BUILDING SUSTAINABILITY MANAGEMENT

Solutions for Building Management and Optimization

Badger Meter

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Message from the President

Sustainability has been vital to Badger Meter since our founders invented the frost-proof water meter in 1905. That invention helped people measure their water use, even during the harsh months of winter in Wisconsin. Today, our smart metering and flow instrumentation, water quality and toxic gas detection solutions help municipal utilities and building management throughout the world measure virtually anything that moves through a pipe or is in the air we breathe. In the process, we deliver long-term value to our customers, employees and investors by providing solutions that help manage and conserve the world´s most precious, natural resources.

As a corporation, Badger Meter pursues continuous improvement initiatives in three major sustainability categories:

- **OUR PRODUCTS** help save water and other natural resources through our highly accurate metering, water quality, analytics and toxic gas detection solutions.
- **OUR OPERATIONS** include socially responsible supply chain practices and responsible use of resources in the management of our facilities.
- **OUR PEOPLE** are a major source of strength and together we strive to cultivate and maintain a healthy, productive and engaged workforce, while contributing to the communities and industries in which we are a part of.

We are proud of our success and the progress we continue to make. Our sustainability team and the company as a whole remain dedicated to helping our customers efficiently use resources, to practice what we preach in our operations and, through our dedicated and engaged workforce, we continue to make our company and the world a more vibrant place.

All the best,

Ken Bockhorst
Chairman, CEO and President - Badger Meter

COMPANY
Measurement

Actionable Intelligence for Buildings

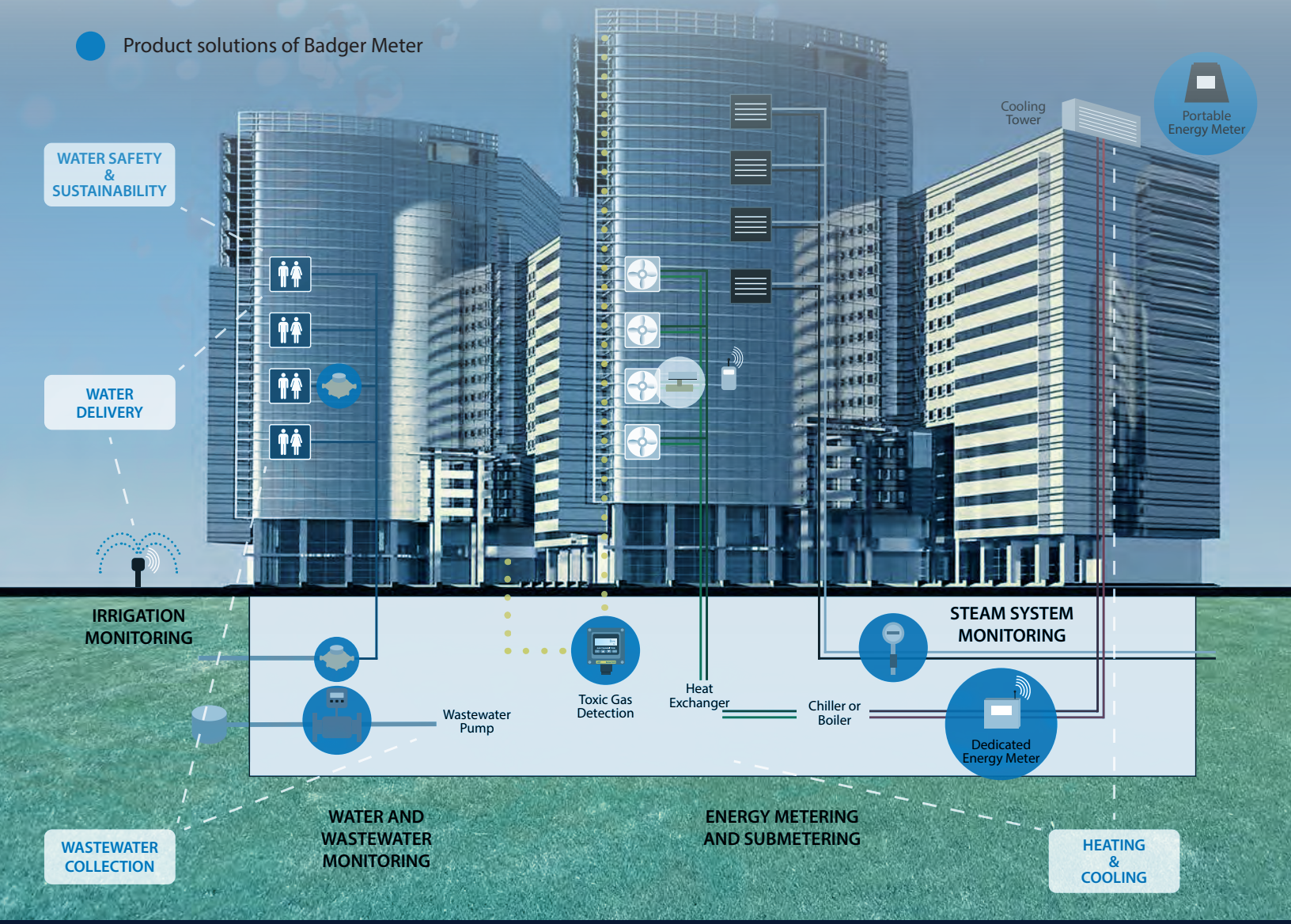
You and your customers expect peak performance every day, all year-round, and optimizing system performance allows the building to respond to changing occupant and environmental demands and to manage costs. Badger Meter products provide the actionable intelligence for property managers to control, manage and optimize their facilities.

Adjusting building automation and water delivery systems to accommodate changes in usage, occupancy and facility age allows facilities to ensure occupant comfort while balancing costs, quality, and extending the useful life of older systems.

With a broad portfolio of technologies, Badger Meter provides solutions for every phase in a building's lifecycle, from new construction to retrofit. A variety of installation styles and options means that Badger Meter delivers solutions specific to your building's needs.

Badger Meter has the measurement solutions you need for:

- Water delivery
- Heating and cooling systems
- Wastewater collection
- Water safety and sustainability



COMPANY
Solutions for Building Management

Technology that measures your building resources

ModMAG® M2000

Electromagnetic flow meter

Features:
- Dual Hastelloy C electrodes come standard
- Bi-directional flow measurement sensing and totalization
- Digital and analog outputs
- Empty pipe detection
- Cost-effective
- BACnet MS/TP and BACnet IP

Dynasonics® TFX-5000

Transit time ultrasonic Clamp-on flow and energy meter

Features:
- Installs without shutting and draining system
- Large, bi-directional flow measuring range
- Data log up to 8 readings
- Water-glycol and energy

Dynasonics® U500w [1]

Transit time ultrasonic water meter

Features:
- Four sizes and lay lengths
- Completely submersible IP68
- Minimum extended low-flow rate lower than typical positive displacement meters
- Simplified one-piece electronic meter and register that integral to the meter body

Dynasonics® TFX-500w

Transit time ultrasonic Clamp-on water meter

Features:
- Low installation costs
- Non-invasive clamp-on flow meter
- Measures flow rate, total and velocity of water flow
- Set up through keypad inter-face and SoloCUE® software

ModMAG® M5000

Electromagnetic flow meter

Features:
- Battery-powered meter
- Internal datalogger
- Strong battery life
- Excellent repeatability
- Cost-effective

[1] **Product available in the Americas only**

COMPANY
Solutions for Building Management

Technology that measures your building resources

Impeller SDI

Insertion flow sensor

Features:
- Low installation costs
- Single direction powered insert with raw, scaled pulse and analog output
- Bi-directional powered insert with analog and scaled pulse output
- Battery powered insert with a local and remote display and scaled pulse output

Impeller 380 Btu Series

Flow sensor with Btu transmitter

Features:
- Single direction powered insert BACnet or Modbus RS-485 communications protocols or a scaled pulse output
- Flow Rate, Flow Total, Energy Rate, Energy Total, Temp 1, Temp 2, and Delta T can all be transmitted on the RS-485 connection

Impeller 220 Series

Flow sensor

Features:
- Six-bladed impeller design with a proprietary, non-magnetic sensing mechanism
- Sensor electronics easily removed from tee
- Digital signal easily interfaced with transmitters, monitors or PLCs

