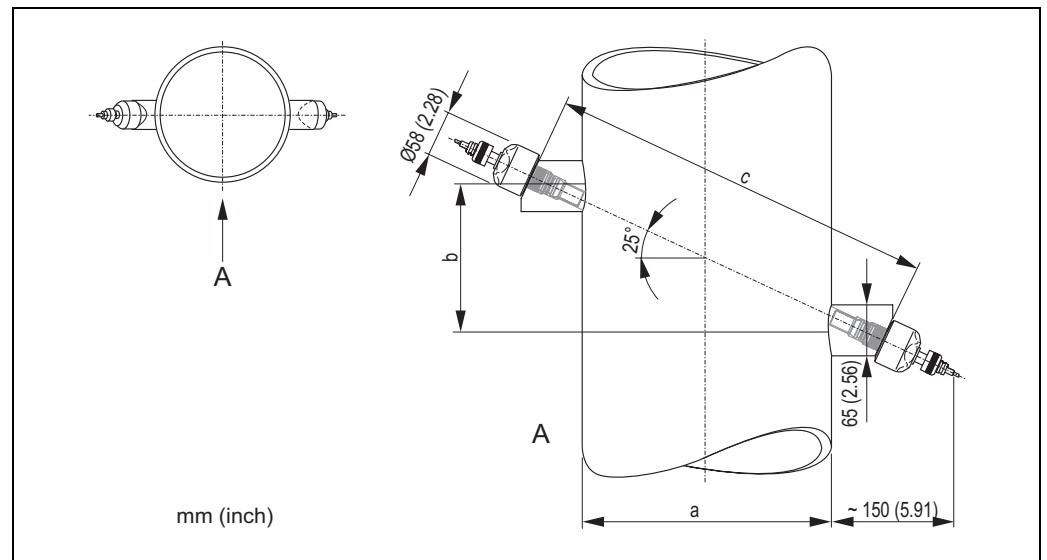


A0001152-ae

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

### Prosonic Flow W (Insertion version)

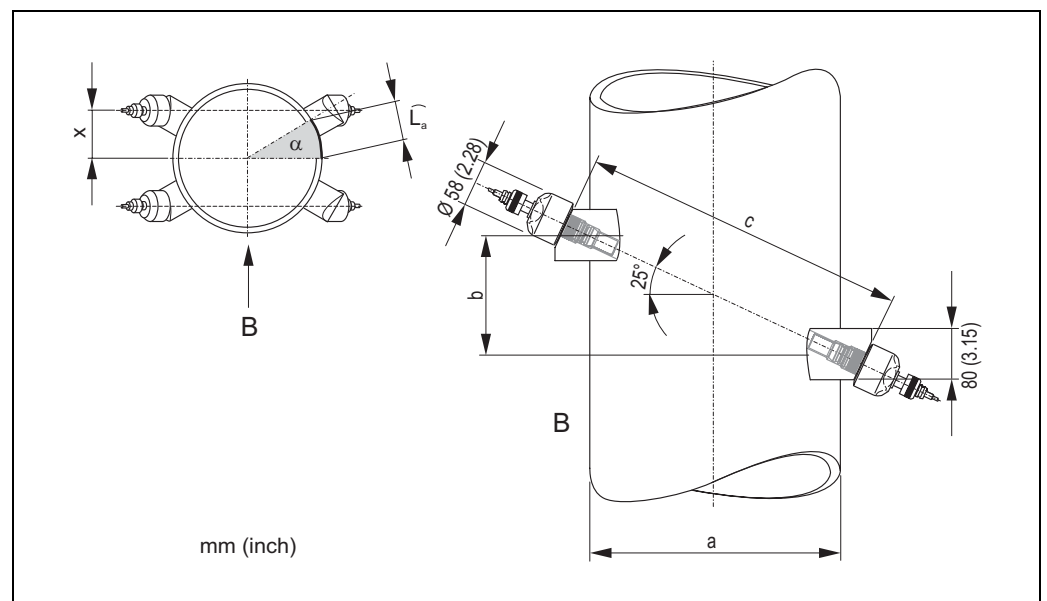
Single-path version



A0001153-ae

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

Dual-path version



A0001219-ae

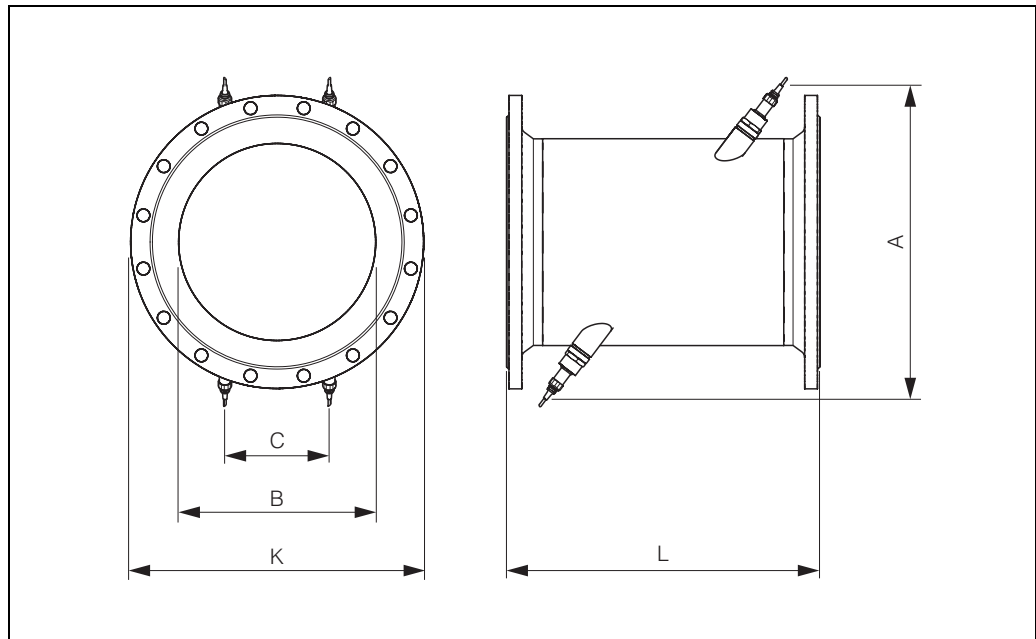
- B View B  
 a Pipe outer diameter (defined by the application)  
 b Sensor spacing can be determined using Quick Setup  
 c Path length can be determined using Quick Setup

$$\text{Arc length: } \widehat{L}_a = \frac{\pi \cdot d \cdot \alpha}{360^\circ}$$

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

**Prosonic Flow C Inline**

Calibrated measuring pipe with flowrate measuring sensors W



F06-9xCxxxxx-06-05-xx-xx-000

DN				A	B	C	L	K
EN (DIN) PN 6 [mm]	EN (DIN) PN 10 [mm]	EN (DIN) PN 16 [mm]	ANSI/ AWWA [inch]	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)
–	300	–	–	520	317.5	165.1	500	445
–	–	300	–	517	313.9	163.2	500	460
