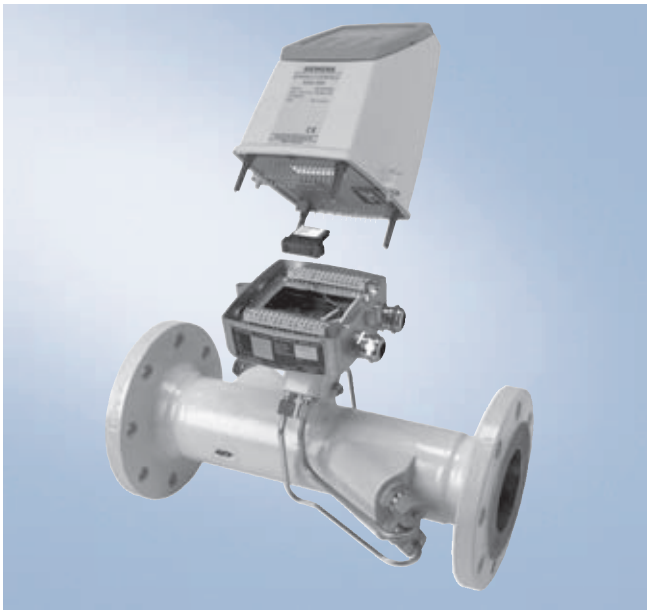
Overview

SONOFLO ultrasonic flowmeters are used to measure the flow of electrically conductive and non-conductive liquids.

Benefits



Greater flexibility

- Wide product program
- Compact or remote installation using the same transmitter and sensor

Easier to commission

All SONOFLO ultrasonic flowmeters feature a unique SENSORPROM memory unit, which stores sensor calibration data and transmitter settings for the lifetime of the product.

At commissioning the flowmeter commences measurement without any initial programming.

The factory settings matching the sensor size are stored in the SENSORPROM unit. Also customer specified settings are downloaded to the unit. Should the transmitter be replaced, the new transmitter will upload all previous settings and resume measurement without any need for programming.

Easier to service

- Comprehensive self-diagnostic for error indication and logging.
- Transmitter replacement requires no programming.
- SENSORPROM automatically updates all settings after initialization.

Application

Ultrasonic flowmeters are suitable for measuring the flow of almost all conductive and non-conductive liquids.

- max. 2% solids
- max. 2% air and gas
- max. 350 cSt

The main applications can be found in the following sectors:

- Raw water intake for water treatment plants
- Treated waste water
- Power generation and utility
- Oil and gas industry and petrochemical industry
- Irrigation systems
- Cooling water plants within the industry and in power stations
- Plants transporting non-conductive liquids

System info and selection guide

		SONO 3300/3000 Industry	SONO 3100/ 3000 Industry	SONOKIT retrofit	SONO 3300/3000 CT	SONOCAL 3000 Flow part	SONOCEL/ SONO 3301
Media – conductive/non-conductive							
Water, treated waste water,		X	X	X			
Utility, district heating water, Cooling		X	X	X	X	X	
Utillity, district heating, approvals required					X	X	
Irrigation		X	X	X			X
HPI, Oil & liquid Gas		X	X	X			
Chemical		X	X				
Cryogenic fluids			X				
Offshore, 2- and 4-track			X				
Type							
Pipe/electronic calibrated on test rig		X	X		X	X	X
Replaceable transducers under pressure			X	X			
Retrofit on existing steelpipes				X			
Retrofit on concrete pipe				X			
Retrofit and Tapping band (non-weldable pipe)				X			
Retrofit with flow in pipe (hot tap)				X			
Dimension							
DN 50	2"	X			X	X	
DN 65	2½"	X			X	X	
DN 80	3"	X			X	X	X
DN 100	4"	X	X	XX	X	X	X
DN 125	5"	X	X	XX	X	X	X
DN 150	6"	X	X	XX	X	X	X
DN 200	8"	X	X	X	X	X	X
DN 225	9"	X	X	X	X	X	X
DN 250	10"	X	X	X	X	X	X
DN 300	12"	X	X	X	X	X	X
DN 350	14"		X	X	X	X	X
DN 400	16"		X	X	X	X	X
DN 500	20"		X	X	X	X	
DN 600	24"		X	X	X	X	
DN 700	28"		X	X	X	X	
DN 800	32"		X	X	X	X	
DN 900	36"		X	X	X	X	
DN 1000	40"		X	X	X	X	
DN 1200	48"		X [1)]	X	X	X	
DN 4000 max.	157“			X			
Measuring range							
m^3/h	USgpm						
0.3	1.5	X			X	X	
2	9	X			X	X	
5	22	X			X	X	X
8	35	X	X		X	X	X
35	155	X	X	X	X	X	X
65	285	X	X	X	X	X	X
80	350	X	X	X	X	X	X
2,200	9,700	X	X	X	X	X	X
3,200	14,100	X	X	X	X	X	X
7,200	31,700		X	X	X	X	X
40,000	175,000		X	X	X	X	
450,000	1,968,000			X			

