



REDRAVEN IOT SOLUTIONS FOR VALVES

Pressure Swing Adsorption

Pressure swing adsorption (PSA) is most commonly used in chemical processing facilities to separate and purify a wide range of industrial gases. It can also be utilized in refinery units, ethylene plants, propane dehydrogenation plants, hydrogen manufacturing units (steam methane reforming) and air separation units. The PSA process uses “beds” of solid adsorbents to filter impurities from a feed gas. Control valves play a crucial role in the process, as they regulate the forward and reverse flows of feed gas across these beds.

Valves used for PSA applications must perform with maximum availability and reliability: they are expected to cycle every few minutes while alternating between tight shut-off and bi-directional flow. Unexpected valve outages or unplanned maintenance would compromise efficiency and production.

Common valve factors affecting PSA operations

- Mechanical damage due to fatigue
- High friction, causing deviations in stroking speed
- Bearing wear in rotary valves
- Packing leaks
- Seat wear, leading to increased leakage
- Loosening of parts due to vibration and cycling

Impact of valve failures

PSA is vulnerable to production constraints when control valves fail or deviate from expected behavior. Typical practice is to follow a reactive approach to maintenance, i.e., addressing maintenance after the failure has occurred. This often leads to PSA beds being taken offline, compromising production rates. In addition to loss of production, valve failures can also lead to hydrocarbon leaks, resulting in regulatory fines and hazardous plant conditions. On a typical large-scale hydrogen plant, a 1% increase in PSA unit availability and production through **reduced downtime** could potentially lead to a direct positive impact of \$3 million to \$5 million annually. When we take into account the cascading effect of the hydrogen network and its impact on downstream units consuming the produced hydrogen, the benefit is significantly higher.





