

ADFM™ Velocity Profiling Flow Meters

a patented family of flow meters employing pulse-Doppler technology

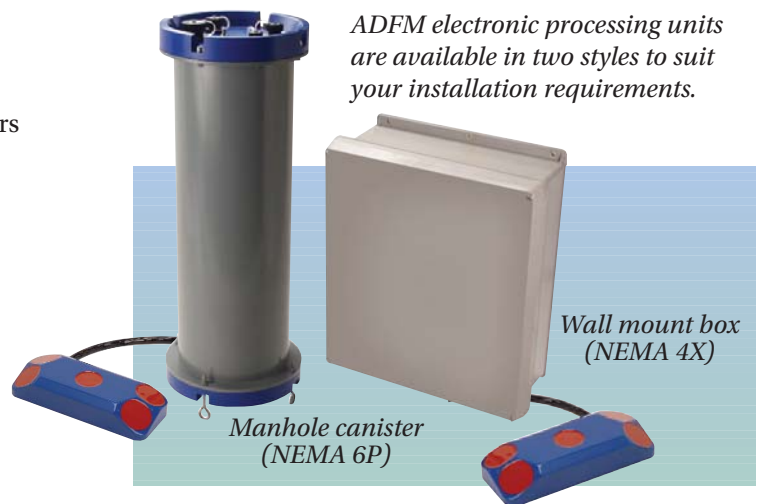


Ideal for open channel flow monitoring in non-potable water, ADFM technology delivers exceptional accuracy and precision at sites with difficult hydraulic conditions; no in-situ calibration is required

ADFM™ Pro20 Flow Meter

for open channels and large pipes (48 to 240 inches)

- Pulse-Doppler velocity profiling technology
- Upward-looking quad-redundant velocity sensors and depth sensor combined in a single housing
- Data quality verification information (signal strength and correlation)
- In-situ calibration never required
- Real-time data output
- Ideal for wastewater collection and treatment facilities



ADFM electronic processing units are available in two styles to suit your installation requirements.

Manhole canister (NEMA 6P)

Wall mount box (NEMA 4X)

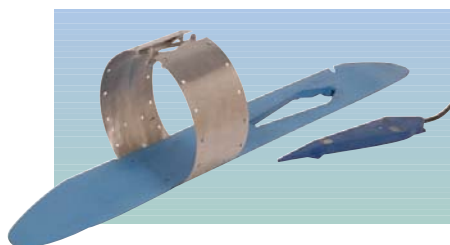
accQmin™ Flow Meter

for shallow water and small pipes/channels (8 to 48 inches)

- Upward-looking tri-redundant velocity sensors and depth sensors combined in a single housing
- NEMA 6P electronics assembly housing
- Secondary depth sensor (optional), pressure or ultrasonic
- Ideal for high accuracy and precision applications



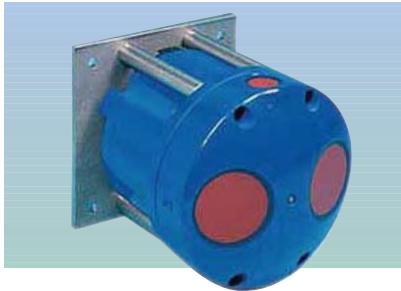
accQmin sensor with interface cable and processing unit



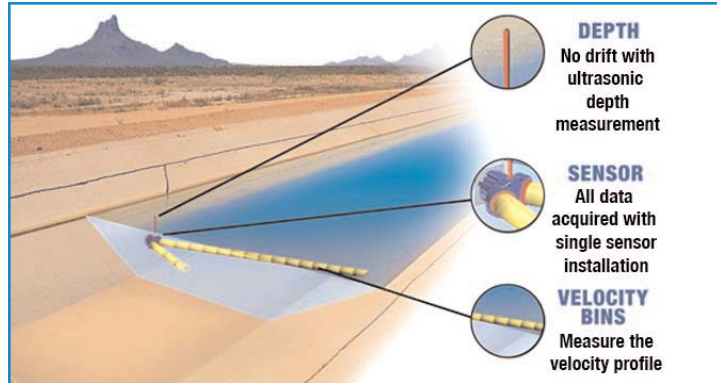
Installing the accQmin sensor in the optional Flow Conditioning Platform effectively eliminates velocity profile distortions.

Horizontal ADFM Flow Meter (H-ADFM)

velocity profiling measurement for channel widths of 10 feet or more



The H-ADFM is a high performance horizontal velocity profiling Doppler flow meter.



