THE SMART SOLENOID –
Reliable Condition Monitoring in Process Industry

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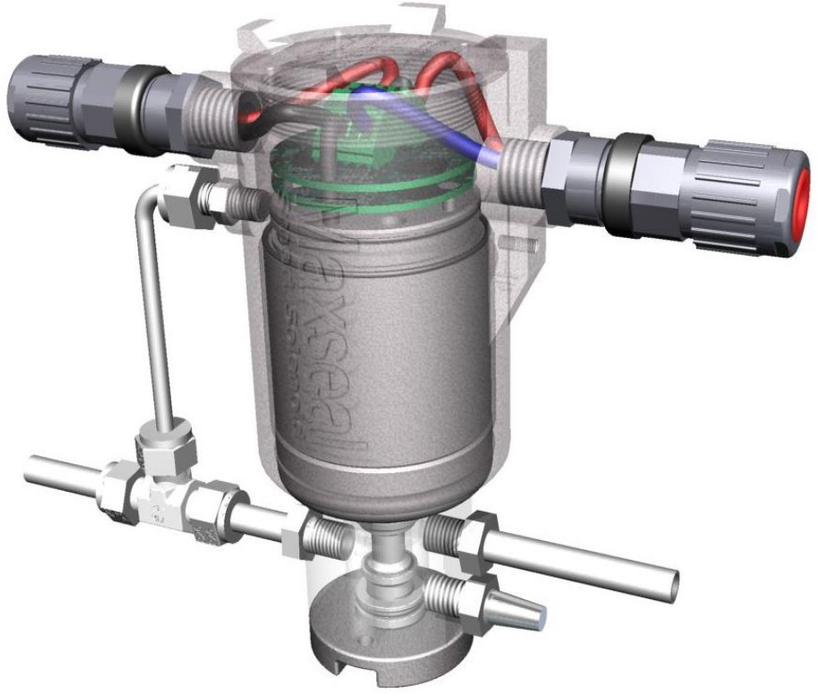

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- World leader in the precise fluid control and movement
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- **MARKETS:** Industrial Automation, Rail, Commercial Vehicles, Life Sciences, Oil & Gas
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- Process and multimedia solenoid valves and system solutions

IMI MAXSEAL®

- Stainless steel solenoid valves for harsh environments

IMI FAS®

- Comprehensive portfolio of miniature fluid control solutions

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A Challenge in Process, Oil & Gas Industry

Safety/Reliability and Operating Time/Profit

Automated Process Control Valves

The reliable „Heart“ of every plant

- **Control production processes**
- **Bypass pipework for maintenance**
- **Emergency shutdown**
- **In short: *Operate on Demand***

High reliability, safety and life time requirements

Need for Data capturing (CM, PdM) and functional testing

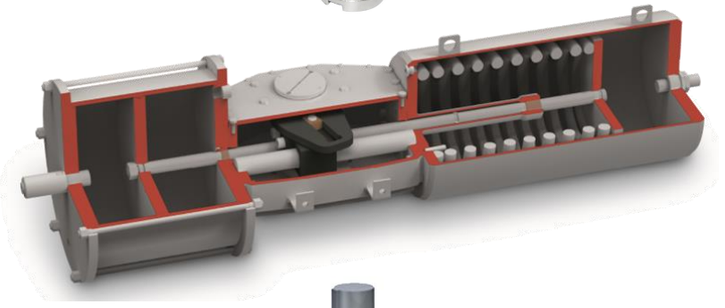
- **Must be reliable at staying on as well as turning off**
- **Must Work in hot and cold places**
- **Product quality is essential**
- **Product must be easy to use**

Typical failures in real life applications

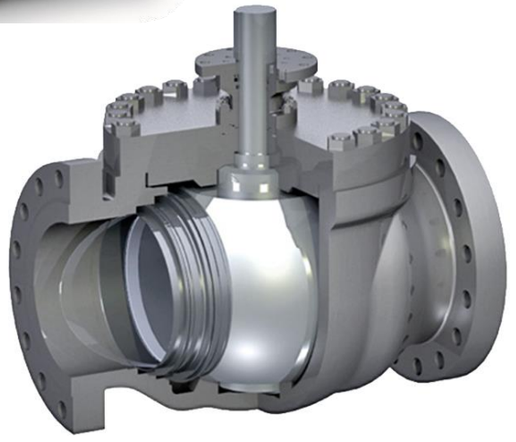
A SMART System has to detect and predict

