Ultrasonic Gas Flow Meters for Gas Processing Facilities

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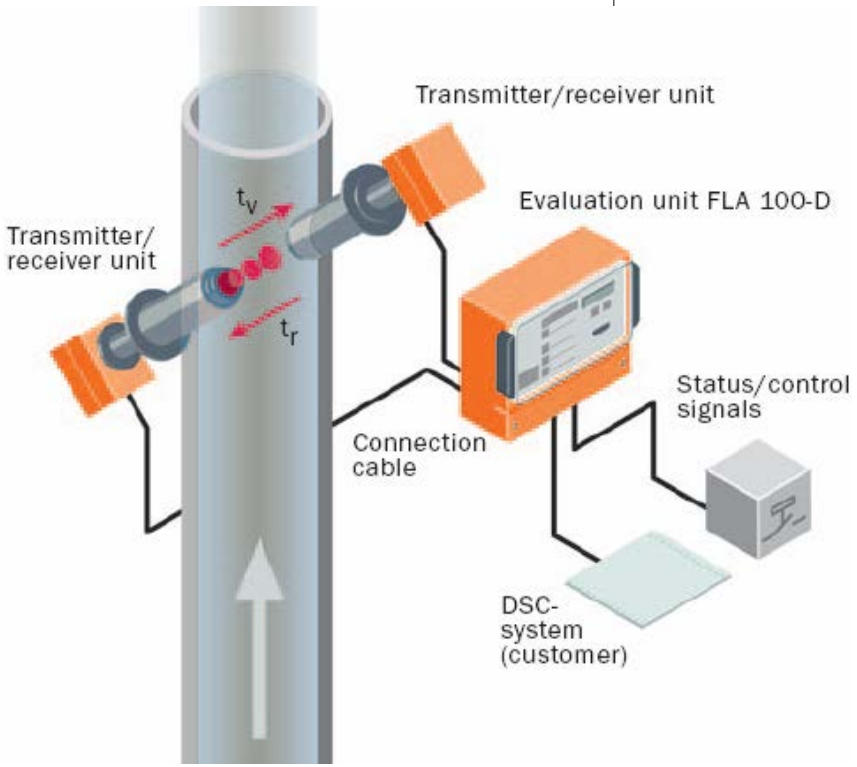
Custody Transfer, Process Control and Flare Measurement



2012 GPAC Operations and Maintenance Conference

SICK isn’t just a name.

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SICK AG Company Founder

- Dr. Erwin Sick founded the SICK, Inc company in Munich in 1946.
- Today the SICK name stands for technical innovation, quality and safety worldwide.

SICK - at a glance

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- Number of patents rose from 162 to 669 in the last 5 yrs
- More than **5100 employees** around the world
- More than **40 subsidiaries**
- 9 per cent of sales spent for R&D expenditures
- Group sales of about **1.1 Billion** in 2009
- **Innovation leader** in sensing technology

SICK - one of the leading manufacturers of sensors and sensor solutions for industrial applications worldwide

Why do we Measure?

Process Control

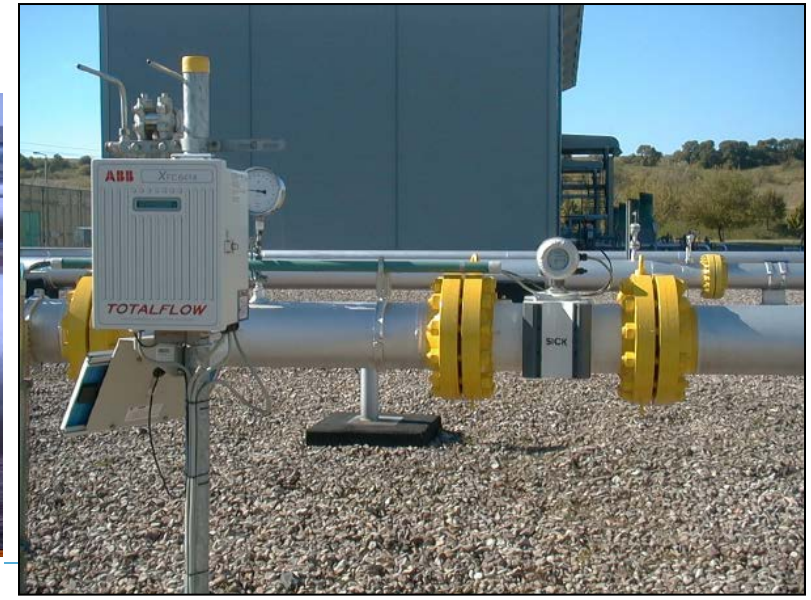
A 1% reduction in raw material that flows at 10 liters per minute and costs $1.00 per liter generates a cost saving of $52,560.00 per year assuming 24/7 operation 365 days a year.