Recordall® Disc Meters

Nutating disc water meter

Features:
- Delivers precision accuracy with extended flow ranges
- Light weight
- Magnetic coupling
- Output: Pulse, 4-20mA, local read, etc.
- Low maintenance and long life

Recordall® Turbo Meters [1]

Industrial turbine meter

Features:
- Direct coupled turbine based on an exclusive "floating rotor" design that reduces bearing friction and associated wear and tear
- Low pressure loss for improved system efficiency

Vortex VN2000

Vortex meter

Features:
- Hot tap or direct insertion
- Steam or wet gases/air
- High flow ranges
- Large pipe sizes
- Cost-effective
- Low installation costs

[1] **Product available in the Americas only**

COMPANY
Solutions for Building Management

Technology that measures your building resources

Preso® Cone Meter

Cone differential pressure flow meter

Features:
- Little or no straight run piping requirements
- No additional flow conditioning devices needed
- Low maintenance and long life
- Steam measurement

FC-5000 Btu Monitor

Compatible with Impeller SDI and ModMAG® M2000

Features:
- Scaled pulse output
- Communication via EIA-485 Modbus
- Control panel mounted or wall mounted

212 Heat Calculator

Compatible with Impeller SDI and ModMAG® M2000

Features:
- 4-20 mA output option
- Communication via M-Bus and Modbus RTU RS 485
- Control panel mounted or wall mounted

About Install Style

Style	Pros +	Cons −
Inline	• The best accuracies and repeatabilities • Wider flow turndown ranges with more low-flow measurement capabilities	• Most labor intensive to install • Requires process shutdown and pipe draining to install (smaller diameter pipes may freeze)
Insertion	• Covers multiple pipe sizes • Less costly to install than an inline meter • Some models can be inserted into an active pipe (e.g. hot tap)	• Lower accuracy than inline • Flow profile dependent
Clamp-on	• Covers multiple pipe sizes • No plumbing skills required • Non-invasive flow meter • Low installation costs	• Lower accuracy than inline

COMPANY
Solutions for Building Management

Turn your Data into Proactive Intelligence

The AquaCUE® Flow Measurement Manager cloud-based software suite offers a wide choice of managed, traditional fixed network, mobile and consumer engagement solutions to meet your meter reading and reporting needs. Increasingly, facility and sustainability managers are looking for ways to understand and monitor their water operations, improve inefficiencies and address equipment problems and wasteful behavior. Sub-metering throughout a facility, property, or campus empowers personnel to make more knowledgeable decisions for more efficient use of valuable, fluid resources.

Benefits

Increased Visibility Through Analytics

- Provides proactive intelligence for optimal water management – faster leak detection, revenue management, water conservation, clarity and easier data collection for compliance reporting.

Enhanced Customer Service

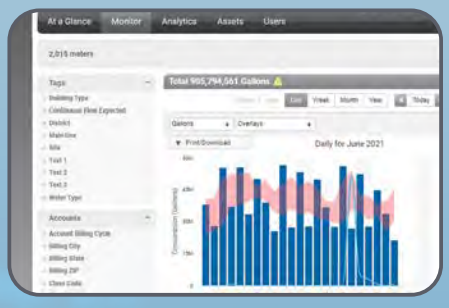
- Advanced user profile and anomaly trending, combined with a cloud-based website and smartphone/tablet apps, allow you to gain a greater understanding of consumption patterns to quickly resolve or prevent related issues.

Focus on Water Management

- Built to minimize your deployment and system maintenance, we provide the hosted software platform, system maintenance and software support.

Future-Proof Technology

- Receive the cloud-based AquaCUE® software suite with regular updates.



HEATING AND COOLING SYSTEMS

Heating and cooling systems exist to deliver thermal comfort and acceptable indoor air quality within reasonable installation, operation and maintenance costs. In facilities that contain computer data centers, HVAC systems deliver the cooling required to maintain critical 24-7 operations.

HVAC systems can be designed for individual buildings, or as a larger district network that delivers heating and/or cooling to multiple buildings. District heating and cooling networks provide an economy of scale that is often not as viable for individual buildings.

All heating and cooling systems are comprised of:
- Heat generation or elimination, e.g. a boiler or chiller
- Distribution of the heat or chilling via water, steam (heat only), or air
- Consumption of the heating or cooling by a tenant, zone, or department

Measurement of key system parameters is critical to optimize operation and for continuity of service. When buildings convert from constant heating/cooling, to as-needed operation to reduce energy costs and provide a more consistent level of comfort, measurement is an essential part of system feedback loops.

E **Hydronic Energy Measurement**

W **Water Measurement**

S **Steam Measurement**

HEATING AND COOLING SYSTEMS

Hydronic Heating and Cooling

Hydronic, water-based systems minimize energy usage, deliver a more even heating/cooling experience, and are compatible with a wide variety of energy sources to heat or cool the liquid. Hydronic systems are one of the most popular methods used in district heating and cooling networks, as well as in many individual systems.

As hydronic systems use water that evaporates and can be prone to mineral build-up, it is necessary to add and strategically eliminate water during system operation. Excessive amounts of added water, known as makeup water, is often indicative of leaks or stuck valves, which in turn correlate to water damage or water waste.

WITH EVERY HYDRONIC ENERGY SYSTEM, WE MEASURE:

1. Energy at each boiler, chiller or cooling tower to determine system efficiency.
2. Energy at each tenant, zone or apartment to determine cost allocation and distribution network load balancing.
3. Makeup water.
4. Wastewater from system blowdown.

Flow Meter Overview

Dynasonics® TFX-5000

Impeller SDI

ModMAG® M1000

ModMAG® M2000

Impeller 380 Btu Series

		Application				Install Style			Communication					Certification				
Solutions	Line Sizes	Heating	Cooling	Glycol water	Potable water	Inline	Insertion	Clamp-on	BACnet MS/TP	BACnet/IP	Modbus RTU	Mbus	AquaCUE®	EN1434 Class 2	CE	NSF 61 / 372	US/Canada Safety	See Page
Dynasonics® TFX-5000	1/2"...48" (DN15...DN1200)	✓	✓	✓	✓			✓	✓	✓	✓		✓		✓	NA	✓	26
Impeller SDI + FC5000	1 1/2"...36" (DN40...DN900)	✓	✓	✓	✓		✓		✓		✓	✓			✓			29/31
Impeller SDI + 212	1 1/2"...36" (DN40...DN900)	✓	✓	✓	✓		✓					✓			✓			29/31
ModMAG® M1000 + FC5000	1"...10" (DN25...DN250)		✓	✓	✓	✓			✓		✓	✓	✓		✓	✓	✓	30/31
ModMAG® M1000 + 212	1"...10" (DN25...DN250)		✓	✓	✓	✓						✓	✓		✓	✓		30/31
ModMAG® M2000 + FC5000	1"...10" (DN25...DN250)		✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	30/31
ModMAG® M2000 + 212	1"...10" (DN25...DN250)		✓	✓	✓	✓			✓	✓		✓	✓		✓	✓		30/31
Impeller 380 Btu Series	3/4"...2"	✓	✓	✓	✓	✓			✓		✓							33

HEATING AND COOLING SYSTEMS

Hydronic Heating and Cooling

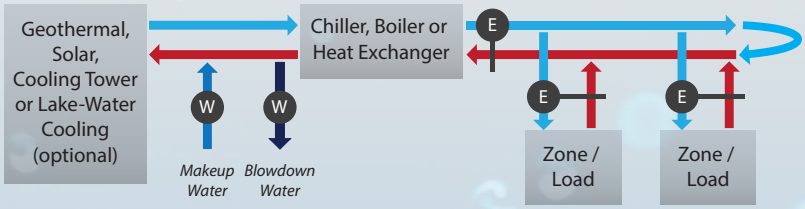
Measurement Location

E W

Hydronic System

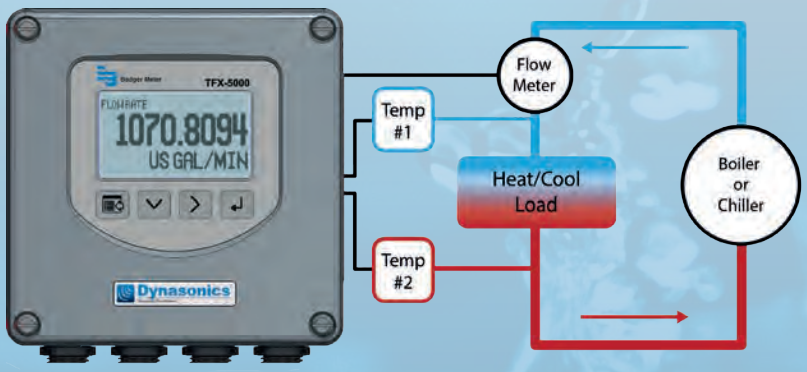
Hydronic systems can use chiller, boilers, or heat exchangers to accordingly increase or decrease the temperature of the water-based fluid in the hydronic system. Buildings may use external heat or cooling sources to further reduce energy costs. During chiller operation, banks of chillers are staged up and down to meet demand, as chillers typically need to a load between 40% and 80% for proper operation.

