LARGE PIPE/CHANNEL

ADFM® Pro20

pulse Doppler velocity profiling flow meter

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Water is life. Protect it.

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LARGE PIPE / CHANNEL

ADFM® Pro20 Flow Meter

Powered by ADFM® Technology

Pulse Doppler Velocity Profiling Flow Meter for Large Pipes/Channel

Figure 1 shows a typical ADFM Pro20 installation for measuring open channel flow in a pipe. A transducer assembly is mounted on the invert of a pipe or channel. Piezoelectric ceramics emit short pulses along narrow acoustic beams pointing in different directions. Echoes of these pulses are backscattered from material suspended in the flow. As this material has motion relative to the transducer, the echoes are Doppler shifted in frequency. Measurement of this frequency enables the calculation of the flow speed. A fifth ceramic mounted in the center of the transducer assembly, aimed vertically, is used to measure the depth.

The ADFM Pro20 divides the return signal into discrete regular intervals which correspond to different depths in the flow. Velocity is calculated from the frequency shift measured in each interval. The result is a profile, or linear distribution of velocities, along the direction of the beam. Each of the rectangular yellow segments in Figure 1 represent an individual velocity measurement in a small volume known as a depth cell.

The directions of the velocity profiles in Figure 1 are based on the geometry of the ADFM Pro20's transducer assembly. Figure 2 shows a side view of the transducer assembly. The profiles shown in Figure 1 are generated from velocity data measured by an upstream and downstream beam.

Since Doppler measurements are directional, only the component of velocity along the direction of transmit and receive is measured, as shown in Figure 2. Narrow acoustic beams are required to accurately determine the horizontal velocity from the measured component. The narrow acoustic beams of the ADFM Pro20 insure that this measurement is accurate.

APPLICATIONS

ADFM Pro20 is designed for high accuracy flow measurement for applications in pipes 48 inches (1220 mm) in diameter and larger. The ADFM Pro-20 is ideal for permanent flow meter networks and temporary flow monitoring studies/surveys. Relevant applications include:

Wastewater collection systems
Infiltration/Inflow studies
Capacity determination
Hydraulic model calibration
Custody transfer (billing) networks
Event notification
Long term trend analysis

Combined sewer systems and outfalls
Data for long-term control plans (LTCPs)
Point discharge measurement
Characterize Combined Sewer Overflow (CSO) impacts
Real-time control

Wastewater treatment facilities
Influent measurement
Real-time process control
Effluent measurement
Regulatory reporting

Irrigation canals and channels
Custody transfer (billing)
Water conservation
Supply management

Industrial process and discharge
Process optimization
Discharge measurement
Regulatory reporting

Stormwater conveyance and outfalls

FEATURES

A full-featured solution, the ADFM Pro20 offers **advanced functionality founded on world-class technology. Features include:**

- Innovative pulse Doppler velocity profiling technology
- Data quality verification information (signal strength and correlation)
- Quad-redundant velocity measuring sensors and upward looking ultrasonic depth sensor combined in a single housing
- Secondary depth sensor (optional), pressure or ultrasonic
- Innovative debris fairing (optional) to mitigate sensor fouling
- In-situ calibration never required
- NEMA 4X or 6P electronics assembly housing
- Flowlink® software for integrated system management
- Historical or real-time data output
- Rugged, long-lasting construction
- ISO 9001 certification manufacturing

