

## 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

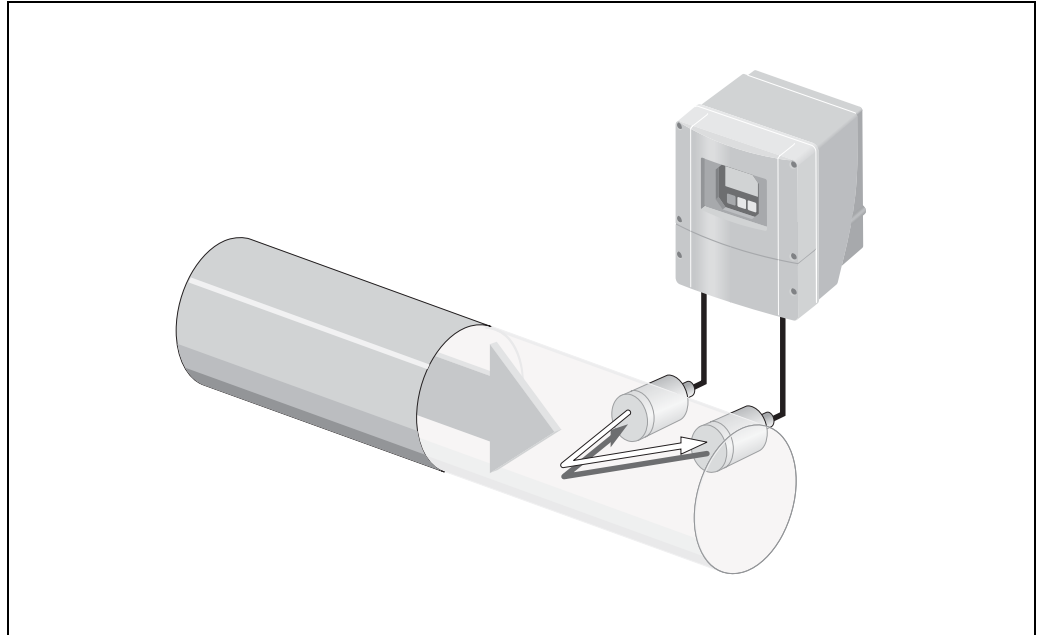
## Function and system design

### 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.



$$v \sim \Delta t$$

$$Q = v \cdot A$$

$$v = \text{Flow velocity}$$

$$\Delta t = \text{Transit time difference}$$

$$Q = \text{Volume flow}$$

$$A = \text{Pipe cross-sectional area}$$

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.

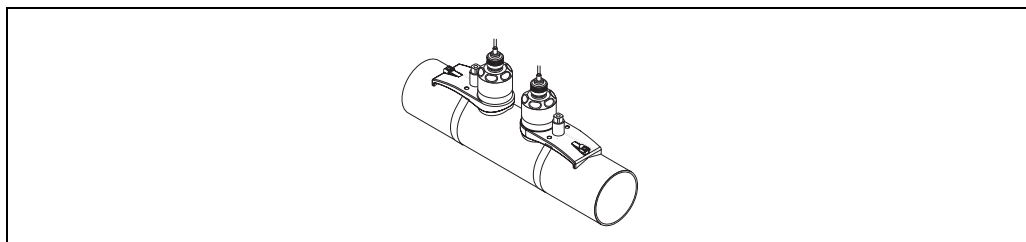
The transmitter is used to actuate the measuring sensors. The electronics and the software in the transmitter are used to prepare, process and evaluate the sensor signals and to convert the measuring signal to the desired output variables.

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-21-05-06-xx-000

#### Design:

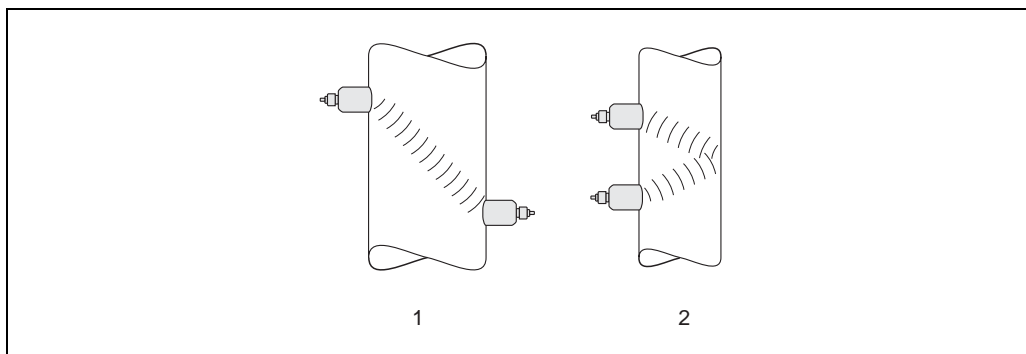
Prosonic Flow clamp-on sensors are mounted on the existing piping from outside.