–	–	–	12"	517 (20.4)	313.9 (12.4)	163.2 (6.43)	500 (19.7)	482.6 (19)
–	350	–	–	548	350	182	550	505
–	–	350	–	546	348	181	550	520
–	–	–	14"	544 (21.4)	346 (13.6)	179.9 (7.1)	550 (21.7)	533.4 (21)
–	400	–	–	590	400	208	600	565
–	–	400	–	589	398	207	600	580
–	–	–	16"	587 (23.1)	396 (15.6)	205.9 (8.11)	600 (23.6)	596.9 (23.5)
–	–	–	18"	629 (24.8)	445 (17.5)	231.4 (9.11)	650 (25.6)	635 (25)
–	500	–	–	676	500	260	650	670
–	–	500	–	674	498	259	650	715
–	–	–	20"	672 (26.5)	496 (19.5)	257.9 (10.2)	650 (25.6)	699 (27.5)
–	600	–	–	763	602	313	780	780
–	–	600	–	760	598	311	780	840
–	–	–	24"	756 (29.8)	594 (23.4)	308.9 (12.2)	780 (30.8)	813 (32)
–	700	–	–	848	701	364.5	910	895
–	–	700	–	842	695	361.4	910	910
–	–	–	28"	846 (33.3)	699 (27.5)	363.5 (14.3)	910 (25.9)	927.1 (36.5)
–	–	–	30"	889 (35)	750 (29.5)	390 (15.4)	975 (38.4)	984.25 (38.8)
–	800	–	–	935	803	417.6	1040	1015
–	–	800	–	930	797	414.4	1040	1025
–	–	–	32"	933 (36.7)	801 (31.5)	416.5 (16.4)	1040 (40.9)	1060.45 (41.8)
–	900	–	–	1019	902	469	1170	1115