Custody Transfer

A 3” ultrasonic meter that flows 25 MMSCF/D of natural gas at $3.00 / thousand SCF equates to $2,250,000.00 per month. Improving the accuracy by 1% will work out to a difference of $22,500.00 per month.

Applications for Ultrasonic Meters

- Custody transfer
  - → Customer delivery
  - → Power plants
  - → Pipeline exchange
- Transmission and Underground storage
- Pipeline operation
- Distribution gas companies
- Allocation
- Fuel gas
- Offshore
- Flare/Vent



Gas Ultrasonic Meters

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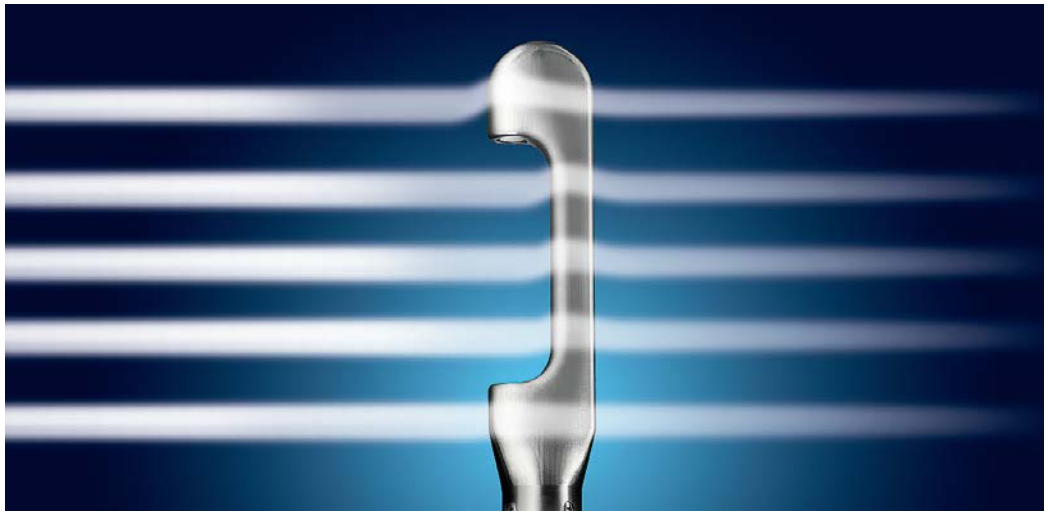
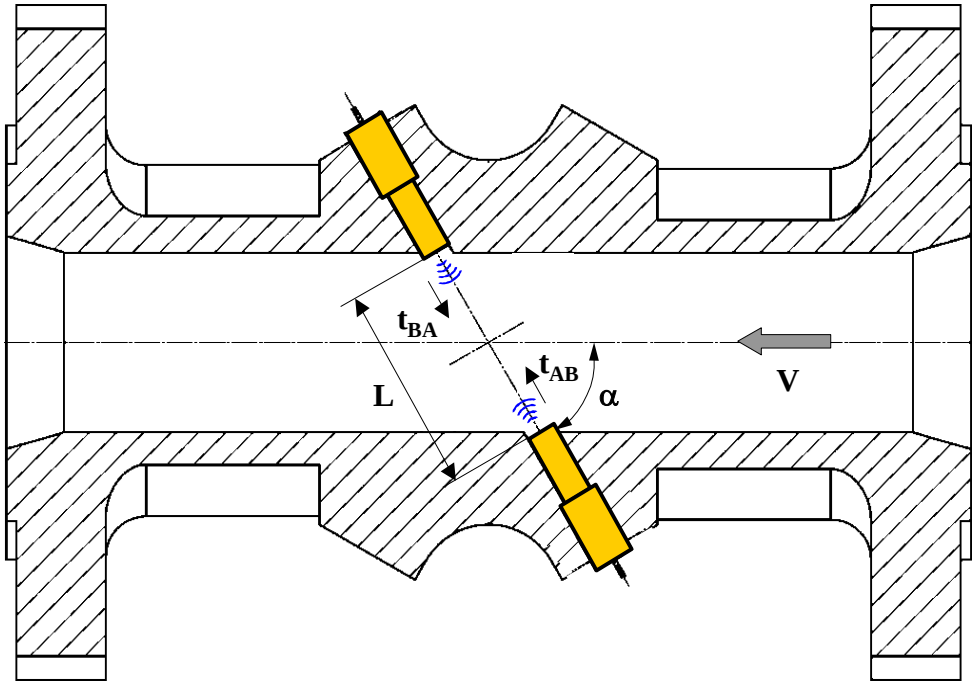
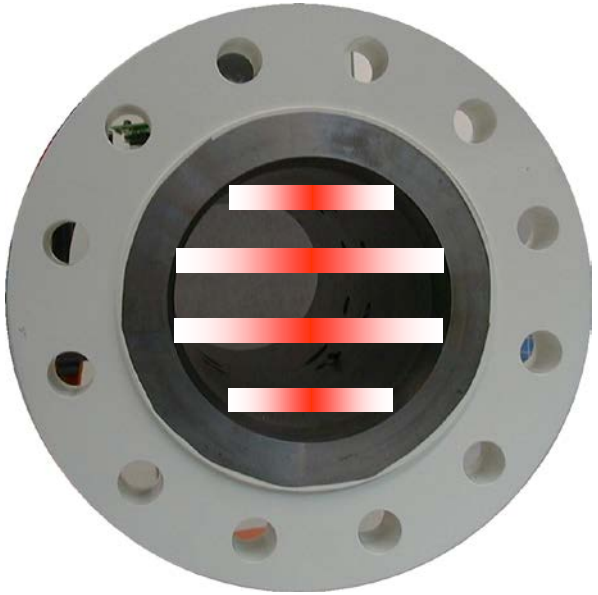
Basic Principle of Operation



