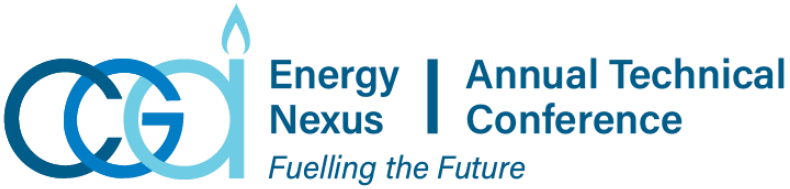
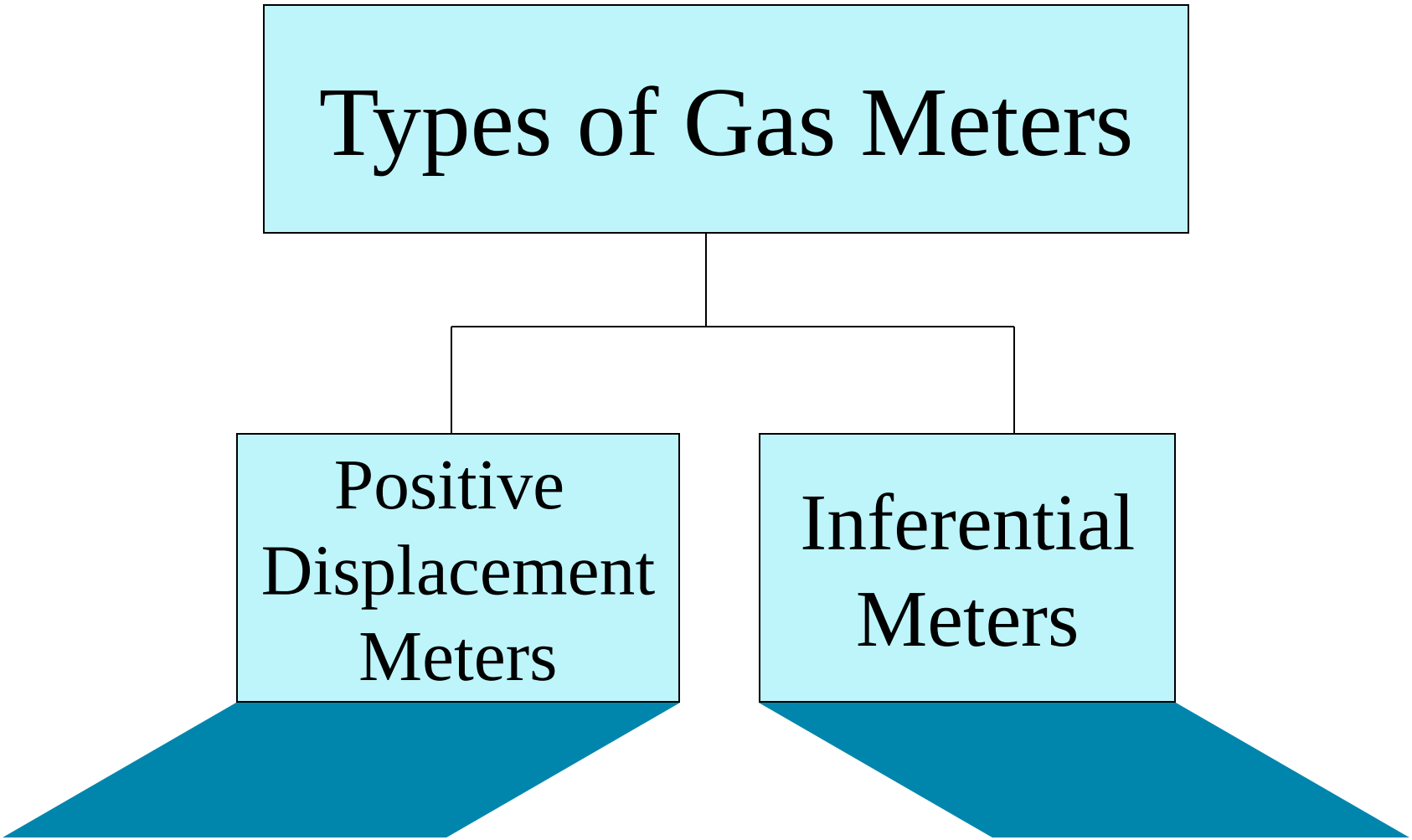
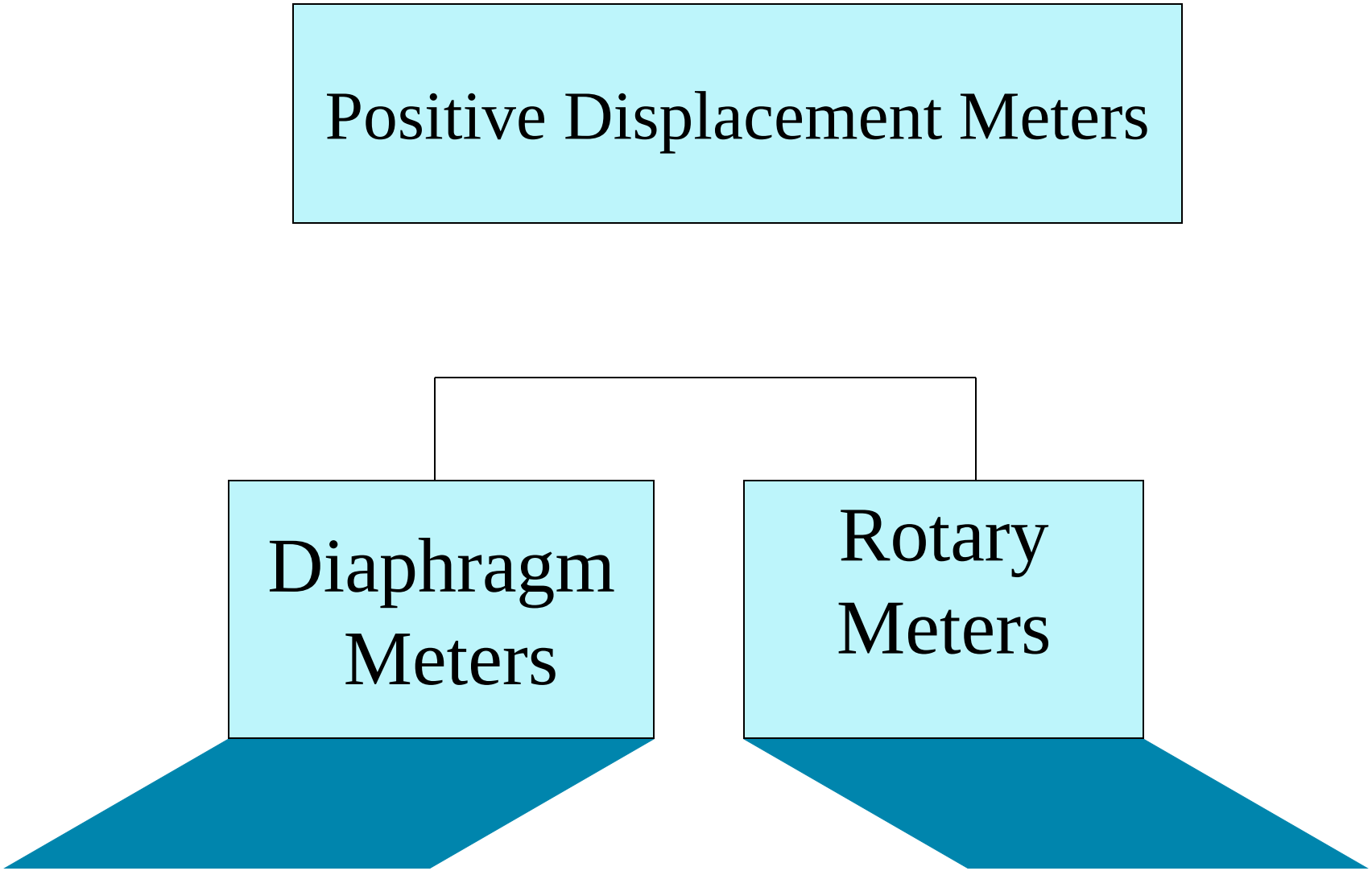
# M102 Basic Metering Devices