Velocity profiling technology allows you to obtain unmatched data quality — even in low velocities and complex flows where a single point measurement cannot provide enough information.

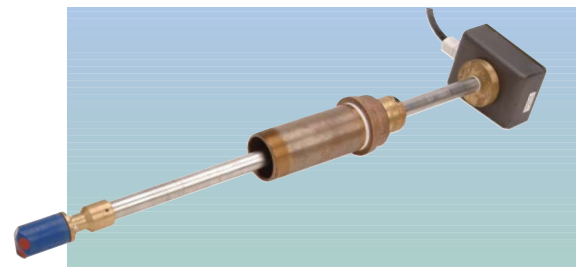
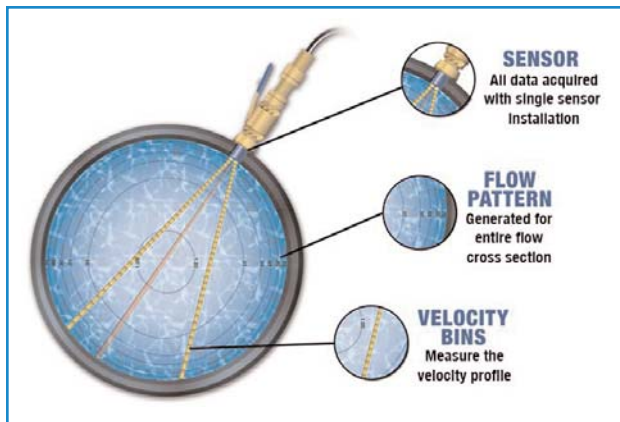
- Horizontally looking redundant velocity sensors and upward looking depth sensors combined in a single housing
- Sensor submersible to 100 feet
- Stainless steel mounting fixture is standard

ADFM Hot Tap Insertion Flow Meter

velocity profiling for full pipes

The Hot Tap is a miniaturized version of the standard ADFM sensor — specifically designed for full pipes. The Hot Tap sensor can be installed in “live” pipe, avoiding operation interruptions.

- Accurate measurement in “difficult” sites (near bends, short straight runs, close to pumps, etc.)
- Installation is accomplished via an industry-standard two-inch tap through the pipe wall



The Hot Tap sensor and mounting assembly allow installation while a pipe is still fully pressurized and in service.



ADFM™ Pro20 Velocity Profiler for Large Pipes and Open Channels

The ADFM™ Flow Meter brings unparalleled flow rate measurement accuracy to a traditionally difficult measurement environment: large pipes and channels. The ADFM measures flow rate to within 2% of actual value, in flow depths up to 20 feet (6 m).

The ADFM's pulse-Doppler velocity profiling technology measures the velocity distribution within the flow, delivering advanced flow measurement performance. This capability makes it versatile and the most suitable choice for metering sites at large pipes and open channels, particularly those with non-uniform, rapidly changing, backwatered, near zero, zero, or reverse flow conditions.

Principles of Operation

Four (4) piezoelectric ceramics in the sensor emit short pulses along narrow acoustic beams pointing in different directions to measure velocity. A fifth ceramic mounted in the center of the sensor assembly, and aimed vertically, is used to measure the depth.

Each acoustic beam measures velocity at multiple points, known as bins, in the water column. The measured velocity data within each bin are very precise – to within 0.01 ft/s. This distribution of accurate velocity measurements is then used to determine the flow pattern over the entire cross-section of flow. Since the flow pattern and measured velocity distribution are dependent on each other, the ADFM's advanced flow algorithms automatically adapt to changing hydraulic conditions within the pipe. This removes the need for in-situ calibration and insures accurate flow rate measurement over a host of different measurement environments and hydraulic conditions.



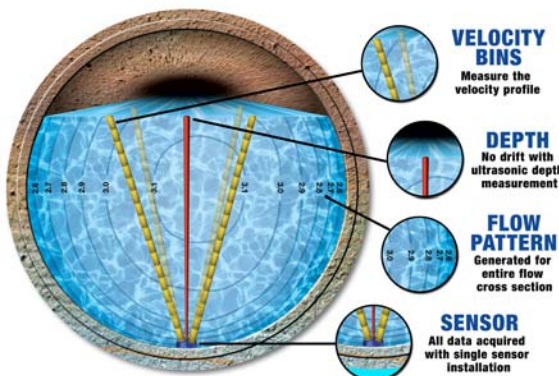
The ADFM enclosure houses the signal processing, data logging, and data output electronics. The enclosure is available as a NEMA 4X Box housing, suitable for wall or console mounting in permanent applications, and a NEMA 6P cylindrical housing for use in manholes or other “wet” environments.