#### 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.

#### 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	2 traverses
Prosonic Flow W	DN 50 to 60 DN 80 to 600 DN 650 to 4000	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 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 is principally recommended for plastic pipes with a wall thickness > 10 mm, pipes made of composites such as GRP, pipes with lining, even for nominal diameters < DN 100. 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 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 nominal diameter range. The use of Prosonic Flow W sensors is principally recommended for applications as of DN 60.
- If the measuring device displays an insufficient signal strength, reduce the number of the traverses.

### 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.

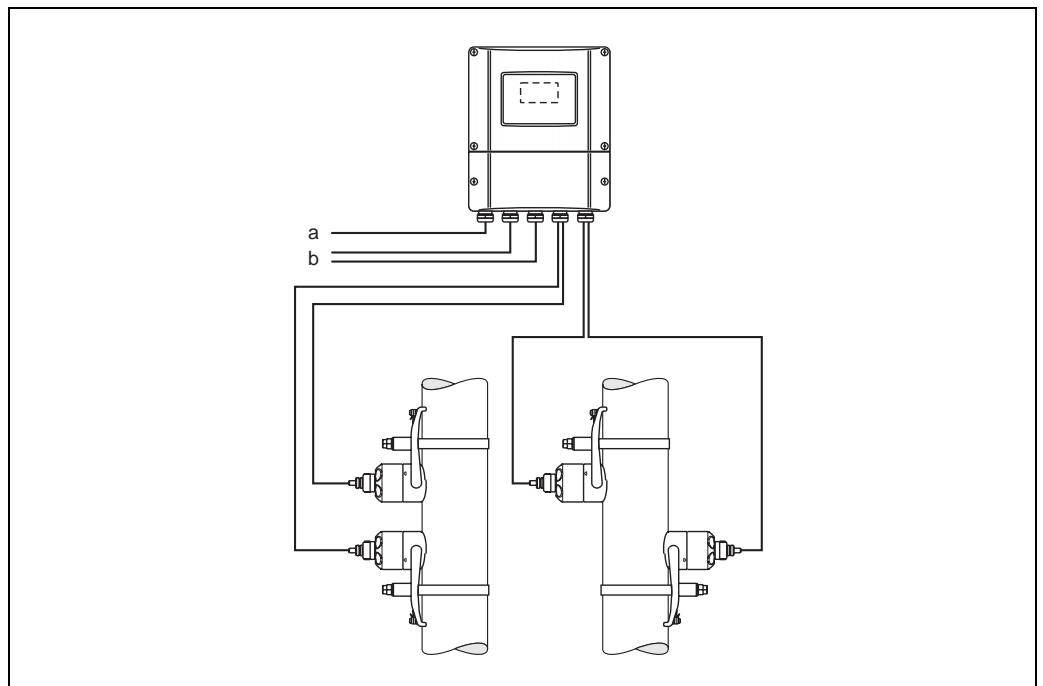
This ability of the transmitter can be used in many different ways:

