

Festo develops electric servo actuator for ASCVs

Festo, in conjunction with Shell Global Solutions, has developed an electric servo actuator for anti-surge control valves (ASCV). The device is also equipped with a unique 'mechanical fail safe' (patent pending) mechanism. The actuator will enable a more precise control, reducing dead band and requiring less maintenance due to a less complex design.

By Folkert Hettinga

About the Author



Folkert Hettinga is Industrial Sales Manager Process Industry Netherlands, & Global business development leader, Servo Actuator, Festo BV

ASCVs are used to prevent compressor surge, which can cause catastrophic damage to turbine compressors. An effective ASCV must operate rapidly and precisely – two aspects that represent a major challenge for the current generation of ASCVs, which are usually actuated pneumatically (see fig. 1).

Because the associated pneumatic systems are often also complex and maintenance intensive, the Subject Matter Expert (SME) for automated valves, Willem van Rijs (initiator and leader of the Servo Actuator Project between Shell Global Solutions International BV (SGSI) and Festo), undertook research to identify innovative new technologies capable of meeting the severe requirements of the application. And with success.

In the course of the research referred to above, the idea arose to apply technologies from the fields of



Figure 1: The challenges with pneumatic actuators are legion, for example the complexity, increasing leakages during life cycle, low reaction time in emergency cases, less accuracy in control and hysteresis.

robotics and mechatronics. Although essentially promising, the developments in these technologies to date had not matured into generally available components for immediate application in the heavy process industry, in particular oil & gas. With this in mind, SGSI engaged Festo as its development partner in the intensive collaboration that was needed to arrive at the present breakthrough. This effort has resulted in an innovative actuator that is energized by an electric servo motor (see fig. 2)



Figure 2: Data regarding the Mechanical Fail safe solution: Type: EMMA 02, Status: Prototype, Force: 50 kN, Stroke: 300 mm, Tension: 400 V

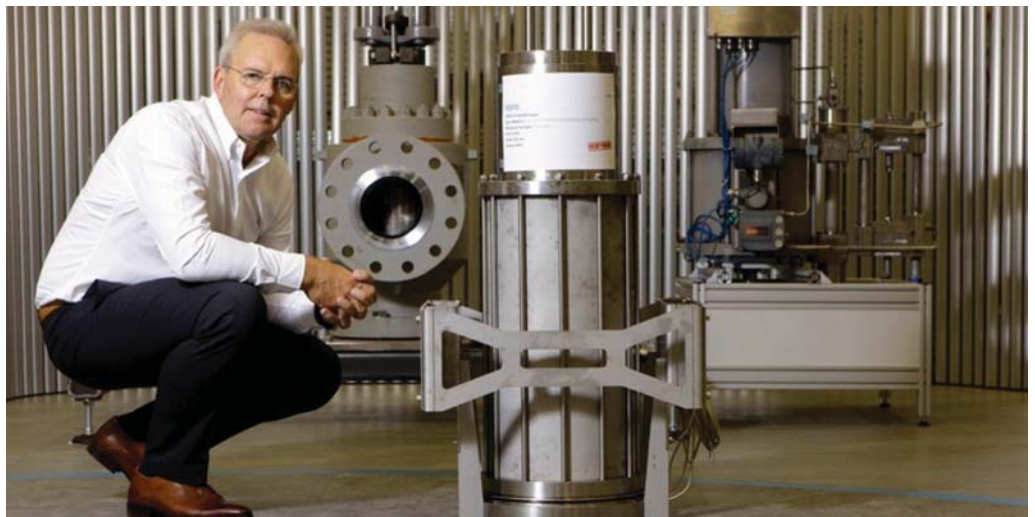


Figure 3: Folkert Hettinga: "The main function of the Mechanical fail Safe is to span the fail safe electrically by an servomotor and a linear spindle into a locking position which will be hold by solenoids to store energy of a mechanical spring for emergency functionality."