		SONO 3300/3000 Industry	SONO 3100/ 3000 Industry	SONOKIT retrofit	SONO 3300/3000 CT	SONOCAL 3000 Flow part	SONOCEL/ SONO 3301
Number of tracks							
1-track				X			X
2-track		X	X	X	X	X	
4-track (on request)			X	X	X		
Flanges Norm							
EN 1092-1		X	X		X	X	X
EN 1759-1		X	X		X	X	
ANSI B16.5							X
Flangeless version (SONO 3300 CT, ≥ DN 200 (8") only)			X		X		
Pressure range							
PN 6			X	X			
PN 10		X	X	X	X		X
PN 16		X	X	X	X	X	X
PN 25			X	X	X	X	
PN 40		X	X	X	X	X	
lb 150		X	X		X		
lb 300		X	X		X		
PN 160			X				
lb 2500			X				
Pipe and flange Material							
Carbon steel		X	X		X	X	
Stainless steel			X				X
Other materials on request			X				
Hot dip galvanised							X
Temperature range							
°C	°F						
-200	-330		O				
-20	-4		X	X			
-10	+14	X	X	X	X	X	
0	+32	X	X	X	X	X	X
+50	+120	X	X	X	X	X	X
+120	+250	X	X	X	X	X	
+160	+320	X	X	X	X	X	
+200	+390		X	X	X	X	
+250	+482		O				
Power supply							
Battery							X
AC 115 … 230 V		X	X	X	X	X	
DC 24 V		X	X	X	X		
National approvals							
OIML R 75 class 4					X	X	
Country specific approval					X	X	
EEx-d		X	X[2)]	X[2)]			
Transmitter mounting							
Compact		X					X
Seperate		X	X	X	X	X	X
Others							
Display with keypath		X	X	X	X		X
Custody parameters pre-set. Optional functionalities possible at odering					X		
Custody parameters pre-set						X	

O = special transducers

XX = Only 1-track

1) Bigger sizes on request.

