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Sensor Type	How It Works	Use in	What's Special
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Interpret Level Readings Right

The type of instrument can make a big difference in deciphering measurements

By Andrew Sloley, Contributing Editor

UNDERSTANDING THE physics of how a sensor works is crucial for grasping what the device really is measuring in unusual conditions versus what it's reporting — and, thus, how you or the control system should interpret the measurement. Let's look at three common level-measuring technologies, displacer, float and differential pressure (DP), to put this into perspective.

A displacer uses a solid body attached to a torque gauge. As liquid rises up the displacer, the displaced liquid creates a buoyant force. This changes the force on a torque connection. A torque gauge measures the buoyant force. The reading is interpreted as a level.

The conversion of the torque force to a level requires knowing the density both of the displacer body and the liquid in the vessel. If either is wrong, the calculated level will be incorrect. The key point here is that the displacer instrument doesn't directly measure level. It measures torque (or force).

A float differs dramatically. Its body must have a density between that of the light phase and the heavy phase in the vessel. The float physically sits on the interface level. As the level of the dense fluid changes, the float moves.

The float location can be measured by different mechanisms. Mechanical options include devices such as gear assemblies. Magnetorestrictive measurement systems use the Villari effect — a magnet on the float induces a stress in an external detector.

IMPACT OF DIFFERENT SITUATIONS

SITUATION	TECHNOLOGY		
	Displacer	Float	Differential Pressure
Level below range	Sits at minimum value	Sits at minimum value	Sits at minimum valve
Level above range	Measures average density but reports a level	Sits at maximum value	Measures average density but reports a level
Density lower than assumed	Level reported is lower than actual	Level accurate unless float density is too high — if so, goes to minimum value	Level reported is lower than actual
Density higher than assumed	Level reported is higher than actual	Level accurate. In liquid/liquid systems may rise to maximum value if float density is too low	Level reported is higher than actual

Table 1. A float responds differently than a displacer or DP instrument to various situations.

DP instruments measure the pressure differential between two points. Based on an assumed liquid density, this pressure difference is interpreted as a level.

All three types of instruments can measure a liquid/vapor level or a liquid/liquid level. The level may be expressed either in a height (inches, for example) or as a percent of range.

The three measurement technologies respond differently to unusual conditions (Table 1).

For a level below the range, all give similar results. The reading sits at a minimum value. Depending upon calibration, the minimum reading might not be zero liquid level. Suspect any instrument that continuously reads the same value without changing. This is especially true of level devices. Even stable processes exhibit variations in level.

For a level above the range, the displacer and the DP instrument behave similarly. Both turn into density measurement devices but report the density difference as a liquid level. The reported level may be less than 100% if too high a density is assumed. Operating changes that affect the density may change the reported liquid level.

Floats always should read a maximum value if the level is above the range.

If the density is lower than expected, the displacer and the DP instrument report a level lower than that actually in the vessel.

The float will continue to work as long as the liquid density remains higher than the float's density. If the liquid density becomes lower than the float density, the float sinks and the instrument reads a minimum value.

If the density is higher than expected, the displacer and DP instrument report a level higher than that actually in the vessel.

Again, the float will continue to work as long as its density remains lower than the liquid density. In liquid/liquid measurements, if the light liquid becomes heavier than the float, the float will jump to the top of the level range.

In general, the displacer and the DP instrument will show the same behavior. The displacer measures torque (or force). The DP instrument measures force per unit area. Because the area of the DP instrument remains constant, changes in DP are changes in force.

Both the displacer and the float have a device that sits in the liquid. Many people mistakenly think a displacer is a float. This error leads to improper interpretation of readings and can have serious consequences. One contributing factor to the 2005 disaster at BP's Texas City refinery (see: "Hard Lessons Worth Sharing," http://goo.gl/m9Drss) was confusing the displacer installed in a tower with a float. The reported liquid level was incorrect because of an inaccurate density. The unit was full of liquid but the level instrument showed a level less than 100%. What was being measured was average liquid density instead of level. Rising operating temperatures were causing the reported liquid level to drop as density decreased.