1. The locking system is (de)activated by solenoids and connected to the Safety PLC. By a possible occur, the solenoids will be de-energized, and independently of the valve position, the complete energy source which is spring operated will lift the spindle and motor upwards to the safe open position of the valve within less than 1 sec.
2. In general, valve manufactures use an 'continuous spring force' which needs extra energy in one direction and will reduce the required opening and closing times as specified by the PEU. With the ServoActuator solution, the energy of the spring is stored and will only be used during ESD. During normal operation there is no need for extra energy against the spring force to move to a certain position.
3. This means low energy consumption (CO2 reduction) and very high accuracy.
4. Noise reduction. During the whole process there is almost no "noise", instead of pneumatic operated actuators, > 80 Decibel, even during a trip situation.
5. The linear actuator is suitable for every valve stroke.
6. The ServoActuator has a closed loop oil damping solution to reduce large forces and speed during ESD, which means the ServoActuator can be placed in certain directions. (on request)
7. Reduced CO2 footprint
8. Suitable for replacing installed base pneumatic / electric actuators



Figure 4:

Modular construction

This 'game changer' has a modular construction, and is built from a minimum number of components. The use of electricity, both as prime energy source and control signal, means this concept has a faster action cycle than conventional pneumatic systems. A major contribution to the short cycle time is the virtual elimination of the 'dead band' (see fig. 5). This means the electric servo actuator moves much sooner, and the compressor surge prevention measure takes place much more rapidly. (see fig. 6 and 7). An additional benefit of the electric servo actuator over pneumatic technology is the considerably less demanding installation and maintenance (see fig. 8). The technology employed also offers extensive possibilities for diagnostics. For the heavy process industry, in particular, this is an important aspect that contributes to enhanced plant safety and availability. Moreover, the associated data forms a basis for predictive maintenance. When applied in combination with Asset Management

Systems (IIoT, a Festo field of development), smart diagnostics will lead to improved control of the Total Cost of Ownership (TCO).

Joint effort

Festo is closely collaborating with CCC (Compressor Controls Corporation) to further develop

and integrate the controller and actuator for optimum surge protection and process efficiency. CCC is the market leader in Turbomachinery Controls and related optimization services for the upstream, midstream and downstream oil and gas and petrochemical industries. Since 1974, more than 37,000 installations have

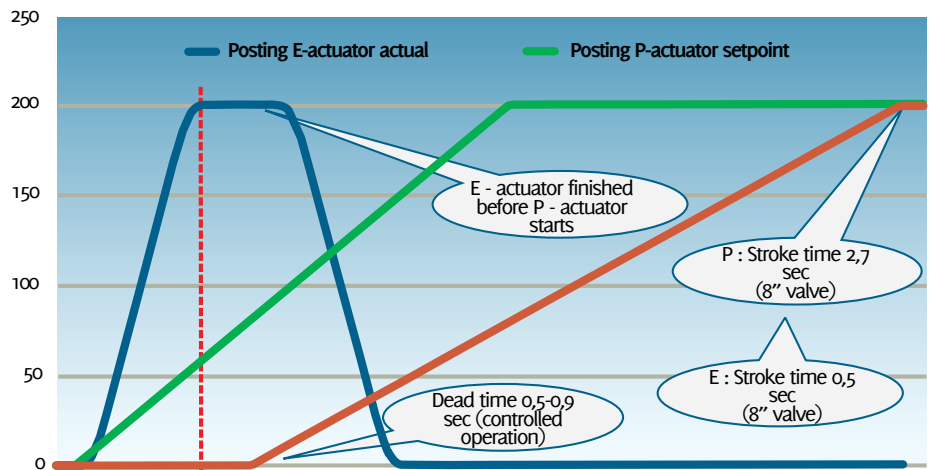


Figure 6:

