

Kimray Level Switches

A practical guide to kimray level switches, covering the reader intent, the relationship to kimray level switches, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



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Main topic: Level Switches

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In the demanding environments of oil and gas production, chemical processing, and industrial automation, the ability to accurately detect liquid interfaces is critical for safety and operational efficiency. Kimray level switches are specialized instruments designed primarily for these rugged applications, particularly in upstream and midstream oilfield equipment like separators, treaters, and scrubbers. Understanding the mechanical principles, configuration options, and installation requirements of these devices is essential for engineers tasked with maintaining process integrity.

While Kimray is a staple in the oilfield, the broader category of Level Switches encompasses a wide range of technologies, including ultrasonic, capacitive, and optical sensors, which are often used in tandem with or as alternatives to traditional float-based mechanical switches.

| Measurement Principles of Kimray Level Switches

Kimray level switches operate predominantly on the principle of buoyancy, specifically utilizing a float or a displacer to actuate a control signal. The physics behind these devices is governed by Archimedes' Principle, which states that any object, wholly or partially immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object.

| Pneumatic Actuation

In pneumatic models, the movement of the float is transmitted through a pivot mechanism to a pilot valve. As the liquid level rises, the buoyant force overcomes the weight of the float (or the spring tension in the pilot), causing the pilot to shift.

Snap-Acting: These switches provide an "all or nothing" signal. Once the liquid reaches a specific set point, the pilot snaps open or shut, immediately sending a full pressure signal to a dump valve or alarm. This is ideal for preventing valve hunting and ensuring a clean opening/closing cycle.

Throttling: Unlike snap-acting models, throttling switches provide a modulating pneumatic signal that varies based on the float position. This is used in applications where a steady flow is preferred over intermittent dumping.

| Electric Actuation

Electric level switches replace the pneumatic pilot with a microswitch. When the float reaches the trip point, the mechanical linkage triggers an electrical contact (SPDT or DPDT). These are commonly used in automated facilities where a PLC (Programmable Logic Controller) or SCADA system monitors the vessel status. Electric models are often housed in explosion-proof enclosures to meet hazardous area classifications (Class I, Div 1).

| Key Product Categories and Specifications

Kimray's portfolio is categorized by the method of signal transmission and the physical orientation of the mounting. The most common versions include the Gen II series and the traditional high-pressure float switches.

| Gen II Level Switches

The Gen II series represents a versatile design capable of being converted between pneumatic and electric operation. It features a compact footprint and is often used on small production vessels.

Body Materials: Typically Ductile Iron or 316 Stainless Steel for corrosive environments.

Pressure Ratings: Standard units often handle up to 2,000 psi (138 bar), though specific configurations vary.

Interface Detection: By adjusting the weight of the float or the spring tension, these switches can be calibrated to detect the interface between two liquids of different densities, such as oil and water.

High-Pressure Float Switches

Designed for heavy-duty applications, these switches utilize robust horizontal or vertical floats. They are frequently found on high-pressure separators where the differential pressure between the vessel and the atmosphere is significant.

Selection Criteria for Industrial Applications

Choosing the correct level switch requires a detailed analysis of the process media and the environmental conditions. The following table provides a general comparison of typical specifications for standard level switch configurations.

Feature	Pneumatic Snap-Acting	Electric (Explosion-Proof)	Throttling Pneumatic
Primary Use	Dump valve control	Alarm/PLC input	Modulating flow control
Max Pressure	Up to 2,000 psi (138 bar)	Up to 1,500 psi (103 bar)	Up to 1,500 psi (103 bar)
Temp Range	-20°F to 400°F (-29°C to 204°C)	-20°F to 250°F (-29°C to 121°C)	-20°F to 400°F (-29°C to 204°C)
Supply Media	Compressed air or Natural gas	N/A (Electrical)	Compressed air or Natural gas
Connection	2" NPT (standard)	1.5" or 2" NPT	2" NPT
Materials	Carbon Steel / 316 SS	Carbon Steel / 316 SS	Carbon Steel / 316 SS

Critical Evaluation Factors

1. Specific Gravity (SG): The float must be lighter than the liquid it is intended to measure but heavier than the gas above it. For interface applications, the float must sink in the top liquid (e.g., oil, SG 0.8) and float in the bottom liquid (e.g., water, SG 1.0).