Measuring principle: Differential Transit Time





Travel time difference

$$t_{AB} = \frac{L}{c + v \cdot \cos\alpha}$$

$$t_{BA} = \frac{L}{c - v \cdot \cos\alpha}$$

Path velocity

$$v_{Pfad} = \frac{L}{2 \cdot \cos\alpha}\left(\frac{1}{t_{AB}} - \frac{1}{t_{BA}}\right)$$

Sound Velocity

$$c = \frac{L}{2}\left(\frac{1}{t_{AB}} + \frac{1}{t_{BA}}\right)$$

Key Benefits of Ultrasonic Gas Meters

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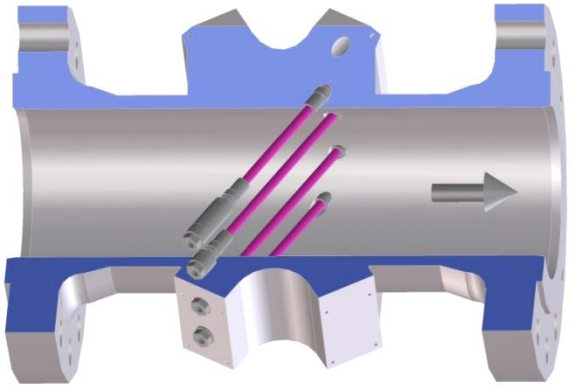
- Very high accuracy (+/- .1%) (flare 3-5%)
- Very wide flow range 200:1 (flare greater)
- Non-intrusive sensors
- No pressure drop or loss
- Not affected by changing gas composition
- No routine maintenance
- Maintenance indicator when needed
- No visual inspections required (safe)
- Sensor replacement under pressure
- Not damaged by liquids or solids in flow
- Flow condition monitoring with software