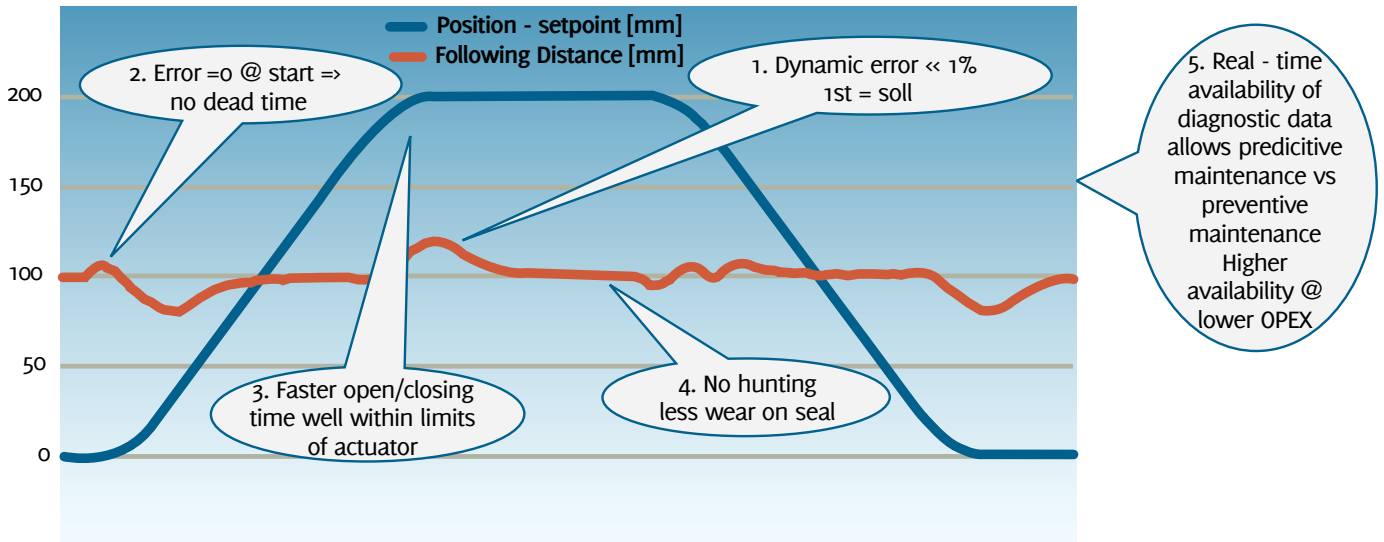


Figure 5:

Article continues on page 76

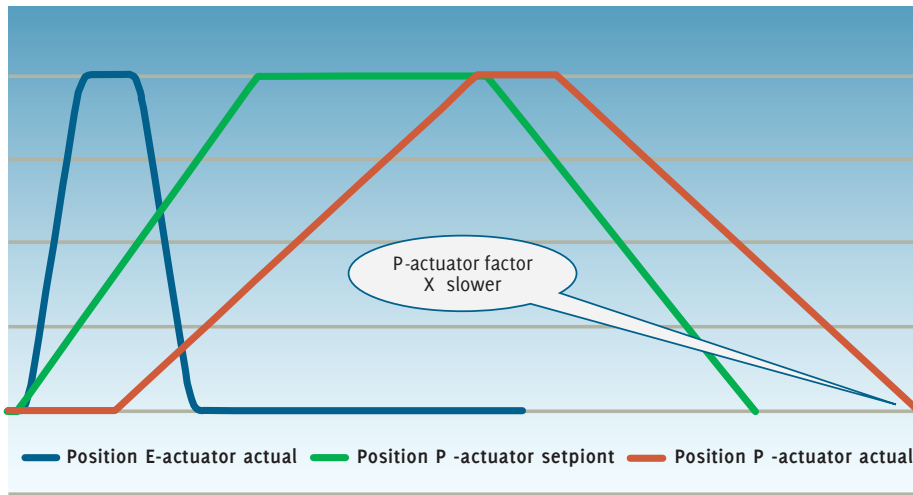


Figure 7:

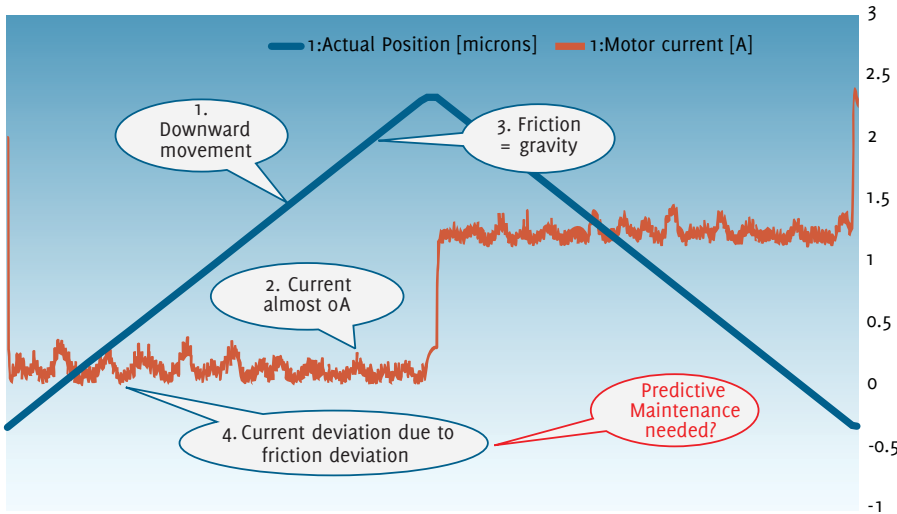


Figure 8:

benefited from over two billion hours of operational experience, using CCC control systems and expertise. This extensive experience has resulted in many unique features of the CCC applications aimed at safe and efficient operation of turbo machinery. The integration of the Festo ServoActuator with CCC control systems increases the operating area while maintaining stable and effective surge protection. Further integration of the CCC control applications and the actuator's controls and diagnostics will optimally utilize the qualities of the servo actuator. To cement the relationship, a letter of intent has been drawn up between Festo and CCC to jointly further shape this development. The Festo servo actuator can be ordered as a complete solution with the CCC controller to maximize performance, reliability, and safety.