- 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

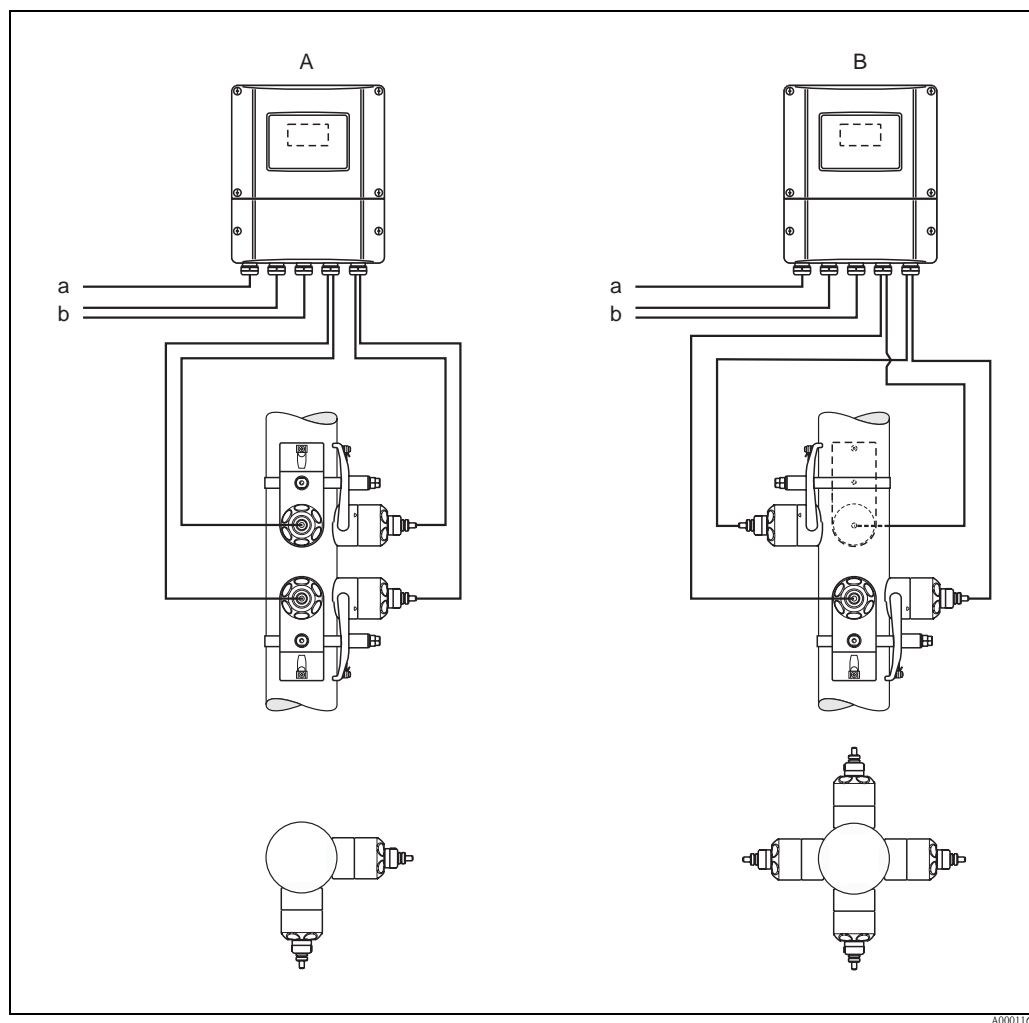
The measuring device supports the individual configuration of the measuring channels and the independent setting of the display and outputs. As a result, the sensor type and type of installation, for example, can be selected and configured separately for both channels.

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:*

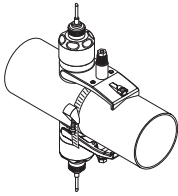
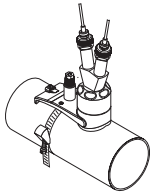
STAINLESS STEEL – SS ANSI 304 – SS ANSI 316 – SS ANSI 347 – SS ANSI 410 – SS ANSI 430 – ALLOY C – PVC – PE – LDPE – HDPE – GRP – PVDF – PA – PP – PTFE – GLASS PYREX – ASBESTOS CEMENT – CARBON STEEL – DUCTILE IRON

*Lining:*

CEMENT – RUBBER – TAR EPOXY

**Additional accessories**

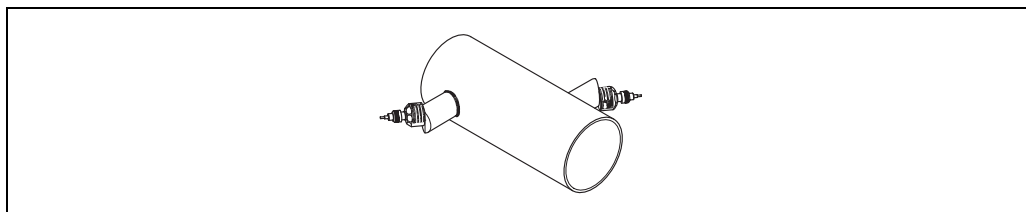
If your liquid or pipe material is not included in the pre-programmed options, and if these data are not known, they can be determined with the aid of the sound velocity measuring sensors DDU 18 and the wall thickness measuring sensor DDU 19. These are only available for Prosonic Flow 93 transmitters.

<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</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 for steel pipes 4 to 15 mm for plastic pipes (suited to a certain extent for use on PTFE or PE pipes)</li> <li>■ Temperature range 0 to +60 °C</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



F06-9xWIxxxx-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.

