

Best Practices for Thermal Energy Measurement

The Basis for Energy Conservation Savings.



Eric Papa

Sales and Marketing Chaltron Systems, Inc.

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Sales and Marketing Chaltron Systems, Inc.

- 11+ Years of experience
- Industrial Sector



The focus of this presentation is to provide energy, water, and facility managers with a framework to achieve accurate, reliable, maintenance free metering of fluids.



- Water
- Steam
- Natural Gas
- Compressed Air
- Hot/Chilled Water
- BTU
- Condensate Return



Optimize existing asset performance without major capital investment resulting in continuous improvement and long term savings.



- Industrial Plants
- Universities/Colleges
- Medical Centers
- Commercial Buildings
- Energy Providers





Where do I start?





What do I need to measure?





What type of equipment is used?





When should I start?





Why should I meter / Sub meter?





How much does this cost?



3 Key Learning Objectives of this Presentation



- **1. Applications & Terminology**
- **2.** Performance
- **3. Proper Equipment Selection**



1.

Understand the what utilities need to be measured, and the proper terminology associated with the application.



2.

Understand metering errors due to inaccuracy and unreliable performance result in major cost savings or losses.



3.

Introduce advanced metering technologies and how best to apply them.



Success Stories

Real World Case Studies and Success Stories





Steve Barlow

Energy Manager Cleveland VA Medical Center





Erika Weliczko

Energy Manager Case Western Reserve University





David Musser

Director of Energy Operations The University of Akron



1. Applications & Terminology





"to measure is to know – if you cannot measure it, you cannot improve it" – Lord Kelvin







Accuracy

"How close does the measurement and the actual value agree."

% of span - GOOD % of rate - BEST



Accuracy

Example % of span - Meter span = 0 – 100 GPM Accuracy 1% of span = 1 GPM is 1% of value @10 GPM accuracy = 10% of value

Example % of rate - Meter span = 0 – 100 GPM Accuracy 1% of rate = 1 GPM @100 GPM @10 GPM accuracy = .1 GPM



Accuracy – Percent of Span



Accuracy – Percent of Rate



Repeatability

"How close does the measurement give identical indications when applications are repeated."

% of reading



Linearity

"How close does the measurement align with the ideal output."

% of reading



Turndown

"Ratio of maximum value measured to the minimum value that can be measured."

Example: 100 GPM Maximum 5 GPM Minimum Turndown = 20:1



Reliability

"Does the meter continue to perform accurately for the next 25+ years."



Maintenance Free

"Does the meter or any auxiliary components require recalibrations and repairs."



Single Processor

"Can the meter calculate mass flow, BTU's, and/or perform pressure and temperature compensation in (1) unit, or are multiple transmitters and flow computers required."





Erika Weliczko

Energy Manager Case Western Reserve University


2. Performance



Meter Accuracy



How important is meter accuracy?



Large University in Ohio

- Chilled Water 12" Line
- Existing mechanical meter reading: 152 GPM
- Advanced technology meter reading: 409 GPM
- Error of 257 GPM



Large University in Ohio

- @ \$0.30/ton-hour
- Loss of revenue = \$777.00/day

\$23,310.00/month

Meter accuracy is very important!



Insertion Turbine



Not a question if this will fail, but when it will fail.



Prone to build up and breakdown over time.



Temperature Accuracy



How important is temperature accuracy?





SENSING DEVICES, INC.

1309 Olde Honestead Lane Lancaster, PA 17601-5337 (717) 295-2311 = Fax (717) 295-2314

REPORT OF CALIBRATION

Plotinum Resistance Thermometer SDI Model: NA Serial Number: XX Puschase Order Number: N/A Submitted by

FLEXIM Instruments LLC

This Plotinum Resistance Themconder was compared to an SPRT using an AC Bridge at a frequency of 90 Hz and a current of 1.0 mA. The calibration procedures followed were SDI Laboratory Procedures Rev1 and are based on the technical information contained in NST frequencies of the second s

| Senia l Number | Temperature *C | Resistance Q | Expanded Uncert(k=2)*C | Alpha |
|----------------|------------------|-----------------------|------------------------|------------|
| 01 | 0.000 100.000 | 1000.1.67 1385.449 | 0.005 0.012 | 0.0038522 |
| 0.2 | 0.000 | 100.250 1385.491 | 0.005 0.012 | 0.009851.4 |

| Serial Number | Manufacturer | Model Number | Description | Due Date |
|---|--|--|---|---|
| 3852 4420 261.624 274.444 1093-1.01-2.62 1138-004-2.90 | Rosemount Rosemount Timsky Tinsky ASL ASL | L62CH L62CH 5685A 5685A F17A F17A | Standard Phrimun Resistance Themcouster Standard Phrimun Resistance Themcouster Standard Resister (100 Q) Standard Resister (25 Q) Automatic Resistance Bridge Automatic Resistance Bridge | 01./08/08 04/19/08 05/05/08 05/17/07 05/17/07 |

Laboratory Environment

Temperature: 25.0 °C Humidity: 34%

Report Number: 11.6-07 Report Date: April 2., 2007 Calibration by:

Isaa A. Santiago

Excellence in temperature

Regel of 1

1000 Ohm matched RTD's are accurate to +/- .03 F



Large University in Ohio

- Chilled Water 12" Line
- Flow rate: 500 GPM
- 1 Degree F error
- Loss of revenue of \$125.00/Day

\$3,750.00/month

Temperature accuracy is very important!