Most errors in understanding won't have such catastrophic results. Nevertheless, understanding the physics of how an instrument works is key to interpreting its reading correctly.

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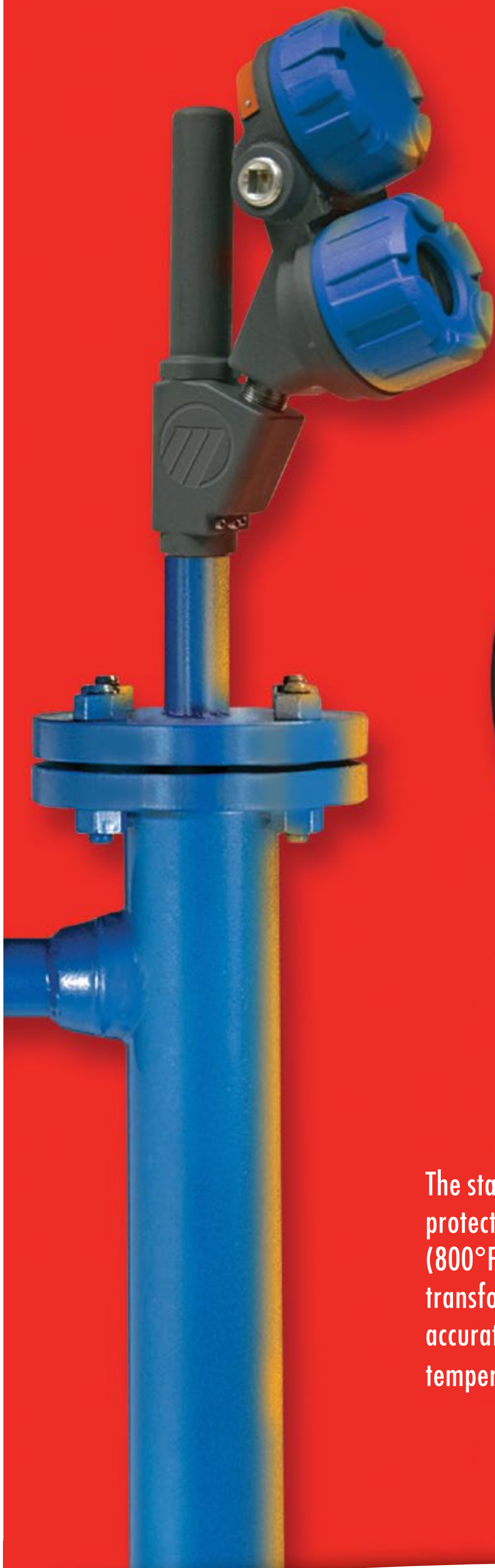

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Choose the Correct Level Sensor

Answer a number of key questions to identify the most appropriate choice

By Brian Sullivan, Valin Corp.

AT PROCESS plants, a significant percentage of measurement devices aren't correctly matched to their application, leading to decreased quality and consistency of the operation. Often, the source of this problem is the assumption that one type of level measurement sensor suits multiple applications. For example, a float sensor may serve its purpose adequately in a completely liquid environment but, when the liquid contains particles or suspended solids, the circumstances change, compromising the accuracy of the sensor. Maintaining a high level of output quality in any plant requires selecting the proper level measurement device for each application. There's no "one size fits all" solution.

Unfortunately, companies and individuals often are tempted to skip a lengthy and involved sensor selection process for a cheaper or faster outcome. This is ill advised, though. To ensure picking the right sensor for long-term durability and safety, engineers must consider all possible factors in a design scenario. After all, in a dangerous application, an incorrectly specified level sensor easily could become the source of a major incident.

A common question is, "Are all these detailed questions really worth it for deciding on a simple level sensor?" The answer is "yes" — because there's no simple sensor.

THE SELECTION PROCESS

You must consider several factors to ensure the accuracy and effectiveness of a level measurement device in a particular application. These factors include the design conditions, the specific media the sensor will contact, how the information gathered from the device must be transmitted, and what additional accessories are needed to complete the operation. Properly considering each of these criteria will lead to choosing a sensor that can provide more accurate inventory, increased product quality and maximized output due to a lack of disruptions.