**Paul Honchar**




Types of Gas Meters
Positive Displacement Meters
Inferential Meters


Positive Displacement Meters
Diaphragm Meters
Rotary Meters

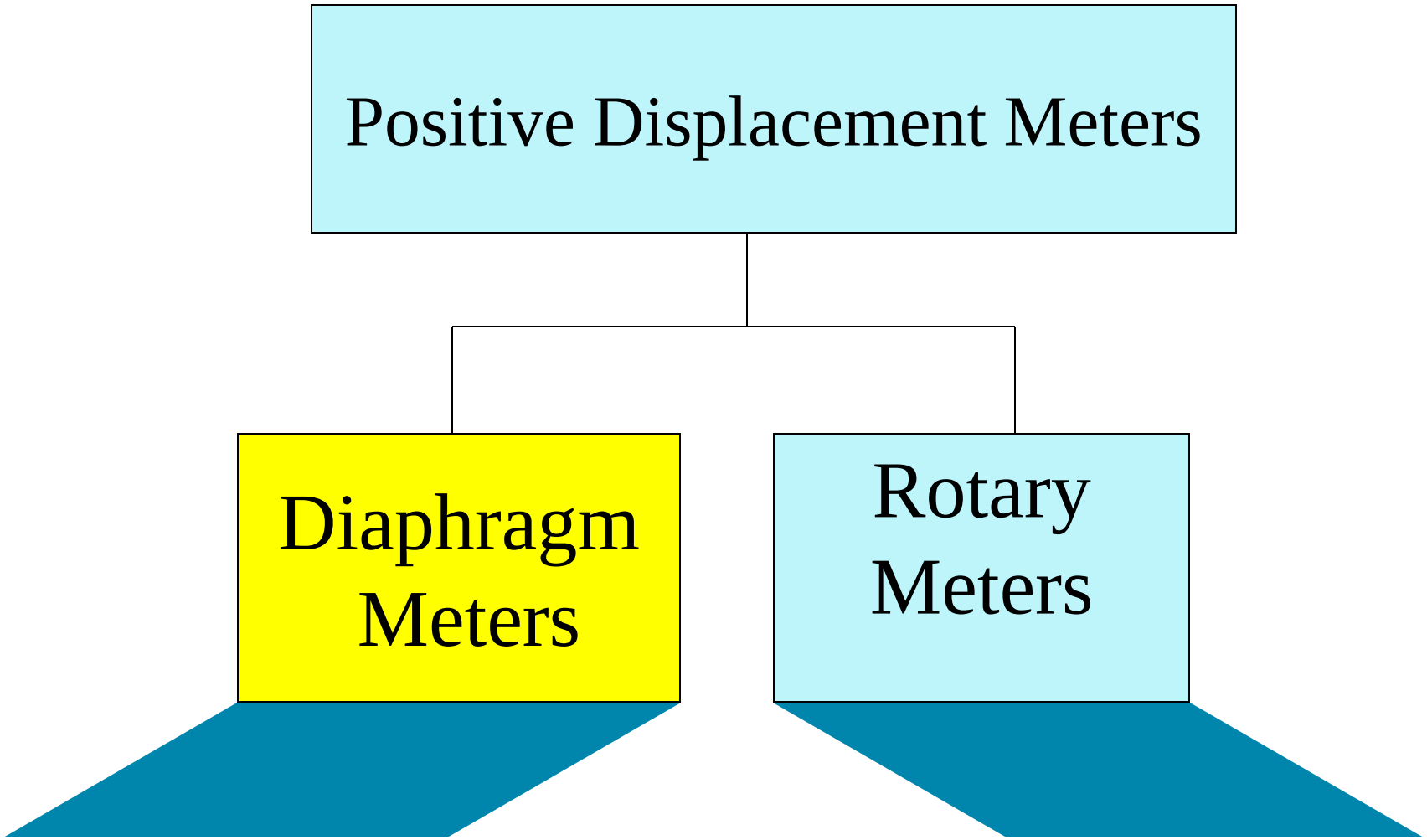
# Positive Displacement Meters

$$Vm = Vc \times Nc$$

Where: Vm = Totalized Volume