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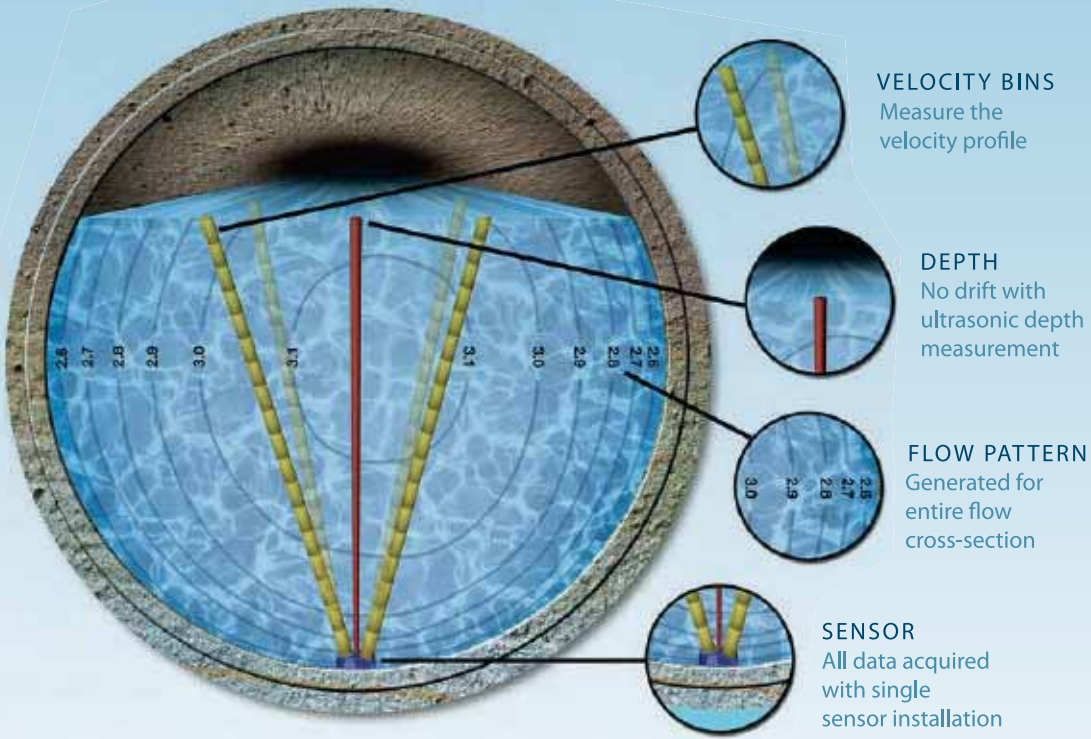
ADFM® Pro20



VELOCITY BINS
Measure the velocity profile

DEPTH
No drift with ultrasonic depth measurement

FLOW PATTERN
Generated for entire flow cross-section

SENSOR
All data acquired with single sensor installation

Key Product Specifications

FLOW RATE	
Measurement Accuracy:	**1 - 2% of reading**

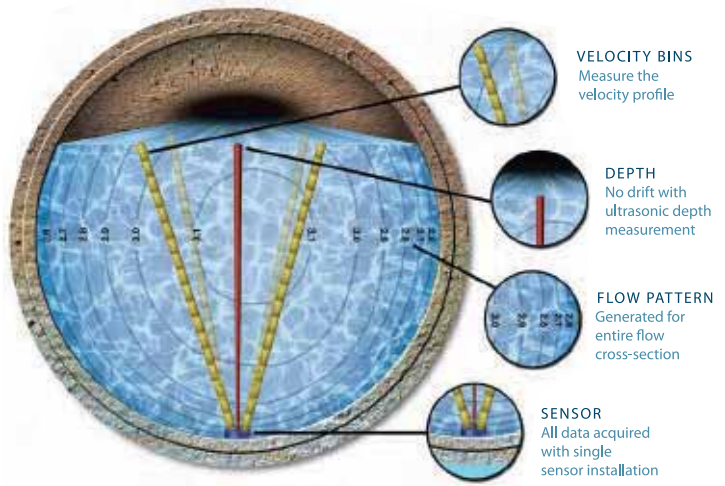
VELOCITY	
Measurement Range:	± 30.0 ft/s (± 9 m/s)
Vertical Profiling Range:	12 inches to 20 feet (300 mm to 6 m), nominal for particle concentrations of 50 – 1000 ppm
Measurement Accuracy:	0.5% ± 0.01 ft/s (3 mm/s)

WATER LEVEL	
Measurement Range:	4.5 inches – 20 feet (110 mm to 6 m)
Measurement Accuracy:	0.5% of reading ± 0.02 inches (0.5 mm)

CAPABILITIES

ADFM Pro-20 transducer assembly, processing unit options and interface cable.

