Developments in electric actuation for process control

Actuators are among the most universal process control system elements used in today's industrial processes. Advancements in DC motor technology which have removed restrictions on modulation rates have created a comprehensive market for electric actuation in new areas, where the benefits and economies associated with electrical operation have not been previously available.

By Derek Olson, Business Development Director, Rotork Controls Division

Actuators today have benefited from simpler components and the improved reliability of electronic products. Electric actuators have improved to the point that in the majority of applications they can outlive the equipment they are installed on due to highly reliable electronic technology and reduced points of possible failure.

Rotork's solution for a compact, modulating actuator to meet the demands of the ever-growing process industries was unveiled in May 2012 with the launch of the CMA Range. Since then, additional features, including more sizes, certifications, local controls and supercapacitors have been introduced, to meet the developing needs of worldwide process control applications and industries.

Fig 1 – One of the developments of the range of CMA electric control valve actuators has been the introduction of a version specifically designed for the demands of choke valve operation.

Cost of ownership

Developed with the benefit of decades of electric control valve actuation, the CMA consolidates many of the successful 1000 Series models into one product range, in line with the Rotork focus on improving the performance of existing products and streamlining product lines.

Electric actuators are generally considerably less expensive to operate than other process valve actuation systems because they only require power when they are actually moving, while even the most efficient alternative systems generate continuous losses. The simplicity of the design makes them less expensive to install, eliminates the requirement for a power source requiring regular maintenance whilst the actuator itself requires virtually no maintenance.

Around the world there is a growing need for automated valve control in remote locations where mains electrical power is not available. Using DC powered electrical equipment to operate remote valve installations offers a number of advantages over other stored energy solutions. Efficiency is further enhanced by the use of solar panels and wind turbines as the power source. Electric actuators with DC motors enable a direct connection to the power supply, simplifying the overall installation.

To satisfy this demand, models in the CMA range are designed to meet the exacting requirements for low power, high torque modulating control in a compact package. Successful applications include severe service upstream wellhead production and injection valves.

Low power can become a critical factor in the automated systems on these sites. Rotork Controls Technical Director Andy Withers explains: "Practically, DC is the main area where a user may have a critical low power requirement. The DC supply may be generated by solar cells with battery storage and the size and cost of these items is heavily dependent on average power consumption. For many applications, this is dominated by the device's standby power. The low standby power of the 24VDC CMA is less than 1W using 4-20mA analogue control. For AC versions the equivalent figure is less than 2.5W. In all cases, low standby power is beneficial in reducing the environmental impact and running costs of an installation."

For applications demanding failsafe operation on power loss, even with recent advances, traditional power sources like batteries still present certain design and performance limitations. These are overcome by using supercapacitors, which do not have the familiar battery memory effect and limited shelf life. With the CMA, a supercapacitor power pack supplies the actuator with sufficient power during emergency situations such as loss of mains power, providing an advanced programmable method for fail-to-position protection, enabling the actuator to perform a predetermined action.

The power pack also preserves position indication on the LCD display during power failure. When mains power is restored, the power pack is swiftly recharged to ensure continued fail-to-position functionality. Action on power loss is easily configured with the standard CMA HMI interface as part of the user-friendly actuator set-up menu, utilising a 6-segment LCD display and push button configuration.

Fugitive emission control

This is an area where the CMA offers many benefits. The venting of natural gas is severely restricted in many countries to reduce greenhouse gas emissions. Systems for any industrial process are regulated for emissions of Volatile Organic Compounds (VOCs), Hazardous Air Pollutants (HAPs) or Nitrogen Oxide (NOX). The Clean Air Act enforces restrictions on these gases in the USA and similar regulations are taking hold throughout the world. Many companies are therefore investing in the operation and maintenance of air pollution control systems for lower operating costs, higher efficiency and reduced carbon footprint.

This is particularly prevalent in the oil and gas industries, where the retrofit or complete replacement of worn units can also provide better system-wide performance and reliability and improve monitoring of parameters such as gas flow and pressure. At remotely sited shale gas installations in the USA, CMA electric actuators have eliminated venting and greenhouse gas emissions in compliance with new environmental protection legislation and delivered an efficient and reliable process control solution.