Applications

- ◆ Wastewater collection systems
- ◆ Combined sewer systems and outfalls
- ◆ Wastewater treatment facilities
- ◆ Irrigation canals and channels
- ◆ Industrial process and discharges
- ◆ Stormwater conveyance and outfalls

Standard Features

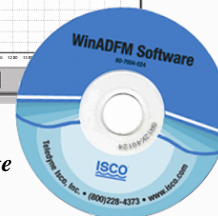
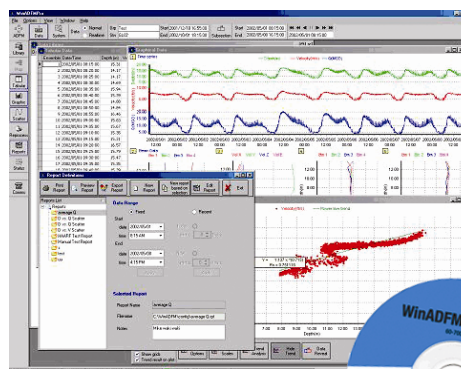
- ◆ pulse-Doppler velocity profiling technology
- ◆ Quad-redundant velocity sensors and depth sensor combined in a single housing
- ◆ Upward looking sensor mounts on a stainless steel band and is positioned in the channel invert
- ◆ Data quality verification information (signal strength and correlation)
- ◆ In-situ calibration never required
- ◆ Rugged, long lasting construction
- ◆ Real-time data output
- ◆ Industry standard communications protocol interfaces (optional)
- ◆ Secondary depth sensor (optional), pressure or ultrasonic



Specifications

ADFM™ Pro20 Velocity Profiler	
Measurement Precision	
Flow Accuracy:	1-2% of reading
Velocity	
Velocity Range:	±30.0 ft/s (±9 m/s)
Velocity Bin Size:	2 to 12 inches (50 to 300 mm) - user selectable
Vertical Profiling Range:	9 inches to 20 feet (230 mm to 6 m) nominal, for particle concentrations of 50-1000 ppm
Accuracy:	0.5% of reading ± 0.01 ft/sec (3.0 mm/s)
Water Level	
Measurement Range:	4.5 inches to 20 feet (110 mm to 6 m)
Accuracy:	0.5% of reading ± 0.02 in (0.5 mm)
Acoustic Frequency	
Frequency:	1.23 MHz
Physical	
Electronics unit	
Electronic unit configurations:	Cylindrical canister or wall-mount box
Operating Temperature	-15 to 125° F (-26 to 52° C)
Storage Temperature	-65 to 160° F (-54 to 71° C)
Packaging:	NEMA 6P (IP 68) for canister NEMA 4X for box
Weight:	Canister Housing 36 lbs (16 kg) Box Housing 24 lbs (11 kg)
ADFM Pro20 Sensor	
Operating Temperature:	23 to 95°F (-5 to 35°C)
Housing Material:	Urethane
Static Pressure:	250 psi Nominal
Dimensions:	8 x 3 x 1.5 inches (200 x 75 x 40 mm)
Weight:	3.2 lbs (1.5 kg)
Sensor Signal Cable	
Operating Temperature:	-40 to 125°F (-40 to 52°C)
Physical:	Polyethylene jacket
Length:	33 ft (10 m) std. (optional 150 ft length (45 m) available)
Minimum Bend Radius:	6 in (150 mm)
Outer Diameter:	0.5 in (13 mm) nominal

Data Management	
Data Output	
Q, V, D:	Discharge, average velocity, depth
Velocity:	Velocity profile data (relative to acoustic beam directions) per beam and bin
Echo Intensity:	Echo intensity data (relative backscatter intensity) per beam and bin
Data Quality:	Profile data quality indicators (Correlation magnitude, % - Good) per beam and bin
Temperature:	Transducer temperature output, range 20 to 125°F (-7 to 52°C)
Sound Speed:	One output for speed of sound data
Leader:	Output of general leader information (time, data, record number, etc.), and for vertical beam data
Data Storage	
Data Storage Capacity:	32 MB std. (300,000 measurements); up to 440 MB optional
Data I/O interface:	RS-232 standard. Multiple industry-standard analog and digital protocols optionally available.
Power	
Internal battery voltage:	24 VDC nominal
Internal Battery Capacity:	13 Ah at 75° F – Alkaline. Battery life 22 weeks at 15 minute sampling interval
External DC:	12 to 36 VDC; 10 VDC absolute minimum; 36 VDC absolute maximum
ADFM Velocity Profiler Software	
WinADFM and WinADFM Pro Software for Windows 98, 2000, NT, XP	



