

Clamp-On Flow Meter Technology For Leak Detection

- Clamp on Ultrasonic Flow Measurement Principal
- Transit Time – Doppler
- What Distinguishes Flexim Technology



... external measurement of internal flow

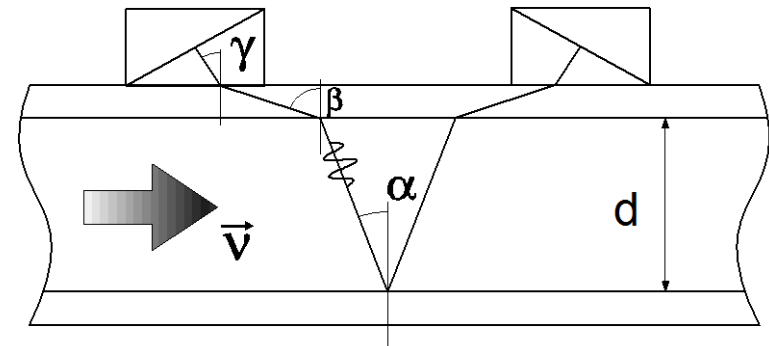
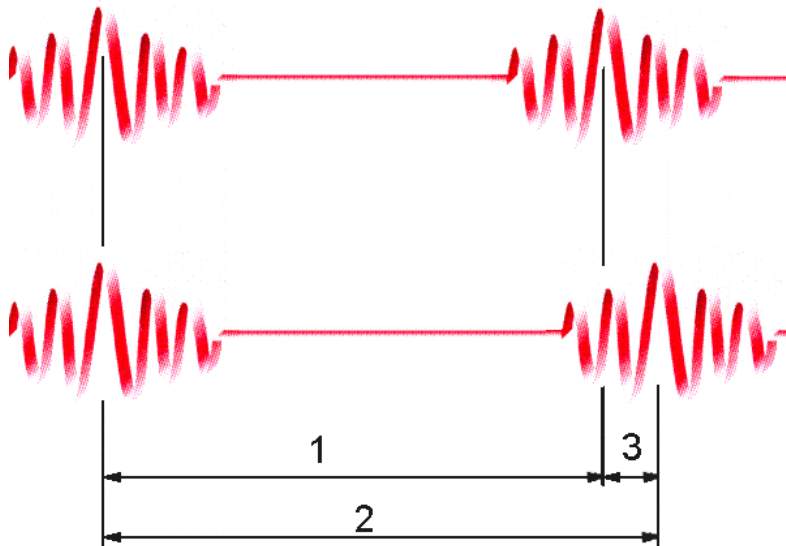
Measurement Principle: Transit Time

(or time-of-flight principle)

Theory:

Signal in the direction of flow travels faster compared to signal against the flow direction

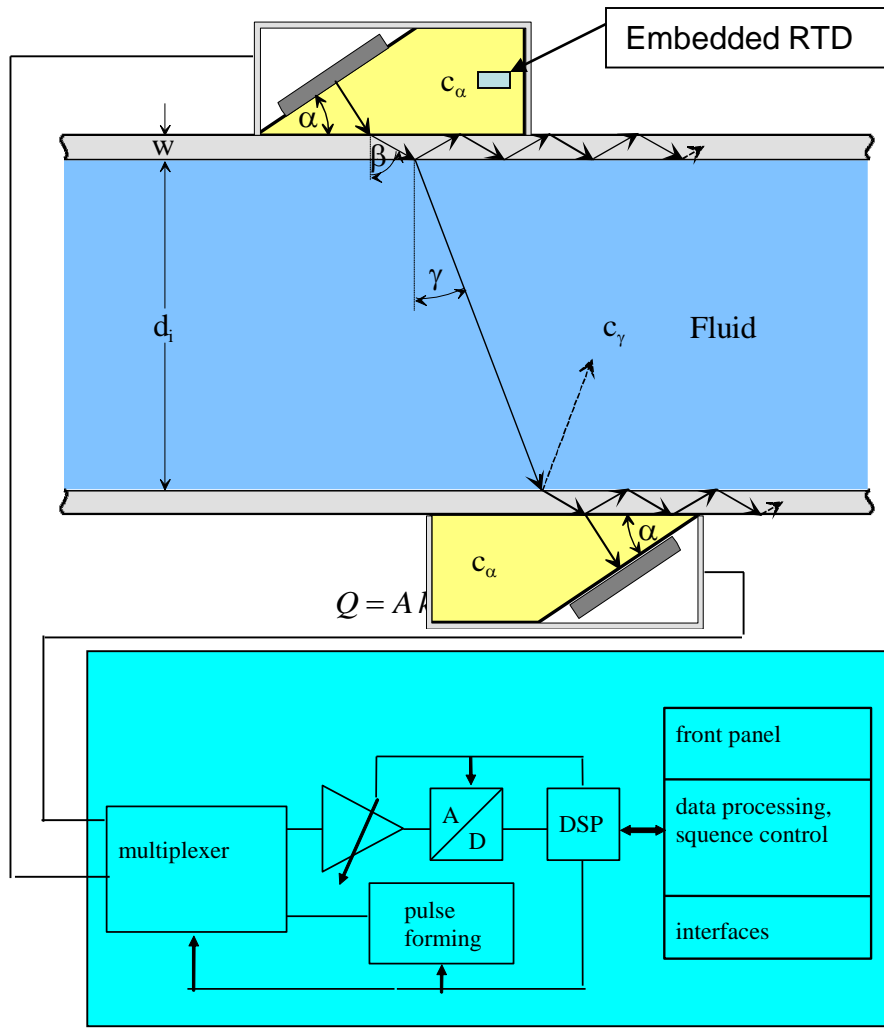
The difference in transit time is a measure for the flow velocity