DN				A	B	C	L	K
EN (DIN) PN 6 [mm]	EN (DIN) PN 10 [mm]	EN (DIN) PN 16 [mm]	ANSI/ AWWA [inch]	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)
–	–	900	–	1012	894	464.9	1170	1125
–	–	–	36"	1016 (40)	898 (35.4)	467 (18.4)	1170 (46.1)	1168.4 (46)
–	1000	–	–	1106	1004	522.1	1300	1230
–	–	1000	–	1100	996	517.9	1300	1255
–	–	–	40"	1103 (43.4)	1000 (39.4)	520 (20.5)	1300 (51.2)	1289.05 (50.8)
–	–	–	42"	1147 (45.2)	1051 (41.4)	546.5 (21.5)	1365 (53.7)	1346.2 (53)
1200	–	–	–	1282	1210	629.2	1560	1405
–	1200	–	–	1277	1204	626.1	1560	1455
–	–	1200	–	1270	1196	621.9	1560	1485
–	–	–	48"	1274 (50.2)	1200 (47.2)	624 (24.6)	1560 (61.4)	1511.3 (59.5)
–	–	–	54"	1399 (55.1)	1347 (53)	700.4 (27.6)	1755 (69.1)	1682.75 (66.3)
1400	–	–	–	1453	1410	733.2	1820	1630
–	1400	–	–	1448	1404	730.1	1820	1675
–	–	1400	–	1441	1396	725.9	1820	1685
–	–	–	60"	1530 (60.2)	1500 (59.1)	780 (30.7)	1950 (76.8)	1854.2 (73)
1600	–	–	–	1622	1608	836.2	2080	1830
–	1600	–	–	1615	1600	832	2080	1915
–	–	1600	–	1607	1590	826.8	2080	1930
–	–	–	66"	1655 (65.2)	1646 (64.8)	855.9 (33.7)	2145 (84.4)	2032 (80)
1800	–	–	–	1793	1808	940.2	2340	2045
–	1800	–	–	1786	1800	936	2340	2115
–	–	1800	–	1776	1788	929.8	2340	2130
–	–	–	72"	1778 (70)	1790 (70.5)	930.8 (36.6)	2340 (92.1)	2197.1 (86.5)
2000	–	–	–	1961	2004	1042.1	2600	2265
–	2000	–	–	1954	1996	1037.9	2600	2325
–	–	2000	–	1943	1984	1031.7	2600	2345
–	–	–	80"	1949 (76.7)	1990 (78.3)	1034.8 (40.7)	2600 (102)	2362.2 (93)
The fitting length (L) is always the same per nominal diameter, regardless of the pressure rating selected.								

**Weight****Transmitter:**

- Wall-mount housing Prosonic Flow 90/93 6.0 kg (13.2 lbs)
- Wall-mount housing Prosonic Flow 91 2.4 kg (5.3 lbs)

**Measuring sensors:**

- Prosonic Flow W (clamp-on) incl. tensioning bands 2.8 kg (6.2 lbs)
- Prosonic Flow U (clamp-on) incl. tensioning bands 1 kg (2.2 lbs)
- Prosonic Flow W (Insertion / single-path version) 4.5 kg (9.9 lbs)
- Prosonic Flow W (Insertion / dual-path version) 12.0 kg (26.5 lbs)
- Sound velocity measuring sensors DDU 18 incl. tensioning bands 2.4 kg (5.3 lbs)
- Wall thickness measuring sensor DDU 19 incl. tensioning band 1.5 kg (3.3 lbs)