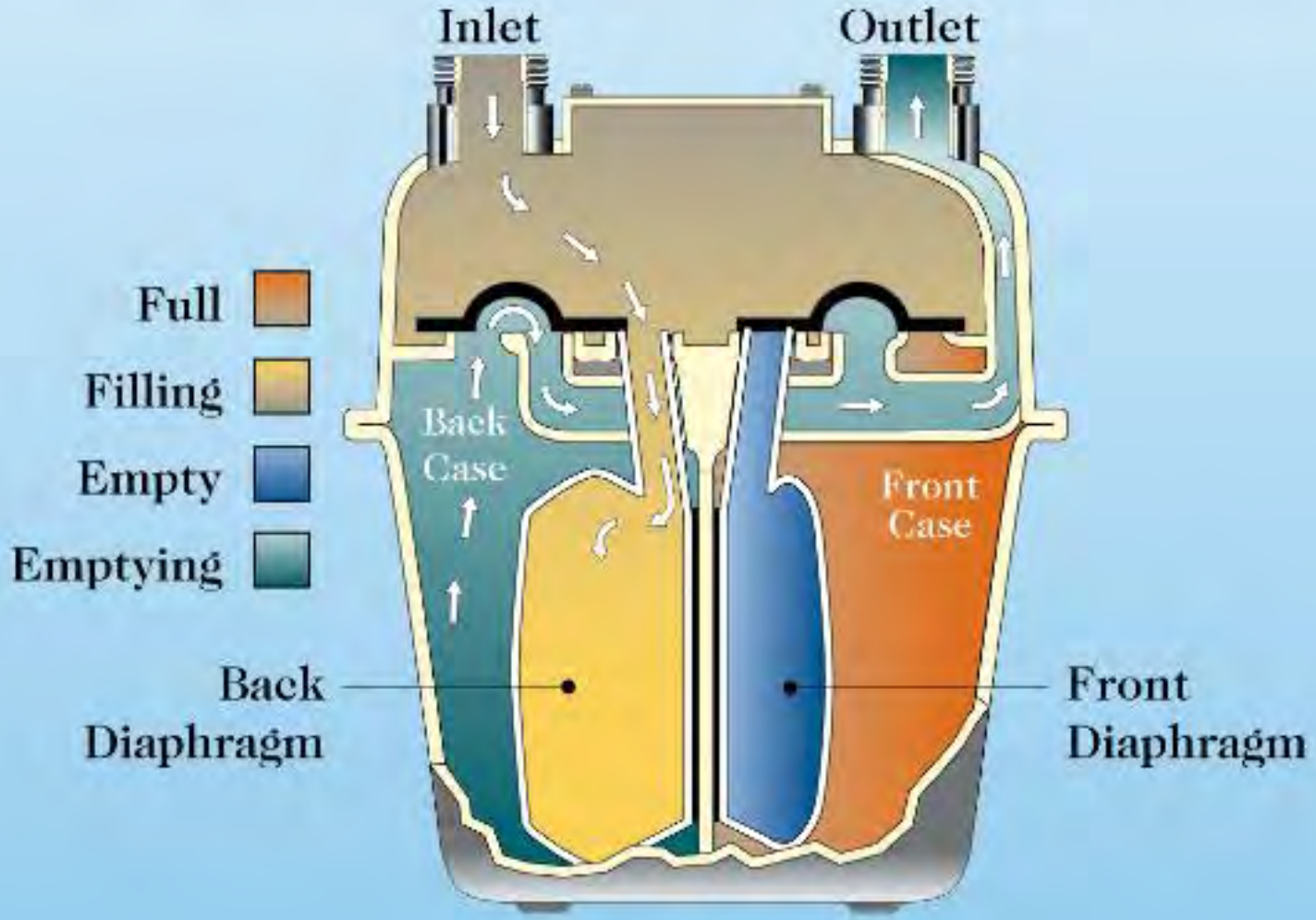
Vc = Volume Per Cycles

Nc = Number of Cycles

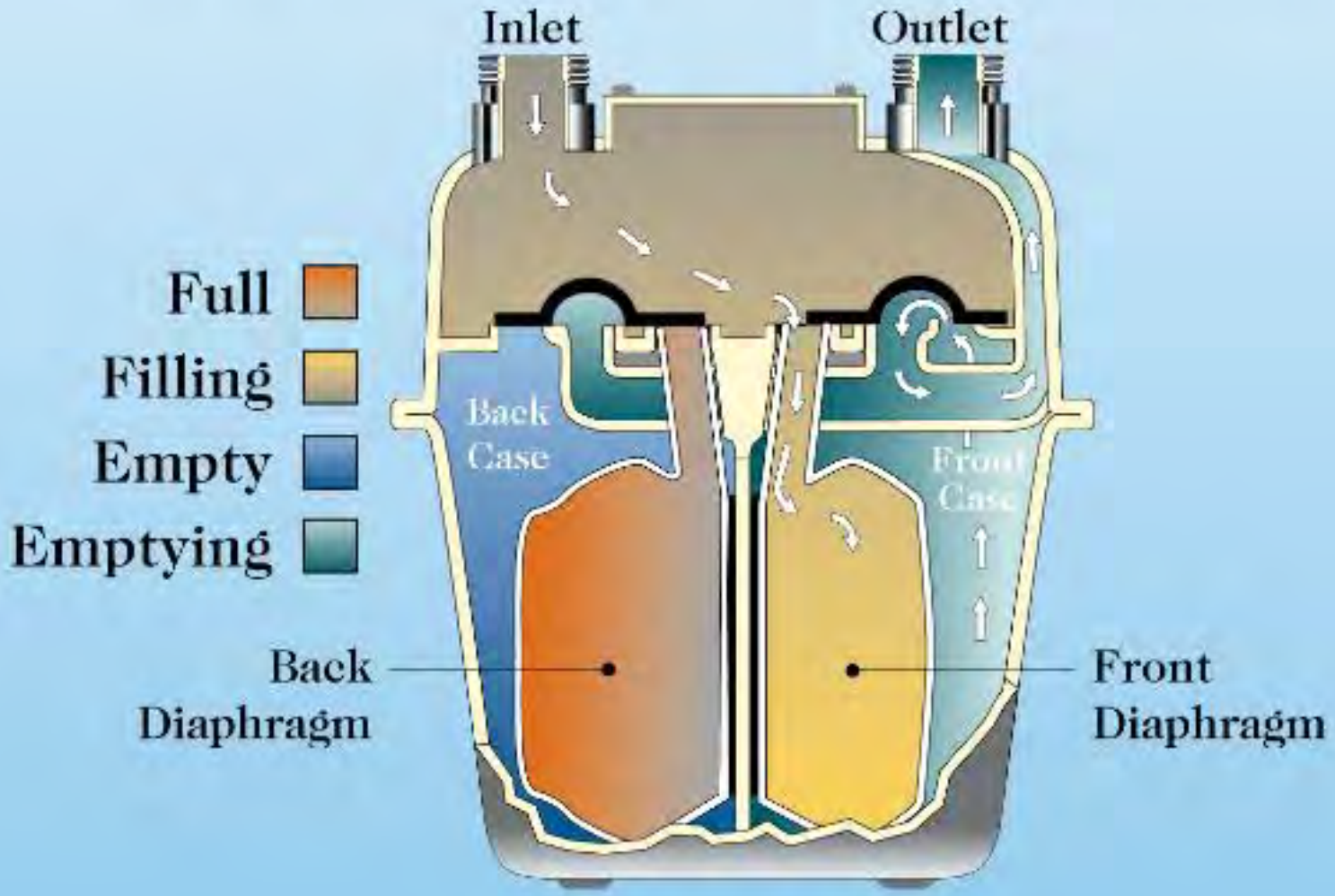

Positive Displacement Meters
Diaphragm Meters
Rotary Meters

# Residential Diaphragm Meter

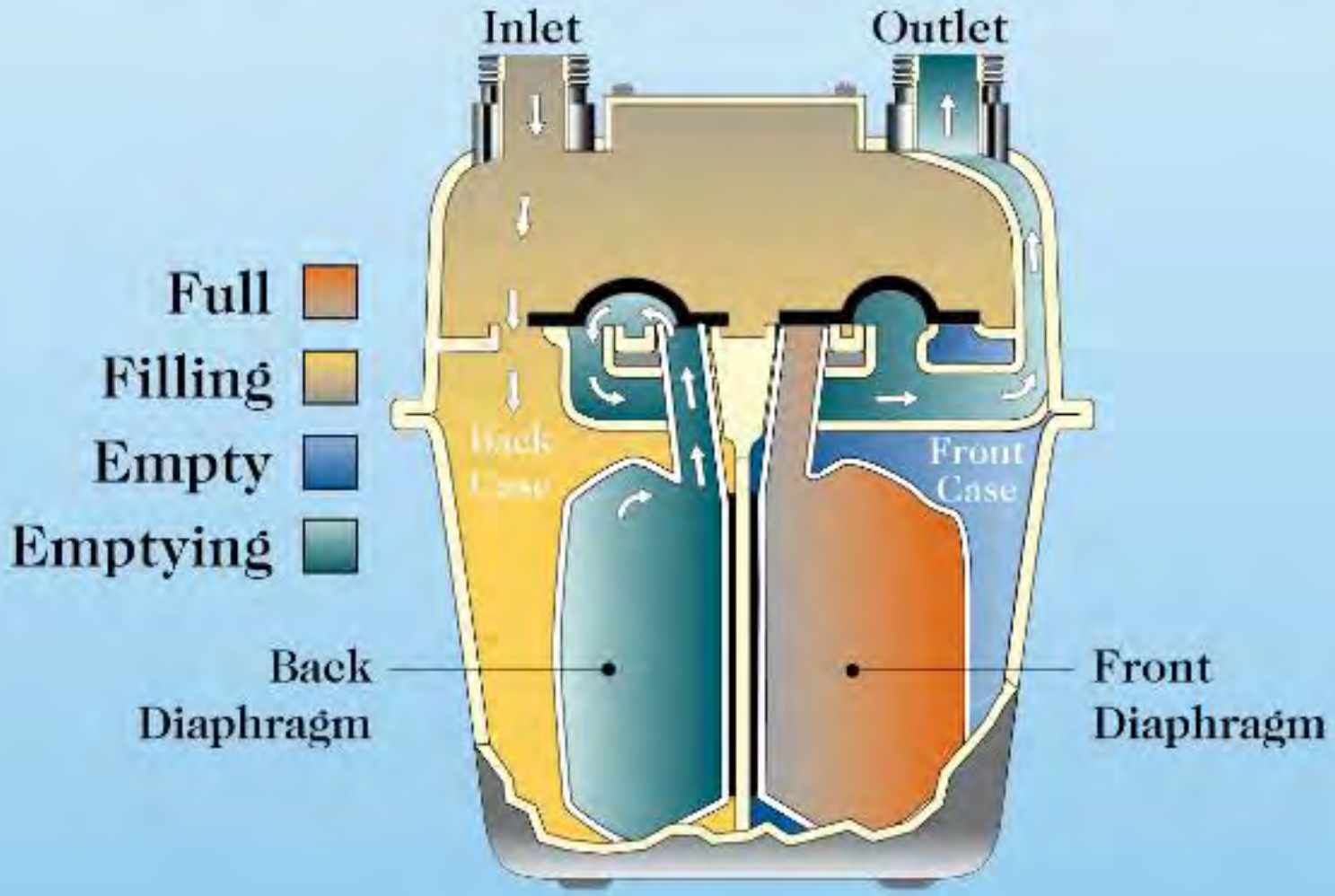
# Step 1 – Cycles of a Four Chamber Diaphragm Meter