As flow rate and the amount of energy distributed varies by the season, especially for heat, be sure to select a measurement device that accommodates the design flow rate and the minimum flow rate.



Boiler Energy Management

Energy flow meters at key locations provide measures of system efficiency and energy use. Energy flow meters calculate energy using one flow rate measurement and two temperature measurements.



HEATING AND COOLING SYSTEMS

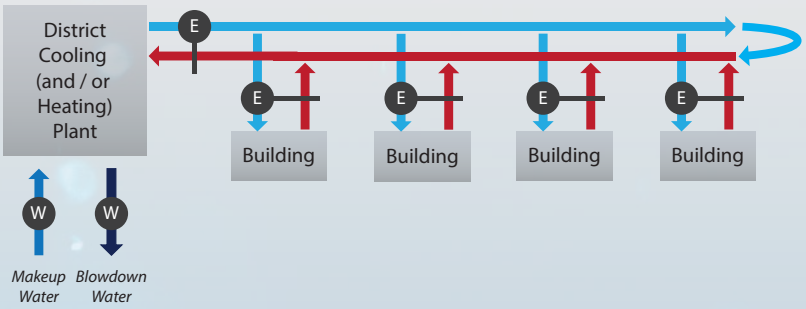
Hydronic Heating and Cooling

Measurement Location

E W

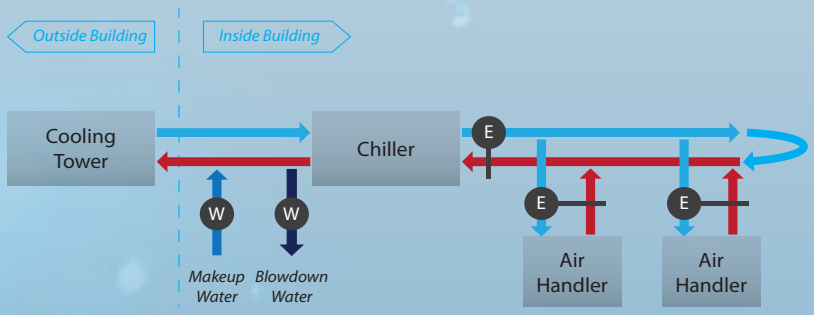
District Cooling and Heating

District cooling is the modern and efficient way to air condition clusters of buildings in cities and on campuses. In a district cooling system, a central plant with large and highly efficient industrial equipment that produces chilled water for supplied buildings through an isolated underground piping network. Cold supply water enters the buildings and flows to a heat exchanger, absorbing heat from the building space and providing air conditioning. The warmed water recirculates back to the central plant through a closed loop return line.



Cooling Towers

Ideally, the amount of makeup water added to a cooling tower loop should equal the amount of water lost through evaporation and blowdown water. The amount of water lost through evaporation will vary based on the type and efficiency of the cooling tower and the amount of cooling. Using too much makeup water often signals a system leak or stuck valve.



HEATING AND COOLING SYSTEMS

Steam Heating

Steam-based systems are used to efficiently and cost-effectively heat facilities in cooler climates. Steam-based systems, similar to their hydronic counterparts, are used in both district heating networks and within individual systems.

IN STEAM HEAT SYSTEMS, WE MEASURE:

1. Energy at each boiler or chiller to determine system efficiency.
2. Energy at each tenant, zone or apartment to determine cost allocation and distribution network load balancing.
3. Makeup water.
4. Wastewater from system blowdown.
5. Water condensate return. Condensate is a byproduct of steam as it cools and offsets makeup water.

Flow Meter Overview

S

Vortex VN2000 - Insertion

Vortex VN2000 - Hot Tap

Preso® Cone Meter

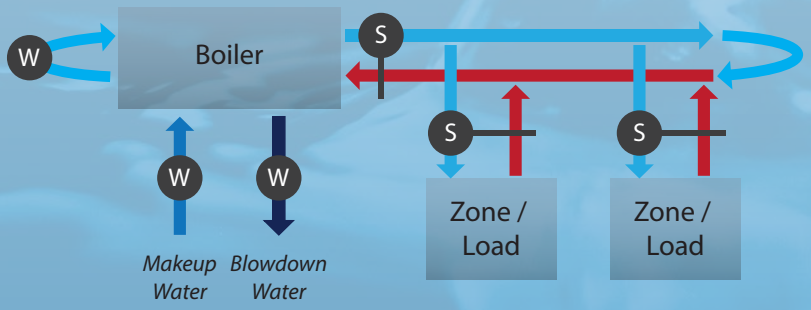
		Install Style			Communication					Certification		
Product	Line Sizes	Inline	Insertion	Clamp-on	BACnet MS/TP	BACnet/IP	Modbus RTU	Mbus	AquaCUE®	CE	US/Canada Safety	See Page
Vortex VN2000	2"...36" (DN50...DN900)		✓		✓		✓					37
Preso® Cone Meter	1/2"...24" (DN15...DN600)	✓			Depends on selected pressure transmitter							38

Measurement Location

S W

Steam Load Management

Measures energy efficiency by measuring steam delivery through a pipe to a heating zone. Low flow capability is important to understand system operation across all settings of heat generation.



WATER MEASUREMENT AND OPTIMIZATION

Water is vital for life but has become a scarce resource in many locations. Besides climate change, economic growth and overpopulation are among the main causes of water scarcity. Another cause is increasing environmental pollution. If a water source is polluted by oil or by toxic substances in the air, it is no longer available as a drinking water reservoir.

As water scarcity increases, regional governments respond by establishing water usage restrictions, or mandating water use reductions. The first step in managing or reducing water usage is to understand your water usage baseline. You cannot manage what you do not measure. Badger Meter provides a complete portfolio of solutions for measuring water usage from small to large pipes, with solutions for common applications including:

- Potable water
- Reclaimed water
- Landscape / irrigation water
- Wastewater

To understand water consumption within a facility that consumes water in multiple locations, Badger Meter recommends adding flow meters at key locations to provide zone-specific water usage reductions. Common areas that measure water within a facility includes:

- Residents or tenants
- Food services
- Landscape / irrigation
- Pool / spa
- Cooling towers
- Departments, such as in manufacturing or medical facilities
- Other facility zones

E **Hydronic Energy Measurement** W **Water Measurement** S **Steam Measurement**

WATER MEASUREMENT AND OPTIMIZATION

Effective Water Measurement for Smarter Buildings

Due to water scarcity, everyone is exploring and implementing methods to reduce total water consumption and waste. While builders designed and oversized the plumbing in older buildings to accommodate future occupancy, even new buildings with more optimized plumbing are finding that bathrooms, appliances, and people are continuing to reduce water usage on an ongoing basis.