WinADFM Pro Software is a comprehensive software package for ADFM Pro20 set-up, operation, data review, analysis, and data management.



Water is life. Protect it.

Teledyne Isco, Inc.

4700 Superior Street
Lincoln NE 68504 USA
Tel: (402) 464-0231
USA and Canada: (800) 228-4373
Fax: (402) 465-3022
E-Mail: iscoinfo@teledyne.com
Internet: www.isco.com

accQmin™ Velocity Profiler

Shallow Water / Small Pipe

The accQmin™ Flow Meter brings unparalleled precision and accuracy to flow rate (Q) measurement in small pipes and channels, measuring flow rates to within 2-5% of actual flow quantity in flow depths of 3 to 39 inches (75 to 1000 mm).

The accQmin's pulse Doppler velocity profiling technology measures velocity distribution within the flow, delivering advanced flow measurement performance. This capability makes it versatile and the most suitable choice for sites with non-uniform, rapidly changing, backwatered, near zero, zero, or reverse flow conditions.

Principles of Operation

Three (3) piezoelectric ceramics in the sensor emit short pulses along narrow acoustic beams pointing in different directions to measure velocity. A fourth ceramic mounted in the center of the sensor assembly, and aimed vertically, is used to measure the depth.

Each acoustic beam measures velocity at multiple points, or "bins", within the water column. The measured velocity data within each bin are very precise – to within 0.01 ft/s. This distribution of accurate velocity measurements is then used to determine the flow pattern over the entire cross-section of flow. Since the flow pattern and measured velocity distribution are dependent on each other, the accQmin's advanced flow algorithms automatically adapt to changing hydraulic conditions within the pipe. This removes the need for in-situ calibration and ensures accurate flow rate measurement over a host of different measurement environments and hydraulic conditions.

For measurement in challenging low-depth-of-flow conditions, the accQmin sensor can be mounted in the Flow Conditioning Platform. This platform effectively reduces velocity profile distortion and adverse effects caused by placing a sensor in the flow stream. The result is precise and accurate data even in flow depths as low as 3 inches (75 mm). Each accQmin sensor comes with one platform for a user-specified pipe diameter. Optional platforms for different pipe sizes are available.

Powered by
ADFM™ Technology

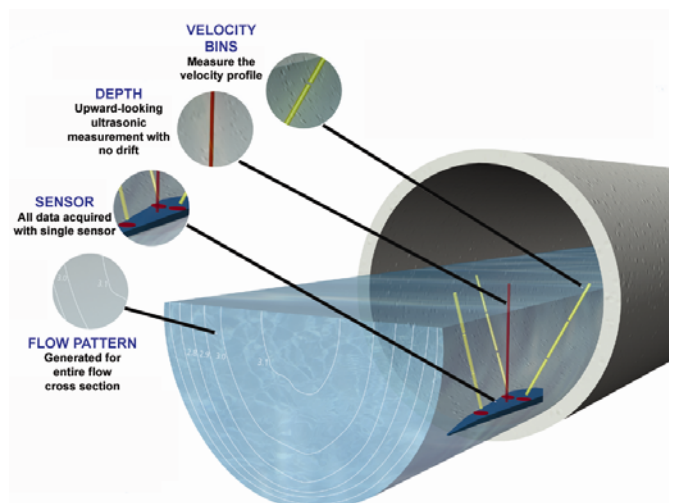


Applications

- ◆ Wastewater collection systems
- ◆ Combined sewer systems and outfalls
- ◆ Wastewater treatment facilities
- ◆ Irrigation canals and channels
- ◆ Industrial process and discharges
- ◆ Stormwater conveyance and outfalls