Present and future applications

The first model to be developed is now available: the EMMA (Electric Mechanical Motor Actuator) type 02, which supplies 50 kN. EMMA types 01 (25 kN) and type 03 (100 kN) will be available in 2019. The EMMA was deliberately developed as a modular product, using available standard elements. Furthermore, all three

versions are equipped with a unique 'mechanical fail safe' (patent pending) mechanism; an 'electronic fail safe' option is also available. Both options will be demonstrated live during Valve World Expo 2018 (see fig. 4).

Demonstration models at Valve World Expo

Partly due to space limitations during Valve World Expo, the servo actuator demonstrations will be conducted on two ASCVs, kindly provided by Flowserve and Mokveld. Both ASCVs will be demonstrated in combination with the CCC software module.

Curious to see this innovative servo actuator working live? Then register for a demonstration at Valve World Expo 2018 via the Servo-Actuator APP. You can choose one of the four demonstrations that will be given daily.

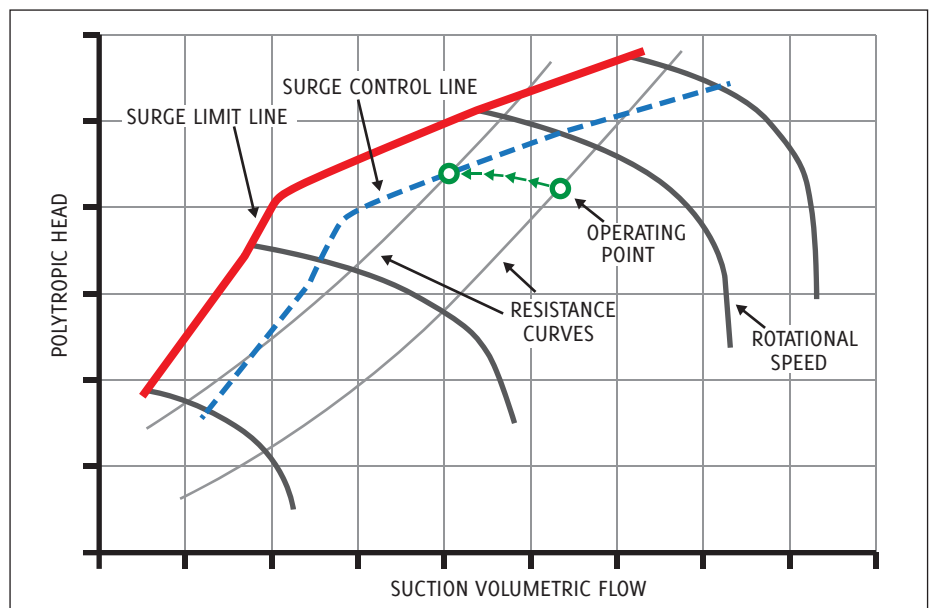
To stay informed, please visit us at www.servo-actuator.com

Festo stand, Valve World Expo, November 27 - 29, 2018. Messe Düsseldorf, Germany, Hall 3, Stand 3B53.

By using open communication protocols, the ATEX-certified digital controller can easily be integrated as a module in future 'open source DCS systems'. The controller can be located close to the ASCV or up to several hundred meters away (safe area), depending on customer requirements.

During the development phase, SGSI and Festo have consulted with five leading valve manufacturers who have unanimously and enthusiastically undertaken to supply the servo actuator on their ASCV at customer (or end-user) request. Nevertheless, these are by no means the sole suppliers; this new Festo product is available to every OEM or user in combination with any brand of ASCV, and/or (in future) with other applications, such as ESD On/Off valves.

Visitors can download the ServoActuatorAPP for demonstration at the Festo Booth



Typical compressor map; combining Festo actuator with CCC's unique algorithms will maximize operating area and efficiency without compromising surge protection.