The first order of business in the selection process is to narrow down the application for which the sensor will be used. In other words, what will its job be? This could be as simple as giving a visual readout or as complex as serving in a multistage automated response system. Answering this question requires knowledge of how the gathered information will be used. Must the sensor continuously monitor the level of a volatile substance? If so, a continuous level sensor is necessary. On the other hand, if the aim is to stop a tank from overflowing or spilling, a point-level sensor might suffice. You easily can determine the complexity and versatility required of a sensor by first assessing the application.

The next step is to determine design conditions; these are crucial in choosing the correct option. Questions to ask at this stage include:

What material(s) will the sensor contact? A sensor must be compatible with the fluids or materials to which it will be exposed. If the sensor will contact any caustic, corrosive or aggressive materials, it must be able to withstand them while maintaining proper functionality. For example, a metal sensor used to measure critical process fluids could release metal ions or particles and contaminate the fluid. In this situation, selecting a sensor made out of a fully compatible material is best.

Are solids or liquids being measured? This is an extremely important question that must be considered upfront. Float-type sensors normally are a good solution for measuring liquids. However, when measuring solids, float-type sensors are impractical.

The following is a list of popular sensor types and the materials with which they are compatible:

- mechanical float sensors — fluids only;
- electromechanical (tuning fork or staff-based) —solid substances only;
- ultrasonic — both solids and fluids; and
- radar — both solids and fluids.

Remember, other design conditions besides the type of substance being measured could cause one of these sensors to perform better than another. The material being measured is just one factor to consider in device selection.

Where and how will the level sensor be placed — internally or externally? This question is important from a logistical standpoint. External sensors could require additional plumbing and installation costs while internal sensors may throw off production amounts or limit tank capacity. Some systems incorporate an internal sensor and an external display to convey information. In this case, always consider the requirements of both the internal and external components.

Is the material at rest or in motion? In a silo or storage vessel, a material may be stagnant at all times except during filling or extraction. In contrast, in a mixing tank, for instance, a substance may experience constant motion or agitation. In the latter case, ensure the sensor can withstand the movement of the material.

What temperatures and pressures will the sensor face? When considering temperature, sensors generally fall into two categories: those built to withstand extreme heat or cold, and those limited to common room temperatures. For example, a metal sensor will withstand

an extremely hot environment much better than a polytetrafluoroethylene one. As far as pressure, most sensors can handle 0 to 100 psi — but an extremely high pressure environment or vacuum could cause rupture or malfunction.

What is the density of the material? This question applies almost exclusively to fluids. Those that are fairly dense or contain floating solid particles often require more-complicated level measurement sensors. So, for example, a simple float sensor will suffice in a water cooler tank but may experience difficulties measuring rough crude oil because of the viscous nature of that fluid. A material also may include a mix of fluids such as oil and water. In such a case, a capacitance sensor can accurately measure the mixture. A magnetic float sensor with the buoyancy factor adjusted to the material would work, too.

Are multiple sensors required? Operations demanding more-detailed information than simply monitoring an overflow level often call for multiple sensors. A common application is when tanks have a recommended capacity as well as further measurements above or below that capacity. For example, a processor may need to know if a tank reaches the level considered "low" and continues to drain. The more advanced a sensor is, the more flexible it will be in these types of situations.

Must the sensor comply with any specific design codes? This is a very important question when dealing with hazardous or flammable materials. The sensors in these services typically must be either explosion-proof or intrinsically safe. Basically, can the sensor in any way be a source of ignition? Can a spark come from it under any conditions? If the answer to either of these questions is "yes," the sensor likely won't meet the required design codes for applications in the chemical, petrochemical, biotech, natural gas and semiconductor industries.

Does the liquid have a boiling or flash point? A sensor that can't withstand the boiling or flash point of a material could become a safety concern. For example, alcohol has a low boiling point and its vapors may degrade the seals of some sensors over time. This is a particular concern in some biotech and pharmaceutical applications and in semiconductor processes.