- **Solenoid valve**
  - *Blocked inlet or exhaust port*
  - *Restricted exhaust flow (Dust build-up, Salt encrustation, Icing, Insect nests)*
  - *Damaged piping*

- **Actuator**
  - *Loss of spring force or Spring broken*
  - *Drop in output torque (Lost lubrication, Seal degradation, Icing)*

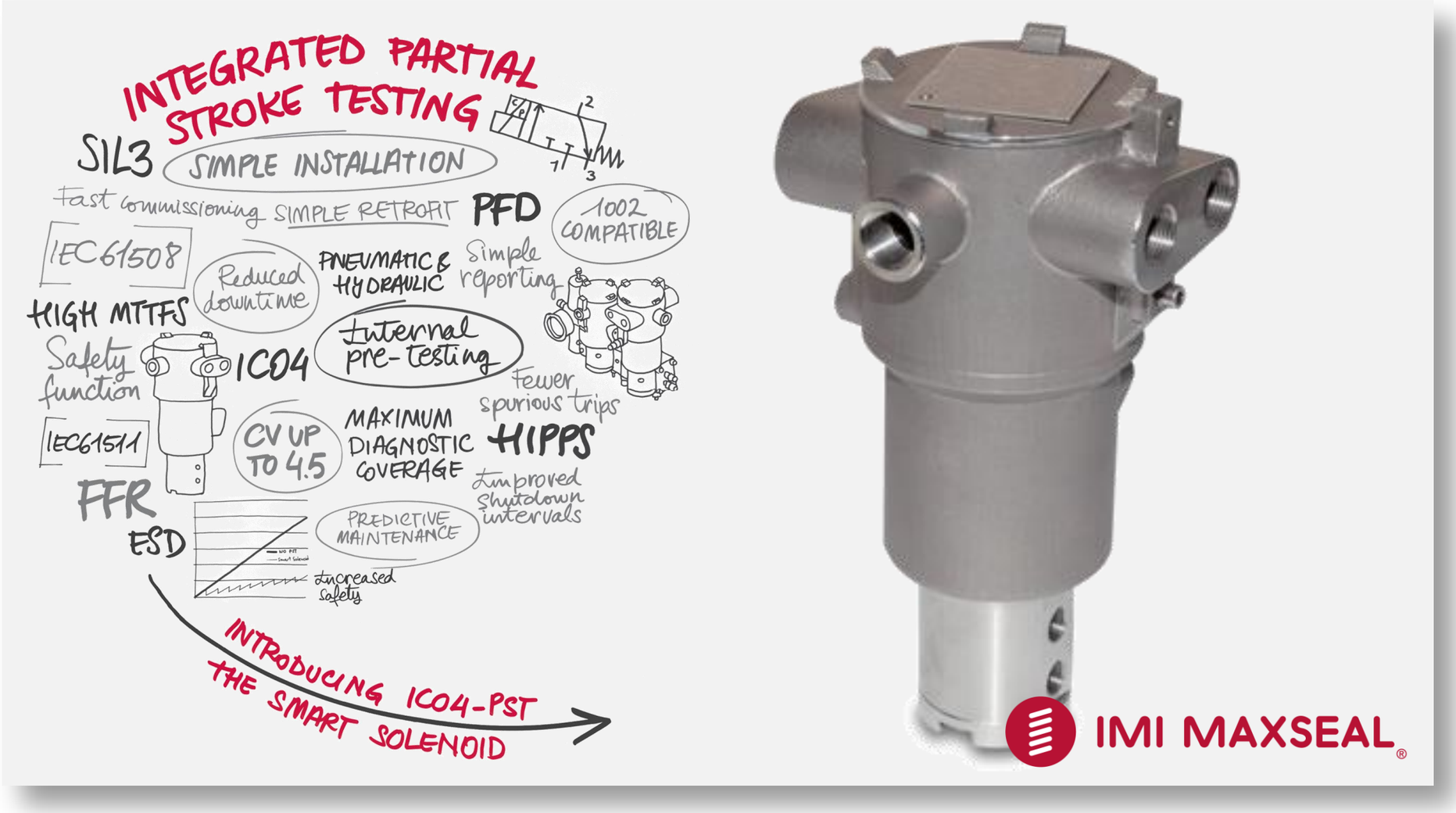


- **Process Valve**
  - *Increased valve breakout torque (Build-up of debris on valve seat)*
  - *Increased valve dynamic torque (Valve packing stiffness over time)*
  - *Stem Shear*