The potential for erosion and corrosion due to extended periods of wear leads the oil and gas producers to rely on dependable products to automate wellheads, valves and chokes. Even upstream companies not planning to drill new wells are investing in aging infrastructure to reduce maintenance costs and improve efficiency. Leading oil and gas exploration companies are now including CMAs for onshore wellhead maintenance programmes where the cost of repairs to failing units was substantial. Installation of CMA actuators has assisted the efforts for a greater return on investment through lower engineering costs, reduced wellhead downtime, fewer repairs and less maintenance. The increased actuator life cycle contributes to an extended economic life for the wellhead and increased profitability for the customer.

Marine and offshore

Actuators are a vital part of all offshore operations, controlling valves in every area and managing the flow of crude, oil, gas, condensate, and water - sometimes at high pressures - and always in difficult environments where safety is paramount.

In the marine and offshore industries electric actuators have proved to be ideal for some of the most remote and demanding environments. Extreme conditions, corrosive environments, low temperatures and difficult to reach locations add to problems with maintenance, putting stringent demands on the design and construction of components and equipment. Very often, weight is a major consideration, as is size and the number of components, and in these scenarios the CMA can offer an attractive solution.

For example, platform and FPSO (Floating Production, Storage and Offloading) vessel applications can often demand fast operating actuators to deliver swift valve closing speeds. HVAC applications are a case in point, demanding precise accuracy to maintain air quality and ventilation in the many enclosed cabins, offices, sub-stations and PLC rooms contained inside the infrastructure. The temperature has to be accurately controlled and the air supply has to be constant. This is controlled by actuators on the HVAC air handling units

Fig 2 – Retrofit installation of Rotork CMA electric actuator on a high pressure control valve at a shale gas well in Louisiana.

Fig 3 – Rotork CMA actuator installed on the HVAC system of an FPSO.

Fig 4 – With the latest developments, the CMA design can now be specified with increased functionality encompassing local controls, LCD positional display and programmable fail-to-position performance.

and cooling water supply, where CMA actuators have been selected and proved to be very reliable.

When the heat's on

A common misconception with electric actuation is that it is susceptible to overheating in certain environments. However, electric actuators will not overheat when used in their stated specifications, enabling them to reliably operate in environments where very high temperatures will be experienced.

Glass container and fiberglass manufacturers are specifying the CMA after extensive testing for a critical valve control function with temperature and pressure in the furnaces by regulating the air and gas mixture with extreme precision. Maintaining a constant temperature and pressure is essential for energy efficient glass making. Traditionally, the industry uses various pneumatic and electric actuators for the modulating and isolating valves involved, but has recognised the need for an alternative, energy efficient universal solution for this application. Furnace revamps provide the opportunity to introduce the upgrade, which typically involves up to 40 valves on each furnace. Following the success of the tests, several hundred ATEX certified explosion proof CMA actuators have been installed during revamps around the world.

This example also illustrates a major trend in process control system design involving the upgrading of actuators on older processes to increase productivity and reduce maintenance. Older systems often contain worn and obsolete control elements causing product quality to suffer and making systems difficult and expensive to maintain. In addition, actuators like the CMA are easy to retrofit on existing valves and offer features and capabilities not available with the older varieties. Since many systems are still serviceable, replacing the actuator can give an older process renewed value at a much lower cost.

Conclusion

The applications described in this article highlight how today's modern actuators can extend machine life, save time, reduce energy consumption, increase production and improve quality. Any application where electric actuation can deliver more precise process operation is a likely candidate for using a process control actuator.

About the author

Derek Olson is the Business Development Director for the Controls Division of Rotork. A veteran of serving the flow control and automation industry, Derek has been with Rotork for nearly 20 years. In that time he has held a number of key strategic business positions in both the UK and USA with responsibilities for systems integration and the manufacturing of products for the power and process control industries.