Flow Meters

Application Based Product and Technology Selection





Flow Meter Technology









Inline Electromagnetic Flow Meters



F-3100 and F-3200 Series

- Highest accuracy & reliability
- Best short straight pipe run performance
- Typically highest cost
- Installation, service, or calibration requires shutdown and drain
- Best choice for high dollar custody transfer or to satisfy owner/engineer technology preference
- Be careful magmeters have become a commodity.



Inline Wetted Ultrasonic Flow Meters





Clamp-on Ultrasonic Flow Meters

7



- High accuracy & turndown
- Can measure bi-directional flow
- Fairly high cost for small pipes, better value on larger pipes
- Non-invasive design can be installed with no shutdown & no tapping the line
- For dedicated applications not portable



Apps / Specs / Products

-11-

V ENTER

F-4000 Series Flow Met

Inline Vortex Steam Flow Meters

For steam, HTHW from 300° F to 464° F, ultrapure water for process.

- High accuracy and reliability
- Limited turndown (must be sized correctly)
- Fairly high cost
- Installation or service requires shutdown and drain





Insertion Vortex Steam Flow Meters

For steam, HTHW from 300° F to 464° F, ultrapure water for process.

- High accuracy and reliability
- Limited turndown (must be applied, process, and sized correctly)
- Competitive price in larger line sizes
- Hot-tap capable no shutdown required





Insertion Turbine Steam Flow Meters

For steam, HTHW from 300° F to 464° F, ultrapure water for process, compressed air, vacuum.

- High accuracy
- Limited turndown (must be sized correctly)
- Competitive price in larger line sizes
- Excellent solution for low flow steam applications!
- Hot-tap capable
- Potential retrofit solution of installed insertion vortex meters

10







Insertion Thermal Mass Flow Meters

For natural gas, compressed air, other combustible and industrial gases

- High accuracy and repeatability; ideal for low flow rates
- Hand insertable, hot-tap design requires no shutdown for installation
- Zero-calibration check feature is unmatched
- Great value vs. mechanical meters 2" and larger



Flow Meter Technology Selection Process



What's driving this decision?

Reliability / Water Quality	Owner/Engineer Preference	Required System Shutdown?
Temperature / Pressure	Straight Pipe Run	Required Accuracy / Turndown
Cost	Pipe Size	Buy American / ARRA
pps / Specs / Products	13	

Strategic Position Factor (SPF)

CAREFUL! You don't want to get *burned*.

Technology	Least Competitive & Defendable SPF 10	SPF 20	Most Competitive & Defendable SPF 30
Insertion Turbine			े
Insertion Electromagnetic			¢
Inline Electromagnetic	¢		
Vortex	¢		
Thermal Mass		¢	
Clamp-on Ultrasonic		¢	
Wetted Ultrasonic		¢	
System-10			¢
System-40		¢	



Flow Measurement Applications

Applications	Turbine M	eters	Electromagnetic Meters		Ultrasonic Meters		Vortex Mass Meters		Turbine Meters	Thermal Mass Meters	
Chilled water	1			✓		1	1				
Heating water <280° F	× .		✓		1	≤ 250°					
Heating water >280° F					≥ 450°		✓	~	~		
Condenser water - Closed loop	~		✓		1	1					
Condenser water - Open loop			×		1	1					
Domestic (potable) water	✓		✓		1	1					
Gray water / Surface water			×			<					
Well water			✓		1						
Seawater			×		1						
Process liquids				F-3100 / F-3200		1					
Steam condensate (pumped)	×		✓		1	1					
Steam								✓	~	~	
Process gases											~
Compressed air								0			1
Natural gas				10°C	<i>K</i>	0		-			1
Meter Series	F-1100 / F-1200	F-1300	F-3100	F-3200	F-3500	F-4200	F-4600	F-2600	F-2700	F-1500	F-5100 / F-5200
Meter style	Insertion	Inline	Inline	Inline	Insertion	Clamp-on	Inline	Inline	Insertion	Insertion	Inline / Insertion
Insertion meter pipe size range	11⁄4"- 72"				3"-72"	1⁄2"-48"			3"-16"	3"-16"	1"- 24"
Inline meter size range		3⁄4" & 1"	1⁄4"- 48"	1⁄4"- 48"	3		1/2"- 21/2"	1⁄2"- 12"			1⁄4"- 4"
Accuracy (% of reading)	1%	1%	0.4%	0.2%	1%	1%	1%	1.5%	1.5%	2%	1%
Bi-directional flow capability	Yes (FB-1200)	No	Yes	Yes	Yes (FB-3500)	Yes	No	No	No	No	No
Requires system shut-down to install	No	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No
Overall flow range (velocity)	0.17-30 ft/sec	0.17-30 ft/sec	0.1-33 ft/sec	0.1-33 ft/sec	0.1-20 ft/sec	0.1-40 ft/sec	0.025-12.5 ft/sec	~10-250 ft/sec	~10-250 ft/sec	6 ranges ≤ 205 ft/sec	5-35,000 SFPM