Prosonic Flow C (Inline)						
Nominal diameter		Measuring pipe incl. measuring sensors in kg (lbs)				
[mm]	[inch]	EN (DIN) PN 6	EN (DIN) PN 10	EN (DIN) PN 16	ANSI Class 150	AWWA Class D
300	12"	–	41.8 (92.2)	59.6 (131.4)	77.2 (170.2)	–
350	14"	–	54.7 (120.6)	70.1 (154.5)	111.2 (245.2)	–
400	16"	–	66.4 (146.4)	90.3 (199.1)	139.6 (307.8)	–
–	18"	–	–	–	162.7 (358.7)	–
500	20"	–	96.8 (213.4)	145.9 (321.7)	197.8 (436.1)	–
600	24"	–	120.4 (265.4)	196.6 (433.4)	287.9 (634.7)	–
700	28"	–	183.6 (404.8)	251.3 (554.0)	–	229.9 (506.8)
–	30"	–	–	–	–	265.1 (584.4)
800	32"	–	245.0 (540.1)	327.0 (720.9)	–	323.9 (714.1)
900	36"	–	313.7 (691.6)	456.3 (1005.9)	–	455.6 (1004.4)
1000	40"	–	379.0 (835.5)	587.3 (1294.8)	–	552.6 (1218.3)
–	42"	–	–	–	–	626.1 (1380.3)
1200	48"	434.6 (958.1)	678.6 (1496.1)	941.7 (2076.1)	–	894.7 (1972.5)
–	54"	–	–	–	–	1280.2 (2822.4)
1400	–	569.2 (1254.9)	907.6 (2000.9)	1267.6 (2794.6)	–	–
–	60"	–	–	–	–	1584.5 (3493.2)
1600	–	818.7 (1804.9)	1381.4 (3045.5)	2012.0 (4435.7)	–	–
–	66"	–	–	–	–	2268.0 (5000.1)
1800	72"	993.5 (2190.3)	1726.7 (3806.7)	2608.2 (5750.1)	–	2707.0 (5967.9)
2000	80"	1508.2 (3325.0)	2393.6 (5276.9)	3601.3 (7939.5)	–	3073.9 (6776.8)
(Weight data valid for standard pressure ratings and without packaging material)						

**Material**

Transmitter Prosonic Flow 90/91/93:

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

Prosonic Flow W (clamp-on):

- Sensor housing: 1.4301/DIN 17440 (304/AISI)
- Sensor holder (cast steel): 1.4308/DIN 17440 (CF-8/AISI)
- Sensor contact surfaces: chemically resistant plastic
- Tensioning bands: 1.4301/DIN 17440 (304/AISI)

Prosonic Flow U (clamp-on):

- Sensor housing: plastic
- Frame ends (cast steel): 1.4308/DIN 17440 (CF-8/AISI)
- Sensor securing rail (aluminum alloy): EN AW-6063/DIN EN 573-3 (AA 6063/UNS)
- Sensor contact surfaces: chemically resistant plastic
- Tensioning bands: 1.4301/DIN 17440 (304/AISI)

Prosonic Flow W (Insertion):

- Sensor housing: 1.4404/DIN 17440 (316L/AISI)
- Weld-in parts: 1.4301/DIN 17440 (304/AISI)

Prosonic Flow C (Inline)

- Sensor housing: 1.4404/DIN 17440 (316L/AISI)
- Weld-in parts: 1.4404/DIN 17440 (316L/AISI)
- Measuring pipe: ST 37.2 (carbon steel)

Prosonic Flow DDU 18 and DDU 19:

- Sensor housing: 1.4301/DIN 17440 (304/AISI)

Standard sensor cable:

- Cable connector (nickled brass): 2.0401/DIN 17660 (C38500/UNS)
- Cable sheath: PVC



High temperature sensor cable:

- Cable connector (stainless steel): 1.4301/DIN 17440 (304/AISI)
- Cable sheath: PTFE

## Human interface

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### Display elements

- Liquid crystal display:
    - Prosonic Flow 90/91: illuminated, two lines, each with 16 characters
    - Prosonic Flow 93: illuminated, four lines, each with 16 characters
  - Custom configurations for presenting different measured values and status variables
  - Totalizers:
    - Prosonic Flow 90/91: 1 totalizer
    - Prosonic Flow 93: 3 totalizers
- 

### Operating elements

Uniform operating concept for both transmitter types:

Prosonic Flow 90:

- Local operation via three operating keys (◀, +, ▶)
- Quick Setup menu for quick commissioning

Prosonic Flow 91:

- Local operation via three operating keys (◀, +, ▶)
- Quick Setup menu for quick commissioning

Prosonic Flow 93:

- Local operation with three optical sensor keys (◀, +, ▶)
  - Application-specific Quick Setup menus for quick commissioning
- 

### Remote operation

Prosonic Flow 90:

- Operation via HART, PROFIBUS PA

Prosonic Flow 91:

- Operation via HART

Prosonic Flow 93:

- Operation via HART, PROFIBUS PA, FOUNDATION Fieldbus
- 

### Language group

#### Prosonic Flow 90/93:

Language groups available for operation in different countries:

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

You can change the language group via the operating program “ToF Tool – Fieldtool Package.”