Standard Features

- ◆ Pulse Doppler velocity profiling technology
- ◆ Tri-redundant velocity sensors and depth sensor combined in a single housing
- ◆ Upward-looking sensor mounts on a stainless steel band and is positioned in the channel invert
- ◆ Data quality verification information (signal strength and correlation)
- ◆ In-situ calibration never required
- ◆ NEMA 6P electronics assembly housing
- ◆ Rugged, long lasting construction
- ◆ Real-time data output
- ◆ Industry standard communications protocol interfaces (optional)
- ◆ Secondary depth sensor (optional), pressure or ultrasonic
- ◆ Unique Flow Conditioning Platform



Specifications

accQmin™ Velocity Profiler	
Measurement Precision	
Flow Accuracy: - Function of depth of flow	
3-6 in (75-150 mm) flow depth:	5% of reading
6-12 in (150-300 mm) flow depth:	3% or reading
> 12 in (>300 mm) flow depth:	2% of reading
Velocity	
Velocity Range:	±15.0 ft/s (±4.5 m/s)
Velocity Bin Size:	0.4 in (10 mm)
Vertical Profiling Range:	3 to 39 in (75 to 1000 mm) nominal, for particle concentrations of 50 to 1000 ppm
Accuracy:	0.5% of reading ± 0.01 ft/s (3.0 mm/s)
Water Level	
Measurement Range:	1.5 in to 39 in (40 to 1000 mm)
Accuracy:	0.5% of reading ± 0.1 in (2.5 mm)
Acoustic Frequency	
Frequency:	2.46 MHz
Physical	
Electronics Unit	
Operating Temperature:	-15 to 125° F (-26 to 52° C)
Storage Temperature:	-65 to 160° F (-54 to 71° C)
Packaging:	IP 68 (NEMA 6P) compliant
Weight:	15 lb (6.8 kg)
Sensor Signal Cable	
Operating Temperature:	-40 to 125° F (-40 to 52° C)
Physical:	Polyethylene Jacket
Length:	33 ft (10 m) std. Optional 150 ft length (45 m) available.
Minimum Bend Radius:	6 in (150 mm)
Outer Diameter:	0.5 in (13 mm) nominal
accQmin Sensor	
Operating Temperature:	23 to 95° F (-5 to 35° C)
Housing Material:	Plastic
Static Pressure:	250 psi Nominal
Dimensions:	10.5 x 2.25 x 0.63 in (267 x 57 x 16 mm)
Weight:	1 lb (0.5 kg)

Data Management	
accQmin Velocity Profiler Data Output	
Q, V, D:	Discharge, average velocity, depth
Velocity:	Velocity profile data (relative to acoustic beam directions) per beam and bin
Echo Intensity:	Echo intensity data (relative backscatter intensity) per beam and bin
Data Quality:	Profile data quality indicators (Correlation magnitude, % - Good) per beam and bin
Temperature:	Transducer temperature output, range = 20 ≤ T ≤ 125° F (-7 ≤ T ≤ 52° C)
Sound Speed:	One output for speed of sound data
Leader:	Output of general leader information (time, data, record number, etc.), and for vertical beam data
Data Storage and I/O	
Data Storage Capacity (optional):	2 MB std. (20,000 measurements); slate or wrap memory
Data I/O interface:	RS-232 standard. Multiple industry-standard protocols optional.
Power	
Internal battery voltage:	18 VDC nominal
Internal Battery Capacity:	26 Ah at 75° F (24° C) - Alkaline. Battery life 30 weeks at 15 minute sampling interval
External DC:	12 - 24 VDC; 10 VDC absolute minimum; 36 VDC absolute maximum
Software	
WinADFM Software for set-up, operation, data review, and data management.	



Mounting the accQmin in the optional Flow Conditioning Platform effectively eliminates velocity profile distortions



Teledyne Isco, Inc.

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 Lincoln NE 68504 USA
 Tel: (402) 464-0231
 USA and Canada: (800) 228-4373
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H-ADFM™ Velocity Profiler for Wide Open Channels

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ADFM™ Technology

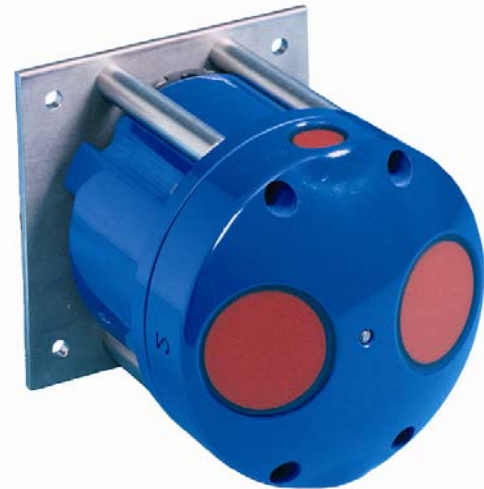


The introduction of the revolutionary H-ADFM Flow Meter has made pulse Doppler technology available for open channel applications 10 feet in width and greater. The H-ADFM has set a new standard for flow rate measurement accuracy that previously was not attainable in wide channel applications.