2. Corrosive Elements: If H₂S (sour gas) is present, NACE MR0175/ISO 15156 compliance is mandatory for all wetted parts to prevent sulfide stress cracking.

3. Vessel Geometry: Ensure the internal float arm has sufficient clearance to move through its full arc without hitting internal baffles or heating coils.

| Installation and Calibration Best Practices

Proper installation is the most significant factor in the longevity of a level switch. Because these are mechanical devices, they are susceptible to wear and fouling if not positioned correctly.

| Mounting Orientation

Most Kimray level switches are designed for horizontal mounting into a 2" NPT female connection on the side of a vessel. It is vital that the switch is level. If the switch is canted, the internal friction on the pivot pin increases, which can lead to sticking or delayed actuation.

| Pneumatic Supply Quality

For pneumatic switches, the quality of the supply gas is paramount.

Filtration: A 40-micron filter should be installed upstream to prevent particulates from clogging the small orifices in the pilot.

Dehydration: If using natural gas as the supply medium, ensure it is dry. Wet gas can lead to hydrate formation in cold weather, which will freeze the switch in position.

Drip Legs: Install a drip leg (sediment trap) immediately before the switch to catch any liquids that condense in the supply line.

| Calibration Steps

1. **Zeroing:** With the vessel empty or the liquid below the float level, adjust the spring tension until the pilot is in the "off" position.
2. **Sensitivity Adjustment:** For snap-acting switches, the "span" or differential can sometimes be adjusted by moving the position of the block on the pilot rod. This determines how much the liquid must rise or fall before the switch toggles state.
3. **Bench Testing:** Whenever possible, verify the switch operation with a bucket of water or the process fluid before installing it on a pressurized vessel.

| Limitations and Environmental Considerations

While float-based switches are highly reliable due to their simplicity, they are not suitable for every application. Engineers should be aware of the following limitations:

Viscous and Coating Fluids: In heavy crude oil or paraffin-rich environments, the float and linkage can become coated. This increases the weight of the float and adds friction to the pivot, eventually causing the switch to fail in the "down" position.

Turbulence: In vessels with high agitation or splashing, a mechanical float may bounce, causing the switch to "chatter." In these cases, a stilling well (a pipe surrounding the float) should be installed to dampen the liquid surface.

Vibration: Extreme mechanical vibration from nearby compressors can lead to premature wear of the pilot seals and pivot pins.

High Solids Content: Sand or scale accumulation in the bottom of a vessel can bury a low-level switch, preventing the float from moving.

In applications where these limitations are present, non-contacting technologies such as radar or ultrasonic level meters may be more appropriate. However, for standard oilfield separation, the mechanical level switch remains the industry standard due to its ability to operate without external electrical power (in pneumatic versions).

| Frequently Asked Questions (FAQ)

Q: Can I use a Kimray level switch for high-temperature steam applications?

A: While some models are rated up to 400°F (204°C), standard seals (usually Viton or Nitrile) may degrade in high-pressure steam. Always verify the elastomer compatibility with the specific temperature and chemical makeup of the steam.

Q: Why is my pneumatic level switch constantly venting gas?

A: This usually indicates a failed O-ring or diaphragm within the pilot assembly, or debris lodged in the pilot seat. If the switch is a "non-venting" model, any continuous bleed is a sign of internal leakage.

Q: How do I convert a pneumatic switch to an electric one?

A: For the Gen II series, this is accomplished by removing the pneumatic pilot housing and replacing it with an electric switch housing. The internal linkage remains the same, but the actuation method changes from air pressure to a microswitch contact.

Q: What is the difference between a displacer and a float?

A: A float is designed to be lighter than the liquid and stay on the surface. A displacer is typically heavier than the liquid and relies on the change in its apparent weight (buoyancy) as it is submerged to actuate the switch. Kimray switches often use the term interchangeably in field manuals, but the calibration logic differs slightly.

Q: How often should these switches be maintained?

A: In standard service, a semi-annual visual inspection and a functional "pull test" (manually lifting the float arm if accessible) are recommended. In corrosive or high-paraffin service, quarterly inspections may be necessary to ensure the float remains free of buildup.

By carefully matching the switch specifications to the vessel's operating pressure, temperature, and fluid properties, operators can ensure reliable level control. For complex automation needs, integrating these mechanical solutions with modern Level Switches provides a robust defense against vessel overfills and equipment damage.