Understanding Deadband: Why the Differential in Your Pressure Switch Matters



What Is Deadband in a Pressure Switch?

In industrial instrumentation, precision and system longevity depend on more than just the accuracy of your set point. One of the most critical mechanical concepts to understand when selecting a pressure switch is **deadband**, also commonly referred to as **differential**.

Deadband is the buffer zone that prevents your system from over-cycling, ensuring equipment operates smoothly rather than toggling on and off continuously.

Technically, deadband is defined as the difference between:

- The **increasing pressure** at which the switch actuates (the set point)
- The **decreasing pressure** at which the switch resets (the reset point)

This differential represents the mechanical motion lost within the electrical switching element as it reverses state.

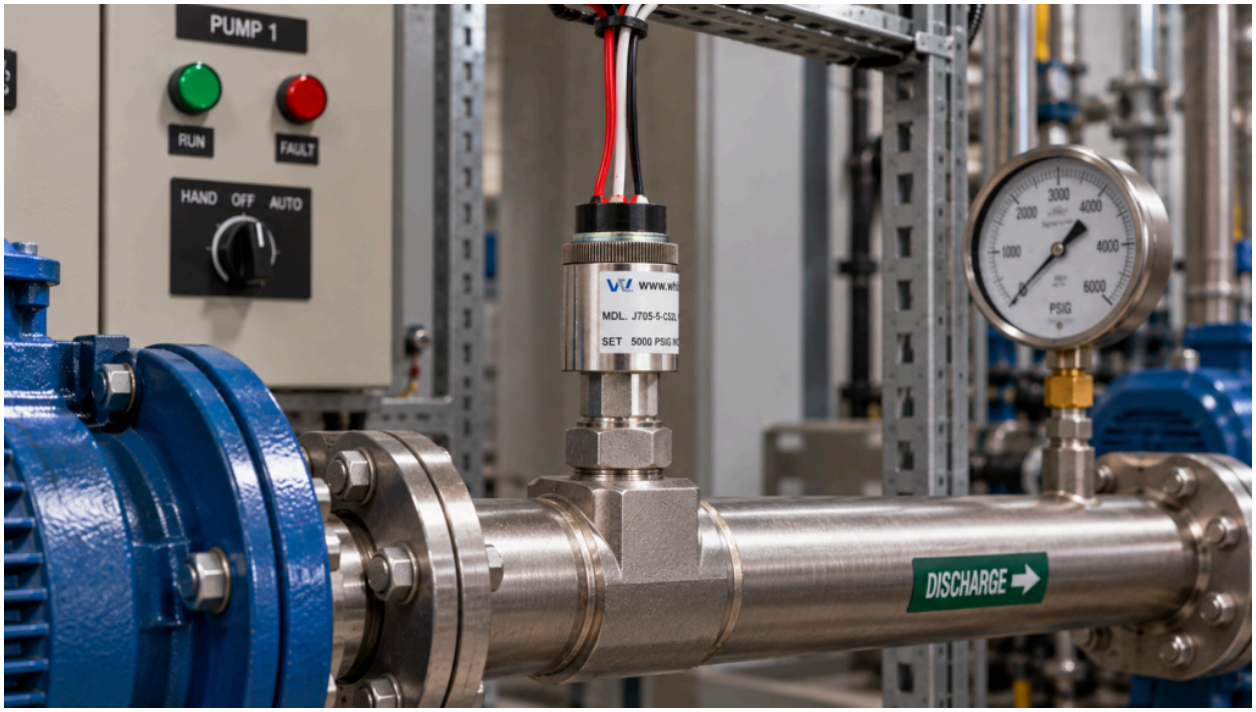
Key Concepts to Know

- **Actuation vs. Reset** The set point is where the switch opens or closes a circuit. The reset point is the pressure level required for the switch to return to its original state.
- **Mechanical Influence** The differential tends to be larger in high-amperage switches than in low-amperage switches due to the physical requirements of the switching element.
- **Hysteresis** This term describes the overall difference in switch response when moving between increasing and decreasing pressure levels, essentially the same phenomenon as deadband, viewed from a system-behavior perspective.

Why Deadband Matters in Industrial Applications

Without an appropriate deadband, a pressure switch would trigger at the slightest pressure fluctuation, a condition known as **switching chatter**. This rapid cycling causes premature mechanical failure in both the switch and the equipment it controls, such as pumps and motors

- **Preventing Over-Cycling**: In pump and fan control applications, a wider differential is often ideal. It prevents the system from turning on and off too frequently, reducing wear across the entire system loop.
- **System Stability**: Proper deadband management keeps process variables within a safe range without causing unnecessary stress on hardware or creating erratic operational behavior.
- **Accuracy and Repeatability**: For high-precision requirements, switches designed with low repeatability errors ensure the deadband remains consistent over time, critical in applications where deviation compounds.
- **Protection Against Pressure Spikes**: In demanding environments, rugged switch models are specifically chosen for their ability to withstand significant pressure spikes without causing the set point or reset point to drift.



Industrial pump control system with pressure switches installed on a pipeline

Selecting the Right Pressure Switch for Your Differential Needs

Every application requires a different balance between a tight actuation range and a protective deadband. Whitman Controls offers a product catalog designed to match the right switch to your specific hydraulic variables.