The SMART Solenoid Valve with PST

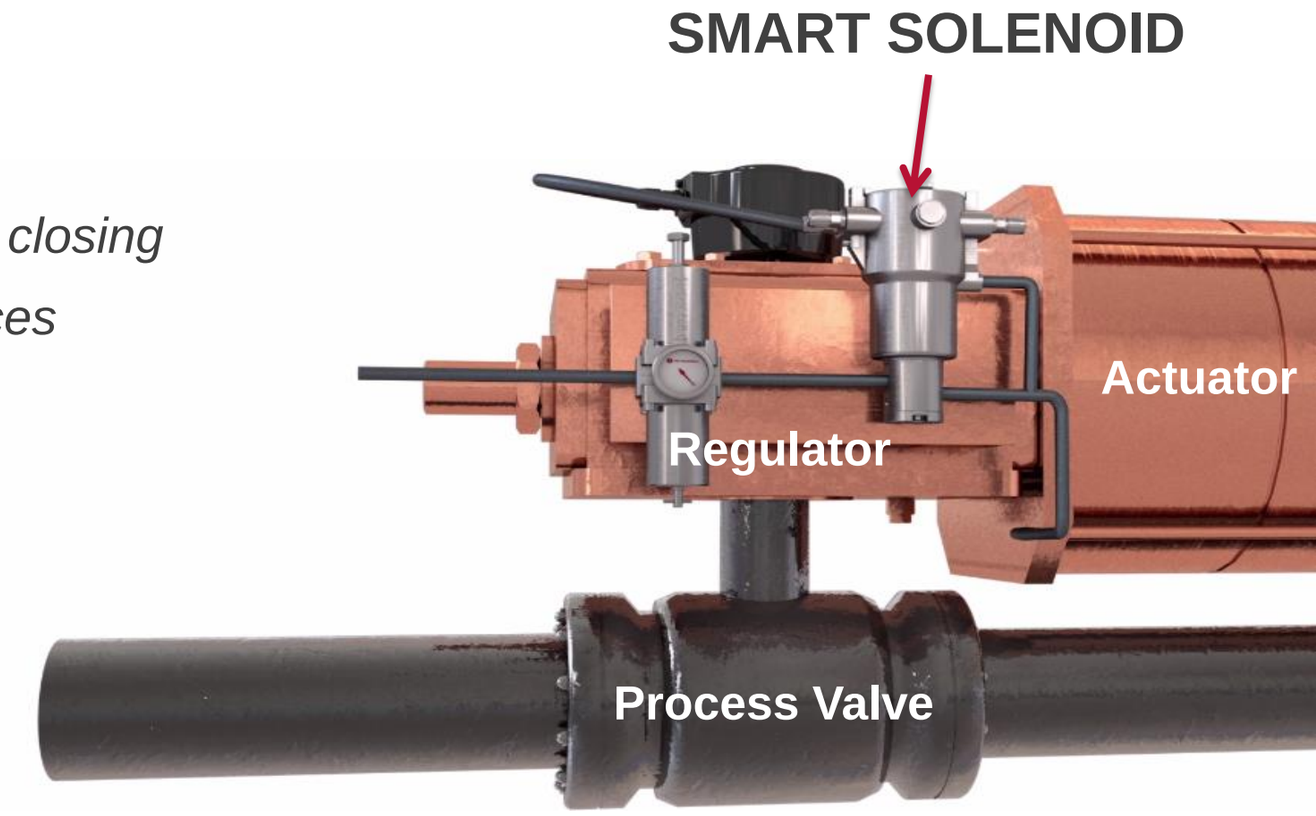
A valve that bring peace of mind to plant operators



The SMART Solenoid Valve with PST

A reliable solenoid valve combined with testing capability

- **SMART Solenoid Valve**
  - *Monitoring functionality integrated*
  - *Automatic & manual full stroke monitoring*
- **Partial Stroke Testing (PST)**
  - *Tests valve functionality online without valve closing*
  - *Allows increase of time between maintenances*