What level of measurement precision is desired? This impacts a sensor's price as well as the delicacy and intricacy of the device. A radar or infrared sensor accurate to ±0.5% costs substantially more than a simple float-level sensor accurate to ±5%. However, for certain critical applications, this investment quickly will pay for itself with more-accurate level measurement.

Is steam present in the process? Steam requires use of a more-robust, durable sensor. In biotech processes, steam-in-place cleaning often is used to sterilize tanks and components. A sensor present in this environment must be able to stand up to the harsh conditions.

What is the size and shape of the tank? A vessel's dimensions and form directly determine the placement of the sensor in relation to the material. This is because different materials fill containers in different ways. Liquids occupy the lowest areas first and rise with a level surface while powders and other solids often stack to a point and leave lower areas empty — perhaps requiring placing the sensor directly in the middle so it can accurately measure the highest point of the material.

Do you need a point value or a continuous mea-

surement? In a point-value measurement application, the sensor only will determine whether the material is above or below a particular point. In contrast, a continuous level sensor will measure the current level of material. Depending upon the application, this can be a very important distinction.

What other factors should be considered? You also may need to account for less-common design conditions such as mechanical shock (vibration or agitation caused by external forces), electrical interference or noise. For example, electrical interference from a radio transmitter like a walkie-talkie can affect the readout of a radio frequency sensor.

Be sure to thoroughly review each design condition of a given application before selecting a level measurement sensor. The specific conditions can make one measurement device suitable but another completely useless. For example, the distance between the sensor and the top of a "full" tank can determine whether or not an ultrasonic device is viable. Furthermore, a film or layer of floating solids at the surface of a liquid may disrupt the measurements of certain sensors. In short, a plethora of variables can and should contribute to the proper selection of a level-measurement sensor.

A specific concern at this point is assessing the potential impact of a material on the level sensor *over time*. For example, a material that's corrosive, viscous or has suspended solids, that can transition from one state to another with changes in pressure or temperature, or that's reactive or hazardous markedly will impact the selection of sensor type, materials of construction and other safety or durability features needed.

The next step in the selection process is to establish what will be done with the information collected by the device. If an alert must be sent when a tank reaches a certain level, the measurement device must be paired with the correct switch or output for transmitting that information. If multiple points along the path of a float sensor are to trigger different operations, each switch must be routed properly to its corresponding destination.

The last step in fully integrating a sensor into an operation is to choose accessories with appropriate functionality with which the sensor must interact to complete its desired task.

If each of these steps is considered with a desired end goal for the level measurement device in mind, the dependability, accuracy and consistency of level measurement should increase in any given operation.

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Customize Your Level Detection

Choose from myriad options to help achieve optimal level indicator performance

By Nicole Emanuel and Jenny Nielson Christensen, BinMaster Level Controls

CHOOSING THE best point level or liquid level sensor to monitor the inventory of valuable liquid, powder and solid chemicals is no small task. With customization options you can be confident that the sensor will be designed to match your inventory measurement specifications. The many types of sensors and myriad options available further complicate the decision-making and product-specification process. A customized level sensor will ultimately increase the utility of a level measurement sensor in a given application. Options to manufacture a device according to your specifications are numerous in devices such as:

- Rotaries
- Capacitance probes
- Vibrating rods
- Diaphragm switches
- Tilt switches
- Pressure transducers
- Magnetostrictive sensors
- Ultrasonic level sensors

These sensors all promise to deliver accurate and repeatable level detection, but when designed to fit a specific purpose, each sensor will reach its optimal performance level. Depending on whether your vessels contain corrosive materials, have thick walls, high temperatures, sanitary regulations, or any one of a number of specifications, customized point level indicators will provide the best fit solution.

ROTARIES DETECT SPECIFIED LEVELS

Rotary level indicators are installed for high, mid and low-level detection applications in bins, tanks or other vessels containing powders and bulk solids (Figure 1). They are integrated into a programmable logic controller (PLC) or connected to an alarm panel and programmed to send audible or visual alerts when tank contents reach specified levels. These alarms help prevent tank depletion and tank overfill, which can be a wasteful and costly consequence of an inadequate level monitoring system.