Ranking Technologies Based on the Applications

Application Central Energy Plants

(CEP, CUP), Data Centers

Clean Closed-Loop Applications

(Lower Temperatures)

- Chilled Water
- Hot Water < 250° F
- Make Up Water
- Closed-Loop Condenser Water
- Closed-Loop Geothermal
- Pumped Condensate < 250° F (Watch out for low conductivity.)
- Boiler Feed (Watch out for low conductivity.)

Technology

Insertion Turbine Insertion Electromagnetic Inline Electromagnetic Inline Wetted Ultrasonic Clamp-on Ultrasonic





Application

Central Energy Plants (CEP, CUP), Data Centers

Open Loop Applications

- Open-Loop Condenser Water
- Cooling Tower Blow-down
- Boiler Blow-down

Technology

Inline Wetted Ultrasonic Insertion Electromagnetic Inline Electromagnetic Clamp-on Ultrasonic





Application Campus Heating Loops, **HTHW Systems**

Technology

(O)|<u>\'\</u>[[

INCORPORATED

 $(C)(\otimes)$

Vortex **Clamp-on Ultrasonic**

Clean Closed-Loop Applications

(High Temperatures)

Hot Water >300° F



Application

Campus Heating Loops, Central Plants, Boiler Efficiency, Sub-metering Saturated & Super Heated Steam

Applications

Steam Systems

Technology

Vortex Insertion Turbine for Steam





<u>Application</u> Campus Sub-metering, LEED, Incentive Programs

- Domestic (Potable) Water
- Solar DHW

Technology

Inline Wetted Ultrasonic Insertion Electromagnetic Inline Electromagnetic Insertion Turbine Clamp-on Ultrasonic





Application

Central Plants, LEED, Energy Conservation Projects, Incentive Programs

Technology

Inline Wetted Ultrasonic Insertion Electromagnetic Inline Electromagnetic Clamp-on Ultrasonic

Open-Loop Applications

- Well Water
- Open-Loop Geothermal
- Sea Water
- Lake Water
- Swimming Pool



22



Application

Central Plants, Boiler Efficiency, Sub-metering, Health Care Facilities, College Labs

Technology

Thermal Mass

- Natural Gas
- Compressed Air
- Other Gases

Important Note: Gas metering applications are downstream of the utility meter.





Energy Measurement Systems (BTU Meters)



Hydronic Cooling System

Energy Load Calculation

BTU Rate = Flow Rate x Delta-T x Specific Heat x Density



System-10 BTU Meters A New Controls Platform

With serial network communication and the ability to accept inputs from virtually any flow meter, the System-10 BTU Meter is not just a sub-metering tool any more...

The System-10 has grown into a new universal platform for flow, temperature and energy control inputs.