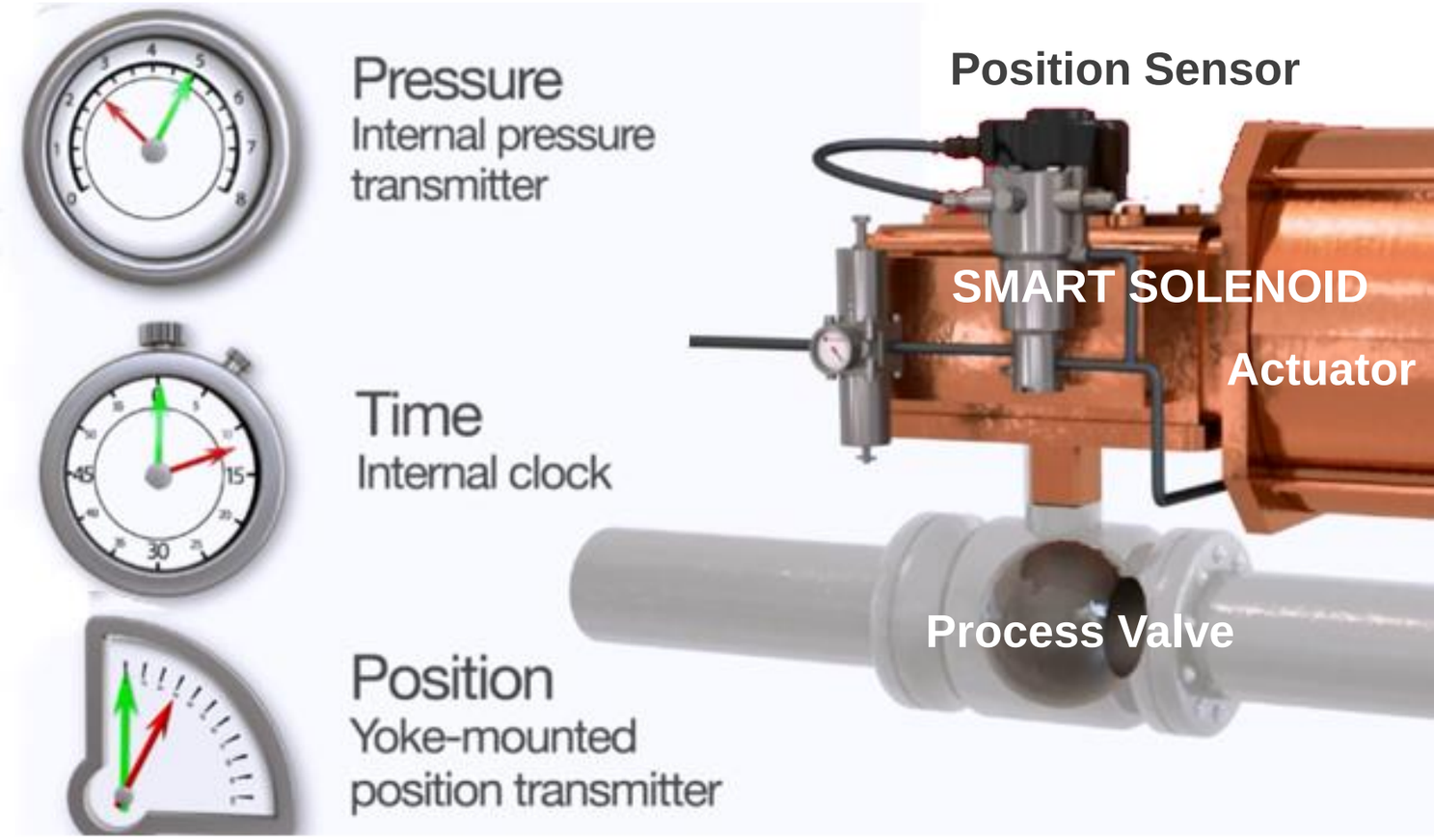


PST methodology and sequence

Ensure no unintended process interruption occurs

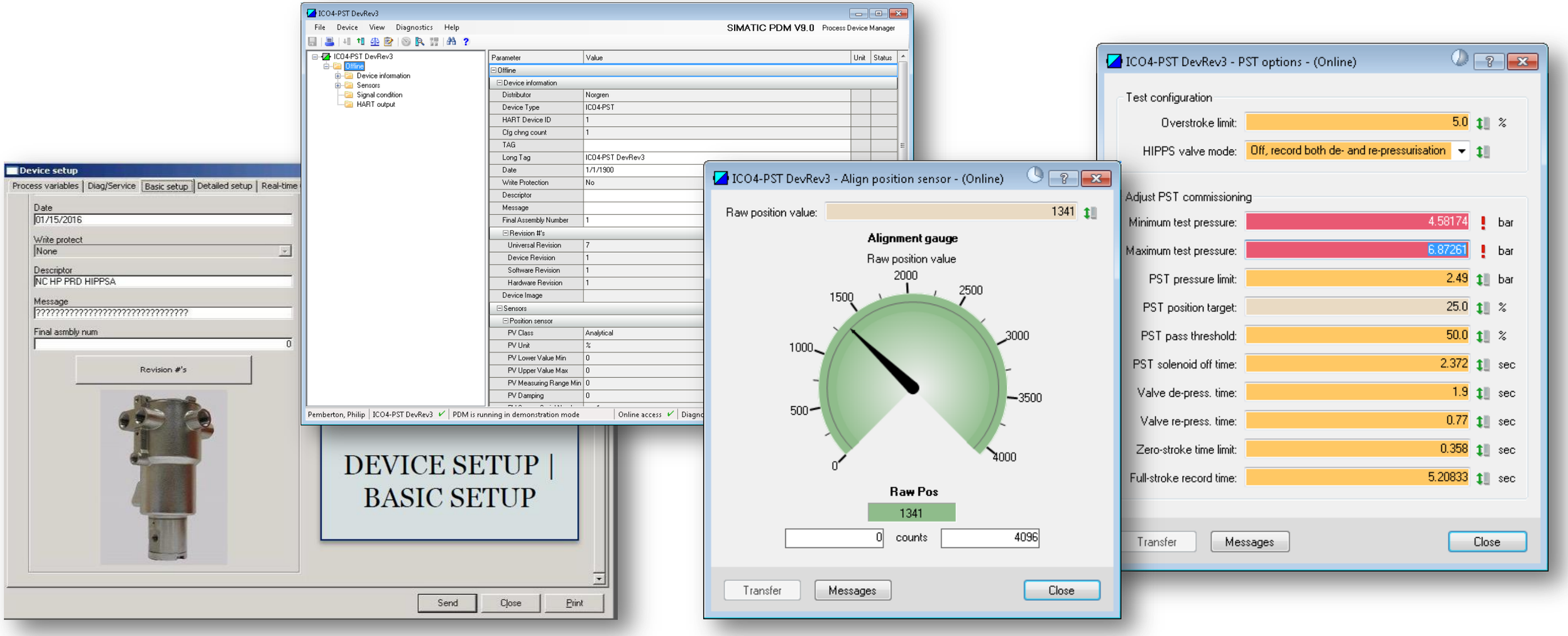
- **Accidental trip protection** *(Dual redundant switching circuit & Software protection)*

1. **System self test**
   - *Minimum coil voltage*
   - *Minimum instrument pressure*
   - *Switching circuit functional*
   - *Pressure transmitter functional*
   - *Air inlet blockage test*
2. **De-energise solenoid valve**
3. **Monitor pressure, position and time**
4. **Re-energise at required position**
5. **Analyse results**