#### Prosonic Flow 91:

- English, German, Spanish, Italian, French

## Certificates and approvals

<b>CE mark</b>	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.
<b>C-Tick mark</b>	The measuring system complies with the EMC requirements stipulated by the “Australian Communication and Media Authority (ACMA)”.
<b>Ex approval</b>	<p>Prosonic Flow 90/93: The transmitter housing (wall-mount housing) is suitable for use in ATEX II3G (Ex Zone 2).</p> <p>Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.</p>
<b>PROFIBUS PA certification</b>	<p>The flow device 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:</p> <ul style="list-style-type: none"> <li>■ Certified to PROFIBUS PA, profile version 3.0 (device certification number: on request)</li> <li>■ The device can also be operated with certified devices of other manufacturers (interoperability)</li> </ul>
<b>FOUNDATION Fieldbus certification</b>	<p>The flow device has successfully passed all the test procedures carried out and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> <li>■ Certified to FOUNDATION Fieldbus Specification</li> <li>■ The device meets all the specifications of the FOUNDATION Fieldbus H1.</li> <li>■ Interoperability Test Kit (ITK), revision status 4.0 (device certification number: on request)</li> <li>■ The device can also be operated with certified devices of other manufacturers</li> <li>■ Physical Layer Conformance Test of the Fieldbus Foundation</li> </ul>
<b>Other standards and guidelines</b>	<ul style="list-style-type: none"> <li>■ EN 60529: Degrees of protection by housing (IP code)</li> <li>■ EN 61010: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.</li> <li>■ EN 61326 (IEC 61326): “Emission as per requirements for class A”. Electromagnetic compatibility (EMC requirements)</li> <li>■ ANSI/ISA-61010-1 (82.02.01): Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment – General Requirements. Pollution degree 2.</li> <li>■ CSA C22.2 (No. 1010.1) Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2.</li> <li>■ NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.</li> <li>■ NAMUR NE 53: Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.</li> </ul>

## Ordering information

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

## Accessories

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Measuring sensors:

- DDU 18 (sound velocity measuring sensors)
- DDU 19 (wall thickness measuring sensor)

Pipe mounting kit for transmitter:

- Wall-mount housing

Mounting material for clamp-on versions:

- Coupling fluid -40 to +80 °C (-40 to +176 °F)
- Coupling fluid 0 to +170 °C (+32 to +338 °F)

Prosonic Flow W:

- Tensioning bands for DN 50 to 200 (2" to 8")
- Tensioning bands for DN 200 to 600 (8" to 24")
- Tensioning bands for DN 600 to 2000 (24" to 80")
- Tensioning bands for DN 2000 to 4000 (80" to 156")

Prosonic Flow U:

- Tensioning bands for DN 15 to 40 (1/2" to 1 1/2")
- Tensioning bands for DN 32 to 65 (1 1/4" to 2 1/2")
- Tensioning bands for DN 50 to 100 (2" to 4")

More detailed information can be obtained from your Endress+Hauser service organization.

## Documentation

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- Flow measuring technology (FA005D/06/en)
- Technical Information Prosonic Flow 90P, 93P (TI056D/06/en)
- Operating Instructions Prosonic Flow 90 (BA068D/06/en and BA069D/06/en)
- Operating Instructions Prosonic Flow 91 (BA100D/06/en)
- Operating Instructions Prosonic Flow 90 PROFIBUS PA (BA074D/06/en and BA075D/06/en)
- Operating Instructions Prosonic Flow 93 (BA070D/06/en and BA071D/06/en)
- Operating Instructions Prosonic Flow 93 PROFIBUS DP/PA (BA076D/06/en and BA077D/06/en)
- Operating Instructions Prosonic Flow 93 FOUNDATION Fieldbus (BA078D/06/en and BA079D/06/en)
- Operating Instructions Prosonic Flow 93 C Inline (BA087D/06/en and BA088D/06/en)
- Operating Instructions Prosonic Flow 93 C Inline PROFIBUS PA (BA089D/06/en and BA090D/06/en)
- Operating Instructions Prosonic Flow 93 C Inline FOUNDATION Fieldbus (BA091D/06/en and BA092D/06/en)

You can order the documents from your Endress+Hauser service organization or download them from the Internet addresses given on the last page.

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