



Femsan Makes a Difference with Reliable, High Performance Electromechanical Actuators

Actuators – which come in electromechanical, hydraulic and pneumatic types – are the components that allow the moving sections of platforms to perform their required range of movement. When compared to electro-mechanical actuators, both hydraulic and pneumatic actuators are heavier, need more space and require more frequent maintenance, and these drawbacks have caused their gradual replacement by electromechanical actuators. The fly-by-wire applications that are becoming increasingly widespread in aviation have further enhanced the importance of electromechanical actuators, as they are far easier to control electronically. The areas of usage of electromechanical actuators are a large variety like land, naval and air platforms. On land platforms their most frequent application is axis motion in azimuth and elevation axes for different turrets, as well as radars and launchers. Examples of applications for naval platforms include drive, propulsion and orientation. On air platforms, electromechanical actuators often find use on unmanned aerial



Brushed DC Motor linear-type actuator

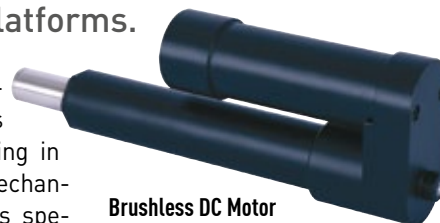
vehicles (UAVs), aircraft and munitions. In this respect, the concept of redundancy is another area where electromechanical actuators stand out in aviation applications. As hydraulic and pneumatic technologies have been in use for many years, solutions that cause to use of these technologies are considered relatively reliable. Electromechanical actuators, on the other hand, are a more recent type of technology, besides, the level of technology and experience behind them become more vital for competent solutions.

Beyond the Electric Motor

Although an electric motor is also an actuator, an electromechanical actuator is defined as a complete sub-system, comprising a motor, a gearbox, a spindle drive, a

Electromechanical actuators are the components of choice for nearly all types of defence and aerospace systems, owing largely to their low weight and volume, and their ability to be controlled electronically. Manufacturing high performance components that are competitive in the market using indigenous technologies demands in-depth experience of product development. Femsan has been engaged in the design and production of electromechanical actuators for more than 10 years, and its products are today serving successfully on over 1,000 platforms.

controller and a feedback component as well – in short, working in the field of electromechanical actuators requires specialization in several different disciplines. It is all but impossible to produce a reliable product in this sector without many years of experience in the fields of electrics, mechanics and electronic engineering, as well as in material sciences. In addition to the technologies on which they are based,



Brushless DC Motor linear-type actuator

the fields in which electromechanical actuators are used also require a deep engineering knowledge. Actuators fitted on land, naval and air platforms need to be able to operate reliably in a variety of different ambient conditions. For example, constant vibration is a key factor that needs



The main areas of use of electromechanical actuators include the turrets of land platforms.

to be taken into account when developing actuators for land platforms, while salt

Rotary type actuator



fog is an issue for naval platforms and low ambient temperatures must be expected for air platforms. Coming up with solutions that can meet such diverse requirements is only possible by via of many years of experience.

Femsan's Experience with Electric Motors Ensures Flexibility and Reliability

Examining companies being in the field of electromechanical actuators at a global scale reveals two types of enterprises: Those who produce the main component of the actuator, namely the electrical motor, by themselves, and those who procure it externally. It is expected from companies, with experience in electrical motor technologies, that they can contribute a great deal of the flexibility and reliability of actuators. The fact that a large proportion of the systems in the defence and aerospace field

need to be mobile, and to be operated independently of existing grids engenders on the basis of needing to use direct current (DC) to supply these systems with energy. Older actuator systems consist of Brushed DC Motors, however, Brushless DC Motors have become almost indispensable in today's actuators. Set to celebrate the 30th anniversary of its foundation next year, Femsan has been producing Brushed DC Motors since day one, and Brushless DC Motors for the past 15 years. To sum up, Femsan has gained in-depth knowledge and experience in the field of electrical motors, which can be considered definitely the heart of an actuator.

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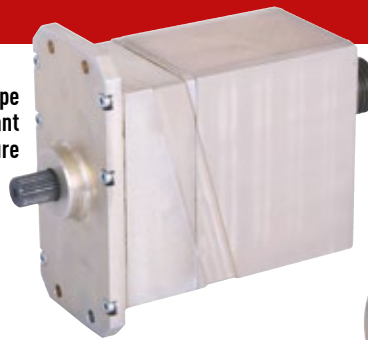
Driver-integrated linear actuator with redundant architecture

Excluding certain rare types, electromechanical actuators generally come in two varieties, being rotary and linear types, and these types can be further subdivided depending on whether their control unit is located inside or outside the actuator (Figure 1). For all these different types of actuators, from A to Z, Femsan has capability of manufacturing the products based on its indigenous Turkish engineering strength.