2) ATEX on flowparts in progress

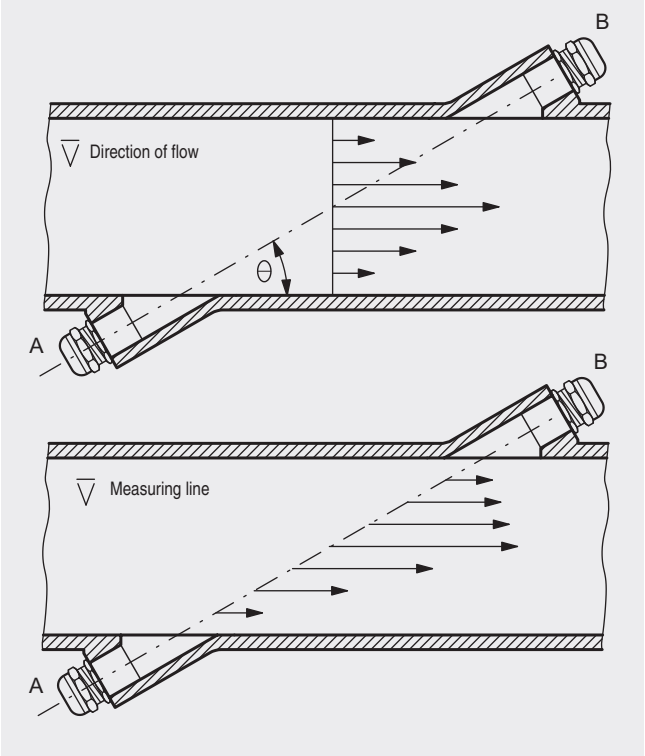
System info and selection guide

Function

Direct signal processing

In the ultrasonic flowmeter program the signal is sent directly and without deflection to the bore wall from the transmitter to the receiver. The advantage gained sending signals from point to point is an extremely good signal strength for the signal processing avoiding a suddenly flowmeter stop.

Physical principle



Velocity distribution along sound path

A sound wave traveling in the same direction as the liquid flow arrives at point B from point A in a shorter time than the sound wave traveling against the direction of flow (from point B to A). The difference in sound transit time indicates the flow velocity in the pipe.

Since delay time is measured at short intervals both in and against flow direction, viscosity and temperature have no influence on measurement accuracy.

Measuring principle

In SITRANS F US SONOFLO flowmeters the two ultrasonic transducers are placed at an angle α in relation to the pipe axis. The transducers function as transmitters and receivers of the ultrasonic signals. Measurement is performed by determining the time the ultrasonic signal takes to travel with and against the flow. The principle can be expressed as follows:

$v = K \cdot (t_{A,B} - t_{B,A}) / (t_{A,B} \cdot t_{B,A}) = K \cdot \Delta t/t^2$

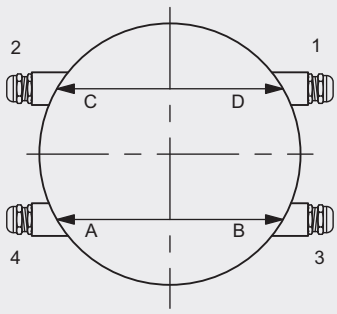
v = Average flow velocity
t = Transit time
K = Proportional flow factor

This measuring principle offers the advantage that it is independent of variations in the actual sound velocity of the liquid, i.e. independent of the temperature. Proportional factor K is determined by wet calibration.

Ultrasonic flow metering based on battery

Siemens offer a solution based on a 3.6-V lithium cell battery with a lifetime of up to 8 years. As the electronics is optimised to operate at extremely low power consumption, the electronics is limited in function and services. The battery powered ultrasonic flowmeter finds its application mainly in power generation, utility and irrigation where mains supply is out of reach.

Pipe geometry with 2-track solution



The accuracy of all flowmeters static or mechanical depends on the pipe geometry before and after the flow meter and the number of ultrasonic measuring tracks.

When water flows through a pipe, it has a tendency to swirl and/or flow with different velocities inside the pipe, depending on the pipe design.

Therefore 2 tracks or more is the most reliable technology today.

2-track systems offer

- less sensitivity to upstream obstruction like bends, pumps or valves.
- high security in the measurements as the meter continues to measure even if, for some reason, one track stops working.

Typical straight inlet requirements are upstream 10 x D_i (D_i = diameter of the flowmeter) and downstream 3 x D_i.

Typical accuracy that can be reached with 2-track ultrasonic flow metering is ±0.5% with installations according to above demands.