The ADFM (Acoustic Doppler Flow Meter) Pro-20 consists of a transducer assembly mounted in the flow, a signal processing unit, and an interface cable. The figure to the right shows a typical ADFM Pro-20 installation with the sensor mounted at the invert of the pipe. The directions of the acoustic beams for velocity profiling are represented by the segmented yellow lines. These narrow acoustic beams are created by piezoelectric ceramics that emit short acoustic pulses. Echoes from these pulses are backscattered from material suspended in the flow. As this material has motion relative to the transducer, the echoes are Doppler shifted in frequency. Measurement of this frequency enables the calculation of the flow speed. Range-gating the return signal allows each segment to be processed for an independent velocity measurement, creating a velocity profile. The fifth ceramic mounted in the center of the sensor measures depth.



CAPABILITIES

- Measures flow rate within 2% of actual flow
- Accurate measurement even in adverse flow conditions
- Flow pattern generation for entire cross-section of flow
- Measurement of positive, near zero, zero and negative flow rate
- Real-time control application
- Wireless, Ethernet or hard-wired data acquisition

Isco's ADFM family of flow meters leverage patented ADFM technology, which uses multiple pulse Doppler beams instead of a single continuous wave transmission. As a result, the ADFM obtains highly accurate and precise flow measurement data.

ADFM Technology Highlights

Transmits short acoustic pulses; received echo is range-gated for velocity profile generation

Flow rate measurement accuracy is unparalleled for acoustic devices; approaches that of magnetic inductive and Venturi flow meters; no range bias

Accurate measurements in varying and adverse flow conditions: positive, near zero, zero and reverse flow conditions

In-situ calibration never required

BENEFITS

Increased Productivity

- Accuracy in adverse or varying flow conditions reduces time spent searching for the perfect metering location – or having to address questionable data
- Calibration-free technology ensures faster installation and eliminates the need for periodic recalibration
- The Pro-20's velocity profiling results reduces time-consuming data analysis

Lower Total Cost of Ownership (TCO)

- Labor intensive periodic recalibration is never required
- Raw data are accurate and immediately usable reducing data processing and reporting time
- Sensors are completely encapsulated in corrosion proof materials for durability; estimated ten (10) year life span

More Certainty, More Intelligent Decisions

- Measurement of flow rate within 2% of actual
- Planning and engineering decisions are made with more certainty because data are accurate
- Capital expenditures are optimized using accurate data
- Custody transfer (billing) charges are properly and fairly apportioned

A Note on Doppler Technology for Water Velocity Measurement

The Doppler effect is the change in frequency of sound waves received by an observer, whenever the wave source and/or the observer are in motion relative to each other. By measuring the difference between a transmitted and received acoustic frequency, a Doppler-based flow meter can determine the velocity of water flow.

The two most prevalent methods employing the Doppler effect to measure water velocity are continuous wave Doppler (CWD), which is used by the Isco 2100 and 4200 series meters, and pulse Doppler (PD), which is used by the Isco ADFM series meters, including the ADFM Pro20, accQmin, H-ADFM and ADFM Hot Tap meters. Both the CWD and PD methods employ sensors that are located within, and measuring throughout, the depth of flow. This removes error arising from making a single point measurement, in the water or on the surface, without regard for the structure of the flow pattern.

The mission of Teledyne Isco is to enable our customers to obtain the highest quality flow measurement data possible for every application. We fulfill this mission by providing our customers with a complete portfolio of accurate and cost-effective flow monitoring solutions for use in open and closed channel, non-potable water applications. Please go to www.isco.com for more information on CWD and PD meters to see how each method can best meet your requirements.

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