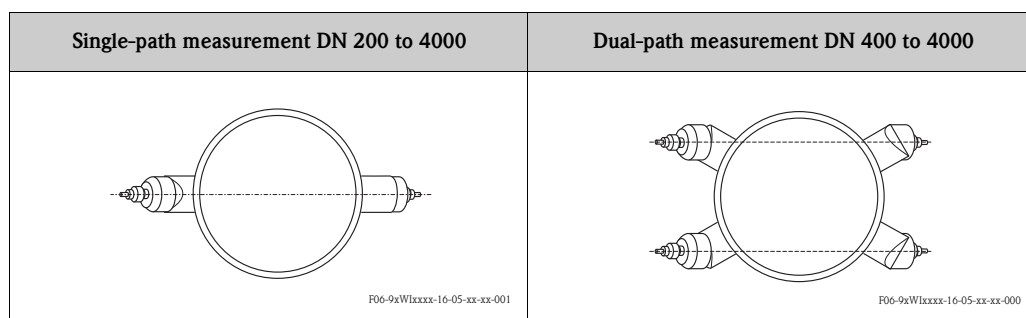
#### Sensor arrangement

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. It offers the following advantages over the single-path version:

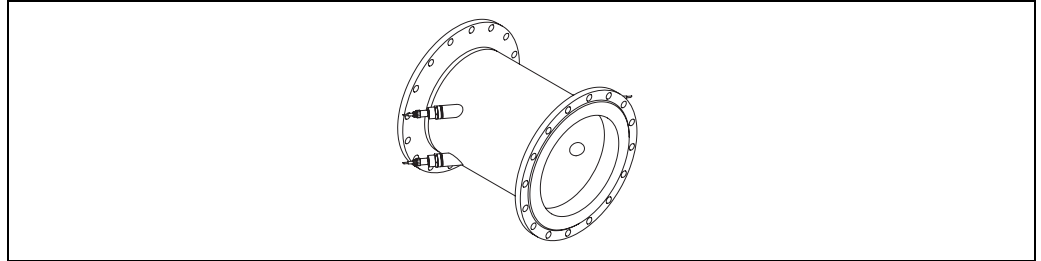
- Short inlet run of only 10 x nominal diameter.
- Increased tolerance towards turbulence (swirl).
- Improved linearity of measurement.

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



**System design**  
**Inline sensors**

**Prosonic Flow C Inline**



F06-9xCxxxxx-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

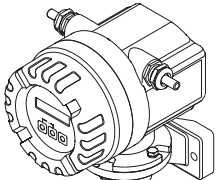
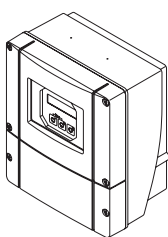
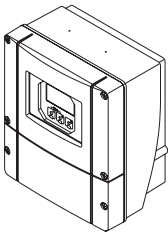
The Prosonic Flow 93 C Inline measuring system always consists of a combination of a Prosonic Flow 93 transmitter in a wall-mount housing and an optimized version of the Prosonic Flow W Insertion sensors integrated in the measuring pipe. Prosonic Flow 93 C Inline is only available as a remote version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

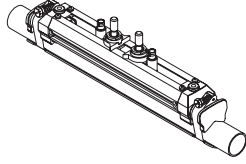
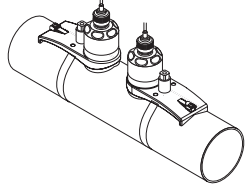
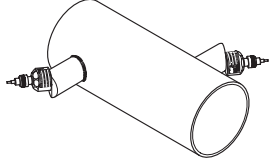
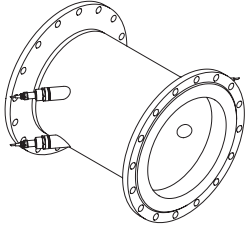
- Short inlet run of only 10 x DN.
- Increased tolerance towards turbulence (swirl).
- Improved linearity of measurement.

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 style="text-align: right; font-size: small;">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 style="text-align: right; font-size: small;">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 style="text-align: right; font-size: small;">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>

<b>Measuring sensors</b>	
<p><b>Prosonic Flow U</b> "Clamp-on" version</p>  <p style="text-align: center; font-size: small;">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</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 style="text-align: center; font-size: small;">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 (optional 0 to +130 °C)</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 style="text-align: center; font-size: small;">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</li> <li>■ Temperature range -40 to +80 °C</li> <li>■ 2 sensor holder types single-channel (DN 200 to 4000) or dual-channel (DN 400 to 4000)</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 style="text-align: center; font-size: small;">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</li> <li>■ Measuring pipe for nominal diameter range DN 300 to 2000</li> <li>■ Temperature range -10 to +60 °C</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>

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