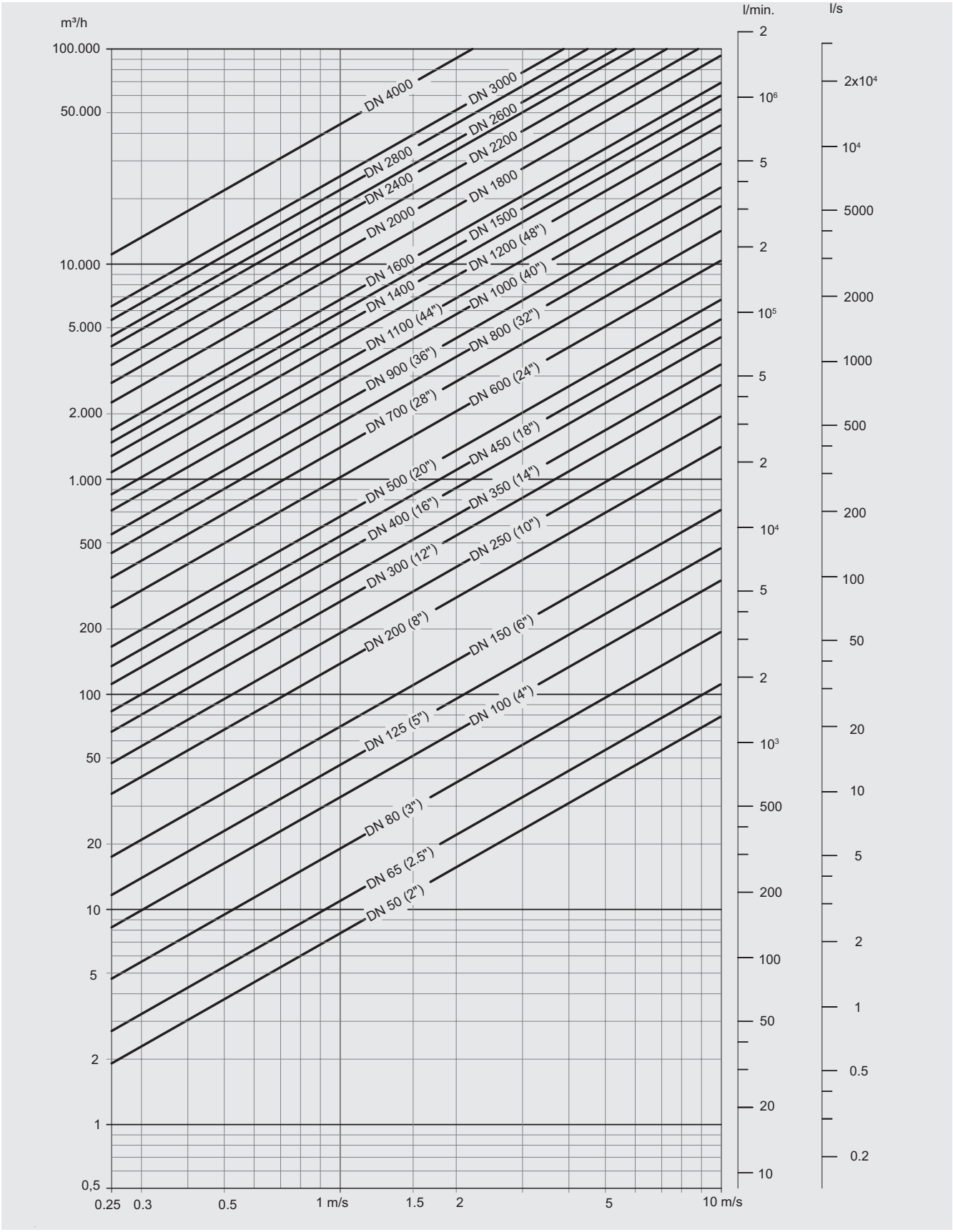
4-track ultrasonic flow meters

Some applications require accuracy under extreme short inlet conditions and swirl that cannot be obtained with 2-track solutions.

For these applications we can offer a 4-track solution – customer specified – according to actual inlet conditions.

Please contact Siemens Flow Instruments for specific applications.