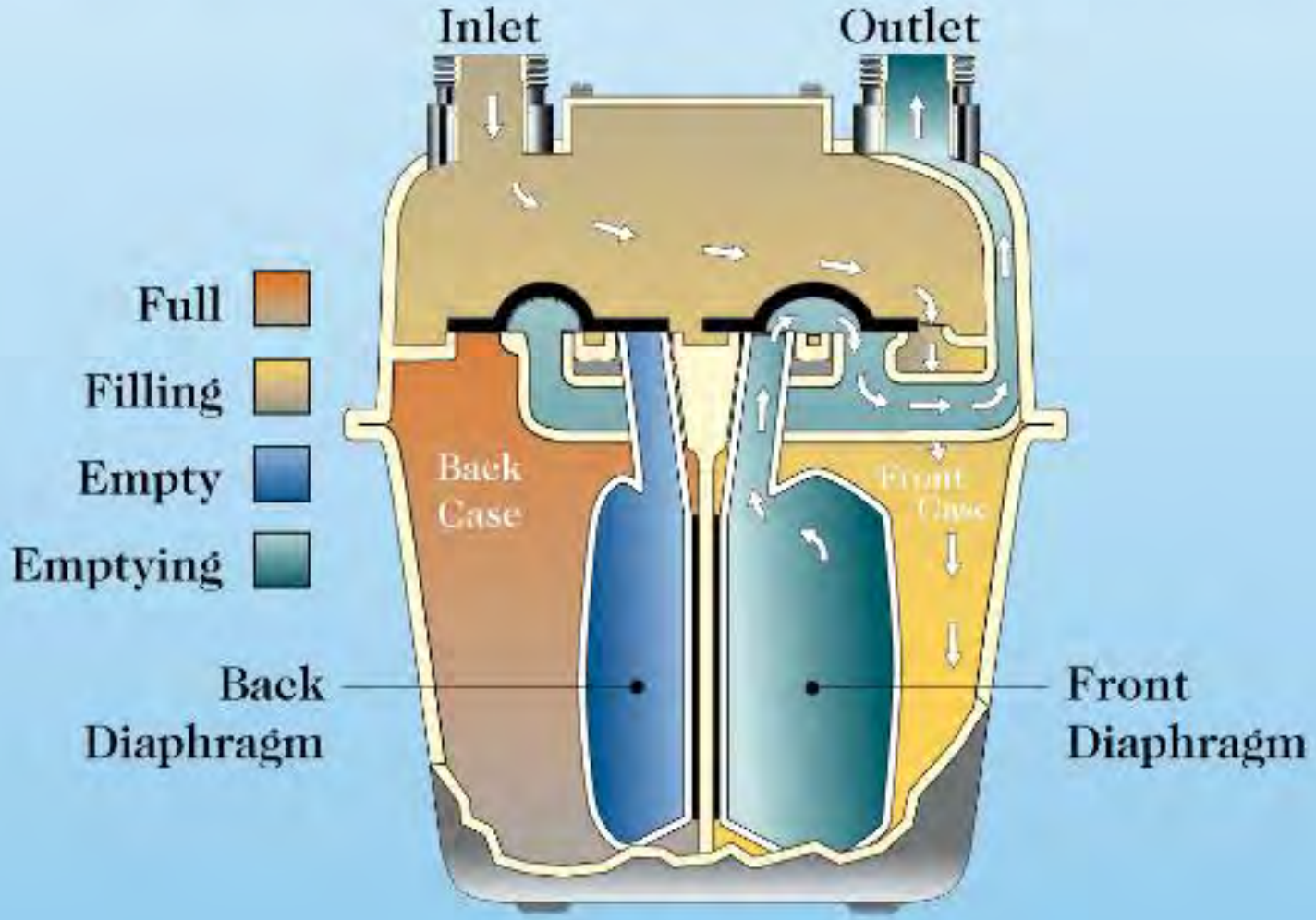
# Step 2 – Cycles of a Four Chamber Diaphragm Meter



# Step 3 – Cycles of a Four Chamber Diaphragm Meter

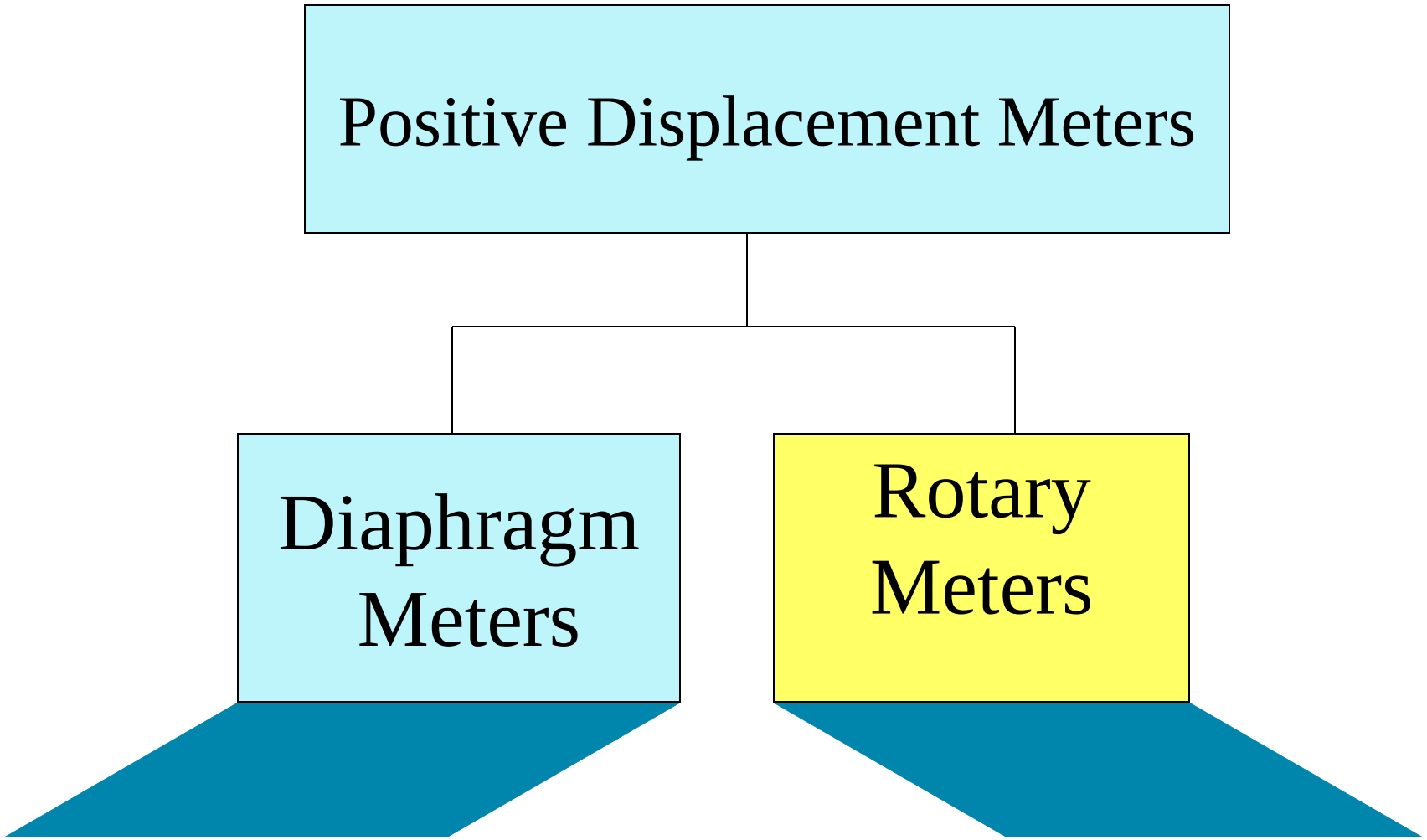


# Step 4 – Cycles of a Four Chamber Diaphragm Meter

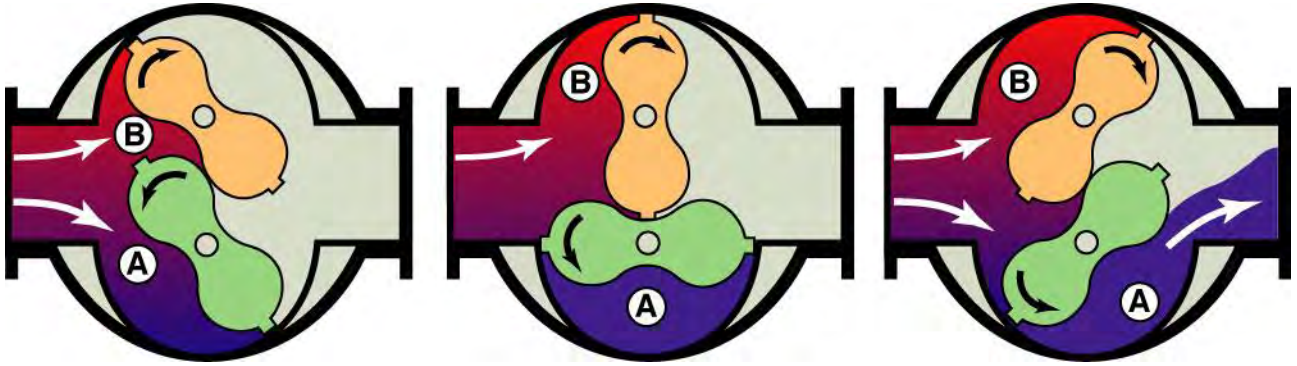


# Residential Diaphragm Meters

Mechanical diaphragm meters are still a solid choice for basic measurement. They have been workhorses for gas measurement for nearly two centuries. However, they have limitations to their future application in smart gas networks.