*A swimmer swims faster with the flow as compared to against the flow
The sonic signal does the same*

... external measurement of internal flow

Operation Principle



Meter formula

$$v_l = k_\alpha \frac{\Delta t}{2 t_F}$$

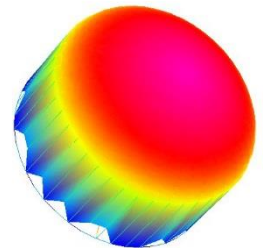
Acoustic calibration factor

$$k_\alpha = \frac{c_\alpha}{\sin \alpha}$$

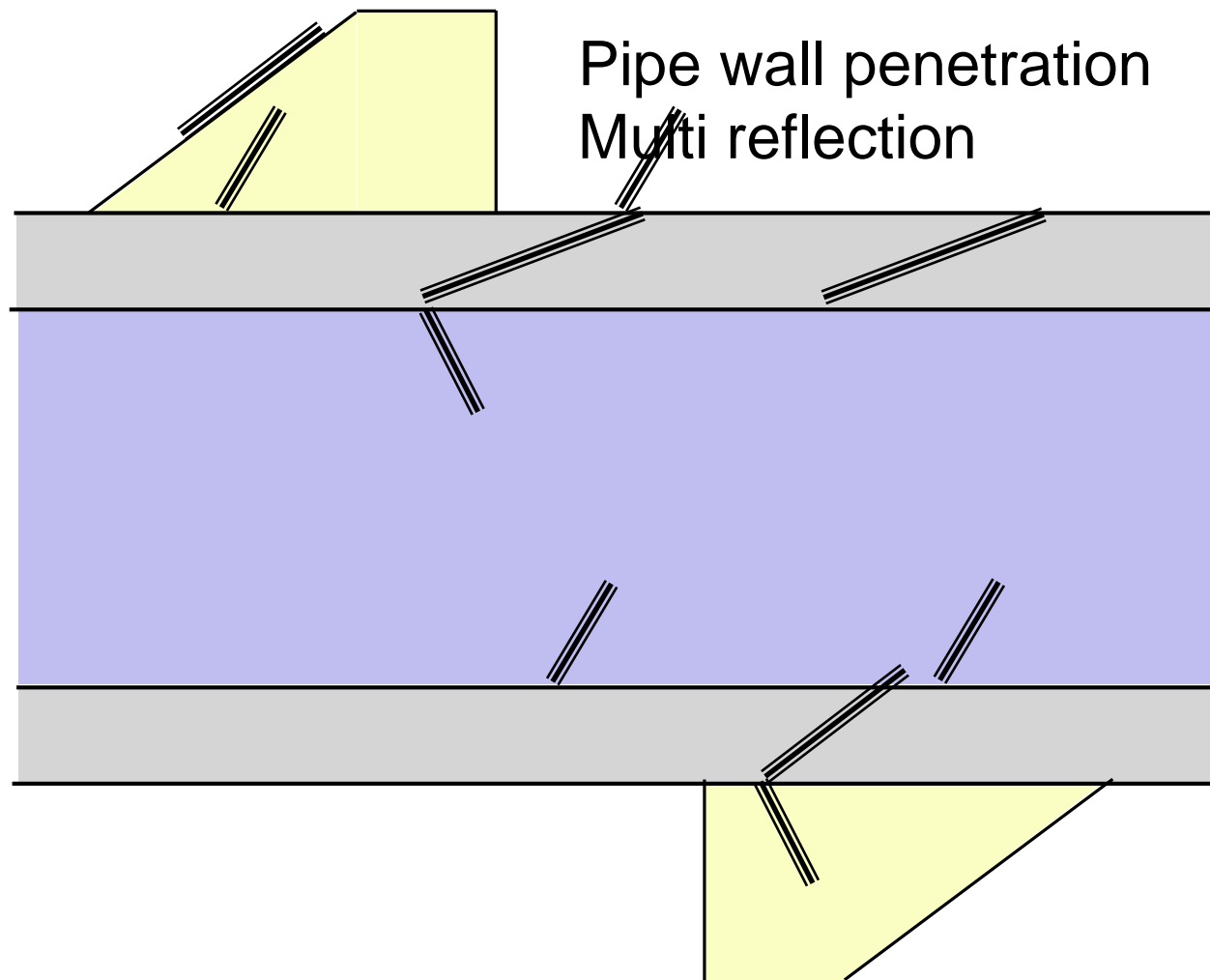
Snells Law: $\frac{c_\alpha}{\sin \alpha} = \frac{c_\beta}{\sin \beta} = \frac{c_\gamma}{\sin \gamma}$