Technical specifications



Nominal size and flow

System info and selection guide

Guidelines for selection of sensor

Min. measuring range: 0 … 0.25 m/s

Max. measuring range: 0 … 10 m/s

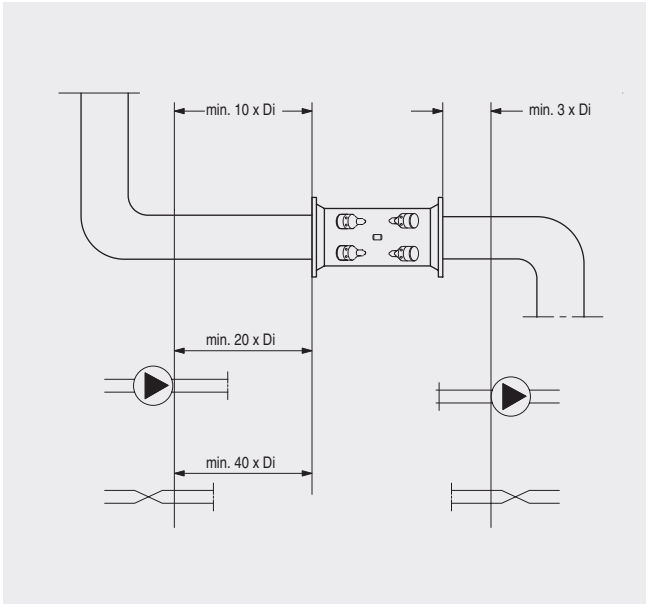
Normally the sensor is selected so that nominal flow velocity is within the measuring range 1 … 5 m/s.

Flow velocity calculation formula:

$v = (4 \times Q_{max}) / (\pi \times D_i^2 \times 3600)$

v in m/s, Q_{max} in m^3/h, D_i in m

Inlet and outlet



Recommended inlets and outlets

To maximize performance inlet and outlet must be straight. There must be a certain distance between flowmeter and bends, pump and valves. It is also important to centre the flowmeter in relation to pipe flanges and gaskets.

Valves must always be installed after the flowmeter. The only exception is installation of the sensor in a vertical pipe. In this case a valve below the sensor is necessary to allow zero-point adjustment. It is important to select a valve which does not alter the flow when fully open.

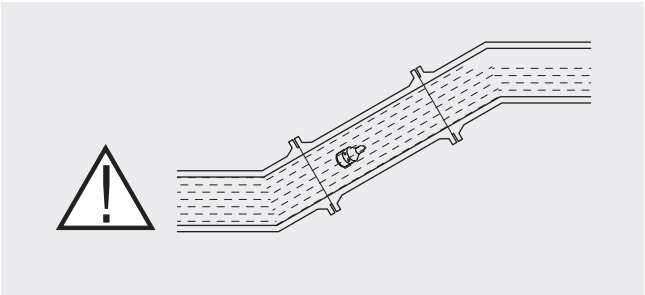
Recommended inlet/outlet

	SONO 3300/3100 SONOKIT 2-track	SONO 3330/3000 CT SONOCAL 3000 2-track	SONOKIT 1-track SONOCELL 1-track
90° bend	10 x D_i	10 x D_i	20 x D_i
Fully opened valve	10 x D_i	10 x D_i	20 x D_i
Partically opened valve	40 x D_i	40 x D_i	40 x D_i
2 x 90° bends in same plane	15 x D_i	10 x D_i *)	25 x D_i
2 x 90° bends in two planes	20 x D_i	20 x D_i	40 x D_i
Outlet	3 x D_i	3 x D_i	3 x D_i

* shorter inlet condition acceptable due to lower accuracy requirements in PTB class C and OIML R 75 class 4 approvals

If more bends then one, please contact Siemens for advice.

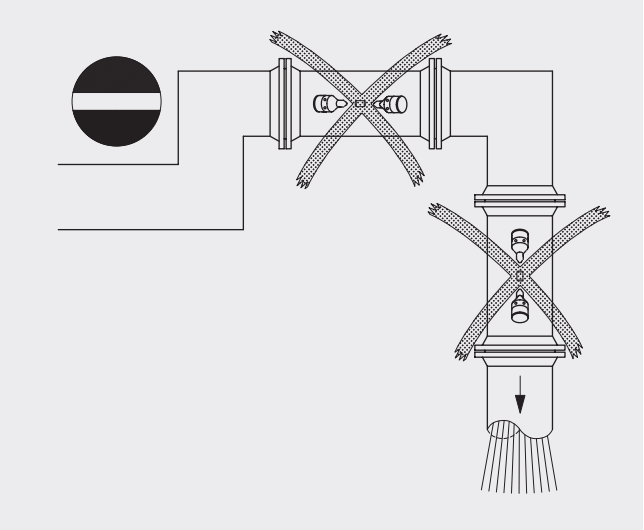
The sensor must always be completely filled with liquid.