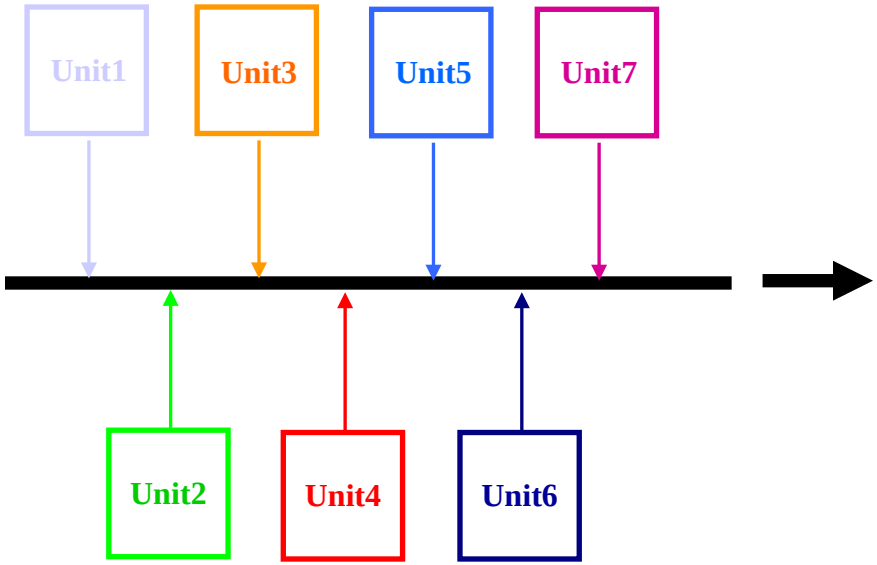


- This multi-path meter is suitable for:
  - Custody Transfer
  - Plant balance
  - Low pressure flare
  - Field metering including wet gas
  - Other gases (CO2, H2S, H2)
- 2” to 30+” sizes
- 0 to 6000+ PSIG
- Flow profile measurement and correction

Application: Flare Gas

What is flare gas ?

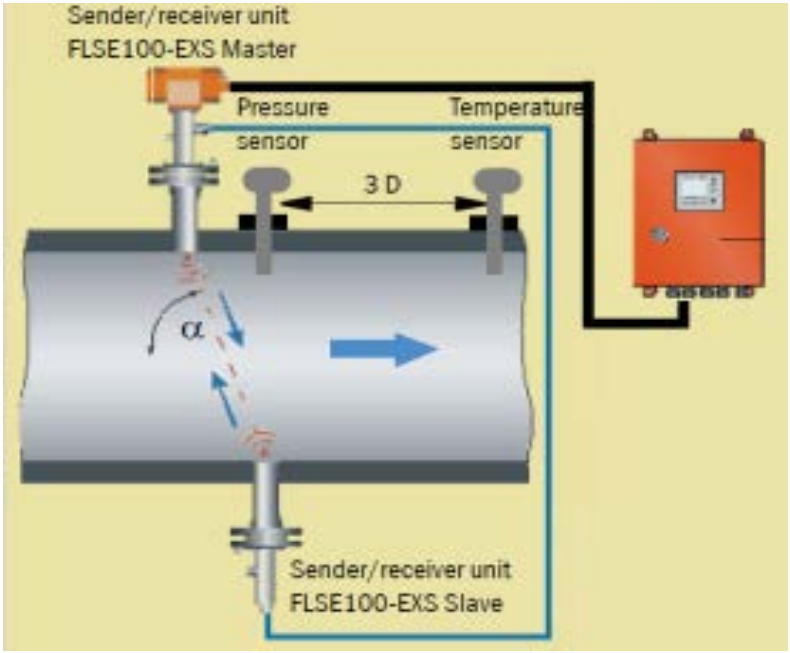
- Standard operation of plant - small quantities of gas have to be burned or disposed of without venting
- In emergency case - very large quantities of gas can occur abruptly and have to be disposed immediately
- Composition of the gas varies



Flare Metering Challenges

- Very wide flow range required
- Extreme velocity affects many intrusive meters
- Liquids and other substances are common
- Flow profile is not always consistent
- Gas density is not consistent
- Accuracy of +/- 5% is required
- Extractable meter type is preferred

  - Few measuring devices are suitable



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- Ultrasonic Flare Meter:
  - High Pressure Flare
  - Sour Flare
  - Very High Velocity
- 4” to 71” sizes
- 4000 to 1 flow range
- Maintenance Indicator Alarm
- Probe type or cross pipe
- Unique velocity sensor design

Application: Sour Gas Measurement

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Key Benefits

- Meters are corrosion resistant
- Self diagnostics means no meter inspections
- Safer to operate and maintain
- Extractable sensors without meter removal