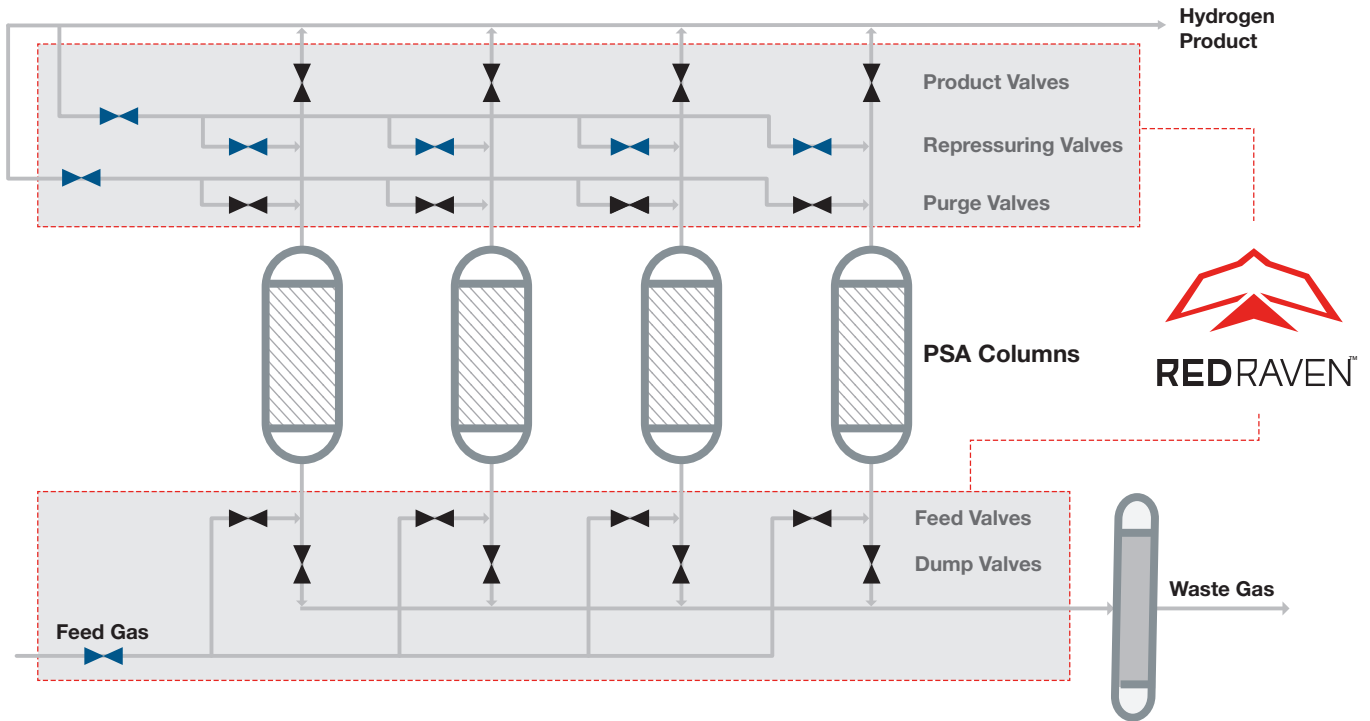
RedRaven IoT Solutions for Valves

RedRaven can prevent valve failures

RedRaven works with existing digital positioners to alert you when a valve deviates from normal operating conditions. Each control valve in the PSA process is connected to the monitoring center and assists operations and maintenance by providing continuous performance insights, keeping the plant operating at peak efficiency, allowing you to:

- Proactively identify upcoming valve failures and take preventive action before they cause an interruption, eliminating expensive repairs, unexpected downtime and thus improving uptime
- Monitor valve performance in near/real time from anywhere
- Make more informed decisions to improve plant efficiency, productivity and profitability
- Improve compliance to health, safety and the environment (minimizing emissions)
- Reduce maintenance costs and required planning time

Typical four-bed PSA process



Valves in Typical Four-bed PSA
 ~16 Actuated Rotary Valves (3 to 6 in)
 ~7 Actuated Globe Valves (2 to 4 in)

- ▶ **Globe Control Valve Connected to RedRaven**
- ◀ **Rotary Control Valve Connected to RedRaven**



RedRaven IoT Solutions for Valves

RedRaven offerings for valves

Insight monitoring: Operators of chemical plants and oil refineries can obtain a detailed view of their valves' health through an online cloud portal and gain access to experienced professionals for analysis.

Access monitoring: With this on-premises solution, your plant personnel and Flowserve technical specialists can view aggregated data while on site to make decisions.

RedRaven compared to other asset management systems

Feature	RedRaven	Other Asset Management Systems
Data	<ul style="list-style-type: none"> - Resolution intact - Continuous capture and storage 	<ul style="list-style-type: none"> - Loss of resolution with limited parameters captured - Overwritten on a 30-, 60- or 90-day cyclical basis
Visibility	<ul style="list-style-type: none"> - Comprehensive asset health view across multiple sites and asset management systems 	<ul style="list-style-type: none"> - View across a single site with only one asset management system - Incompatible with multiple sites across different asset management systems
Trend/event logs	<ul style="list-style-type: none"> - Detailed historical information captured 	<ul style="list-style-type: none"> - Positioner has limited memory and is overwritten via first in, first out (FIFO) log
Failure detection and analytics	<ul style="list-style-type: none"> - Packing leaks in control valves - Signature comparison 	-
Valve information	<ul style="list-style-type: none"> - Links to birth certificate - IOM 	-
Expertise on demand	<ul style="list-style-type: none"> - Access to experienced professionals for analysis - Failure notification, enabling serviceability - Quick Response Center support 	-
Pumps, valves and seals	<ul style="list-style-type: none"> - Detailed, holistic information on a subprocess 	-

RedRaven compared to ValveSight™

Feature	RedRaven	ValveSight
Connectivity and availability	<ul style="list-style-type: none"> - Continuous, multiple positioners, readily accessible 	<ul style="list-style-type: none"> - Only while connected to the positioner
Data capture and resolution	<ul style="list-style-type: none"> - Continuous capture - Resolution intact 	<ul style="list-style-type: none"> - Snapshot when connected - Resolution lost over time
Sensor types	<ul style="list-style-type: none"> - Positioner, vibration, temperature 	<ul style="list-style-type: none"> - Positioner
Alerts	<ul style="list-style-type: none"> - Notifications for alarms 	-
Positioner visibility	<ul style="list-style-type: none"> - Comprehensive dashboard of multiple positioners 	<ul style="list-style-type: none"> - Single positioner visibility while connected
Trend/event logs	<ul style="list-style-type: none"> - Detailed historical information available 	<ul style="list-style-type: none"> - Positioner has limited memory and is overwritten via FIFO log
Valve information	<ul style="list-style-type: none"> - Links to birth certificate - IOM 	-



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