- **Economical Control – P88G Series**: The **P88G Series** is suited to applications where reliable switch control matters more than extreme set point accuracy. It delivers consistent differential control for pumps and fans in standard-duty environments.
- **High-Pressure Precision – J205G Series**: The **J205G Series** provides versatility in high-pressure environments up to 5,000 PSIG while maintaining clear, repeatable set points and stable differential performance.
- **Severe-Duty Resilience – P605 Series**: For hydraulic test rigs or mining equipment, the **P605 Series** handles pressure spikes up to 9,000 PSIG without compromising internal differential settings, purpose-built for the harshest conditions.
- **Calibrated Reset Points**: Whitman also provides options with specific, calibrated reset point ranges, ensuring your system behaves precisely as intended across varying operating conditions.

How to Select the Right Pressure Switch for Your Application

Choosing between diaphragm, piston, and capsule switches requires a structured review of four core variables. Work through these in order:

Step 1 – Determine Maximum System Pressure: Account for normal operating pressure and potential surge or spike pressures. This will immediately eliminate sensing technologies that cannot handle the load.

Step 2 – Define Your Required Set Point: Identify the exact pressure at which you need the switch to trigger, and whether activation should occur on increasing or decreasing pressure.

Step 3 – Confirm Media Compatibility: Match the wetted materials such as 316 Stainless Steel, Buna N, or Viton O-rings to the fluid, gas, or chemical your system carries. Incompatible materials will degrade switch performance and reduce service life.

Step 4 – Decide on Adjustability: Choose between a factory-set (F-set) non-adjustable model for fixed, repeatable set points or a customer-set (C-set) field-adjustable model for applications where conditions may evolve over time.



Whitman Controls pressure switch models including the P88G Series, J205G Series, and P605 Series

About Whitman Controls and Industrial Control Solutions

Whitman Controls, part of Industrial Control Solutions, has been manufacturing precision vacuum, temperature, pressure, and liquid level switches and sensors for over 40 years. What began as a focused instrumentation manufacturer has grown into a trusted name across some of the most demanding industries in the world – aerospace, defense, semiconductor, medical and industrial automation.

As a **Service-Disabled Veteran-Owned Small Business**, Industrial Control Solutions was built on the same principles that define military service: tireless dedication, rigorous quality standards, and an unwavering commitment to the mission. That foundation isn't marketing language, it shapes how we engineer every product, handle every order, and support every client relationship.

We don't offer off-the-shelf compromises. Every sensor solution we build is configurable to your exact application, accounting for media environment, pressure range, temperature exposure, mounting constraints, and dozens of other specifications. If a standard product doesn't meet your requirements, we build one that does and we back it with full documentation and traceability at every step.

Every product ships with full traceability documentation under our ISO 9001:2015 certification, giving customers confidence that internal processes, materials, and finished products have all met the highest standards of quality and regulatory compliance.

At Industrial Control Solutions, our most loyal clients have been with us for the entirety of our 40+ years in business. That kind of partnership isn't accidental. It is the direct result of a commitment to delivering exactly what we promise; high-quality products, built to specification, backed by people who stand behind their work.

Our product portfolio spans four specialized USA-manufactured lines:

Whitman Controls – Vacuum, pressure, temperature, and liquid level switches engineered for precision and durability in extreme environments
Load Controls – Pump load controls, compact power sensors, fast-response load controllers, current sensors, and VFD-compatible solutions
Thomas Products – Flow switches, level switches, pump controls, multi-level switches, and visual indicators
Duro-sense – High-quality platinum and noble thermocouples, RTDs, and ISO 17025 calibrated wire

Frequently Asked Questions

Q1: What is the difference between deadband and hysteresis in a pressure switch?
They refer to the same underlying behavior but from different perspectives. Deadband specifically describes the pressure gap between the actuation point and the reset point. Hysteresis is the broader engineering term for this lag in switch response when transitioning between increasing and decreasing pressure states. In practice, both terms are used interchangeably in pressure switch documentation.

Q2: What causes switching chatter in pressure switches?
Switching chatter occurs when a pressure switch has an insufficient deadband relative to the natural fluctuations in system pressure. The switch repeatedly triggers and resets in rapid succession, accelerating wear on the switch contacts, motor starters, solenoids, or other controlled equipment. Selecting a switch with an appropriately wider differential for your system eliminates this issue.

Q3: Is a larger deadband always better for my system?
Not necessarily. A wider deadband prevents over-cycling but allows the process variable to deviate further from the set point before the switch resets. For applications requiring tight process control such as precision hydraulic systems – a narrower, calibrated deadband is preferable. The right deadband depends on your tolerance for pressure variation versus mechanical longevity.

Q4: Can the deadband on a pressure switch be adjusted?
Some pressure switch models offer adjustable differential ranges, while others are factory-calibrated to fixed reset points. Whitman Controls offers both standard and calibrated switch options, depending on how precisely your system needs to operate.

Q5: What pressure switch should I use for high-spike environments like mining or hydraulic test rigs?
The Whitman Controls P605 Series is engineered for exactly these conditions. It can withstand pressure spikes up to 9,000 PSIG without causing the set point or reset point to shift, maintaining consistent internal differential settings even under severe mechanical stress.