Positive Displacement Meters
Diaphragm Meters
Rotary Meters

# Fundamentals of Rotary Measurement




Rotary Meter Operation

# Fundamentals of Rotary Measurement

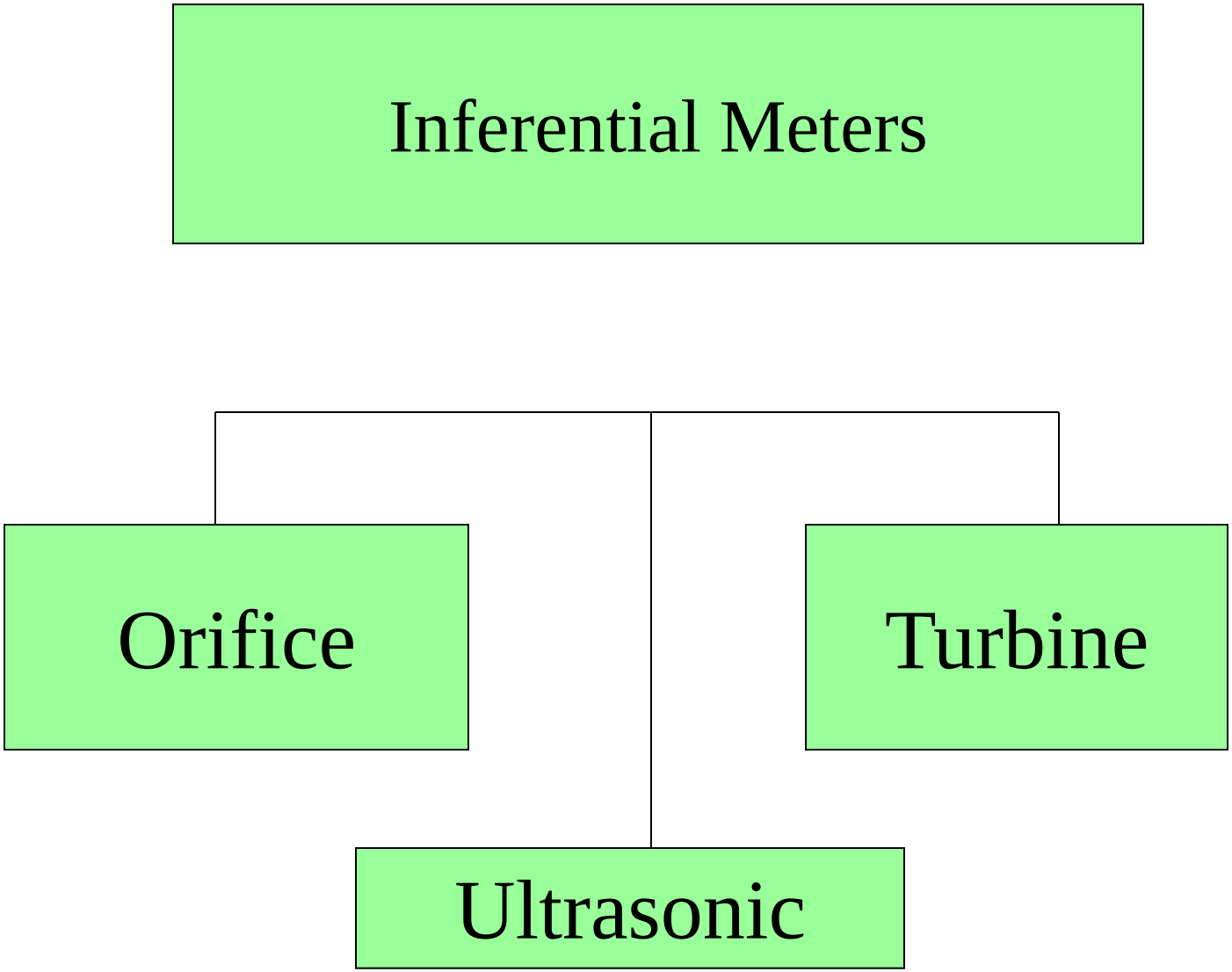
# Rotary Measurement

## Advantages

- Compact, smaller sizes
- Various sizes available
- Wide variety of readouts

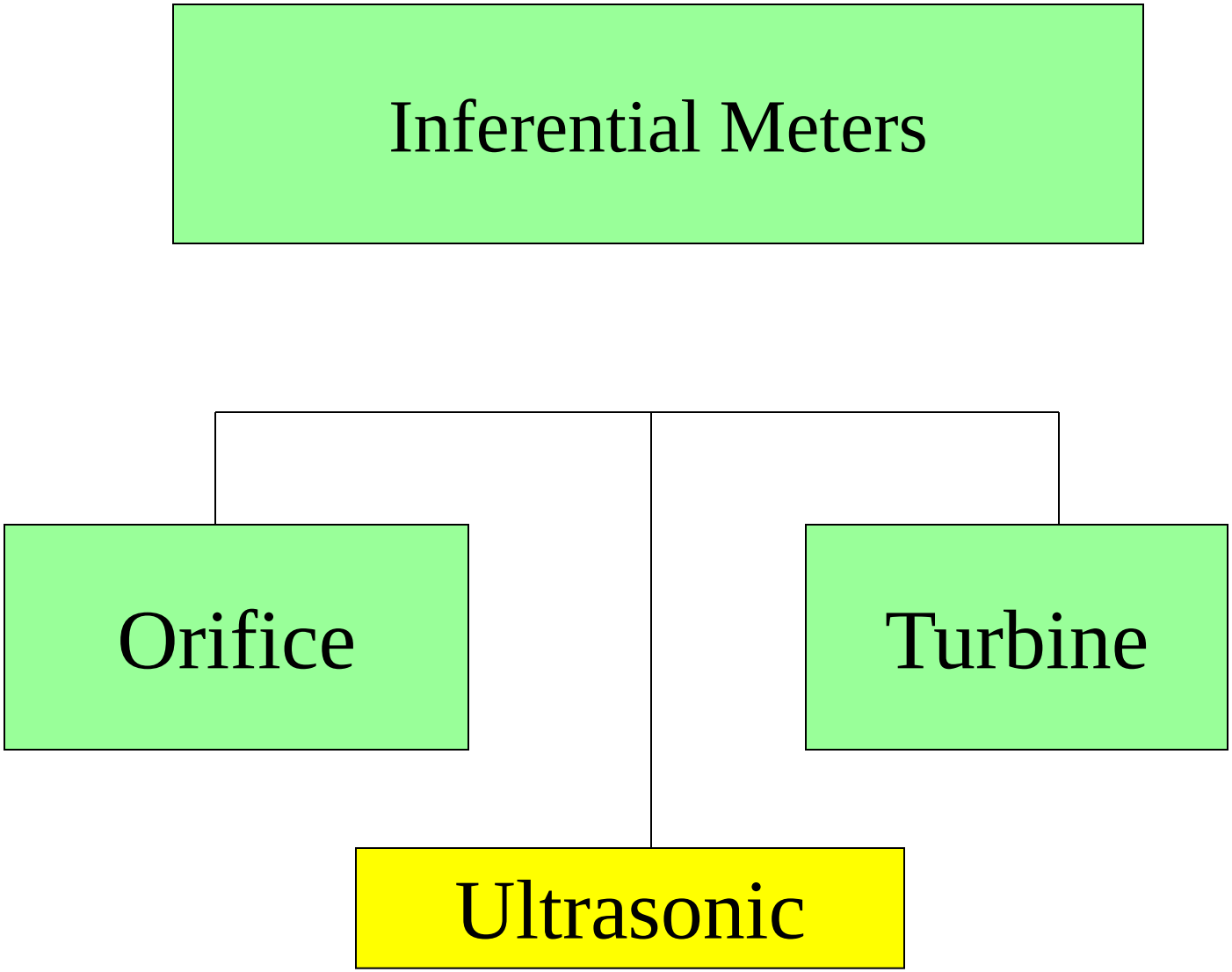
## Disadvantages

- Heavy, larger sizes
- Low-flow limitations
- Maximum pressure limitation
- Pulsation generated affects
  - Regulation
  - Calibration
  - Process
- Potential service interruption
- Susceptible to contamination
- Requires lubrication