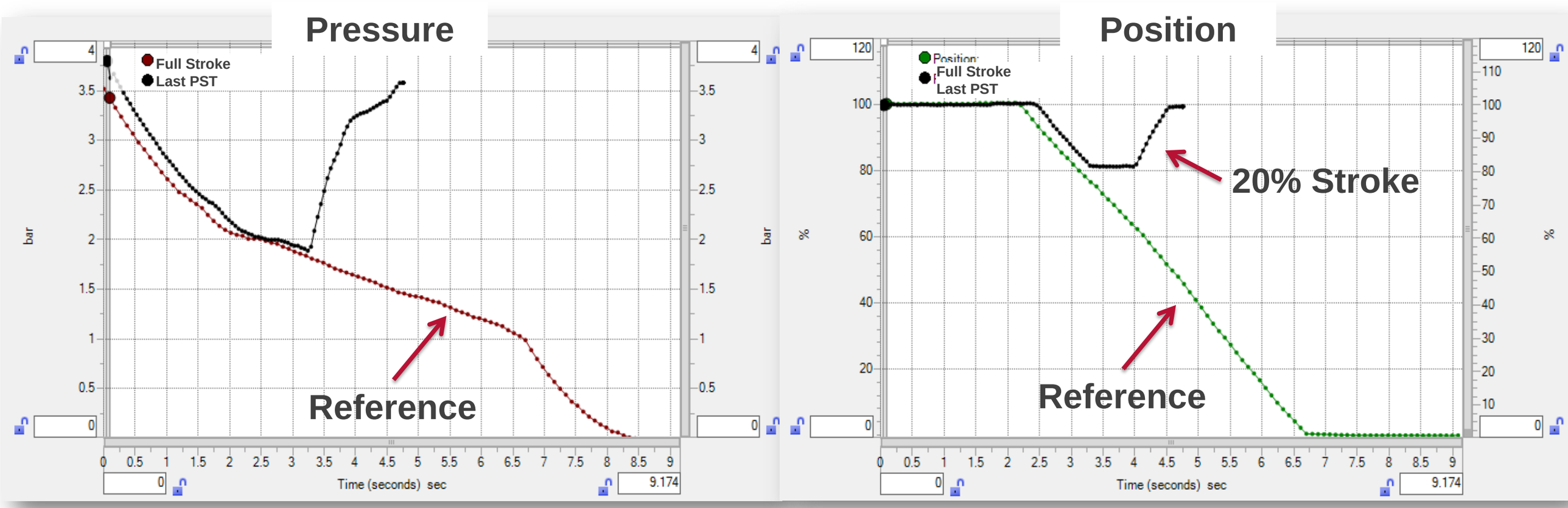
Configuration software & GUI

Easy to use with every PDM system



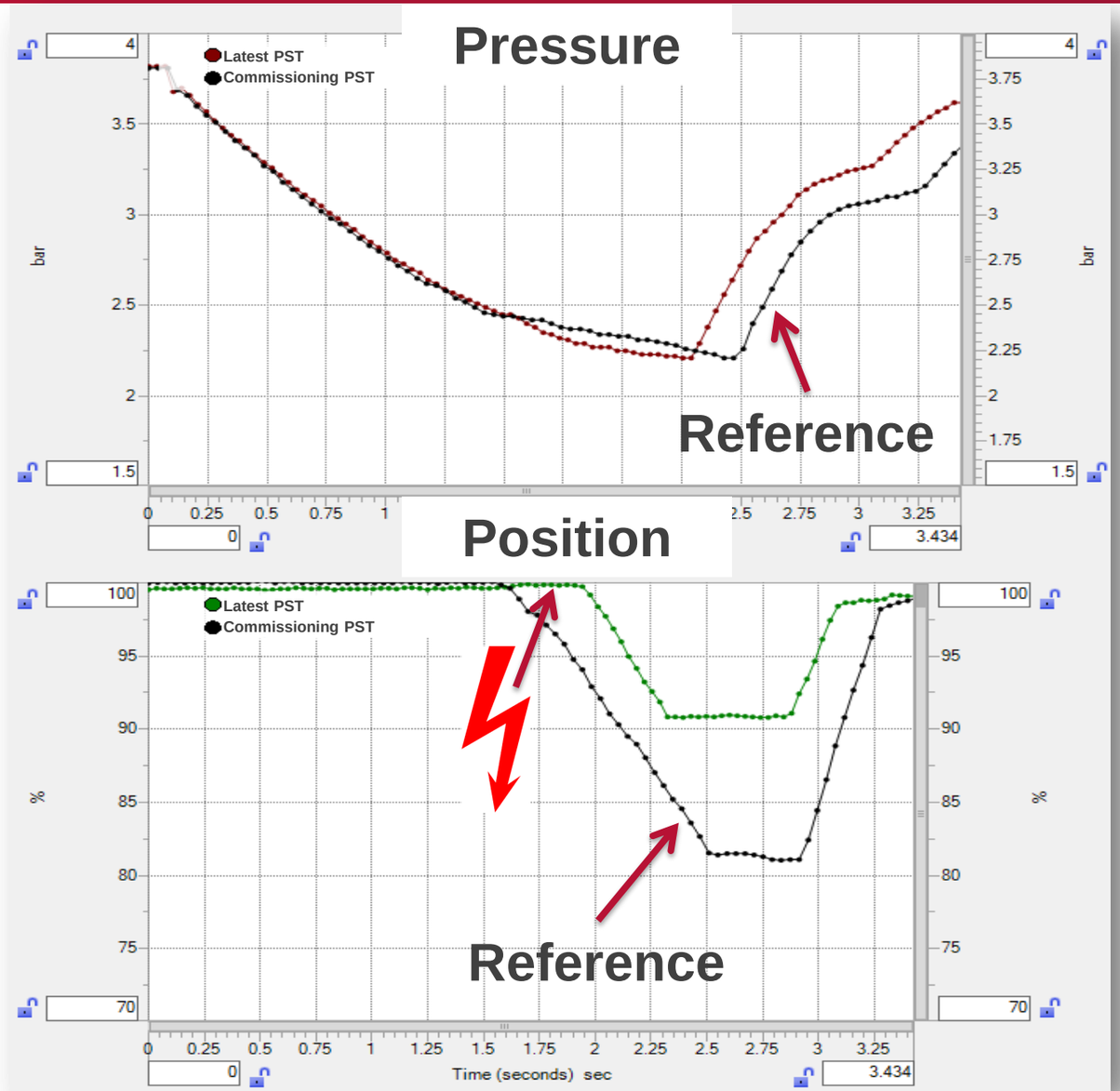
Measurement data in as-new condition