Install in completely filled pipes

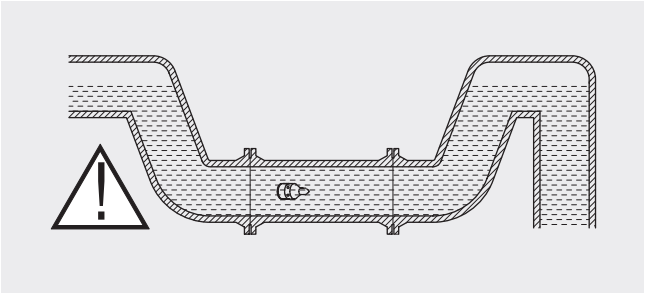
The following installations should be avoided:

- Installation at the highest point of the pipe system
- Installation in vertical pipes with free outlet



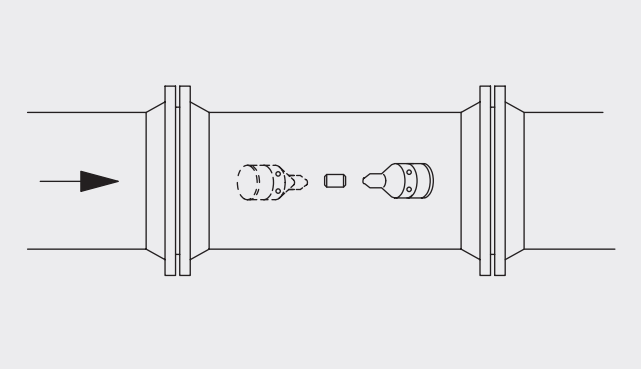
Do not install at the highest point or in vertical pipes with free outlet

With partially full pipes or pipes with free outlet the flowmeter should be located in a U-shaped tube.



Install in U-shaped tube if pipe is partially filled

Installing the transducers in horizontal position is recommended.



Install transducer in horizontal position

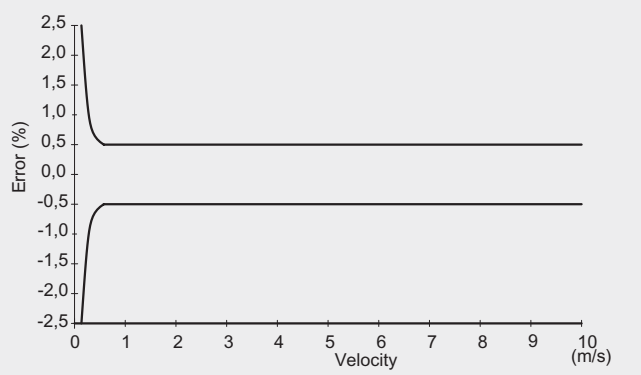
To ensure maximum accuracy sensor and transmitter must be calibrated together.

SONO 3000 consists of an electronic device and a separate SENSORPROM. Flowmeter calibration data are stored in the SENSORPROM, and in the internal EPROM. The SENSORPROM contains all necessary information for a quick startup.

The system accuracy refers to the following systems:

SONO 3300/3000 SONO 3300/3000CT SONO 3100/3000.

Reference conditions



Fluid	Water
Fluid temperature	22 ± 5 °C
Ambient temperature	22 ± 5 °C
Supply voltage	AC 115/230 V +10 … -15% DC 24 V +25 … -15%, AC 24 V ±15%
Straight inlet length	20 x D_i
Rangeability	0 … 1 m/s to 0 … 10 m/s
Repeatabilty	Better than 0.25% in the range 0.5 … 10 m/s
Linearity	
• Reynolds number 1000 < Re < 5000	Better than 1%
• Reynolds number > 5000	Better than 0.4%

Additional effects of deviations from reference conditions

- Current output: As frequency output ±(0.1% of actual flow +0.05% FSO)
- Effect of ambient temperature: Frequency/pulse output: < 0.005% SPAN/K
- Current output: < ±0.0075% SPAN/K
- Effect of supply voltage: 0.005% of measuring value at 1% change

4