Inferential Meters
Orifice
Turbine
Ultrasonic

# Inferential Meters

Infer = A conclusion derived from evidence (Velocity through a known area)


Inferential Meters
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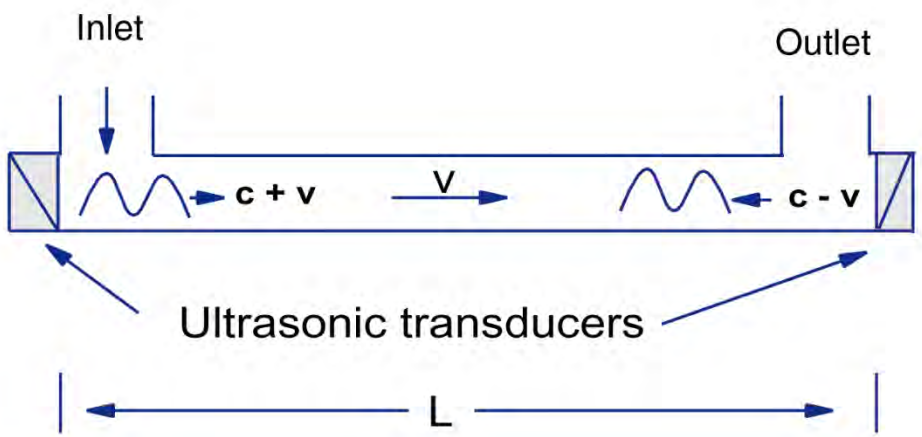
# Fundamentals of Ultrasonic Measurement

Single Path – Low Flow




Ultrasonic pulses are produced with - and against - the gas stream. Pulses flowing with the gas velocity speed up; pulses flowing against the gas velocity slow down. The difference is used to calculate the gas speed or velocity within the known area.

# Single Path Ultrasonic Meters

There are several single path ultrasonic meters being offered in the North American market


Itron


Landis + Gyr


Pietro Fiorentini


Sensus



sensus
a xylem brand

# Single Path Ultrasonic Meters

Commercial and industrial single path ultrasonic meters are expanding in the North American markets, with more to come

Sensus Sonix IQ 425

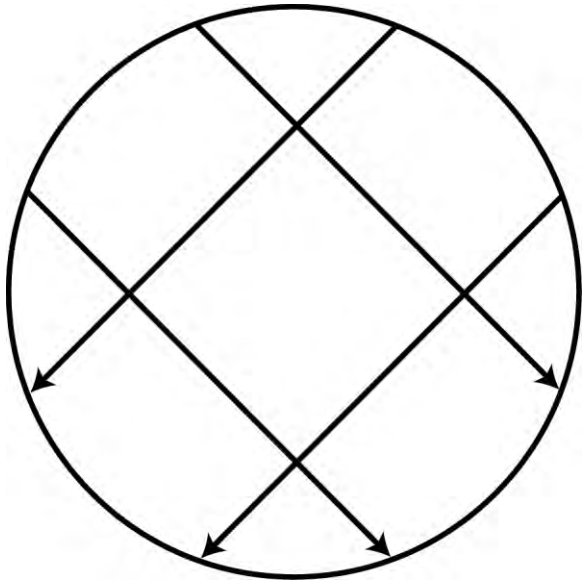
Sensus Sonix 600/880/2000

# Single Path Ultrasonic Meters

Single path ultrasonic meters offer forward thinking utilities the opportunity to embrace the next generation of smart gas measurement. The solid-state digital platform already offers features and benefits well beyond traditional assets. This technology can provide solution to problems that we have yet to be encountered. The data analytics will reshape how the industry manages business.

# Multipath Ultrasonic Meters

Multi Path – High Flow



Because of the larger flowing diameter, the profile of the gas can take various shapes. Therefore, multiple path measurements are required to determine the average gas velocity.

# Multipath Ultrasonic Meters



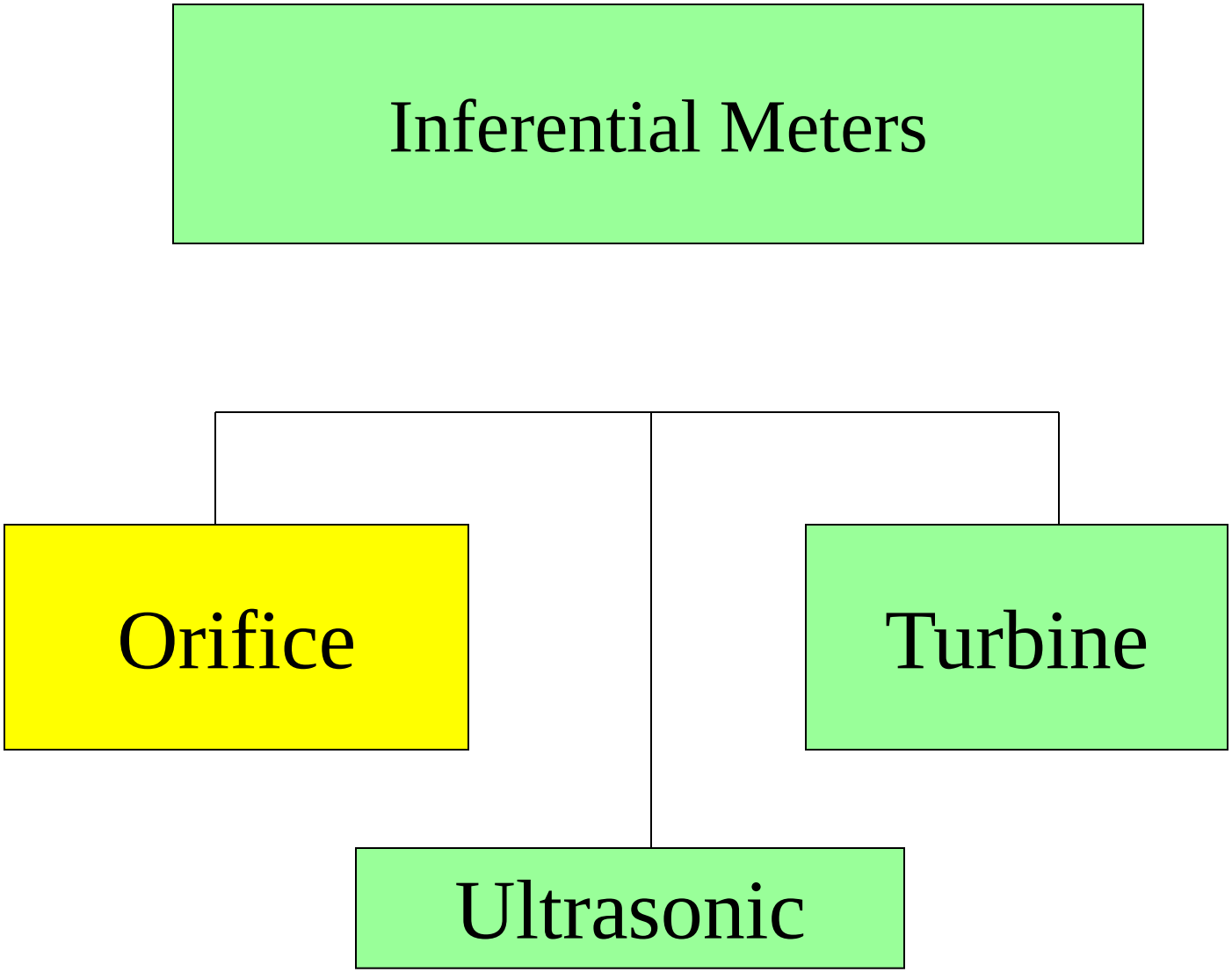
# MultiPath Ultrasonic Measurement

## Advantages

- Low pressure loss across meter
- No mechanical components
- Bi-directional flow

## Disadvantages

- Higher pressure loss due to required flow conditioning
- No mechanical backup
- Gas composition / liquid effects
- Velocity profile effects
- Complex calibration requirements
- On site power requirements
- System complexity