Reference curve and 20% PST



Measurement data in used condition

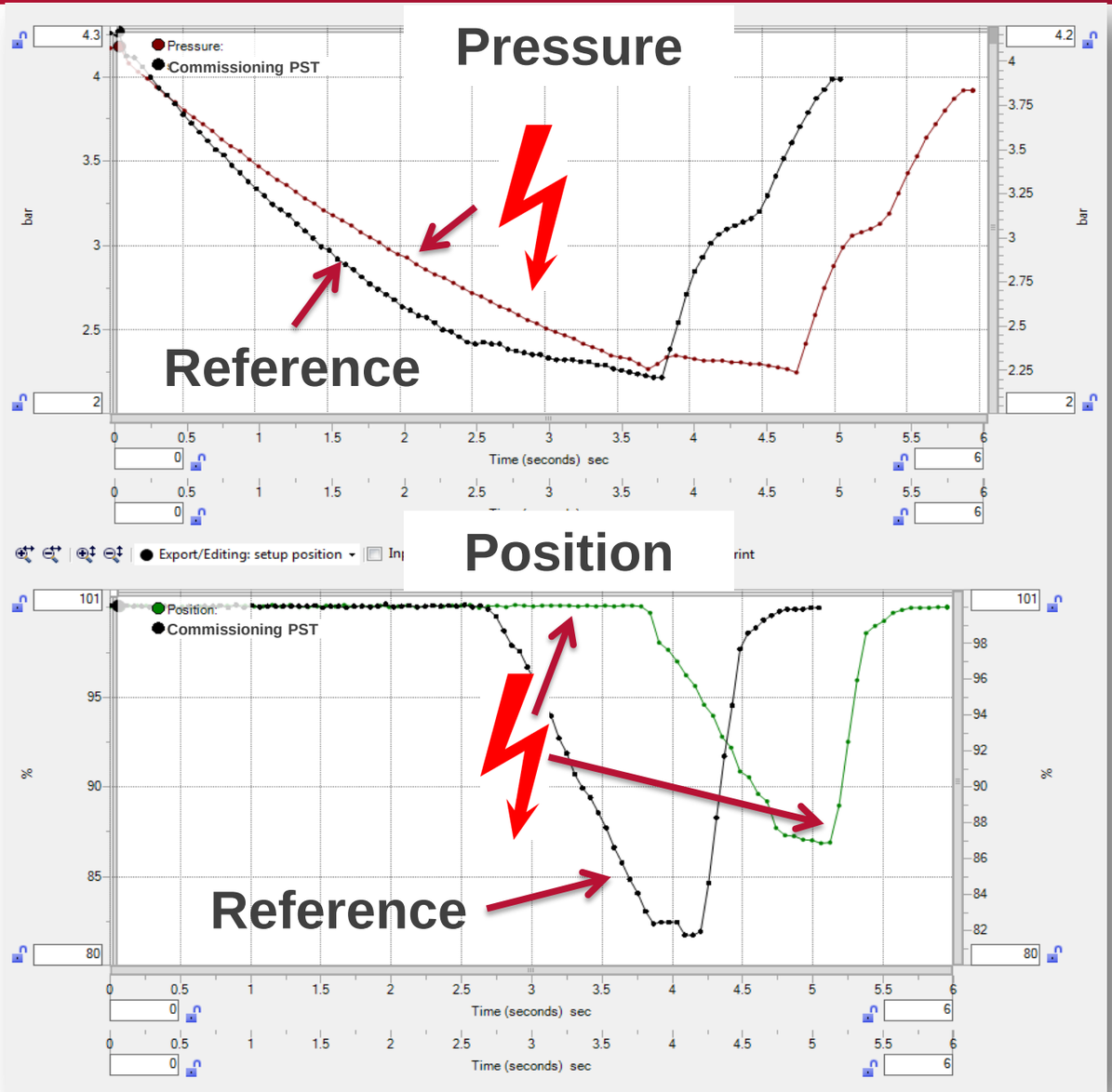
Reference curve and increased breakout torque



