

Process Instrumentation

Lesman Instrument Webinar

Choosing the Right Level Technology

April 8, 2014



Agenda

- Safety moment
- Level technologies
- How do you choose?
- Design criteria
- Summary
- Q&A



Safety Moment – Eye Protection



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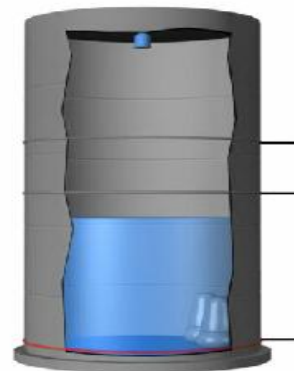
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Level technologies: types

Two groups of level measurement:

- Point measurement (discrete)
- Continuous measurement (analog)

■ Solid engineering practices require a point level back-up for continuous level measurement.



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Common Types of Level Technology

What is the oldest Level

Technology?

Plumb Bob

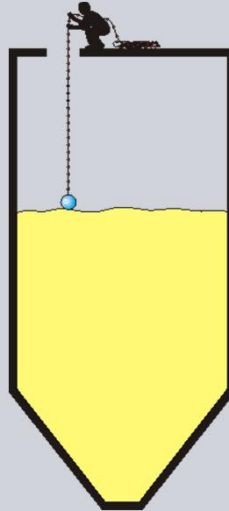
A worker drops a length of pre-measured rope until a float contacts the material surface.

Advantages

- Simple

Disadvantages

- Human non-repeatability
- Hazard exposure
- Process damage from broken cable
- Not instantaneous



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Ultrasonic (non-contacting)

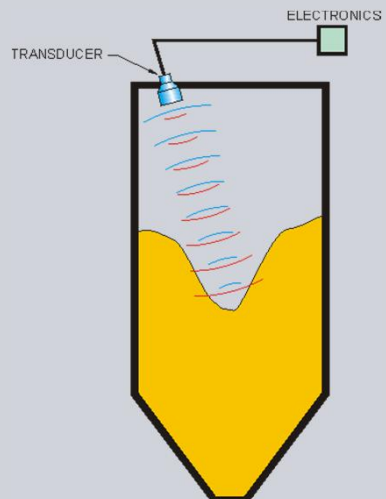
Measures time of flight from transmission to received echo. This determines distance and calculates level.

Advantages

- Non-contact
- Well proven
- Solids, liquids or slurries
- Control capabilities (pumping & alarms)
- Potted /robust transducer for vibration and shock (no electronics in vessel)
- Remote display

Disadvantages

- Sensitive to vapor changes in medium
- Can be sensitive to foam
- Limited pressure and temperature range



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Radar (non-contacting)

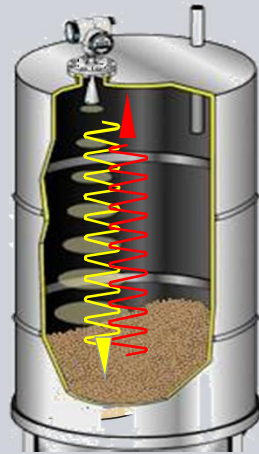
Measures time of flight from transmitted signal to return signal for distance measurement.

Advantages

- Non-contacting
- Insensitive to vapors and dust
- Unaffected by temperature and pressure
- Very long ranges (up to 100m or 328 feet)

Disadvantages

- Can be sensitive to foam
- Can be sensitive to very heavy condensate
- Display and antenna are integral



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Guided Wave Radar (GWR) or Capacitance (contacting)

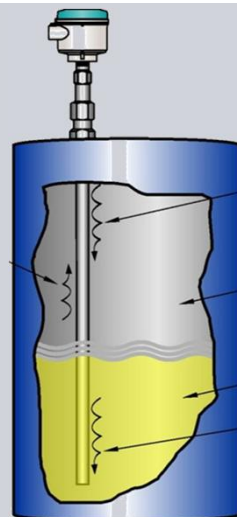
Both technologies use a rod or cable which extends into the material being measured.

Advantages

- Able to measure the liquid-liquid interface of two immiscible liquids (maximum dK of upper fluid is 5)
- Wide temperature / pressure ranges - up to 427°C (800°F) or up to 431 bar (6250 psig)

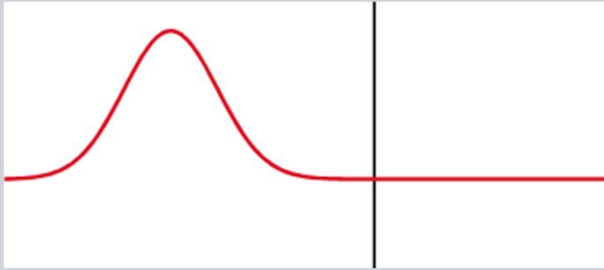
Disadvantages

- Can be sensitive to material build-up
- Wear in solids
- Pull forces on roof - solids applications
- Equipment damage from broken rods



