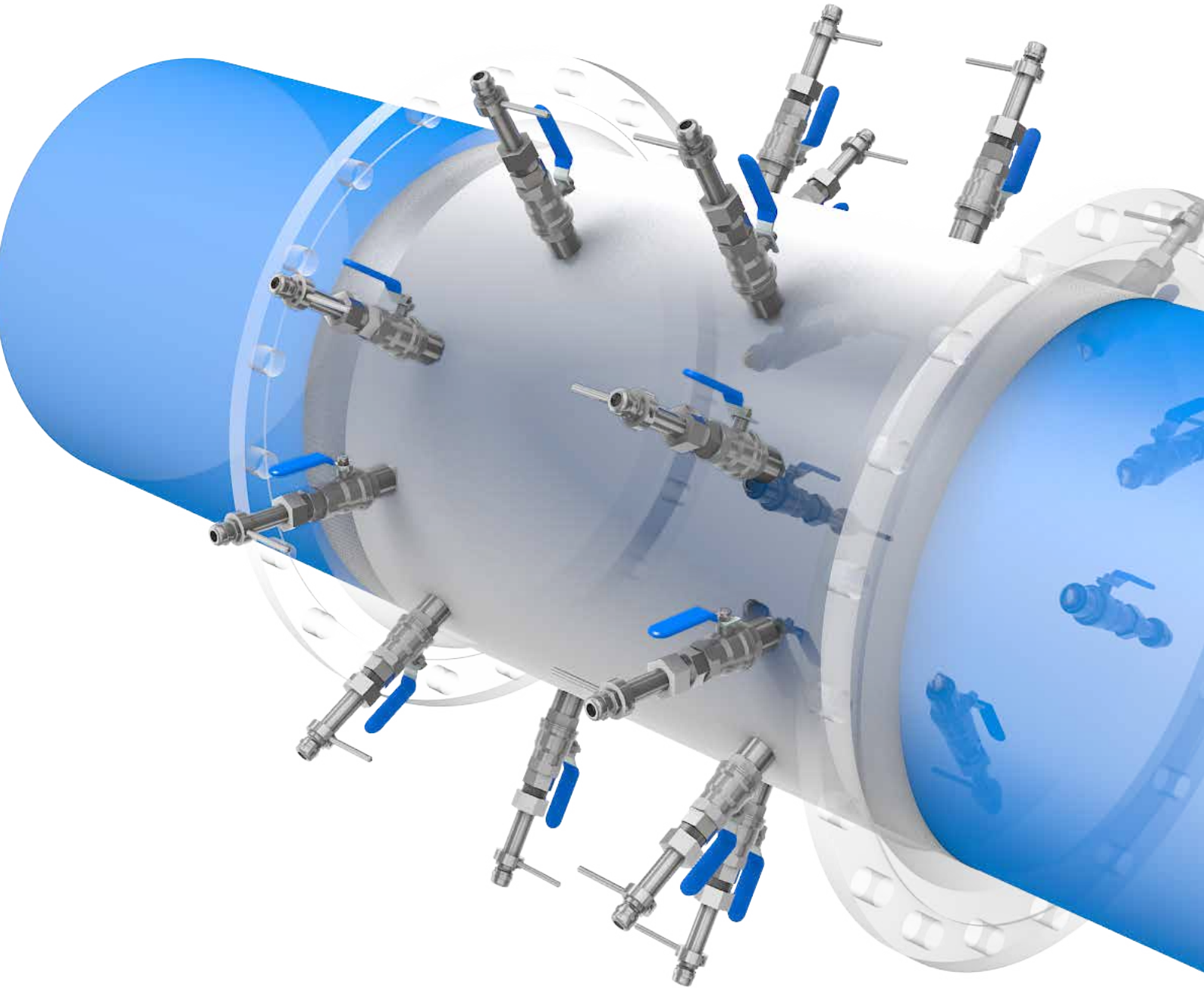
HydroVision

Two Steps Ahead in Acoustic Flow Metering

ReVision™



Application

The ReVision™ flow meter is an up to 10 path acoustic meter with ISP-Technology for liquid fluids.

The ReVision™ flow meter is a new entry in the HydroVision family of high accuracy acoustic metering products. It increases your profitability with exceptional repeatability and linearity throughout the flow range.

Flow Velocity Profile

There are currently discharge measurement techniques for completely filled pipes. However, instead of measuring the velocity distribution, these methods assume a velocity distribution which corresponds to a fully developed velocity profile. Unfortunately, the assumed fully developed velocity profile only exists in regions of the pipe where changes of the velocity distribution in flow direction are very small and not along lengths of entire pipes. Many existing techniques for discharge measurement require extended regions of straight pipes, and such pipes may be unavailable in premises which are space-constrained.

flow meter after a 90° elbow

Many industrial applications deal with fluids in **complex pipe systems**. However the flow velocity varies widely across the cross section of conduit. Thus usually it is not possible to use a single flow sensor to detect the average flow velocity. Even with multiple flow sensors, there may still be a significant error which is known as the profile factor. Prior knowledge of the profile factor can be used to correct the velocity measurements made by flow sensors to a true spatially averaged velocity.

The velocity profile within a pipe is a function of at least two sets of forces: inertial forces and viscous/friction forces. For example, at the outlet of an elbow or similar piping component that changes the direction of the flow, the inertial forces dominate often resulting in a grossly distorted velocity profile.

The viscous/friction forces then become more dominant as the distance from the elbow/disturbance increases. It is the viscous/friction forces along the pipe wall that dissipate the distortion caused by the inertial forces. If the pipe is long enough, the effects of the inertial forces are completely eliminated and a „fully developed“ condition is reached where the flow profile does not change. Unfortunately, in practice it can take a length of fifty pipe diameters or more for the profile to be “fully developed”.