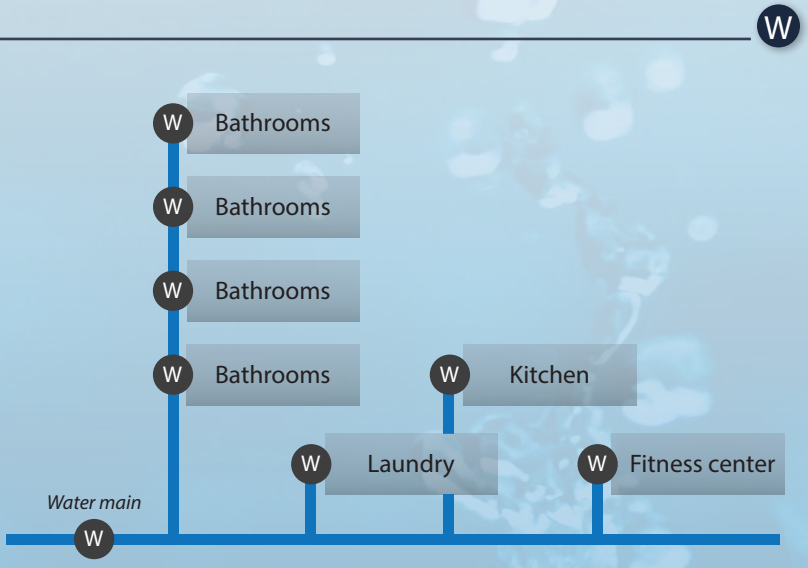
IMPORTANT POTABLE WATER FLOW METER SECTION TIPS:

1. Always select a flow meter size designed to measure the anticipated flow rates based on expected water usage.
2. Strategically position flow meters in all key locations, such as by bathrooms and kitchens, to quickly pinpoint abnormal water usage patterns that could indicate a possible leak.
3. Always be mindful of site installation constraints when selecting a meter, because while all meters should be plumbed to operate under full pipe conditions, some meters require straight runs of pipe before and after the meter.

Share the data where needed

Not all currently deployed building management systems provide data views that allow an entire organization to view and manage water usage, however Badger Meter flow meters offer multiple output options to enable sharing of water measurement data.

1. Outputs for AquaCUE® and other water consumption dashboards
2. Modbus and BACnet connections for Building Energy Management Systems (BEMS)
3. Pulse and analog outputs
4. AquaCUE® provides an additional REST API interface for sharing water consumption data



WATER MEASUREMENT AND OPTIMIZATION

Effective Water Measurement for Smarter Buildings

Flow Meter Overview

Dynasonics® TFX-5000

ModMAG® M5000

ModMAG® M2000

ModMAG® M1000

Impeller SDI

Dynasonics® U500w[1]

Recordall® Disc Meters

		Application			Install Style			Communication					Certification			
Product	Line Sizes	Makeup Water	Blowdown Water	Condensate Return	Inline	Insertion	Clamp-on	BACnet MS/TP	BACnet/IP	Modbus RTU	Mbus	AquaCUE®	CE	NSF 61 / 372	US/Canada Safety	See Page
Dynasonics® TFX-5000	1/2"...48" (DN15...DN1000)	✓	✓	✓			✓	✓	✓	✓		✓	✓	NA	✓	26
ModMAG® M5000	1/2"...24" (DN15...DN600)	✓	✓	✓	✓					✓	✓	✓	✓	✓		32
ModMAG® M2000	1/4"...54" (DN6...DN1350)	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	30
ModMAG® M1000	1/4"...20" (DN6...DN500)	✓	✓	✓	✓					✓	✓	✓	✓	✓		30
Impeller SDI	1 1/2"...36" (DN40...DN900)	✓	✓	✓	✓	✓										29
Dynasonics® U500w [1]	5/8"...4"	✓	✓	✓			✓					✓	✓			27
Recordall® Disc Meters	1/2" ... 2" (DN15 ... DN50)	✓	✓	✓	✓						✓	✓	✓	✓		35

[1] Product available in the Americas only

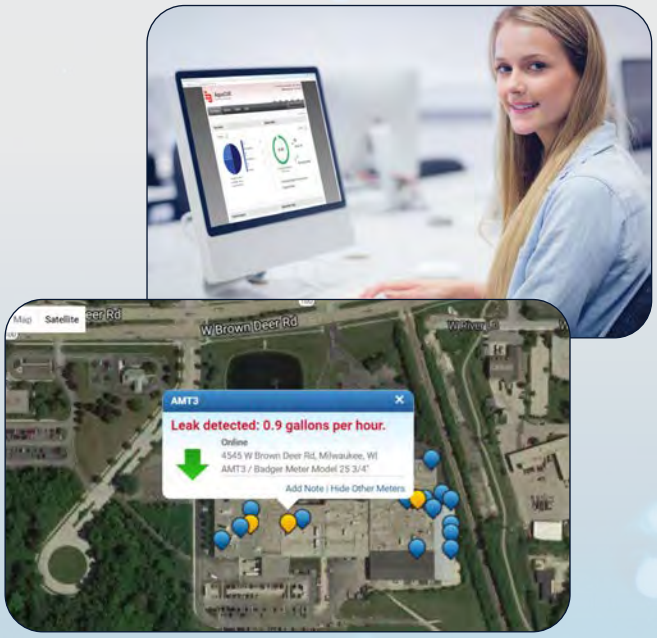
WATER MEASUREMENT AND OPTIMIZATION

Optimization

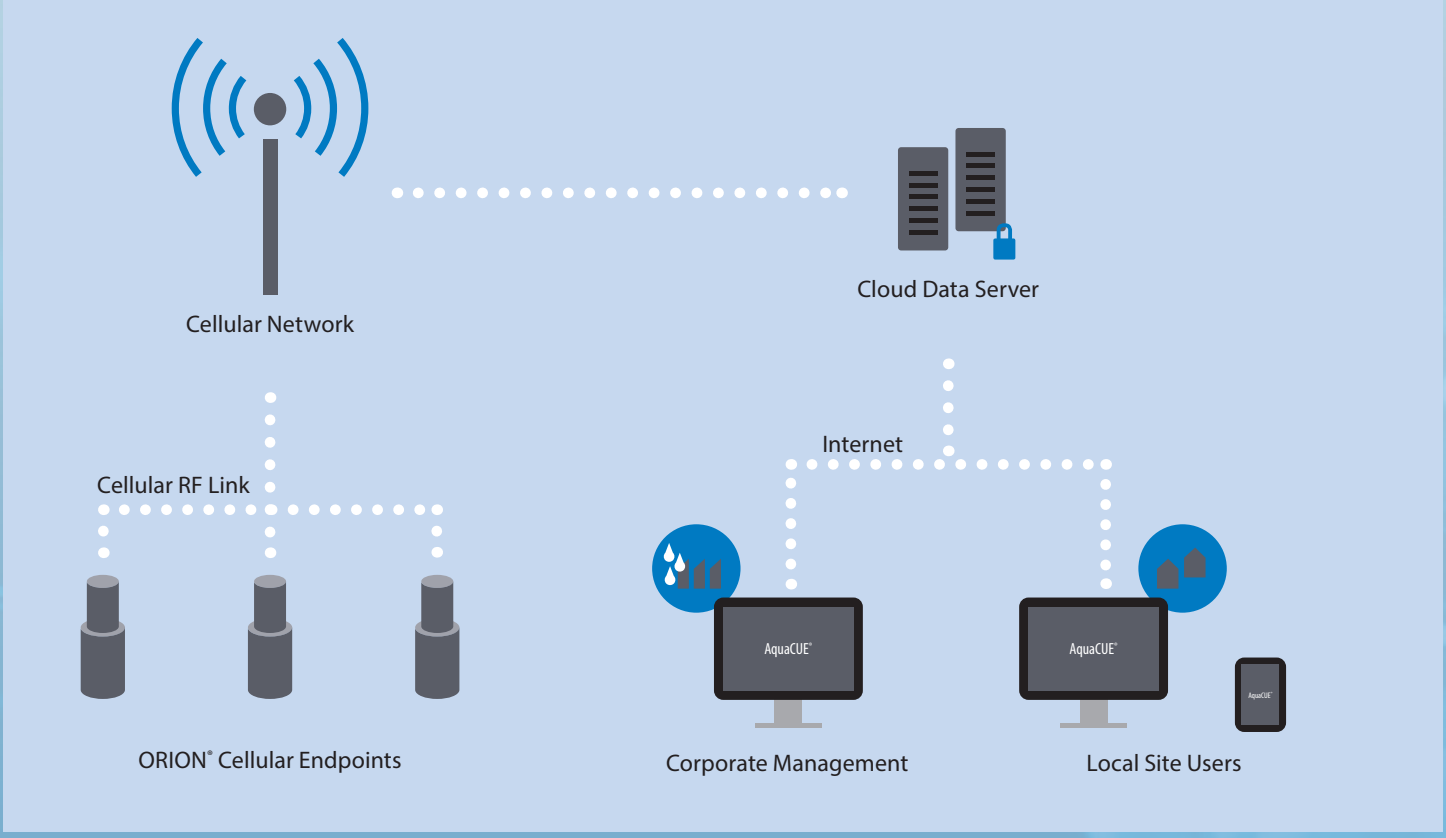
AquaCUE® turns your data into proactive intelligence

The AquaCUE® Flow Measurement Manager brings a new level of optimizing information to light. Its intuitive software suite with targeted advanced metering analytics, combined with proven cellular communication technologies, enables greater visibility and control over water resources. The system puts interval meter data to work to address demands for actionable intelligence and improve operations.