Inferential Meters
Orifice
Turbine
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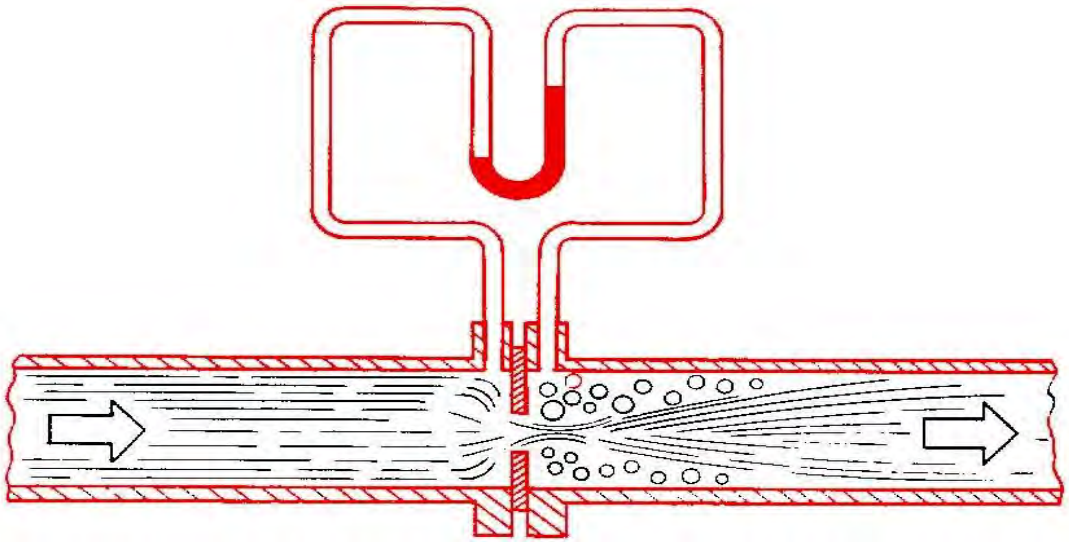
# Fundamentals of Orifice Measurement



When a fluid flowing through a closed cross-sectional area encounters a restriction, a local pressure drop is developed. The magnitude of the pressure drop is related to the flow rate at which the fluid flows through the cross-sectional area.

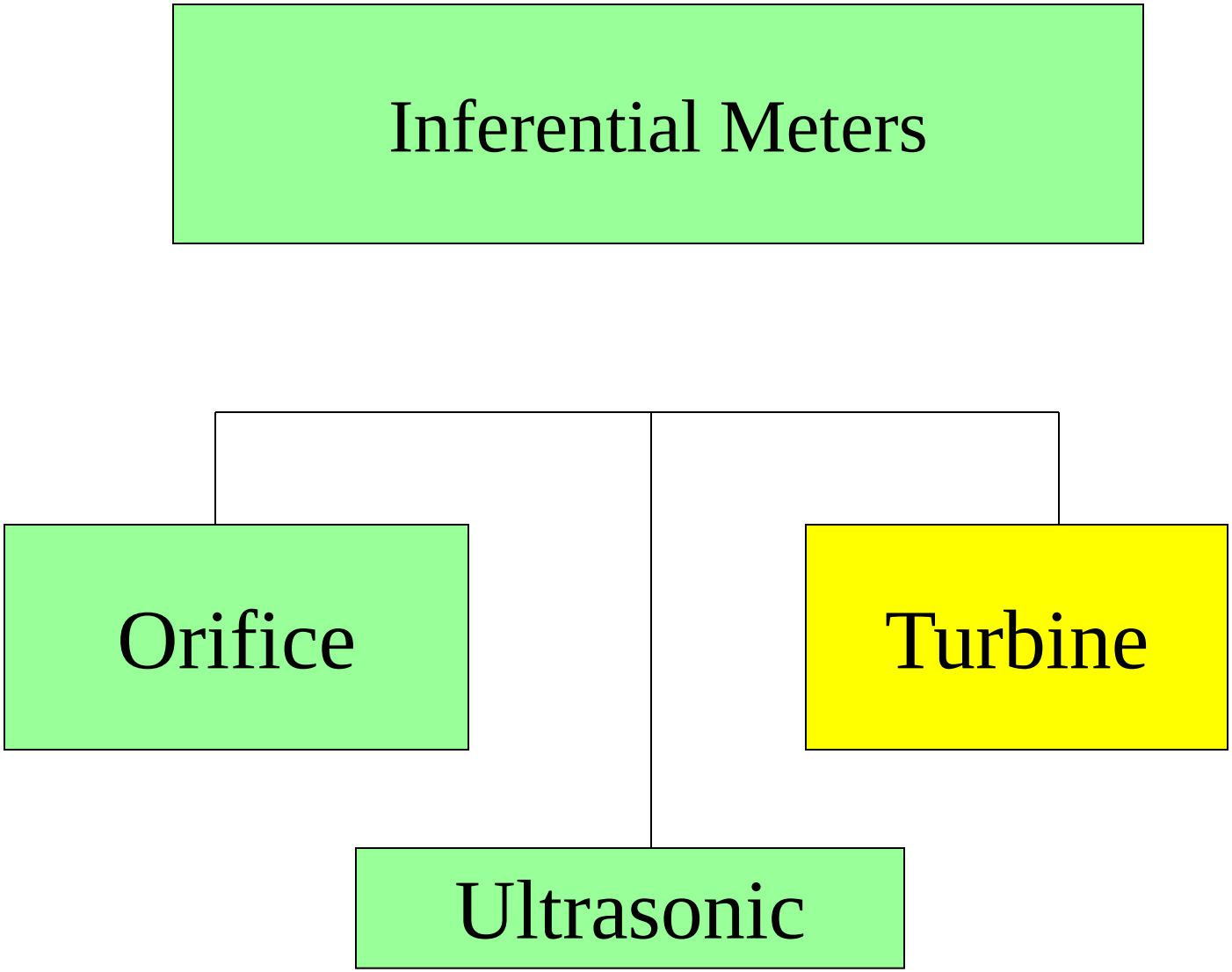
# Orifice Measurement

## Advantages

- Accurate at constant flow
- Large sizes available
- Low initial cost
- Easy to calibrate
- Uninterrupted flow

## Disadvantages

- Poor rangeability
- High pressure loss
- High operating expense
- Pulsation inaccuracies
- Complex calibration
- Many variables to maintain accuracy
  - Pressure
  - Temperature
  - Gas composition
  - Installation
  - Orifice condition