Flow Turndown



How important is flow turndown?



Large University in Ohio

- Domestic Water 12" Line
- City utility water supply to University
- Common use: Blending, Optional use: Total Supply
- Common use = 100 GPM (.30 ft/sec)
- Below minimum capability of existing magnetic flow meter
- Installation of ultrasonic meter measures as low as .01 ft/sec (3.50 GPM)



Large University in Ohio

• Loss of revenue \$600.00/Day

\$18,000.00/month

Turndown allowing for measurement of extremely low flow rates is very important!





Steve Barlow

Energy Manager Cleveland VAMC

3. Proper Equipment Selection



Natural Gas/Compressed Air

Accurate gas flow measurement requires large turndown and the measurement of the fluid's temperature and pressure in addition to flow to compensate for density changes.

Thermal Dispersion technology measures on a mass basis eliminating the need for density compensation, and has a turndown of 100:1.



Magnetrol TA2



Insertion or in-line meters are available



Steam

Accurate steam flow energy content measurement requires large turndown and the measurement of the fluid's temperature and pressure in addition to mass flow.

New Vortex metering technology provides internal pressure and temperature compensation along with an Enthalpy (BTU/Ib) lookup table to output in BTU's/hour.



VorTek M22/M23



Single processor technology instead of a combination of multiple transmitters and a flow computer.

Insertion or in-line meters are available



Hot Water/Chilled Water BTU Metering, Domestic Water

Accurate technology with a large turndown ratio is critical for water flow measurements.

Temperatures can vary from 40F to 400F and beyond. High accuracy temperature measurements are required for BTU metering.

A single processor BTU meter is desired.



Condensate Return

Metering of steam flow can be a challenge due to large seasonal turndown requirements. Measuring Condensate Return can solve this problem.

Fast processing with an internal temperature measurement is required for mass flow.



Flexim F704 Ultrasonic

FLEXIM



Single processor technology instead of a combination of multiple transmitters and a flow computer.

FLEXIM



Advanced Ultrasonic Technology

- Rubber coupling pads (no more grease)
- Matched, calibrated, temperature compensated transducers with NIST traceability
- Rugged construction, including mounting assemblies and SS armored cable
- Fast processing
- High Accuracy RTD's
- Wave Injector for (-300F to +1000F) applications





David Musser

Director of Energy Operations The University of Akron



David Musser

Director of Energy Operations The University of Akron

- Energy Management since 1995
- 30+ Years of engineering experience



"The most rewarding parts of being an energy manager are saving your company significant money and knowing that by doings so, you're protecting the environment either directly through modern technologies or indirectly through reduced consumption."

- David Musser



Starting Point

- Started in 2004 to meter HTHW system
- Steam was purchased from Akron Thermal
- Chose Flexim for its high temperature and low flow measuring capabilities



Metering Goal

- Measure 400F campus heating water supply
- Install meters but avoid shutdowns on campus
- Also meter Chilled Water and Domestic Water



Wave Injector



Unique Hi Temperature Non-Intrusive External Measurement Solution



Current Metering Footprint

- 40+ HTHW, Hot Water, Chilled Water, Domestic Water
- 6 Natural Gas Meters



Operational Review

- Operation is looked at, in some detail, about every day.
- Vast number of different types of systems across campus



Training

- No specific formal training
- Talking with vendors and reading information about metering has been most beneficial



Day to Day Activity

- Very busy Only Mechanical Engineer on campus
- Ongoing infrastructure projects
- Verifying meter reads
- Reporting on BAS



Day to Day Obstacles

- Concerns over space temperatures
- Process Shutdowns HTHW is run 365 days a year and any process shutdowns are extremely disruptive.
- 400F temperatures caused previous ultrasonic meters to read inaccurately due to a melt away of coupling gel



Immediate Benefits

- Simple installation with no service interruptions
- Accurate and reliable flow measurement of 400F water in 20 locations – Foil coupling pad
- Quantification of under billing the Flexim meter was capable of reading lower flows where the suppliers meter would drop out
- Little to no maintenance required



Immediate Benefits

- Flexim meter used for billing other entities on campus accurately
- Regardless of flow, meter maintains accuracy



Thoughts on Progression

"The subject of utility usage for any business is a highly important part of the company's budget. For the University of Akron, it is a matter of survival..."



Thoughts on Progression

"..Utility usage measurement is the first step in controlling that portion of the budget. Metering will continue to become more important with each passing year as budgets become scrutinized more closely."

- David Musser


Recommendations For New Users

- Do your homework
- There are a multitude of options for saving usage



Future Trends

 20 Wave injector high temperature meters and 25 general purpose meters on water supply has resulted in completion of the performance based contract







Eric Papa Sales and Marketing Chaltron Systems, Inc.

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Covering Ohio and Kentucky

We specialize in level & flow solutions and offer free consultations on your application. Call us today for a competitive quote or to set up an appointment.

We also provide services such flow surveys & portable flow meter rentals on a daily or weekly basis.