Fluid mechanical calibration factor

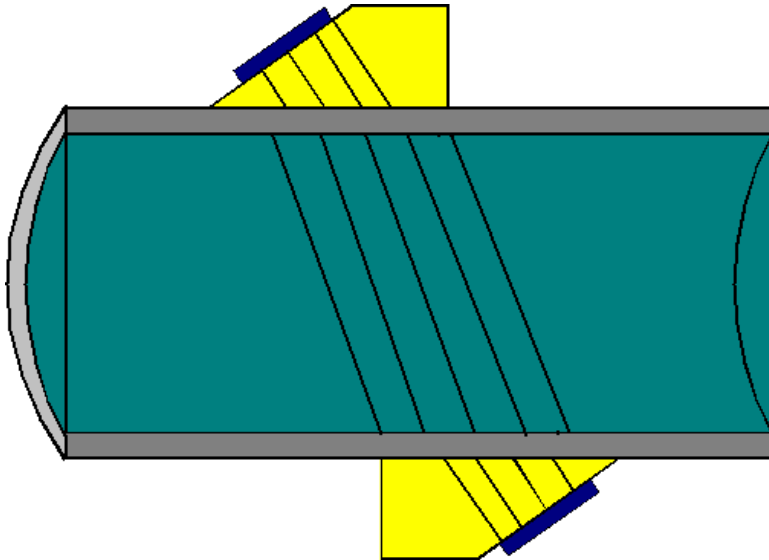
$$Q = A k_{\text{Re}} v_l$$



Shear wave principle – for thick wall pipes



Shear Wave Transducer

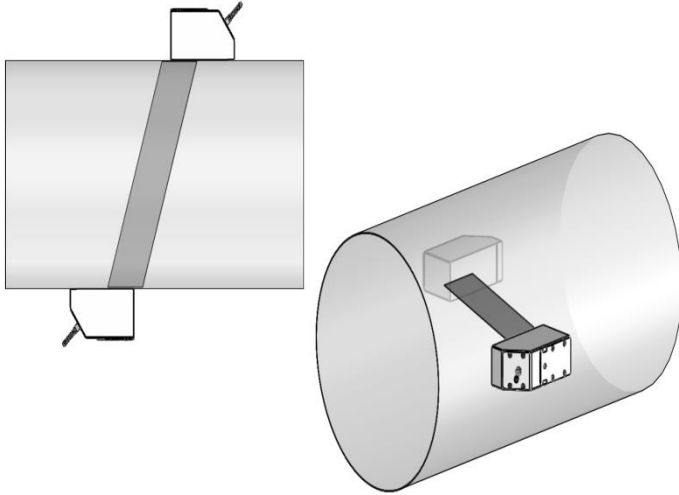


- No pipe frequency dependency
- 2 size transducers covers full pipe range
- Greater certainty of installed accuracy
- Not preferred for applications with high changing sound velocities or gas flow measurement with high flow velocities