The H-ADFM pulse Doppler velocity profiling technology measures the horizontal distribution of velocity within the flow, across a channel. Horizontal profiling provides increased information of the velocity structure and flow conditions; information that a single point measurement on the surface or in the flow cannot provide.

The H-ADFM mounts on the side of a channel allowing easy access to the system for maintenance when needed. Additionally, several H-ADFM sensors can be “stacked”, providing horizontal profiles at multiple levels in the depth of flow. This generates increased accuracy and enables superior data quality even in difficult hydraulic conditions.

The H-ADFM’s advanced flow measurement performance capability makes it versatile and the most precise and accurate choice available for metering sites in very large pipes and open channels, particularly those with non-uniform, rapidly changing, backwatered, near zero, zero or reverse flow conditions.

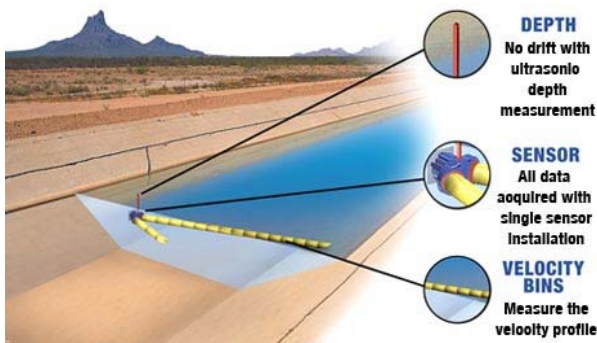


Applications

- ◆ Wastewater collection systems
- ◆ Combined sewer systems and outfalls
- ◆ Wastewater treatment facilities
- ◆ Irrigation canals and channels
- ◆ Industrial process and discharges
- ◆ Stormwater conveyance and outfalls

Standard Features

- ◆ Pulse Doppler velocity profiling technology
- ◆ Redundant cross-channel velocity sensors and upward-looking depth sensor combined in a single housing
- ◆ Sensor submersible to 100 ft of depth.
- ◆ Stainless steel mounting bracket for installation on the channel side
- ◆ Data quality verification information (signal strength and correlation)
- ◆ Rugged, long lasting construction
- ◆ Real-time data output
- ◆ Industry standard communications protocol interfaces (optional)
- ◆ Secondary depth sensor (optional), pressure or ultrasonic
- ◆ Sensor and processing electronics all in a single module



Specifications

H-ADFM Velocity Profiler	
Velocity Profiling	
Number of Cells:	1-128
Minimum cell size:	0.8 ft (250 mm)
Maximum cell size:	12 ft (4 m)
Maximum profiling range ¹ :	65 ft (20 m) at 1200 kHz
Minimum recommended channel width:	10 ft (3 m) at 1200 kHz
Velocity Range:	±15 ft/s (±5 m/sec)
Velocity Accuracy:	±0.5% ±0.01ft/s (3mm/s)
Flow Accuracy: Function of depth of flow	
Flow Rate:	2-5% of reading
Water Level	
Measurement Range:	0.3 to 30 feet (100 mm to 9 m)
Accuracy:	±0.25%
Transducer Assembly	
Geometry:	2 beams, ±20°
Beam width:	1.5°
H-ADFM Standard Internal Sensors	
Temperature	
Range:	-25° to 105°F (-4° to 40°C)
Accuracy:	±0.4°F (0.2°C)
Tilt (2 axes)	
Range:	±10°
Accuracy:	±0.2° at 0°, ±0.5° at 10°
Physical	
H-ADFM Sensor	
Weight:	7.5lb (3.4kg)
Dimensions (H x W x D) ² :	7.2 x 7.2 x 7.4 inches (183 x 183 x 189 mm)
Construction:	Cast polyurethane with titanium hardware, mounting plate included.
Sensor Signal Cable	
Operating Temperature	-40 to 125°F (-40 to 52°C)
Physical	Polyethylene jacket
Length:	80 ft (25 m)
Minimum Bend Radius:	6 in (150 mm)
Outer Diameter:	0.5 in (13 mm) nominal

¹ Maximum range depends on a number of factors, including temperature, salinity, suspended materials, etc

² Mounted horizontally.

