Understanding the Industry's most versatile Point Level Control

The level control industry is beginning to see a shift away from electro-mechanical devices, such as rotary probes and pressure switches, as people gain a better understanding of capacitance probes.

In most applications, capacitance probes are marginally more expensive then traditional level devices. However, solid state devices have no moving, parts, are inherently more reliable and usually have a longer working life.

Capacitance probes function like big capacitors. The active portion of the probe and the wall of the storage vessel act like two conductors, the probe energising the conductors and measuring the capacitance that exists between them.

The amount of capacitance depends upon the size of the conductors, the physical spacing between the conductors and the dielectric constant of the particular material stores. This is the ratio of the amount of capacitance produced when the stored material is the insulator, compared to the capacitance produced when air is the insulator. Capacitance, normally expressed in farads, is considered in terms of picofarads (one-trillionth of a farad) for level control purposes.

When material makes contract with the probe, the capacitance between the two conductors changes. The unit perceives the change and sends a relay signal to a light panel, PLC, motor starter or other equipment, signifying the material's presence. Most capacitance probes use fail-safe relays, so if the unit loses power, the relays signal an alarm condition.

Although capacitance level probes have a simple operating principle, users still need to be aware of the problems.

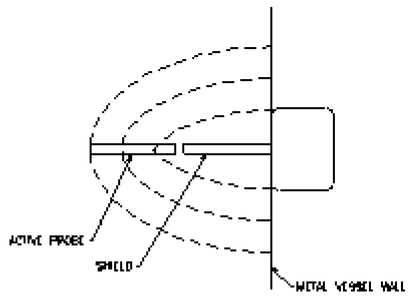
Conductive materials which leave a residue once they have fallen away (most liquids, for instance) require a coated or sleeved probe. This non-conductive coating keeps a conductive material from grounding the probe to the vessel wall. Any conductive residue, which builds up from the vessel wall to the active portion of an un-coated probe, will short out the two conductors. It would be like pressing the two conductors right next to each other, making it impossible to sense anything between them.

The probe examines a large area around itself, not just the area immediately surrounding it. This allows non-conductive build-up to be ignored on the probe assembly and enables coated or sleeved probes to be used.

When calibrating a probe, you are essentially telling it what the dielectric constant of the ambient environment (air) is and what the dielectric constant of the material in store is. The dielectric constant of air is (1). Different makes of probe have different sensitivity ranges. Some probes can sense material with a capacitance of ½ picofarad above air.

A shield (or guard, as it is sometimes referred to) is designed to overcome problems resulting from side-wall build-up, or bridging between the side wall and the probe, generally only a concern in the case of side mounted units.

The shield is essentially a portion of the probe that is inactive or non-sensing, usually the first 100-150mm of the shaft as it extends out from the enclosure.



SIDE MOUNTED PROBE

Intrusion

In applications where intrusiveness is a concern, most probes have a flush mount option, where the probe assembly is replaced by a flat disc, which mounts flush with the bin wall. Custom adapters can be made to make the surface truly flush and some flush mounts even have shields.

It is worthwhile knowing the problems that can occur in certain applications. These include:

- Radio frequency interference. Any capacitance probe that operates in the RF range is susceptible to interference from other plant equipment that emits RF signals (such as two-way radios). If this is a concern, be sure to use a probe that operates outside the RF range.

- Low Dielectric constants. Few products have such a low dielectric constant that they pose a problem for capacitance probes, but they do exist. Light fluffy materials are sometimes difficult to sense, because of the ratio of air to material for a given volume. If the material around the probe is mostly air, then it may not see enough of a capacitance change from an empty vessel to recognise the material. The sensitivity of the probe will also be a factor in these situations. Probe sensitivity range from ½ to 2 picofarads shift from ambient.
- Variable materials. If several materials with widely varying dielectric constants are kept in the same vessel, it may be difficult to calibrate the probe to sense them all accurately. A similar problem can arise when trying to sense a product with a low dielectric constant when steam is present in the vessel. The probe must be set to a point which is sensitive enough to detect the material, but not sensitive enough to see the steam.
- Static Discharge. Different probes have different levels of static protection. This is especially important in applications where product is pneumatically conveyed. If static electricity is a concern, be sure that the unit has adequate protection.

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