Application: Wet Gas Measurement

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Key Benefits

- Not damaged by liquid slugs
- No pressure loss/drop
- Multi-path accurate with up to 2% liquids
- Meters are corrosion resistant
- Diagnostics shows liquids history

Diagnostic Software Dashboard

Meter Values – Possible Path Contamination

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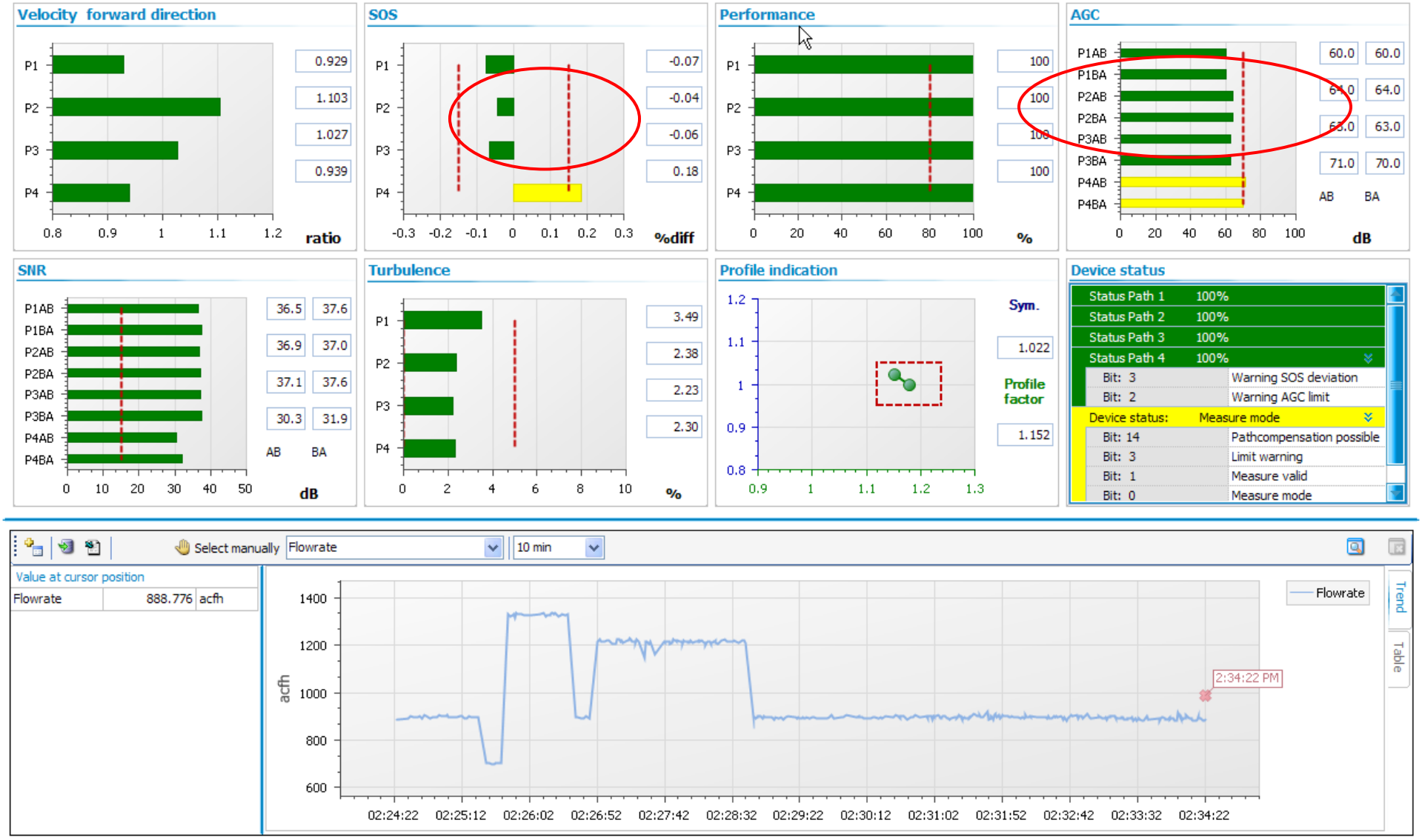

Questions?

Wade Stinson
Regional Sales Manager
Wade.stinson@sick.com

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