Extension options, made of galvanized or stainless steel, are available to tailor inventory management to each vessel. Vertical rotaries are ideal for when the rotary is used as a high-level

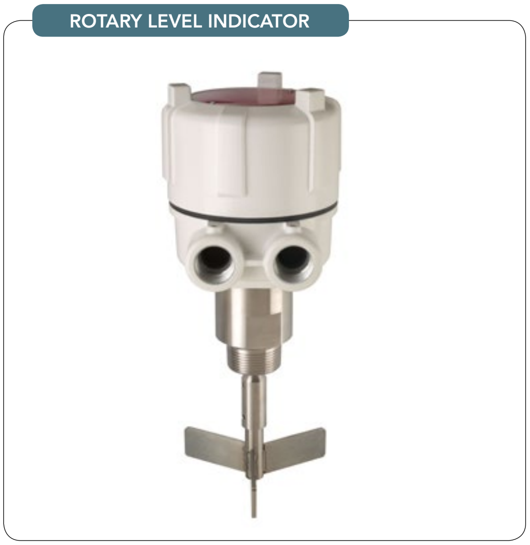

Figure 1. Rotary level indicators prevent depletion and overflow in bins, tanks and other vessels containing powders and bulk solids.

alarm. Most operators do not want to fill the vessels completely to the top and need to allow for a specific amount of headroom. This potential problem can be addressed with a customized shaft length, adjusted for the amount of headroom that is desired. A rotary shaft that is customized for high-level detection will send an alert when material reaches the desired level and will prevent bin overfill.

A second extension option is manufactured to address the problems of lump material level measurement. Flexible shaft rotaries (Figure 2) are ideal for high level detection in heavy materials or other lump solids. In these situations, a rigid extension can be damaged by the heavy materials. Instead of a fixed solid shaft extension, a flexible cable is attached to the rotary and mounted on top of the vessel. Extra movement capabilities allow for the rotary to detect high levels in a challenging environment without the risk of bending a rigid rotary extension shaft.

If the vessel that contains the material being measured has thick bin walls, such as a concrete silo, horizontal rotary extensions can be installed to ensure the shaft and paddle adequately clear the structure so the rotary can do its job. Horizontal extensions provide the ability for side-mounted rotaries to perform high, mid or low-level detection in a vessel. This design reduces the risk of damage during operation by allowing for the rotary to be attached through the side of a bin wall.

To accommodate differing material levels in a bin or silo, adjustable top-mounted rotaries (Figure 3) offer the ability to easily make changes without replacing the device or entering the bin. Installed on top of the bin, the

FLEXIBLE EXTENSION

Figure 2. Flexible shaft rotaries help detect high levels in heavy materials or other lump solids.

ADJUSTABLE ROTARY

Figure 3. Installed on top of the bin, an adjustable coupling can be moved up or down the length of the shaft to accommodate differing material levels.

top-mount rotary features an adjustable coupling that can be moved up and down the length of the shaft. This movement allows the rotary to accommodate material levels that are regularly or seasonally changing.

In smaller bins or hoppers where space is confined, a mini-rotary can be the best level measurement option. Designed to control material levels in compact spaces, its small size allows it to function where other devices simply will not fit. Although small, mini-rotaries are rugged and can handle a variety of light to heavy materials. Mounted on the top or side of a bin, the motor rotates when no material is present. As the material level rises, an alarm will sound to alert the operator that the bin is full.

Fail-safe rotary level indicators offer more advanced technology featuring a system that alerts to the loss of power, failure of the motor or failure of electronics, in addition to monitoring vessel levels. These progressive fail-safe capabilities make this type of rotary one of the best options in applications where continuous operation is essential. This device is also a good choice when operators need to constantly be knowledgeable of the unit's status. Appropriate for a variety of bulk solids, these rotaries can be mounted either on the side or the top of vessels.