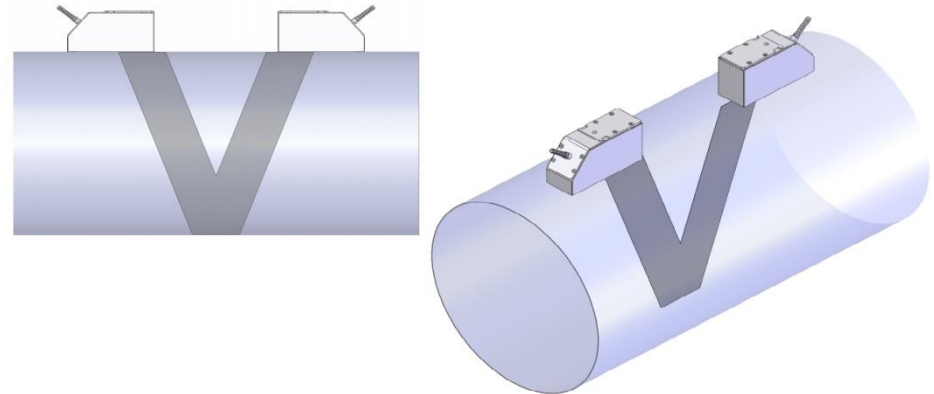
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Mounting Configurations