- **Same de-pressurisation curves**
- **Extended time to breakout**
- **Test failed**
  - ***Indicates sticking valve***
- **Maintenance recommended**

Measurement data in used condition

Reference curve and restricted SOV exhaust



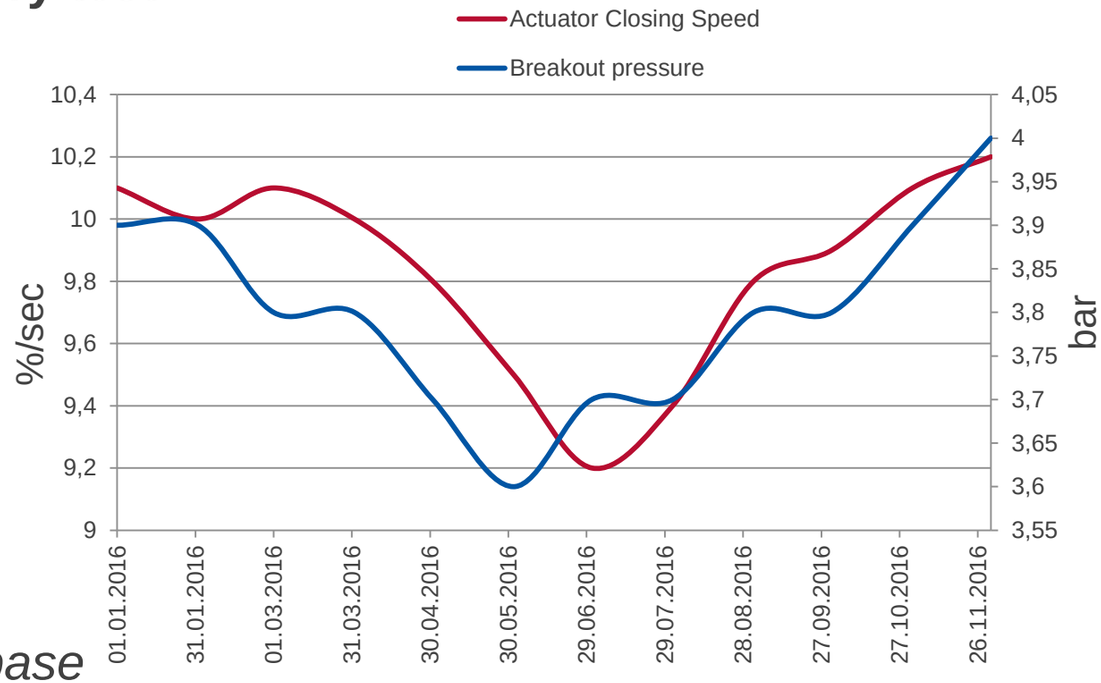
- **Different de-pressurisation curves**
- **Extended time to breakout**
- **Time override engaged / Position not reached**

- **Test failed**
  - ***Indicates exhaust restricted***
- **Maintenance recommended**

Diagnostic data analysis and trending

Use data frequently to generate new information

- **The following data points are measured & stored for every test**
  - *Valve movement percentage*
  - *Internal temperature*
  - *Starting pressure*
  - *Valve closing speed (%/sec)*
  - *Process valve breakout pressure*
  - *Solenoid valve reaction time*



- **Parameter export and analysis over time**
  - *Facilitates capability to create custom diagnostic database*

- **Condition Monitoring (CM) and Predictive Maintenance (PdM)**

Summary

CM and PdM bring value to our customers!

- **Originally developed for the Oil & Gas industry**
- **Easily adaptable for Industrial Automation, Life Science and other markets**
- **Improving**
  - *Safety performance & Reliability*
  - *Production performance & TCO*
- **Easy to**
  - *Engineer & Install*
  - *Commission & Service*
  - *Operate*
- **Intelligent system able to provide CM and PdM capability to process valves**

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