Campus Environments

- Cost Allocation
- Growth Planning
- Energy Management
- Basis for LEED[®] points





Central Plants

- Chiller Staging
- Chiller Efficiency (kW/ton)
- Boiler Efficiency
- Thermal Storage
- LEED[®] points



Sub-metering Within Buildings

- Cost Allocation
- LEED[®] Points



BUILDING 2 DETAIL



Cogen System Monitoring

Required by many state & federal incentive programs

30

- Performance contracts
- District cooling & heating





Traditional Approach to Energy Measurement in Hydronic Systems



Typical Error Using Traditional Methods

Example: 4" pipe, 300 GPM, 10° F Delta-T

* Flow Measurement Error

Combined Error = 1.6% of reading

* Temperature (RTD's)

Combined Error = 0.5° to over 1° F

- Energy value error equals
- \$9/Day \$270/Month \$3,285/year

(Based on 1.2 KW/ton, 10 cents per KWH, 24 hr operation)



Energy Measurement the ONICON Way

Btu meter, flow meter and temperature sensors specified, purchased, and installed as a

COMPLETE FACTORY-CALIBRATED SYSTEM



System -10 BTU Meter with Insertion Turbine Flow Meter



ONICON BTU Measurement System Accuracy



Error Comparison ONICON Btu System vs. Traditional Approach (Using Insertion Turbine Flow Meter)

	ONICON System	Traditional Method
Flow	1.0 %	1.6%
Temperature	1.5%	5 to 10%
Computation	0.05%	?
Combined Error	1.58% to 1.8%	>5.3 to 10%

(4" pipe, 300 gpm, 10° Delta-T)



ONICON BTU Meter Models

System-10

System-30

ONIC CON ASSAULTS







13.1 BTU/HR X 1K

> SYSTEM-10 BTU METER

ONICORPORATED



System-10 Series Suitable for all commercial and industrial sites

- Conduit ready Required for most installations!
- Integral LCD (ideal for stand alone use).
- Accepts an input signal from virtually any flow transmitter, even non-ONICON products!
- Analog (4-20 mA, 0-10 V, 0-5 V) one or four channels for energy rate, flow rate, temperatures
- Serial Network Communication; provides all process data on a single twisted pair. Available protocols:

BACnet[®] LONWORKS[®] MODBUS[®] Apogee[®] Metasys[®]

38







System-40-BAC

Principle of operation

BTU meter in a single compact package

Thermal energy measurement for chilled, hot and condenser water systems. Energy is calculated by measuring the flow rate and differential temperature of the process fluid.

The energy measurement calculation is performed by the integral electronics.



System-40-BAC

For light commercial and residential applications

- BTU meter in a single compact package
- Low voltage 24V AC/DC operation
- BACnet MSTP Communication or dry contact output for energy total, dual mode capable
- Integral LCD remote mountable
- Field set-up and commissioning via front panel, no additional equipment required.
- ✤ Available in line sizes from ½" through 2 ½"
- NIST traceable calibration with certificate
- Custom configured at the factory delivered ready to go out of the box!

41



System-40 Applications

 Hydronic Systems – Commercial Applications Chilled water sub-metering Heating hot water sub-metering Condenser water / heat pump sub-metering LEED applications – Advanced metering required Data center CRAC unit metering

Hydronic Systems – Residential Residential apartment and tenant billing CHW and HHW applications

42

Domestic Water
Domestic hot water
Solar domestic hot water





Installation







Choosing Sensor Locations for Energy Measurement Systems



- For applications with a bypass, locate flow and both temp sensors on the "central plant side" of the bypass.
- In any case, all sensors must be located on the same side of the bypass.



"Closing Arguments" for our Calibrated System Approach

Value:

When you consider the costs for wiring three analog inputs and programming, the ONICON networked system is a great value compared to "contractor assembled" systems.

Reduced Liability:

Providing a factory-calibrated system is much safer for the contractor than trying to "be the instrument" himself.





N.I.S.T. Traceable Calibration Station



ONICON Technology Tour

 \bigotimes

 $C_{\overline{}}$

INCORPORATE

0