When corrosive materials are present, a stainless steel process connection can be used in conjunction with a rotary to provide more accurate measurement and a longer lifespan for the device. Rotaries equipped with the connection are configured so all materials that come into contact with the bin are stainless steel. This makes stainless steel process connections ideal for food and pharmaceutical applications where sanitary requirements exist. It's also suitable for rugged applications, such as when working with caustic or corrosive materials.

When external temperatures outside the bin regularly reach high temperatures, a heat tube can be added to distance electronics away from the heat source. Heat tubes attach to top- or side-mounted rotaries in environments with high temperature. They can also be used to extend the rotary beyond insulation on the outside of a vessel.

Rotary customization options are not limited to, but include:

- Vertical rotaries
- Flexible shaft rotaries
- Horizontal rotary extensions
- Adjustable top-mount rotaries
- Mini rotaries
- Fail-safe rotaries
- Stainless steel process connections
- Heat tubes

In addition to several rotary extensions and custom fittings, selecting one of the numerous paddle options will further customize your rotary device and ensure a high performance level. Whether you are measuring the levels of light or heavy material, selecting the right paddle will improve the rotary's function. Options for single blade, double blade, three-vane and bayonet-style paddles vary in diameter to achieve the best fit for each vessel. To prevent personnel from entering the bins, collapsible rotary paddles are an available solution to address safety concerns. Made of stainless steel or nylon, paddles attach to top- and side-mounted rotary level indicators.

CAPACITANCE PROBES SUIT DIRTY ENVIRONMENTS

Capacitance probes are point level indicators used for high- or low-level detection. Installed in bins, tanks, silos, chutes and other vessels, this device monitors inventory accurately in several material storage applications. These sensors can monitor content levels with precision in environments with sticky, dusty or clinging materials and offer a variety of customization options to ensure that the device is well designed to meet unique inventory management needs.

The probes sense minute changes in material presence or absence by detecting differences in dielectric constants. Interference-free operation ensures that the capacitance probe will not interrupt the signals of other equipment operating in the radio spectrum. An adjustable time delay can be programmed to allow for material settling. These devices are suitable for many applications and include options for solid and flexible extensions.

For materials that have rigorous sanitary regulations, there are capacitance probe options designed to perform under these operational and clean-in-place (CIP) requirements.

Challenging environments create difficult inventory management problems. However, there are capacitance probes designed to perform in hazardous locations that offer a solution in these applications. Supported by a variety of approvals and certifications, these point level indicators are installed where there is a risk of explosion and when working with volatile materials.

In hostile conditions, such as hazardous environments, high temperatures and high vibration, capacitance probes with remote electronics are a suitable solution. These sensors locate their electronics in a remote housing, separated from the probe, to offer accurate readings in tough conditions. Adjustable sensitivity makes these probes highly reliable in a variety of powders, liquids, solids and slurries.

Capacitance probes with auto calibration provide simple and automatic calibration and external testing without having to remove the unit's cover. A specific magnet is used to perform the calibration in just seconds.

In small spaces, flush mount and compact capacitance probes can make a big difference in materials management. Flush mounted probes are

FLEXIBLE PROBE

Figure 4. The flexible capacitance probe is ideal for measuring levels in tight spaces.

non-intrusive and are ideal for confined spaces where material flow may damage a standard probe. Compact capacitance probes are designed for application in tanks, silos, chutes, pipes or other tight spaces. These sensors offer reliable level measurement and plugged chute detection where proximity switches will not work. Bendable capacitance probes also are designed for tight spaces. They provide a bendable attachment for applications where obstructions prevent the installation of a straight probe (Figure 4). This probe is side-mounted and often used for high and low detection in smaller containers.

Capacitance probes feature made-to-order options for applications such as:

- Sanitary applications
- Hazardous locations
- Remote electronics
- Auto calibration
- Flush mount
- Compact probes
- Bendable probes

VIBRATING ROD

Figure 5. Vibrating rods are point level indicators used for a variety of materials and can detect plugged chutes.