Cellular endpoints minimize the need for complicated infrastructure and are pre-programmed to automatically broadcast hourly meter reading and event data to the system software. This information helps identify potential leaks and other anomalies in water use. The customizable dashboard delivers information set per individual requirements.



Data transfer and data collection



WATER MEASUREMENT AND OPTIMIZATION

Optimization

Define and design

- Sub-metering improves water-use visibility. Identify, define and install flow meters anywhere water flows through a pipe. Set parameters and design the optimal flow management system to meet your water efficiency goals.

Monitor and learn

- The intuitive AquaCUE® dashboard features in-depth analytics and graphs that incorporate historical data, such as temperature and rainfall overlays, to provide an easy to understand picture of how water is currently being used throughout your facilities.

Take action and make a difference

- With smart flow measurement comes smart flow management. AquaCUE® empowers users at all levels of an organization to identify and quickly address flow inefficiencies, equipment problems or wasteful behaviors. Smarter water consumption helps conserve water and save money.

FEATURES YOU NEED

- Customize dashboards to deliver information in a format matched to your response
- Ability to set unique alert conditions to define and monitor exceptions
- User friendly website interface enables access to users at all metering locations
- Secure, cloud-based - ISO 27001 certified and SOC 2 examined for security, availability and confidentiality
- Automatic software updates
- Integration with your operations and process systems via API

Water Measurement

		Application			Install Style			Communication						Water Safety	
Product	Line Sizes	Water	Wastewater	Landscape irrigation	Inline	Insertion	Clamp-on	BACnet MS/TP	BACnet/IP	Modbus RTU	Mbus	AquaCUE	Pulse and/or Analog	NSF 61 / 372	See Page
Dynasonics® TFX-500w	1/2"...10" (DN65...DN250)	✓		✓			✓	✓		✓		✓	✓	NA	28
Dynasonics® TFX-5000	1/2"...48" (DN15...DN1000)	✓	✓				✓	✓	✓	✓		✓	✓	NA	26
Dynasonics® U500w [1]	5/8"...4"	✓		✓	✓							✓	✓	✓	27
ModMAG® M5000	1/2"...24" (DN15...DN600)	✓	✓		✓					✓	✓	✓	✓	✓	32
ModMAG® M2000	1/4"...54" (DN6...DN1350)	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	30
Recordall® Disc Meters	1/2"...2" (DN15...DN50)	✓		✓	✓							✓	✓	✓	35
Recordall® Turbo Meters[1]	1 1/2"...12" (DN40...DN300)	✓			✓							✓	✓	✓	36

[1] Product available in the Americas only

WATER MEASUREMENT AND OPTIMIZATION
Irrigation

Flow Meter Overview

Impeller SDI

Impeller 220 Series

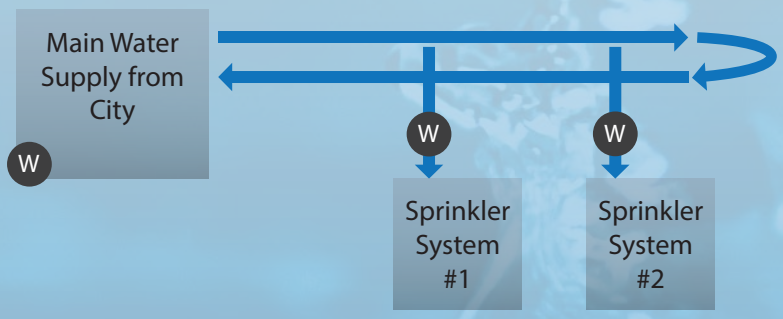
		Application			Install Style			Communication						Water Safety	
Product	Line Sizes	Water	Wastewater	Landscape irrigation	Inline	Insertion	Clamp-on	BACnet MS/TP	BACnet/IP	Modbus RTU	Mbus	AquaCUE®	Pulse and/or Analog	NSF 61 / 372	See Page
Impeller SDI	1 1/2"...36" (DN40...DN900)	✓				✓							✓		29
Impeller 220 Series	3"...40" (DN80...DN1000)	✓		✓	✓	✓							✓		34

Measurement Location

Irrigation Water Management

A dedicated irrigation meter exclusively meters water used for outdoor watering and irrigation. A separate irrigation meter provides accurate measurement of outdoor water use and better ability to manage peak demands driven by irrigation demands.

Some water utilities and municipalities allow customers to deduct irrigation water usage from their wastewater billing. Irrigation systems are a common source of many leaks, the water lines are susceptible to freezing in some climates and raised sprinkler heads can be damaged during lawn mowing.



WATER MEASUREMENT AND OPTIMIZATION
Wastewater

Flow Meter Overview

Dynasonics® TFX-5000

ModMAG® M1000

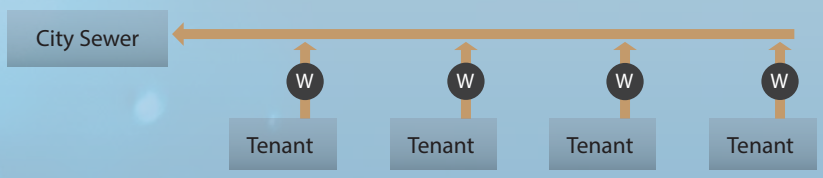
ModMAG® M2000

		Application			Install Style			Communication						Water Safety	
Product	Line Sizes	Water	Wastewater	Landscape irrigation	Inline	Insertion	Clamp-on	BACnet MS/TP	BACnet/IP	Modbus RTU	Mbus	AquaCUE®	Pulse and/or Analog	NSF 61 / 372	See Page
Dynasonics® TFX-5000	1/2"...48" (DN15...DN1200)	✓	✓				✓	✓	✓	✓		✓	✓	NA	26
ModMAG® M1000	1/4"...8" (DN6...DN200)	✓	✓		✓					✓	✓	✓	✓	✓	30
ModMAG® M2000	1/4"...54" (DN6...DN1350)	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	30

Measurement Location

Wastewater Management

Humans consume vast quantities of water and create an increasing amount of wastewater. We help customers measure their water usage. Measurements help customers determine where they can reduce costs, identify losses and comply with water use restrictions.



WATER QUALITY MONITORING

Badger Meter is an added-value solutions partner that strives to help our customers and channel partners control, manage and optimize water resources, from when it enters the building, to when it leaves. As global leaders in smart water quality monitoring, disinfection control and digital management tools, Badger Meter delivers pioneering, innovative, smart sensor technology that measures water quality and reduces the risks of corrosion, leaks, bursts and repairs within water systems.

WATER QUALITY MONITORING

nano::station

The modular nano::station combines leading water quality instruments into a versatile system for real-time water quality monitoring. Integrating the i::scan multi-parameter spectrophotometer probe, this solution helps facilities managers to create conditions that prevent the growth of waterborne bacteria. By monitoring water quality online, favorable conditions for Legionella growth can be detected in real-time, allowing for immediate action to be taken to prevent harmful effects.

Strategically placed nano::stations measure water quality at crucial points by monitoring biocides, organics and parameters at the inlet point. Combined with the con::cube event detection and control terminal, this helps to detect unusual events that affect water quality. The nano::station also takes into consideration flow-dependent biocide injections at the inlet and critical points, utilizing one main control terminal with multiple measuring points.