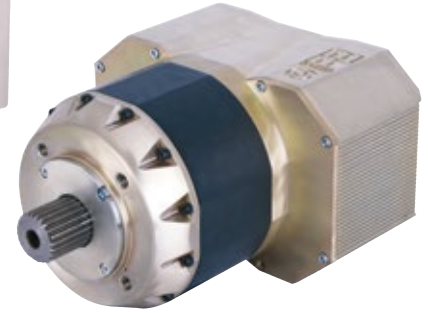
Femsan's Skills Cover All Actuators

The gearbox and the controller (driver) are, after the electric motor itself, the two most important components in electromechanical actuators. As with electrical motors, it is also important that the actuator-producing company maintains design and qualification capabilities for the development of these two components. A company that is in possession of such capabilities is able to carry out any configuration changes required on the entire actuator and to meet customer requirements with greater reliability, more economically and within a shorter time-frame. Capable of rolling out gear and driver designs internally thanks to its expert

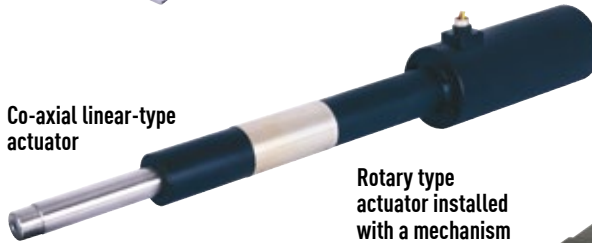
Driver-integrated rotary-type actuator with redundant architecture



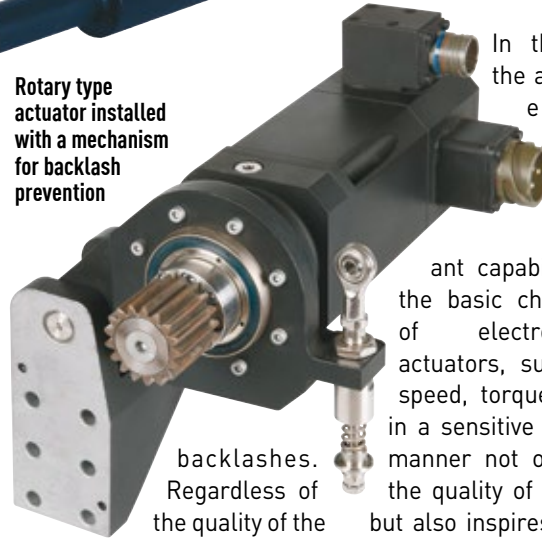
Angular rotary-type actuator with digital control



Co-axial linear-type actuator



Rotary type actuator installed with a mechanism for backlash prevention



and experienced engineering force, Femsan can also devise and test driver software in compliance with the related standards.

The structure of electromechanical actuators also varies depending on their area of use. For instance, the control unit may be installed remotely of the actuator, if required. This unit, known as the driver, is sometimes produced by the integrator, although it may be based on a ready-to-use solution. The gearbox, which is the other important component, is generally procured as an off-the-shelf product and installed onto the actuator. On air platforms, on the other hand, both the control unit and the gearbox are designed and produced by a single manufacturer in accordance with the requirements of the application, and following the same approach adopted for the motor.

In actuator groups, a common problem is the prevention of

backlashes. Regardless of the quality of the selected components, if the positioning of the actuator's movements causes backlashes that exceed the set limits, an additional mechanism will be required to bring this backlash to within the required tolerances. This problem can be circumvented through a variety of methods. For the actuators it produces, Femsan cooperates with its customers to develop and apply various backlash prevention mechanisms. One of the qualification stages applied to products used in defence and aerospace is an assessment of the manufactured product's performance.

In this respect, the ability to test electromechanical actuators is, in itself, an important capability. Testing the basic characteristics of electromechanical actuators, such as their speed, torque and force, in a sensitive and reliable manner not only ensures the quality of the product, but also inspires confidence in the end user. For the different electromechanical actuators found in its product range, Femsan uses its internally-developed rotary and linear type actuator testing systems that measure not only the products' basic characteristics, but also their distinctive features, such as dynamic behaviour, permanent state errors, response time to command and response time to loads. All of these tests help ensure that the product meets the required performance expectations. In addition to this, Femsan also endows the testing systems it has developed with new features. By uploading real-life flight load data obtained from the field into the testing system it is possible to simulate the load applied on each electromechanical actuator. As a result, electromechanical actuators can experience flight conditions even before being installed on a platform. The application of these tests takes the reliability of the product to the highest level. ♦

Figure 1. Types of electromechanical actuators