DETECT PLUGGED CHUTES WITH VIBRATING RODS

Vibrating rods, also called vibrating switches, are reliable point level indicators used for high and low detection or to detect plugged chutes (Figure 5). These sensors offer several options to match the vibrating rod with your specific inventory management application.

Standard vibrating rods are suitable for a variety of materials, but in some applications its insertion length will hinder the rod from achieving its peak performance capabilities. In these situations, mini vibrating rods can offer a compact solution. In small bins and silos, these sensors can be top- or side-mounted and are easy to install. These point level indicators are designed to overcome difficulties associated with changes in dielectric constant, humidity, temperature and material density. Mini vibrating rods feature sensitivity adjustments to function in materials ranging from light and fluffy to heavy and clingy.

Another option for point level detection, including detection in chemicals that are extremely light and fluffy, is a flexible extended vibrating rod. These sensors use a reinforced cable that is custom manufactured to the desired length specification, which allows for the insertion length to vary from a few

DIAPHRAGM SWITCH

Figure 6. High performance diaphragm switches can be mounted inside or outside of a vessel.

inches to several feet. In tanks where a sturdier rod is required, rigid vibrating rod extensions are available. Rigid extended vibrating rods are also built to customized lengths. These extensions are intended for top mount locations with galvanized or stainless steel options and are designed to allow material to easily flow and prevent buildup.

Vibrating rods can also be used for point level detection in sediments that have settled under water. Designed to detect the level of submersed solids that have settled in a tank containing liquids, the vibrating rod vibrates in the water and then stops vibrating when solid material reaches the level of the probe. An alarm alerts facility operators that the sediment has reached the probe and needs to be removed. This type of point level indicator is frequently used to detect chemical levels and other solid material that has settled in tanks containing wastewater generated from the processing of chemicals.

Advanced options available for vibrating rods include:

- Mini Vibrating Rods
- Flexible Extended Vibrating Rods
- Rigid Extended Vibrating Rods
- Sediment Level Detection Vibrating Rods

RELIABLE DIAPHRAGM SWITCH

A diaphragm or pressure switch works by activating a sensitive microswitch when material reaches the level of the switch in the bin, tank or silo. It sends an alert that can be used to start or stop a process or alert to a high, medium or low level in a vessel. This switch can be mounted inside or outside of a vessel and features options designed for high performance in numerous applications (Figure 6).

In environments where there is risk of combustible dust, a diaphragm switch for hazardous locations provides automatic point level indication. This device senses free-flowing, dry materials and can be installed to detect high, medium and low levels. Audible or visual alerts are programmed to easily monitor inventory. Rugged construction enables this diaphragm switch to perform in vessels reliably and over a long lifespan.

The plugged chute detector is a type of diaphragm switch designed specifically to send alerts when a chute becomes plugged. This pressure switch is made of rugged materials and ideal for applications in chutes that transport flowing granular or pelleted materials. Many plugged chute detectors

TILT SWITCH

Figure 7. As material level rises in a bin, the tilt switch tips and activates a microswitch, which causes an alarm to sound.

feature explosion-proof certification, so they are appropriate when working with volatile materials.

VERTICAL TILT SWITCH

A tilt switch is used for point level detection and plugged chute detection. As material level rises, the switch tips and activates a microswitch, which causes an alarm to sound. Tilt switches are suspended vertically over a silo, conveyor belt, over an open pile and are also used in plugged chute detection (Figure 7).

Due to environmental compliance, some operations may require a mercury-free tilt switch option. This type of switch is installed on the vessel roof and is used for high level detection. Its principle of operation is the same, but it comes without the risk of mercury contamination and the inherent hassle of mercury disposal. Both types of tilt switches offer sphere or paddle attachments for the end of the shaft and customizable shaft lengths. A tilt switch manufactured to meet specific length requirements will be a valuable asset in materials management.