Water quality monitoring and optimization in water systems

- Online, real-time monitoring and event detection
- Measures NTU, TOC, DOC, Conductivity, pH, Free Chlorine
- Multiple measuring points, one control terminal with advanced alarm algorithms

MetriNet

MetriNet water quality monitoring solution provides class-leading, smart sensor technology for the continuous policing of water systems, providing 24/7 data to demonstrate validity and system efficacy.

This bespoke, low-powered system for closed & open loop applications can be configured to suit individual building requirements, enabling key parameters to be measured at any location to safeguard water and reduce the risk of corrosion within pipes. By installing MetriNet smart sensors at water supply pinch-points, including HVAC systems, toilets, showers and cooling towers, early warnings alert to any changes in Dissolved Oxygen, pH, Conductivity and Pressure conditions, allowing for timely action. With a small footprint for easy installation anywhere within a building, biocidal sensors can also be added to reduce the risk of Legionella.

Water quality management in HVAC systems

- Continuous measurement, alarming & sensing for hot & cold water systems
- Dissolved Oxygen, pH, Conductivity, Turbidity, Pressure & Temperature
- Flexibility in data backhaul via BMS or Cellular to AquaCUE
- Low-powered smart sensor technology

GAS DETECTION SOLUTIONS

Badger Meter offers class-leading toxic and hazardous gas detection instrumentation for over 60 gases and vapors, providing the latest smart, digital technology for fixed, portable and bespoke solutions. Our expertise in sensor design and manufacture allows us to deliver the highest level of protection for people and processes, helping facilities managers to ensure a safe, healthy environment. Our gas detectors, featuring the exclusive AutoTest verification system, automatically test themselves daily with self-generated gas to safeguard system integrity and the quality of the environment in which we live and work.

F12

F12 Toxic Gas Detectors employ smart sensors & feature the exclusive AutoTest verification system. Automatically testing itself daily with self-generated gas, the F12 safeguards the quality of the environment in which we live and work & provides system integrity

Features

- Test & calibration history stored in sensor memory
- LCD graphic display
- Internal data logger stores gas values at user-defined intervals from 1 to 60 minutes
- CE & RoHS Compliant

- Measures over 60 different gases & vapors
- AutoTest sensor verification
- Available as an intrinsically safe 2-wire transmitter or an AC/DC powered unit with multiple alarms
- Interchangeable, pre-calibrated smart sensors
- Internal data logger

H10

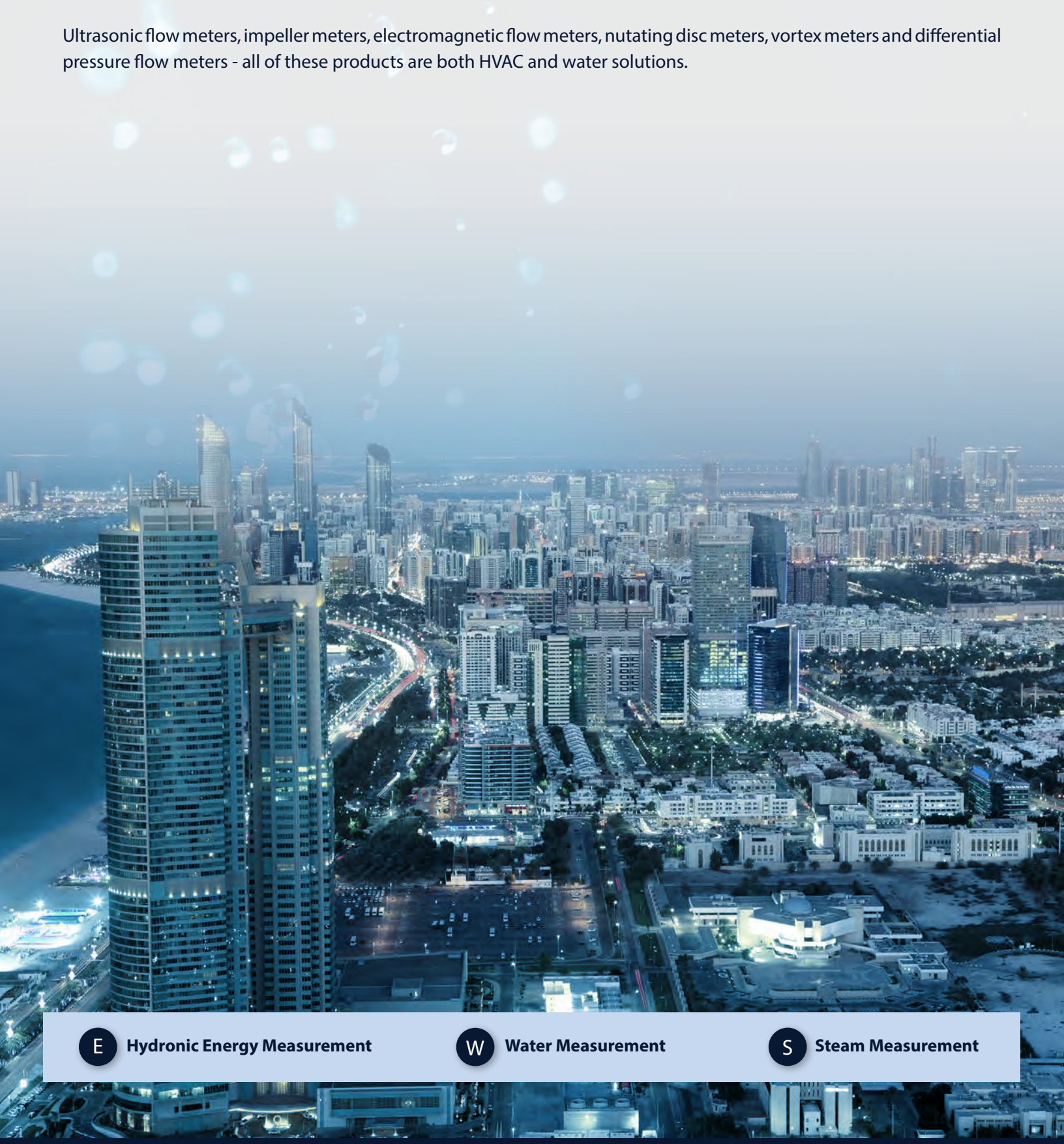
The interchangeable H10 smart gas sensors utilize advanced smart sensor technology, capable of measuring over 60 different gases and vapors. This allows facilities managers to measure anything from ozone to chlorine gas in less than one minute, simply by plugging the sensor directly into any of our smart detectors for immediate use.

When installed in our gas detectors, calibration data is loaded into the microprocessor so that no adjustments are needed.

- Advanced smart sensor technology
- Measures over 60 different gases & vapors
- Sensor, amplifier & memory module in one compact package
- Interchangeable & pre-calibrated

FLOW METERING SOLUTIONS

Ultrasonic flow meters, impeller meters, electromagnetic flow meters, nutating disc meters, vortex meters and differential pressure flow meters - all of these products are both HVAC and water solutions.



E **Hydronic Energy Measurement**

W **Water Measurement**

S **Steam Measurement**

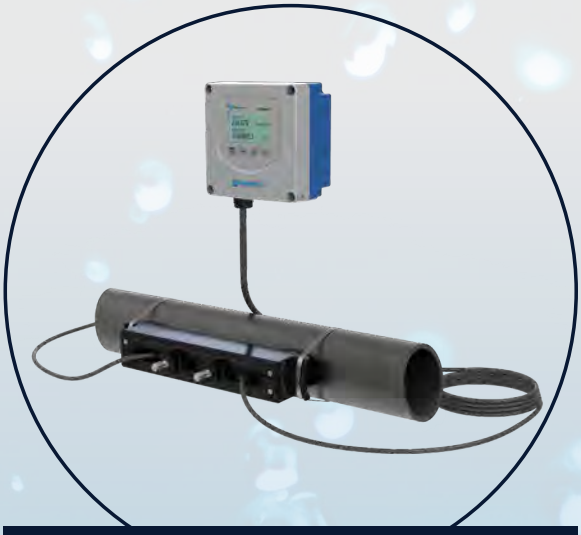
FLOW METERING SOLUTIONS

Dynasonics® TFX-5000

Transit Time Ultrasonic Clamp-on Flow Meter

The TFX-5000 transit time ultrasonic flow meter measures volumetric flow and heating/cooling energy rates in clean liquids, as well as those with small amounts of suspended solids or aeration, such as surface water or raw sewage.