Communications	
RS-232:	Simultaneous RS-232 and internal logging supported. Serial baud rates – 300 to 115,200 bps.
Software	
WinHADFM Software is a comprehensive software package for H-ADFM set-up, operation, data review, and data management.	
Power	
Voltage:	9 to 18 VDC
Max Current:	1.5 A
Power consumption:	Energy consumption depends on velocity profiling parameters. Contact the Isco factory or your Isco representative for an accurate prediction in your specific application.



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 Lincoln NE 68504 USA
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 USA and Canada: (800) 228-4373
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 Internet: www.isco.com



ADFM™ Hot Tap Velocity Profiler for Closed Pipes

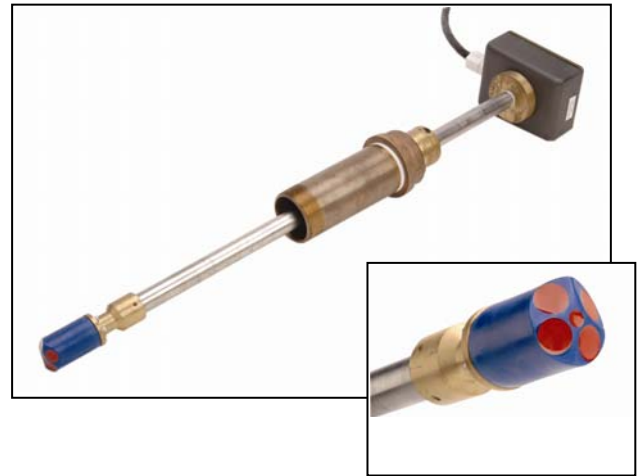
The ADFM Hot Tap Flow Meter provides precise and accurate flow rate measurement in full and pressurized pipe applications. The Hot Tap can be used in the difficult hydraulic conditions often found in force mains, siphons, process lines, and other full-pipe applications.

The ADFM Hot Tap is a variant of the standard, open channel ADFM flow monitoring system. The Hot Tap combines the widely used ADFM pulse Doppler velocity profiling technology with a unique sensor assembly suitable for insertion into full, operating pipes.

The Hot Tap's velocity profiling technology enables accurate flow rate measurement without the usual lengthy upstream and downstream straight-line conditions required by other technologies. It measures flow rate to within $\pm 2\%$ of actual flow rate in closed pipes, even in difficult applications such as installations near bends, short straight runs, near pumps, etc.

Installation is accomplished by inserting the sensor into an industry standard two-inch tap through the pipe wall. Installation is straightforward and quick, providing easy access to the sensor for routine inspection and maintenance when needed. The Hot Tap is constructed of robust materials insuring years of worry-free operation.

The Hot Tap sensor uses standard ADFM electronics for data processing, collection, and storage. For customers already familiar with the standard ADFM system, operating the Hot Tap system will be intuitively easy. All standard ADFM software, communication, and interface equipment are available for the Hot Tap.

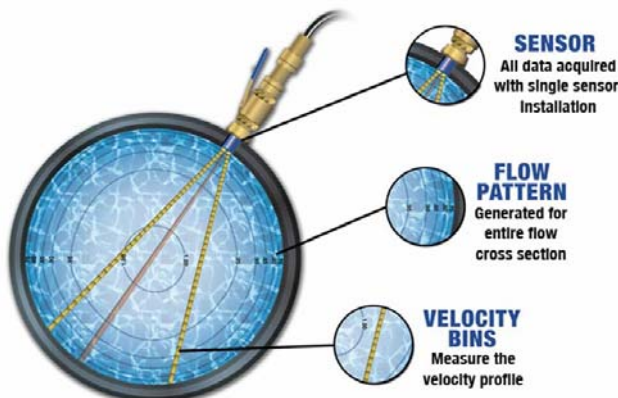


Applications

- ◆ Wastewater collection systems
- ◆ Combined sewer systems and outfalls
- ◆ Wastewater treatment facilities
- ◆ Irrigation canals and channels
- ◆ Industrial process and discharges
- ◆ Stormwater conveyance and outfalls