The shape of the profile when „fully developed“ is a function of the viscosity and roughness of the pipe wall. In most applications, the viscosity is not well known and the effective roughness of the pipe wall is typically never defined. As a result, the profile factor in „fully developed flow“ can vary by +/-10% depending on the fluid viscosity and wall roughness (from laminar flow regimes up to turbulent flow regimes). As such, it is evident that correctly compensating for the varietion in the profile factor effects the accuracy of the flow meter.

Concept Innovation

Space constraints and/or appropriate application configurations lead to complex industrial pipe flows which contain elbows, tees and/or other disturbing and non-uniform elements. This leads to difficulties in installing flow meters at a recommended "optimum" location, which is defined by a minimum distance upstream or downstream of known disturbances like an elbow or pump where a fully developed velocity profile is present. Even with multiple flow sensors, there may still be a significant error which is known as the profile factor.

Prior knowledge of the profile factor can be used to correct the velocity measurements made by flow sensors to a true spatially averaged velocity.

The ReVision™ acoustic system provides detailed information on the flow velocity profile and an accurate measurement of the flow rate can be achieved by rebuilding the whole flow velocity profile across the pipe using predetermined conduit configuration parameters and correction factors.

Principle of Operation

The ReVision™ flow meter is based on the well-established acoustic transit time principle. The measuring principle utilizes the fact that the direction and propagation velocity of an acoustic pulse will be modified by the flowing medium. An acoustic pulse propagating with the flow will experience an increase in velocity while an acoustic pulse propagating against the flow will experience a decrease in velocity.

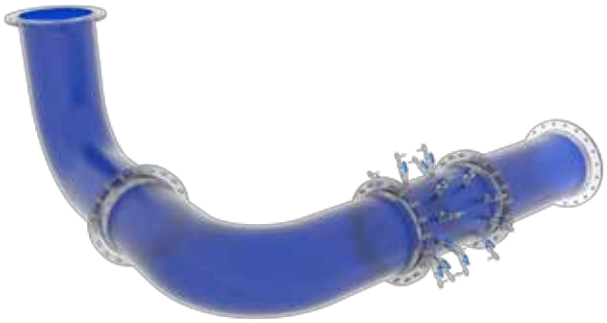
ReVision™ measures the transit time of the acoustic signal that is transmitted. The start of the transmission and the arrival of the correct signal is detected by the software.

Advantages

» Accurate flow measurements
» No on-site calibration required
» No flow straightener needed
» Patented (pending) velocity profile compensation
» Fully integrated metering solution

Asymmetric and Swirl Profiles Compensation

Flow meters are also sensitive to velocity profiles where there is a large rotational component (swirl). Swirl is normally generated by two or more out of plane changes in flow direction (e.g. one elbow/tee that goes from vertical to horizontal followed by an elbow/tee that changes the direction of flow in the horizontal plane). Swirl is present to some extent in almost every application and can generate significant transverse velocity components plus it takes a long distance to dissipate. If the swirl is not centred, it can cause significant errors. Thanks to the predetermined conduit configuration parameters and correction factors, the flow meter measurement accuracy is kept when asymmetric profiles and swirls are present in the pipe.



flow meter after two out of plane changes in flow direction

Transducer Replacement

In the unlikely event that a transducer should fail, the ReVision™ can be programmed to automatically compensate for the loss in path information with a little reduced accuracy in addition to advising the operator that an alarm is present. The transducer housings are separate from the transducers, allowing the transducers to be changed without special tooling and without shutting down the process.

spool piece with 5 acoustic planes (crossed)

Technical Specifications

Meter Type

Number of Paths: up to 10 paths (20 transducers)
arranged in max. 5 planes, crossed
Meas. principle: Acoustic Transit time

Flow: Bi-directional

Meter Performance

Range: 0 to ± 20 m/s (0 to ± 66 ft./s)
Accuracy: < ± 0,15 % of measured value
Repeatability: < ± 0,02 %
Zero Stability: < 1 mm/s

Meter Size

Pressure Range: PN6, PN10, PN16
Flanges: EN1092-1 (DIN2501), AWWA C207
Line Sizes: DN 200 (8") to DN1200 (48")

DN	Inch	Length
200	8"	400 mm
250	10"	450 mm
300	12"	500 mm
350	14"	550 mm
400	16"	600 mm
450	18"	700 mm
500	20"	750 mm
600	24"	900 mm
700	28"	1100 mm
750	30"	1150 mm
800	32"	1200 mm
900	36"	1400 mm
1000	40"	1500 mm
1050	42"	1600 mm
1100	44"	1700 mm
1200	48"	1800 mm

Line Sizes: > DN 1200 (48")
Cold tapping into an existing pipeline

Hot tapping service for all line sizes.

Protection Category Sensors

IP-Classification: IP68
NEMA-Classification: 6P

Temperature Range

Operating: -20°C to 70°C
(-4°F to 158 °F)

Interfaces

Communication: Ethernet 10 / 100 Mbps
wireless LAN
GSM/GPRS
RS485 and MODBUS

Power Supply

DC Input: 9-36 V_{DC}, 10 Watt
AC Input: 85 to 260 V_{AC} (48 to 60 Hz), 10 Watt

Electrical Inputs

Digital Inputs: 2, optically isolated
Analog Inputs: up to 4 analogue inputs, 4-20 mA
isolated from ground,
programmable as to function

Electrical Outputs

Pulse Output: 2 pulse outputs, open collector
selectable pulse units, polarity selectable
(Normally Open or Normally Closed)
Analogue Output: up to 4 analoque outputs, 4-20 mA,
isolated from ground,
programmable as to function

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