By clamping on to the pipe, the meter installs without having to shut down the system or drain the pipes and are never in contact with the internal liquid.



- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Large, bi-directional flow measuring range
- Data log up to 8 records
- Non-invasive clamp-on
- BACnet MS/TP, BACnet/IP, Modbus RTU, Modbus TCP and AquaCUE® connectivity
- Large, easy-to-read graphical display
- Rugged, aluminum enclosure for a long service life in harsh environments

Technical data

Types	Flow meter Heating & cooling energy flow meter	
Sizes	1/2"...48" (DN15...DN1200)	
Flow rate	0.7...33000 gpm (0.19...7500 m^3/h)	
Accuracy	Medium pipes	± 0.5% ± 0 0.025 ft/s (0.008 m/s)
	Small pipes	1" (25 mm) and larger = ±1% ± 0.03 ft/s (0.009 m/s) 3/4" (20 mm) and smaller = ±1% of full scale
Display (flow rate/total)	8-digit	
Installation position	All installation positions (vertical, horizontal)	
Medium temperature measurement range	-40...350 °F (-40...176 °C)	
Power supply	• External 24 VAC / 9 - 28 VDC • Mains supply 85 - 264 VAC	

FLOW METERING SOLUTIONS

Dynasonics® U500w [1]

Ultrasonic Water Meter

Dynasonics® U500w ultrasonic water meters use solid state technology in a compact, totally encapsulated, weatherproof and UV-resistant housing, suitable for building and property management submetering applications. Equipped with an easy-to-read, 9-digit LCD display, the ultrasonic meter presents consumptions, rate of flow, reverse-flow indication and alarms. With no moving parts, the U500w meter also improves reliability and has greater extended low flow accuracy compared to other positive displacement meters.

- Low flow ranges
- Small pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Four sizes and lay lengths
- Completely submersible IP68
- Minimum extended low-flow rate lower than typical positive displacement meters.
- Simplified one-piece electronic meter and register that are integral to the meter body.
- Sealed, non-removable, tamper-protected meter.
- Easy-to-read 9-digit LCD display.
- AquaCUE® connectivity

Technical data

Sizes	5/8"...4"
Flow rate	0.1...1100 gpm (0.02...300 m^3/h)
Accuracy	• ±1.5% over the normal flow range • ±3.0% from the extended low flow range to the minimum flow value
Display (flow rate/total)	9-digit
Installation position	All installation positions (vertical, horizontal)
Nominal pressure	Up to 175 psi (12 bar)
Medium temperature measurement range	45...140 °F (7...60 °C)
Power supply	Battery-powered
Approvals	NSF 61/372

[1] **Product available in the Americas only**

FLOW METERING SOLUTIONS

Dynasonics® TFX-500w

Ultrasonic Clamp-on Flow Meter

The TFX-500w ultrasonic clamp-on flow meter is quickly and easily installed without cutting or tapping the pipe. Ultrasonic waves transmit upstream and downstream through the pipe wall and water flowing in the pipes. By measuring the difference in the travel time and knowing the pipe size, the meter determines the velocity and flow rate. TFX-500w flow meters are a cost effective meter for measuring water flow in a variety of applications.

- Low flow ranges
- Small pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Low installation costs
- Non-invasive clamp-on flow meter.
- Bidirectional, full pipe flow measurement.
- Measures flow rate, total and velocity of water flow.
- Large easy to read display.
- Set up through keypad interface and SoloCUE® software.
- Connects to AquaCUE® flow analytics.
- Modbus RTU and BACnet MS/TP communications.

Technical data

Sizes	1/2"...10" (DN65...DN250)
Flow rate	0.1...9800 gpm (0.02...2673 m^3/h)
Accuracy	±1 %
Display (Flow rate/total)	8-digit
Installation position	All installation positions (vertical, horizontal)
Power supply	9...28V DC@5 W maximum
Temperature measurement range	-40...250 °F (-40...121 °C)

FLOW METERING SOLUTIONS

Impeller SDI

Insertion Flow Sensor

E W

The SDI series flow sensor offers unparalleled performance for liquid flow measurement in closed pipe systems, in an easy-to-install economical package. Impeller sensors offer a quick response to changes in flow rate and are well suited to flow control and batch type applications, in addition to flow monitoring. The new four-bladed impeller design is rugged, non-fouling and does not require custom calibration. The battery-powered versions are a complete flow measuring system, providing a programmable display of rate, total or both powered by a "C" sized lithium battery.

- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal installation

Features

- Low installation costs
- Single direction powered insert with raw, scaled pulse and analog output
- Bi-directional powered insert with analog and scaled pulse output
- Battery powered insert with a local and remote display and scaled pulse output

Technical data

Sizes	1-1/2"...36" (DN40...DN900)
Accuracy	±1%
Installation position	Horizontal installation
Nominal pressure	Up to 1000 psi (68 bar)
Power supply	• Battery powerd • 8-35 VDC • 12-30 VAC

FLOW METERING SOLUTIONS

ModMAG® M1000 & M2000

Electromagnetic Flow Meter

E W

Combining a general-purpose detector with an amplifier, the ModMAG® M1000 and M2000 electromagnetic flow meters feature an advanced, user-friendly design for field verification testing, with the use of a simple, handheld device. The meters are manufactured under strict quality standards and employ sophisticated, microprocessor-based signal conversion with accuracies up to 0.3 percent of reading for ModMAG® M1000 and 0.2 percent of reading for ModMAG® M2000. The wide selection of liner and electrode materials helps ensure maximum compatibility and minimum maintenance over a long operating period.

- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Dual Hastelloy C electrodes come standard
- LCD display
- Verification device
- Bi-directional flow measurement sensing and totalization
- Digital and analog outputs
- Store and restore parameters
- AquaCUE® connectivity
- BACnet MS/TP and BACnet IP

Technical data

Types	M1000	M2000
Sizes	1/4"...20" (DN6...DN500)	1/4"...78" (DN6...DN2000)
Flow velocity	0.10...39.37 ft/s (0.03...12 m/s)	0.10...39.37 ft/s (0.03...12 m/s)
Accuracy	± 0.3 %	± 0.2 %
Display	LCD display	LCD display
Installation position	All installation positions (vertical, horizontal)	All installation positions (vertical, horizontal)
Temperature measurement range	Up to 302 °F (150 °C)	Up to 302 °F (150 °C)
Power supply	9...36 VDC, 92...275 VAC	10...36 VDC, 85...265 VAC

FLOW METERING SOLUTIONS

ModMAG® M1000 & M2000

Impeller SDI and ModMAG® M1000/M2000 are compatible with FC-5000 BTU Monitor

The FC-5000 product lines are microprocessor-driven devices designed for flow monitoring, while the BTU Monitor expands device capabilities by integrating inputs for fluid temperature data. Instantaneous rate and total energy consumption is achieved simultaneously.

Features

- BTU calculator
- Large, easy-to-read display
- Intuitive navigation and programming
- Fully programmable inputs and outputs
- Scaled pulse output
- Communication via EIA-485 Modbus and USB
- Control panel mounted or wall mounted

Impeller SDI and ModMAG® M1000/M2000 are compatible with 212 Heat Calculator

The 212 heat calculator has been designed to measure the energy consumed in hot water heating systems and chilled water cooling systems.

The 212 is supplied with temperature probes and easily interfaces with our impeller meters, electromagnetic flow meters and non-invasive ultrasonic flow meters.

- 4-20 mA output option
- Communication via M-Bus and Modbus RTU RS 485
- Control panel mounted or wall mounted

FLOW METERING SOLUTIONS

ModMAG® M5000

Battery-powered Electromagnetic Water Meter

The ModMAG® M5000 is a battery-powered electro-magnetic flow meter, with a very high accuracy even at very low flows. The excellent repeatability, as well as the above-average battery life, makes this innovative water meter indispensable for the water market. Typical applications are leak detection in water networks, water consumption measurements and irrigation plants.