Standard Features

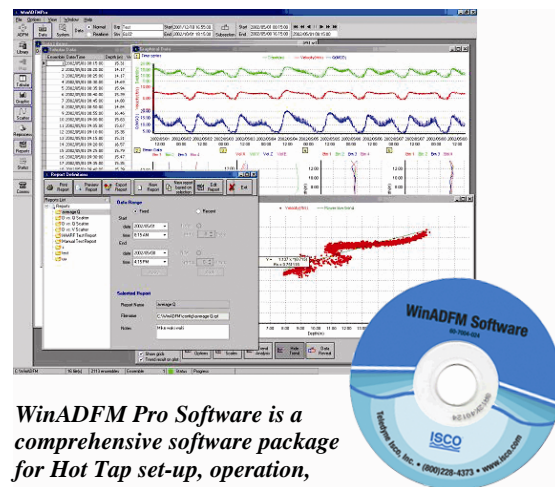
- ◆ Pulse Doppler velocity profiling technology
- ◆ Quad-redundant velocity sensors in a single housing
- ◆ Data quality verification information (signal strength and correlation)
- ◆ In-situ calibration never required
- ◆ Rugged, long lasting construction
- ◆ Real-time data output
- ◆ Industry standard communications protocol interfaces (optional)
- ◆ Secondary pressure depth sensor (optional)



Specifications

ADFM™ Hot Tap Velocity Profiler	
Measurement Precision	
Flow Accuracy:	1-2% of reading
Velocity	
Velocity Range:	±30.0 ft/s (± 9 m/s)
Velocity Bin Size:	2 to 12 inches (50 to 300 mm) user selectable
Vertical Profiling Range:	9 to 108 in (230 mm to 2.7m) nominal, for particle concentrations of 50-1000 ppm
Accuracy:	0.5% of reading ± 0.01 ft/s (3.0 mm/s)
Acoustic Frequency	
Frequency:	1.23 MHz
Physical	
Electronics unit	
Electronic unit configurations:	Cylindrical canister or wall-mount box
Operating Temperature:	-15 to 125° F (-26 to 52° C)
Storage Temperature:	-65 to 160° F (-54 to 71° C)
Packaging:	NEMA 6P (IP 68) for canister NEMA 4X for box
Weight:	Canister Housing 36 lbs (16 kg) Box Housing 24 lbs (11 kg)
ADFM Hot Tap Insertion Sensor	
Operating Temperature:	23 to 95° F (-5 to 35° C)
Housing Material:	Plastic transducer assembly on corrosion resistant stainless steel stem
Static Pressure:	50 psi Nominal
Dimensions:	1.375 in (35 mm) diameter with standard stem length of 24 in (610 mm); fits 2 in (50 mm) standard tap
Weight (including 50 ft cable):	15 lbs (6.8 kg)
Sensor Signal Cable	
Operating Temperature:	-40 to 125° F (-40 to 52° C)
Physical:	Polyethylene jacket
Length:	33 ft (10 m) std. Optional 150 ft length (45 m) available.
Minimum Bend Radius:	6 in (150 mm)
Outer Diameter:	0.5 in (13 mm) nominal

Data Management	
Data Output	
Q, V, D:	Discharge, average velocity, depth
Velocity:	Velocity profile data (relative to acoustic beam directions) per beam and bin
Echo Intensity:	Echo intensity data (relative backscatter intensity) per beam and bin
Data Quality:	Profile data quality indicators (Correlation magnitude, % - Good) per beam and bin
Temperature:	Transducer temperature output, range = 20 ≤ T ≤ 125° F (-7 ≤ T ≤ 52° C)
Sound Speed:	One output for speed of sound data
Leader:	Output of general leader information (time, data, record number, etc.)
Data Storage	
Data Storage Capacity:	32 MB std. (300,000 measurements); up to 440 MB optional
Data I/O interface:	RS-232 standard. Multiple industry-standard analog and digital protocols optionally available.
Power	
Internal battery voltage:	24 VDC nominal
Internal Battery Capacity:	13 Ah at 75° F (24° C) – Alkaline. Battery life 22 weeks at 15 minute sampling interval
External DC:	12 - 36 VDC; 10 VDC absolute minimum; 36 VDC absolute maximum
ADFM Velocity Profiler Software	
WinADFM and WinADFM Pro Software for Windows 98, 2000, NT, XP	



WinADFM Pro Software is a comprehensive software package for Hot Tap set-up, operation, data review, analysis, and data management.



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