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Guided wave radar - principals of operation



Signal (or energy) transmitted through and reflected from a discontinuity (or impedance change)

Hydrostatic Level (contacting)

Measures head pressure of material in vessel

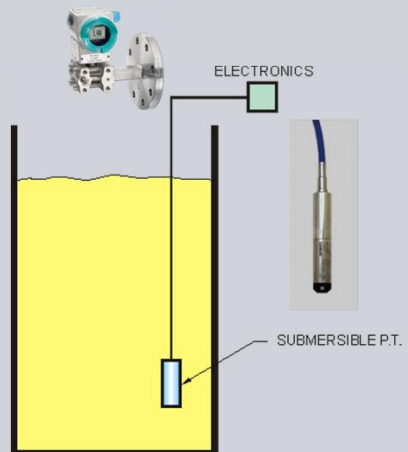
Advantages

- Easy to use
- Complex internal geometry possible
- Suitable for high temperature and pressure
- Most common level measurement across all industries

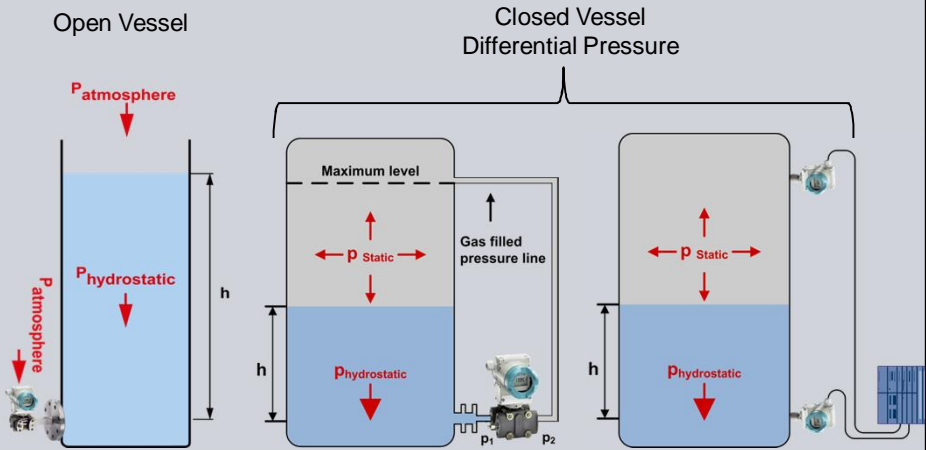
Disadvantages

- Contacting – chemical compatibility with seals
- Susceptibility to specific gravity changes – may require recalibration
- Adds fitting/piping to system if not submersible

Note: If top vessel is under pressure or vacuum, differential pressure is required.



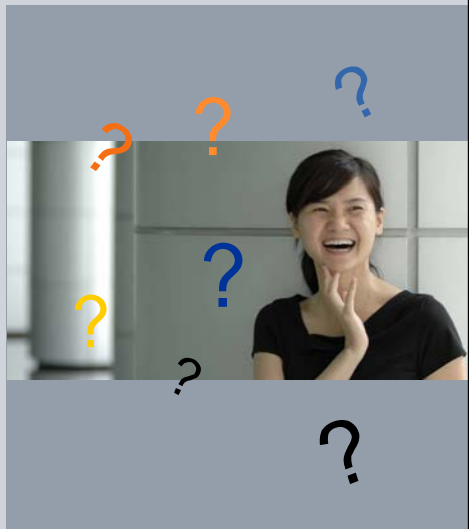
Hydrostatic - principals of operation



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With all of the different technologies available to measure level, how do you decide:

What is the best solution?



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Application Basics – 6 Key Questions

- 1. What is the material to measure? Liquid, slurry, or solids?**
- 2. Contacting or non-contacting measurement required?**
- 3. What are the temperature and pressure ranges?**
- 4. What is the distance of measurement?**
- 5. Is it an open air or closed vessel application?**
- 6. What material is the vessel made of?**

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Application Basics – Other design criteria

End-user preference	Common spares, training
Application type	Level, interface, flow, pump control, volume, weight
Physical arrangement	Process connection available (nozzle length & width) Internal geometry, external geometry
Application criteria	Vapors, dust, density, foam, viscosity, specific gravity
Accuracy required	How precise a measurement is needed

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Application Basics – Other design criteria

Electrical supply	AC, DC, 4 wire, 2-wire (loop powered)
Communications	4-20, Modbus, Hart, PA, FF, DeviceNet, Relays
Diagnostics desire	Local, PDM, Pactware, HART
Area of classification	General Purpose, Intrinsically Safe, Explosion Proof
Certificates	Pressure directive, calibration....

Questions?

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Contact**Mark Klee**

Sr Application Engineer / Product Promoter
Level and Weigh Technologies

Siemens Process Instrumentation
53 Parke Lane
Longview, WA 98632

Mobile: (360) 431-5341

E-mail: mark.klee@siemens.com