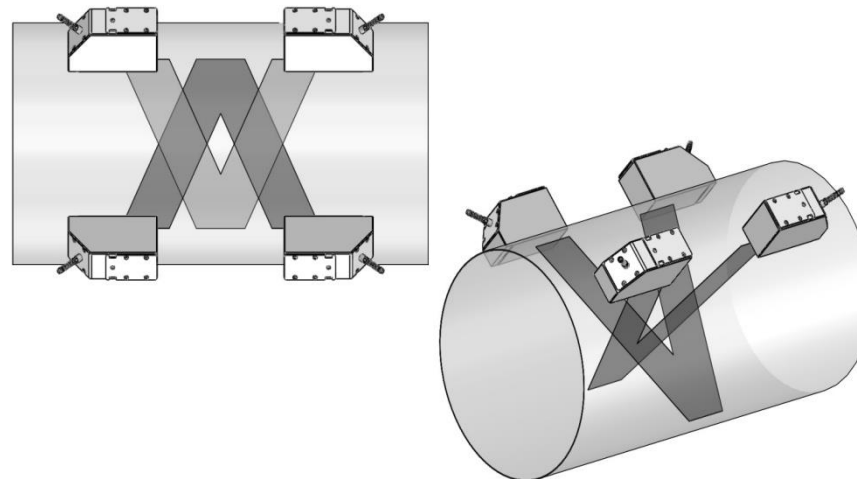
Direct Mount



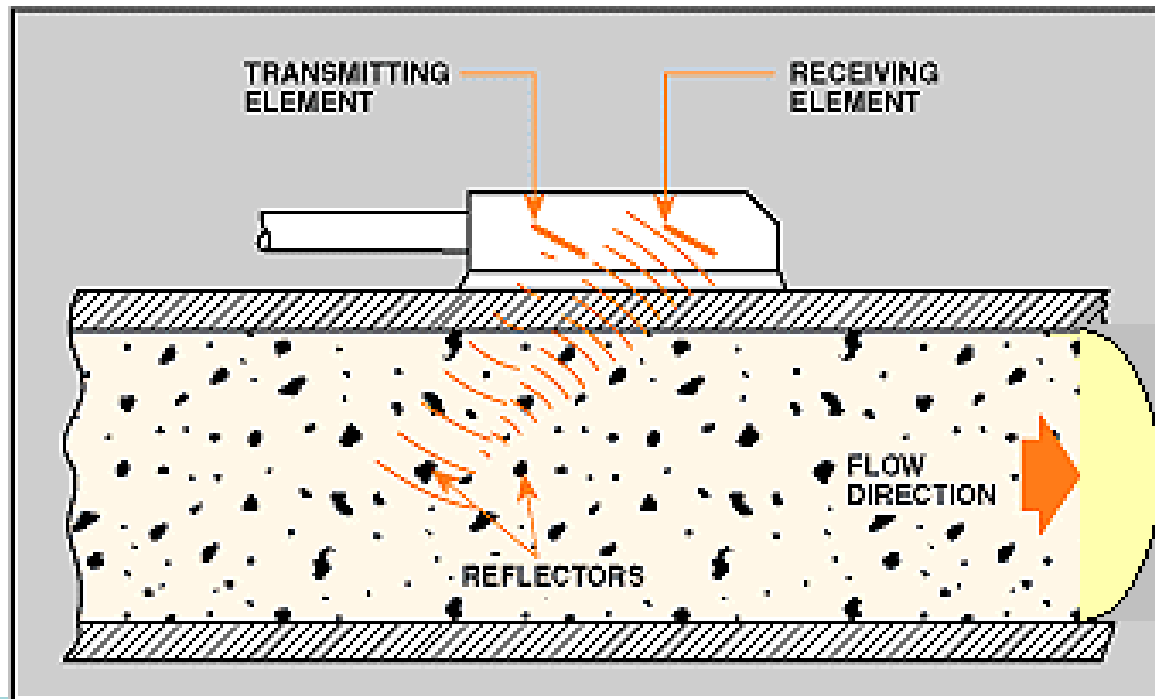
Reflect Mount



Dual Beam



Doppler in Flow Measurement



Doppler meters use sound pulse reflection principle to measure liquid flow rate, solids or bubbles in suspension in the liquid reflect the sound back to the receiving transducer. **Assumption** - Reflected particle representative of average flow

Dual Mode

“Transit Time – Doppler”

The Flexim meter can be set up to automatically switch from Transit Time to Doppler (Noisetrek)

Both measurements made from the same transducer

... external measurement of internal flow

General advantages of Clamp-on vs. In-line devices

- Independent from media and pressure
- Minimum installation effort
- Installation/changes possible
- No disturbances in the pipeline
- No leakage
- No interruption of process during installation/maintenance
- Low stocking costs
(2 xdcers cover all standard applications)
- Cost advantages on pipes with large OD

... external measurement of internal flow

Performance advantages of clamp-on flowmeters against in-line devices

- Bidirectional flow measurement
- Unlimited turndown
- Very good low flow sensitivity
- Dynamic zero
- High Accuracy
 - 1-2% installed accuracy (intrinsic)
 - 0.5% accuracy with flow calibration
 - Higher accuracy possible.
- Aggressive liquids no problem
- High temperature capability

... external measurement of internal flow

What Loss???

- **Authorized consumption:** is water the utility gave someone permission or authorization to use. Whether it was billed or not, it is still authorized consumption.
 - Fire Department
- **Unauthorized consumption,**
 - water taken by theft,
 - data analysis errors and data used for billing).
 - Since real loss is water lost while in the distribution system, a production cost is associated with it. The retail rate is associated with the cost of apparent loss because it had the opportunity to be metered.
- **Non-revenue water (NRW)** is simply water that the utility does not receive compensation for.
- **Real Loss:** water lost through distribution system leakage
 - deterioration of infrastructure
- **Apparent Loss:** water that was not read accurately by a meter

Flexim meters can be used in all of these scenarios.

Finding Large Leaks

Reliable and Fast Metering is Key

Flexible instrument for challenging applications

Low flows

Bidirectional flow challenges

Birmingham AL
54" Concrete Pipe ~4" Pipe Wall



Meter Verification

Apparent Loss: water that was not read accurately by a meter

- A meter test was performed between Flexim F601 and a Large Utility's meter test standard.
 - A newly calibrated electromagnetic flowmeter
 - A newly calibrated turbine flowmeter
 - A graduated tank
- The utility tested the F601 with M transducers meter over various flow rates
- The accuracy of the Flexim meter was $\pm 0.9\%$



Compared to master meter

Use
Flexim
meters to
compare
other
meters



36" Venturi

Portable Flow Meter FLUXUS F601

- automatic detection of the transducer type and transmission of the transducer calibration data
- data logger with a capacity of > 100,000 measured values
- Supporting 6 transducers (tuned filters)
- Carry Case – very smartly designed
- 14 – 20hr battery
- Flow and Energy



