Residential Ultrasonic Smart Gas Meters

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Background

- Diaphragm meters have many moving parts and performance suffers over time

- Supply Chains for these components have become very long and intensive labor to manufacture difficult to find/retain

- Prices have escalated along with leads times

- State Commissions require periodic testing or sampling to insure they retain accuracy

- AMR/AMI components with different lifecycles have complicated the procurement and long-term handling of these combination meters

Principle of Operation

Transducer B
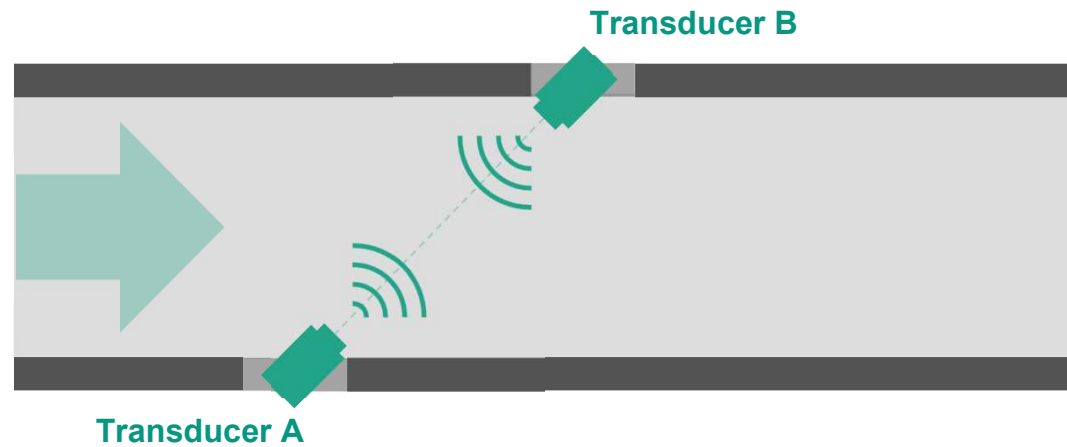
Transducer A

$$\Delta t = t_{BA} - t_{AB}$$

Ultrasonic wave pulse (frequency>20kH) is generated in a transducer (A). The pulse goes trough the pipe, and then received and measured by another transducer (B).

The time of travel of the acoustic wave from point A to point B (t_{BA}) is not the same that from the point B to the point A (t_{AB}), which generate a delay (Δt). This difference is due to the flow stream inside the pipe: the higher is the flow velocity, the greater is the difference. Knowing the distance between the two transducers and the travel time difference, the volume flow rate is calculated.

Features & Functionality

❖ ANSI B109.6 Compliant

❖ High Accuracy with no moving parts to wear

❖ Data:

- Monthly to Hourly Volumes
- Temperature of Gas, Meter Case or Ambient
- Meter Pressure
- Seismic Detection
- High Resolution Inputs
- Meter Performance

❖ Communication:

- Radio Public & Private Bands
- CatM1 & NB IoT

❖ Gas Shut Off via Network or Autonomous Decision Made by the Meter

- Excess Flow, Pressure, Temperature, Seismic, Tamper, Air, Non-Payment, Leak Calls

Hourly Consumption Data

- Hourly Volumes allow analytics for leak detection, enhance safety for "soft close" policies and emergency response

- Residence flow never falls below 5 cfh indicating leakage on customer piping

- Monitoring of flow rate during "soft close" with ability for network shut off for excess flow

- Excess flow at residence during mud slide or other natural disaster indicates damage to customer piping

- Air detected or low pressure detected during pipeline damage

- Pipeline System Modeling based on hourly consumption with time of use for all customers

Temperature and Pressure Data

- Accurate TC due to electronic components

- Ambient temperature can provide input to shut off valve for fires

- Meter pressure data provides performance data for the regulator with situational "lock up" testing at high flow and low/pilot flow

- High pressure alarms communicate regulator AOC prior to customer complaint of gas odor

- Low pressure alarms can be used to identify outages

High Resolution, Meter Performance & Seismic Data

- High Resolution consumption can be used for leak testing

- High Resolution Data may be used as forensic data to investigate home damages

- Meter Performance Data may be used like DP on Rotary meters if unchanged the meter has retained accuracy

- Seismic Data can link valve shut off to event that created excess flow

Communication

- Public radio
- Private radio
- Public cellular/IP
- Private IP
- Interoperability for multiple manufacturers
  - Meter Manufacturers
  - Communication Manufacturers
  - Data Integration

Shut Off Valve

- Autonomous Shut Off
  - Excess Flow
  - Excess Pressure
  - Excess Ambient Temperature
  - Seismic Followed By Excess Flow
- Network Shut Off
  - Empty Home With Flow Beyond Normal Pilots
  - Gas Leak Reports
  - Non-Payment
  - Network Latency

Deployment

- Accelerated project integrating to existing network
- Accelerated project installing network or enhancing existing network
- Gradual installation to existing network utilizing existing funded meter work
- Gradual Installation to new network utilizing existing funded meter work
- Utility collection and data management
- Cloud Hosted service for collection and data management

Deployment to Installed Network

- Accelerated project integrating to existing network
  - Installed battery life is the timeline driver and geographic deployment driver
  - Increased labor and project related needs are capitalized with reduced work/cost in post deployment years
  - Existing IT System Integration is utilized

Deployment With New Network

- Accelerated project with new network
  - Network build out is the driver for geographic deployment
  - Increased labor and project related needs are capitalized with reduced work/cost in post deployment years
  - IT systems must be built and integrated – Head End, Meter Management, Customer Information and Billing
  - Consideration should be done for data types and purpose/programs it will be used for

Deployment On Public Network

- Accelerated project utilizing public network
  - Increased labor and project related needs are capitalized with reduced work/cost in post deployment years
  - Utility can decide geographic deployment considering public network availability
  - IT systems must be built and integrated – Head End, Meter Management, Customer Information and Billing
  - Consideration should be done for data types and purpose/programs it will be used for
  - Communication costs and network collection costs can be integrated with meter purchase price to capitalize into BC 163

Deployment On Public Network

- Gradual deployment
  - Utility can decide geographic deployment considering public network availability
  - Routine/Planned O&M meter changes can be utilized as deployment schedule moving those costs to capital
  - Levelized workload and meter purchase may fit within GRC Budgets
  - IT systems must be built and integrated – Head End, Meter Management, Customer Information and Billing
  - Consideration should be done for data types and purpose/programs it will be used for
  - Communication costs and network collection costs can be integrated with meter purchase price to capitalize into BC 163

Benefits

- Reduced size and weight make for compact MSA's, reduced shipping costs and storage space both at warehouse locations and on service trucks

- 20-year life cycle capital asset refresh and depreciation schedule

- Possibility to modify or remove statistical sampling programs for meter accuracy

- Safety Shut Off

- Regulator Performance data and alarming

- Hourly data analytics for customer safety and pipeline system modeling