LIQUID LEVEL SENSORS IN CHEMICAL TANKS

Chemical tanks require liquid level sensors for a variety of applications. Common sensor types used in liquid level applications include:

- Pressure Transducers
- Magnetostrictive Sensors
- Ultrasonic Level Sensors

A popular type of liquid level sensor is a pressure transducer or pressure transmitter. These devices are used in both process and storage environments. They are affordable and versatile for a wide range of chemicals. There are both submersible sensors (Figure 8) and models for external mounting, depending on the design of the vessel and the application. External mounting is often preferred on tanks located in extreme environments. A heavy-duty pressure transducer can handle dirt and fine dust, water spray and wash downs and outdoor installation in inclement weather, hazardous locations and high vibration. A submersible pressure sensor can be used in just about any liquid. They are also commonly used in wastewater and leachate tanks. Amplified output pressure sensors are designed for industrial applications and suitable for both liquids and gasses. They provide accurate measurement and a long life expectancy at a low cost.

LIQUID LEVEL SENSOR

Figure 8. A submersible pressure sensor can be used in just about any liquid.

Magnetostrictive level sensors are a type of continuous float level transmitter used in a wide variety of chemicals. They are suitable for rigorous applications requiring a heavy duty sensor and offer a simple setup and long lifespan. These sensors' features generally offer hazardous location certifications crucial in the chemical industry. They are used in chemical tanks, wastewater lift stations, and process tanks with reliable results. They are appropriate for applications where there is violent turbulence inside the tanks — with no bent probes or stuck floats. They are often used to detect interface levels inside production tanks, as a two-float design allows monitoring of both the top level and the interface level with a single sensor.

Ultrasonic level sensors provide precision and accuracy to monitor tank levels. These non-contact liquid level sensors offer remote monitoring for very small to very large tanks and various hazardous location approvals. Ultrasonic sensors have proven reliable in demanding applications in chemical processing and industrial waste management. Measuring the level or volume of a body of liquid in a tank, well or pit is one of the most popular uses for ultrasonic sensors. A variety of sensor options gives plant managers the power to decide which ultrasonic sensor will be most successful in their facility.

NO ONE-SIZE-FITS-ALL APPROACH

There is no blanket solution to solving level indication problems, which is why customized devices offer the best solution. These devices are manufactured based on the specific needs of each unique operation. This additional attention to detail will translate to longer product life spans, more accurate level detection and reduce maintenance labor, among other cost-saving benefits. From rotaries to ultrasonic level sensors and everything in between, the effort to determine the exact features that you require in a level indicator will be rewarded over time.

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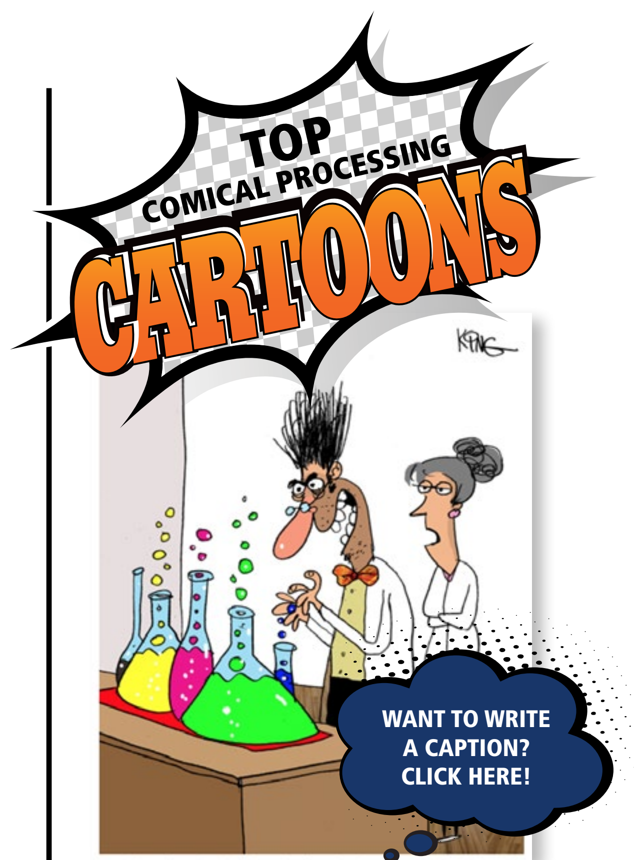

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