Inferential Meters
Orifice
Turbine
Ultrasonic

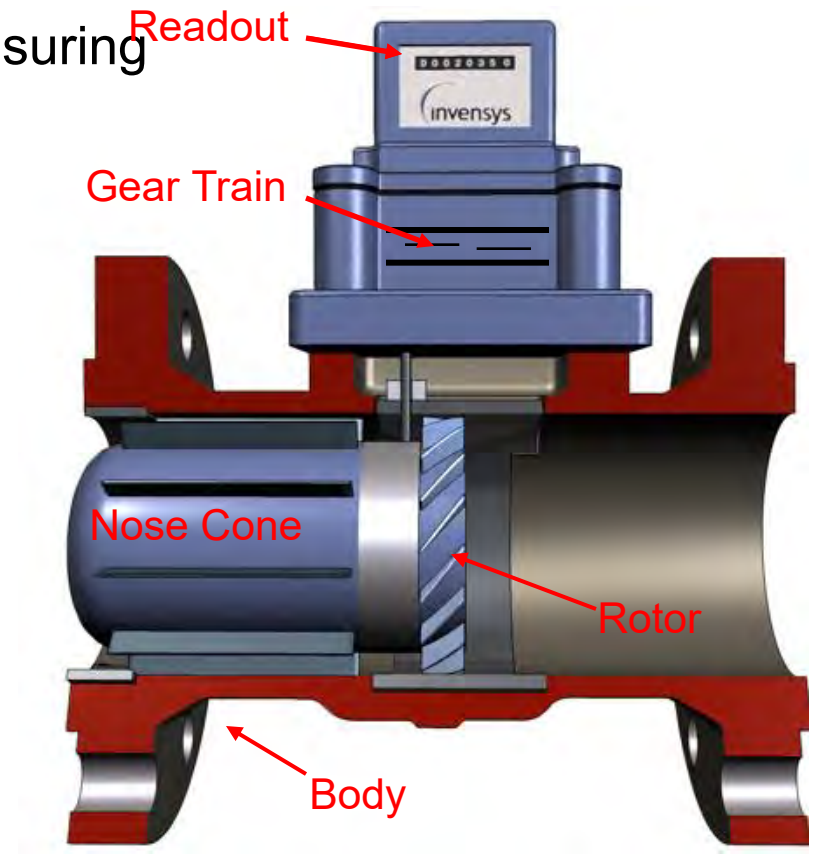
# Turbo-Meter Fundamentals

## Inferential Measurement Device

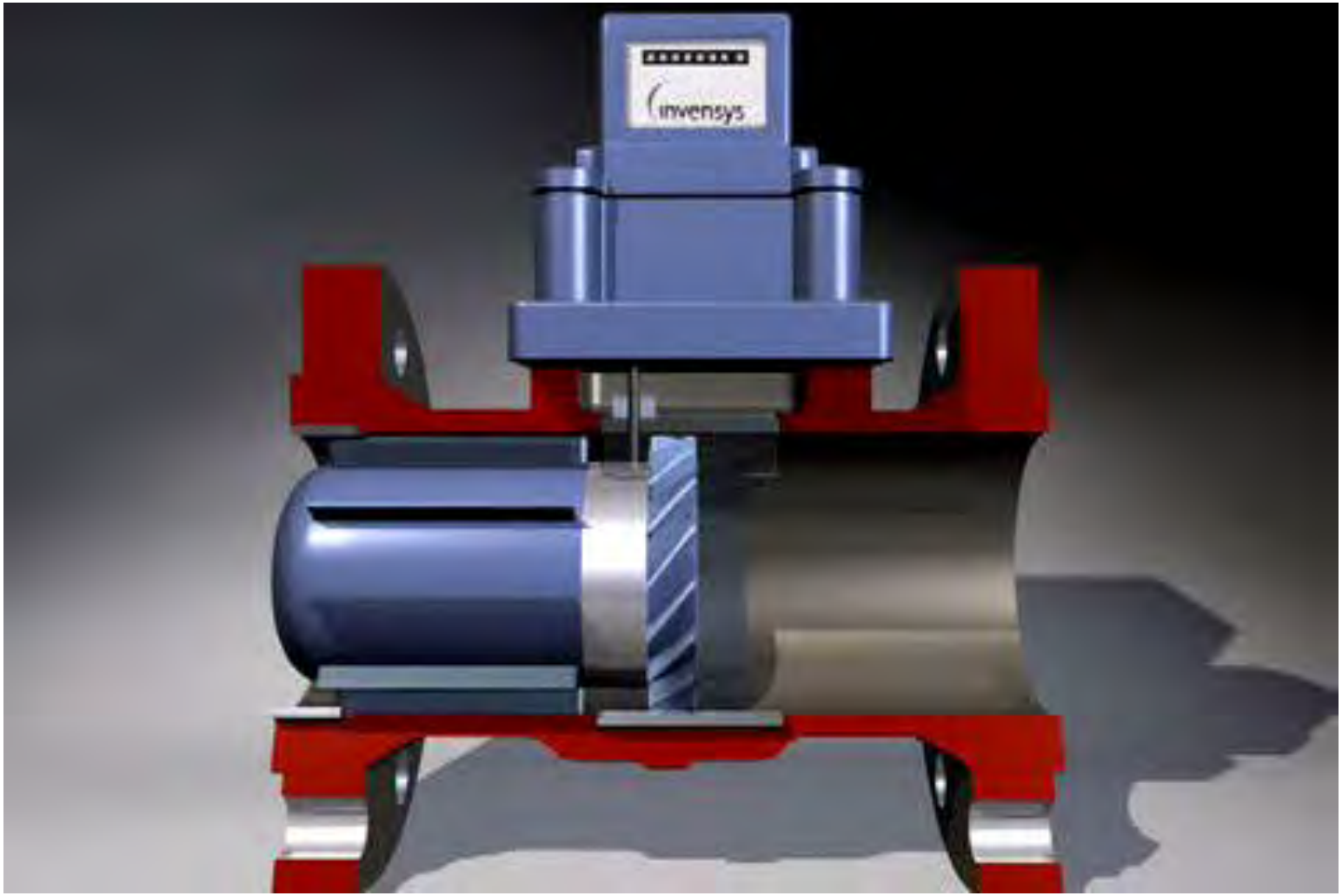
"Infers" volume of gas by measuring the velocity of
gas through a known area.

Flow Rate  Velocity  Area

Basic Components of a Turbo-Meter



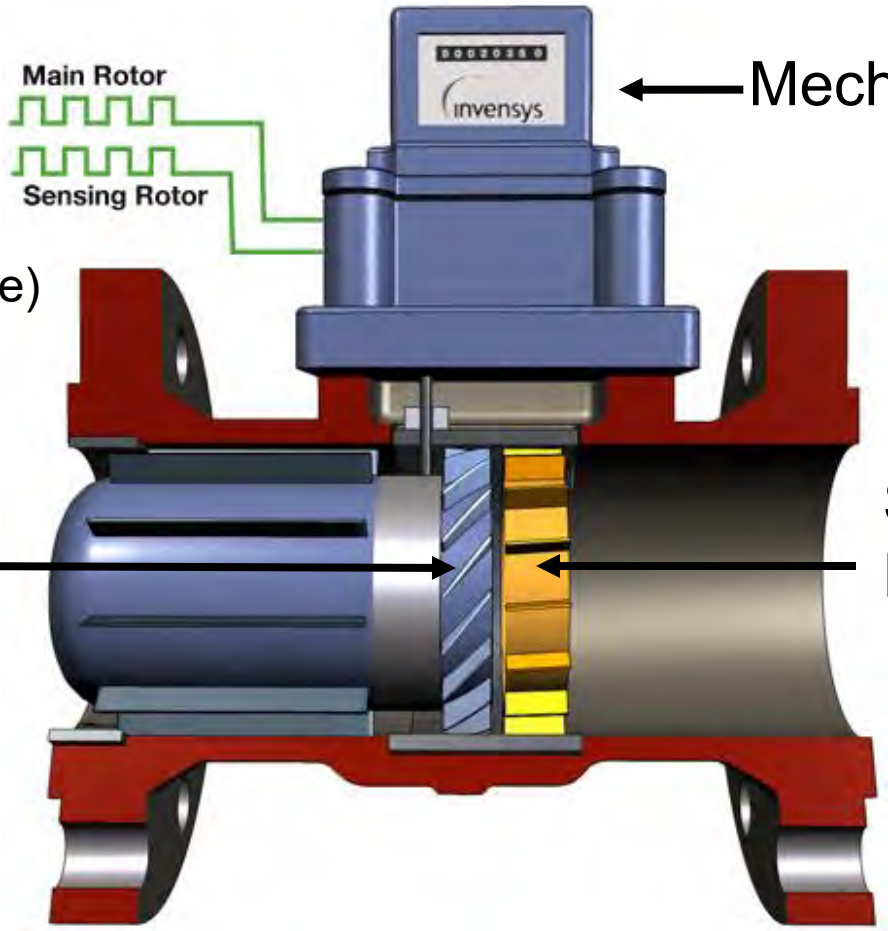
# Turbo-Meter Fundamentals



# Operating Conditions

Adjusted Volume
Pulse Output

(MR Volume – SR Volume)



# Turbine Meter Measurement

## Advantages

- Prove Technology
- Best in Class Accuracy
- Mechanical and Electronic Outputs
- Modular Concept for Field Exchange and Reverification
- Self Checking (Dual Rotor)
- Self Adjusting (Dual Rotor)

## Disadvantages

- Mechanical Device
- Bearing Lubrication Required
- Installation Requirements

## *Coriolis Meter*

Uses the distortion of a vibration tube as gas velocity passes thru it.

- Advantages –
  - Can measure mass, not just volume

- Disadvantages –
  - Expensive
  - Liquids and Containments in the line can effect accuracy
  - Not always approved for custody transfer

# Measurement Summary

- There are many choices for measurement products.
- Not all technologies fit all applications
- There are advantages and disadvantages purely due to the technology
- Chose the best technology for your application

# Thank you!

**Paul Honchar**

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