The meter is best suited for applications without a power supply, where exact consumption or flow rates are required. Of course, the ModMAG® M5000 can also be used with an available power supply. The meter can be powered with main voltage and in case of a main failure, it is powered by an internal battery. Important data is consequently saved.

- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- LCD display
- Battery-powered
- Internal datalogger
- Strong battery life
- Excellent repeatability
- AquaCUE® connectivity

Technical data

Sizes	1/2"...24" (DN15...DN600)
Flow rate	0.08...44816 gpm (0.018...10178 m^3/h)
Accuracy	± 0.4 %
Display	LCD display
Installation position	All installation positions (vertical, horizontal)
Temperature measurement range	Up to 302 °F (150 °C)
Power supply	Battery-powered

FLOW METERING SOLUTIONS

Impeller 380 Btu Series

Flow Sensor with Btu Transmitter

E

The 380 BTU meter is an all-in-one energy usage package for monitoring hydronic heating and cooling systems. This meter accurately measures flow and temperature differential to compute energy and can interface with many existing control systems.

The rugged design incorporates an impeller flow sensor and two temperature probes. One temperature probe is conveniently mounted directly in the flow sensor tee. The second is placed on either the supply or the return line, depending on the application. These minimal connections help simplify installation and save time.

- Low flow ranges
- Small pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Single direction powered insert BACnet or Modbus RS-485 communications protocols or a scaled pulse output
- Flow Rate, Flow Total, Energy Rate, Energy Total, Temp 1, Temp 2, and Delta T can all be transmitted on the RS-485 connection

Technical data

Sizes	3/4"...2"
Flow rate	1.7...157.3 gpm (0.36...35.7 m^3/h)
Accuracy	± 2 %
Installation position	All installation positions (vertical, horizontal)
Nominal pressure	Up to 400 psi (27 bar)
Temperature measurement range	-4...260 °F (-20 °C...125 °C)
Power supply	12...35 VDC, 12...28 VAC

FLOW METERING SOLUTIONS

Impeller 220 Series

Flow Sensor

220 Series sensors are specifically designed for installation in underground vaults that might be subjected to flooding.

As the liquid flow turns the impeller, a low impedance 8V DC square wave signal is transmitted with a frequency proportional to the flow rate. This signal can travel up to 2,000 feet (610 m) between the sensor and the display unit without the need for amplification.

- Low flow ranges
- Small pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Six-bladed impeller design with a proprietary, non-magnetic sensing mechanism
- Sensor electronics easily removed from tee
- Two-wire sensor - power and signal transmit on a single pair of wires up to the distance of 2000 feet (610 m)
- Flow indicators are configured with two 48 inch (DN1200) single conductor leads
- Digital signal easily interfaced with transmitters, monitors or PLCs

Technical data

Sizes	1/2"...4" (DN15...DN100)
Flow rate	0.3...30 ft/sec (0.9...9.14 m/sec)
Accuracy	± 1 %
Installation position	All installation positions (vertical, horizontal)
Nominal pressure	Up to 400 psi (27 bar)
Temperature measurement range	Up to 221 °F (105 °C)

FLOW METERING SOLUTIONS

Recordall® Disc Meters

Nutating Disc Flow Meters

The Recordall® disc meter combines the accuracy of positive displacement design with the reliability and economy of nutating disc technology. They provide an accurate, cost-effective solution for your residential metering needs. Combining the accuracy of positive displacement meters with the reliability and economy of nutating disc technology, the simple but efficient design of this meter makes it an ideal solution for measuring flow. Well suited for measuring the flow of water and compliant with the Safe Water Drinking Act.

- Low flow ranges
- Small pipe sizes
- Cost-effective
- Horizontal/vertical installation

Features

- Delivers precision accuracy with extended flow ranges
- Light weight
- Magnetic coupling

Technical data

Sizes	1/2"...2" (DN15...DN50)
Flow rate	0.5...170 gpm (0.3...38 m^3/h)
Accuracy	± 1.5 %
Installation position	All installation positions (vertical, horizontal)
Nominal pressure	Up to 150 psi (10 bar)

FLOW METERING SOLUTIONS

Recordall® Turbo Meters[1]

Turbine Flow Meters

The Recordall® Turbo Meter is a rugged, reliable meter ideally suited for measuring potable water applications. Its compact size and ease of serviceability, without removal from the line, make this a cost-effective selection. Designed with performance in mind, the meter provides a high level of accuracy over a wide flow range with a minimum of pressure loss.

- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal installation

Features

- Direct coupled turbine based on an exclusive "floating rotor" design that reduces bearing friction and associated wear and tear
- Low pressure loss for improved system efficiency
- Exceptional registration accuracy across low flow rate, normal operating flow rate and maximum continuous operation flow
- Permanently sealed, tamper-resistant register or encoder
- AquaCUE® connectivity

Technical data

Sizes	1 1/2"...12"
Flow rate	1:30
Accuracy	± 0.5 % ... ± 1.5 %
Installation position	Horizontal position
Nominal pressure	Up to 150 psi (10 bar)
Temperature measurement range	Up to 120 °F

[1] **Product available in the Americas only**

FLOW METERING SOLUTIONS

Vortex VN2000

Vortex Meters

VN2000 Hot tap Insertion Flow Meter

The VN2000 Hot Tap Insertion Vortex Flow Meter measures the volumetric or mass flow rate of steam, gases or liquids over a large flow range. The meter is a heavy-duty design engineered to stand up to the most abusive environments inside and outside the pipe. A removable insertion/ extraction tool aids in installation or removal in high pressure applications.

VN2000 Compact Insertion Flow Meter

The VN2000 Compact Insertion Vortex Flow Meter measures the volumetric or mass flow rate of steam, gases or liquids over a large flow range. The meter is a heavy-duty design engineered to stand up to the most abusive environments inside and outside the pipe. The meter includes a mounting assembly to simplify the installation and ensure proper installation depth and orientation for a specified pipe size. Additionally, the probe length is sized to match the pipe size to minimize the meter length.

- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal installation

Technical data

Types	VN2000 Hot tap Insertion Flow Meter	VN2000 Compact Insertion Flow Meter
Sizes	2"...36" (DN50...DN900)	2"...24" (DN50...DN600)
Flow rate	Steam: 26...2282271 kg/m³ Gas/air: 0.5...187593 kg/m³	Steam: 26...981449 kg/m³ Gas/air: 0.5...80671 kg/m³ Liquids: 52...142280 kg/m³
Accuracy	± 1 %	± 1 %
Display	Rotatable display: Flow rate - 6 digits	Rotatable display: Flow rate - 6 digits
Installation position	Horizontal installation	Horizontal installation
Nominal pressure	Up to 1000 psi (68 bar)	Up to 1000 psi (68 bar)
Temperature measurement range	-250...400 °F (-120 °C...204 °C)	-250...400 °F (-120 °C...204 °C)
Power supply	14...36 VDC, (loop-powered with 4...20 mA) option, 28 VDC max	14...36 VDC, (loop-powered with 4...20 mA) option, 28 VDC max

FLOW METERING SOLUTIONS

Preso® Cone Meter

Cone Differential Pressure Flow Meter

S

The Preso® Cone differential pressure flow meter has a cone-shaped element that shapes the flow profile ahead of the differential pressure measurement port, without impacting the flow against a sharp surface, creating an extremely stable signal for measurement with minimal wear on the cone edge.

Features

- Little or no straight run piping requirements
- No additional flow conditioning devices needed
- Low maintenance and long life
- Wide variety of fluids
- No moving parts
- Low head loss

- High flow ranges
- Large pipe sizes
- Cost-effective
- Horizontal/vertical installation

Technical data

Sizes	1/2"...24" (DN15...DN600)
Flow rate	10:1 and greater
Accuracy	± 0.5 %
Installation position	All installation positions (vertical, horizontal)

DELIVERING SMART WATER SOLUTIONS

Smart Network Overview

Smart Network

With current and future communication and software technologies, we are creating robust digital solutions to help users turn data into actionable insights that drive better results, changing the way our customers collect, communicate, store and leverage data.

Building Sustainability Management

Solutions for Building Management and Optimization

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Every drop counts.

www. badgermeter.com

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