Easy Applications



Trick Applications



... external measurement of internal flow

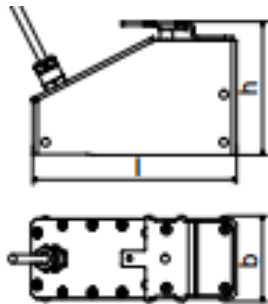
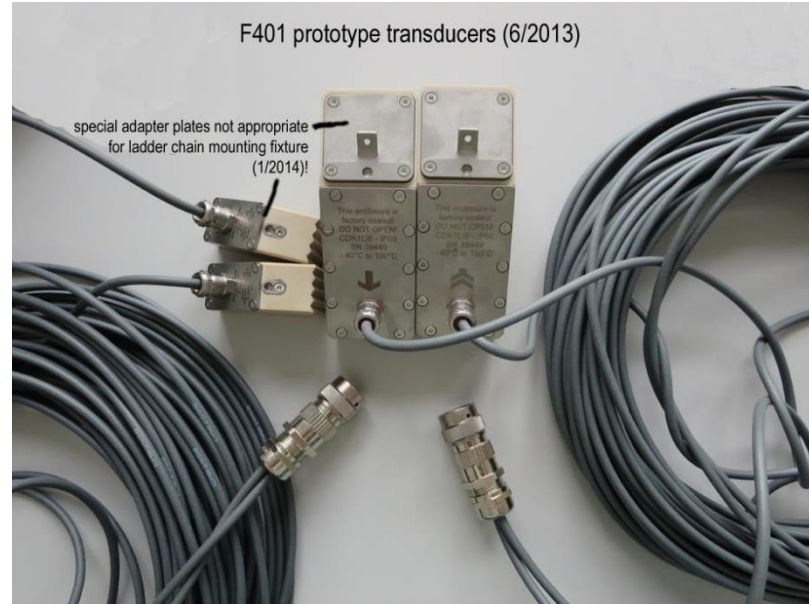
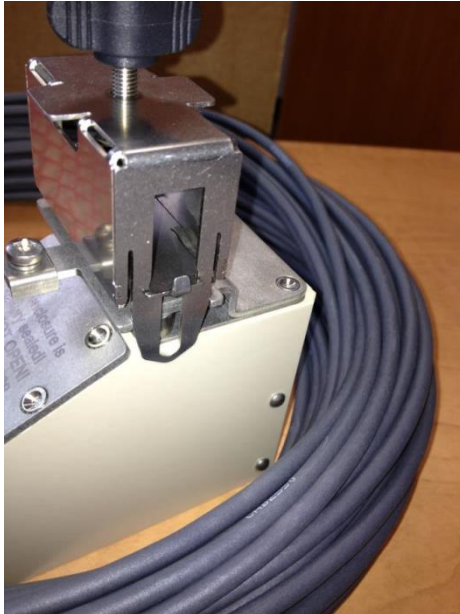
Permanent Application For Leak Detection and Non Revenue Water Loss

FLUXUS 7407 for liquids

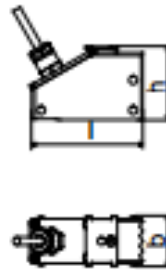
- District metering
- Fire Water
- System Balancing
- Monitoring/trending



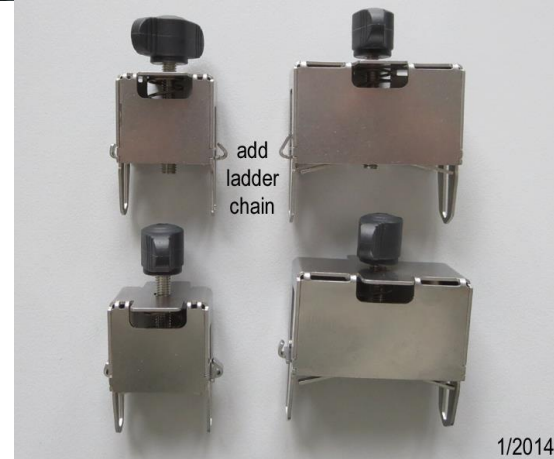
F401/ IP68 Transducer



K



P



IP68 Transducers for Fire Water



20 Inch Lift Station with Poor In-flow conditions



Summary

- Most developed technology in the world (no drift, no zero calibration, very low offset, fast signal processing)
- Portable and Permanent flow meters that meet real standards – ASME-MFC-5M, AWWA C750, ISO 17025 Calibration lab, NIST Traceable
- 3rd Party Validation and Testing backing our accuracy and repeatability claims
- Quickly measure Flow over wide range of applications

Thank you for your time

Frank Flow

Flexim Regional Manager

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