AIRTECHNOLOGY / AMETEK®

ELECTROMECHANICAL ACTUATORS



WHEN
EXCEPTIONAL PERFORMANCE
MATTERS

OVERVIEW

Description

AMETEK Airtechnology Group is renowned for producing high performance, highly reliable wound electrical products. We've been designing and manufacturing electric motion control products for the Aerospace & Defense industry for almost 100 years. Our products includes motors and rotary angular position sensors, such as resolvers, RVDTs, synchros and encoders.

Over the last decade, demand for electromechanical actuators (EMAs) has soared, driven by evolutionary changes in the transport industry and development of electric vehicles.

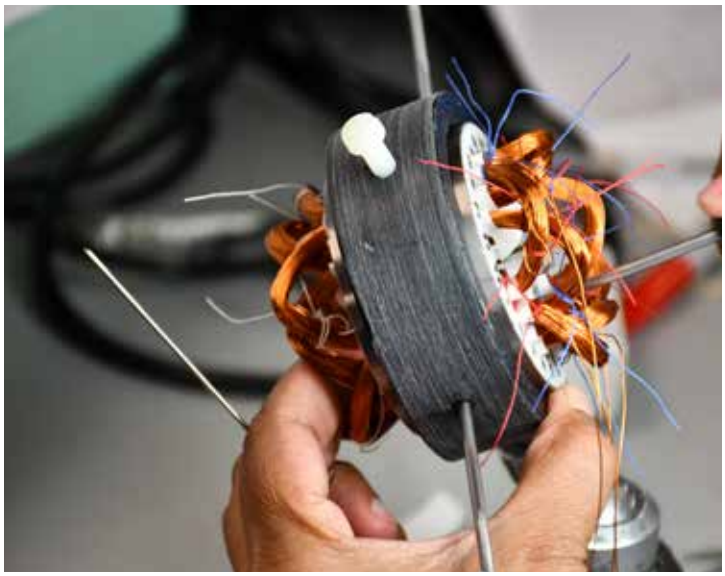
Today, AMETEK Airtechnology Group uses its vast experience at a subcomponent level to transform its motors and sensors into complex assemblies that produce some of the world's most advanced electromechanical actuator designs.

Our actuators help modernize vehicles through reliable, easy to install, low weight, low maintenance alternatives to traditional control systems.

What makes our actuators different?

Our expertise begins in an actuator's heart – its motor. Our team skillfully winds copper wire in the core (or stator).

We don't use automated winding facilities as we feel the best way to achieve the high performance our customers' product demand is through manually packing as much copper into a space as possible. The skills required to hand load a motor core take months of training and the upmost precision, dexterity and technique. The result is a motor that produces optimum performance from a very small package. Having these manufacturing skills inhouse gives our designers a high degree of freedom when designing the best solution for a new project.



Just as the density of our copper core is important to the motor performance, how we protect the windings is critical to our products' ability to operate in extreme environments. With many decades of experience protecting copper from corrosive and aggressive environments, we have developed techniques for encapsulating (impregnating) copper. We use vacuum/pressure impregnation and various epoxy resin formulations to coat our windings. After this treatment, our copper windings are capable of operation within a wide variety of applications and environments such as — in the most extreme cases — submerged in hydraulic fluid, fuel or water.

Design integration and knowhow

Our engineers have all the necessary tools and experience in electromagnetic design and electromechanical integration to create solutions for the most challenging requirements including high reliability, flight-critical applications. We also have very close working relationships with our suppliers for key items such as ball screws, lead screws, roller screws, gearboxes and LVDTs, all of which are critical to producing high performance actuators.

An experienced team and certified products

We have produced several successful and unique designs,each of which have pushed our technical abilities and the boundaries of actuator technology. Through our customers' projects, we have developed actuators that can generate high forces, operate at temperature extremes, and actuate with a high-speed response. They are subjected to high G-loads, have multilevel redundancy and can operate in concert with other actuators as part of a flight-critical system.

Benefits of Electromechanical Actuators

- Plug and play installation
- Low maintenance
- MInimum aircraft turnaround time
- Eliminates hazardous fluid usage and disposal
- No high pressures or fire hazards
- No hydraulic architecture, pipe routings and components
- Low weight
- Low through life cost

APPLICATIONS

Electromechanical actuators are at the forefront of AMETEK Airtechnology Group's vision for the future. Our team has been responsible for producing several successful and unique designs over the past decade and the following is just a sample of our work. As you will see, we can to translate the most challenging requirements into a certifiable actuator product. If you are interested in discussing your needs, please contact your local sales representative or AMETEK Airtechnology Group directly. We will be pleased to advise you on custom-made designs and to assist you to fulfill your requirements.

FUEL CELL INLET GUIDE VANE (IGV)

This actuator controls a variable inlet guide vane as part of a hydrogen fuel cell. Its basic design is the same as that of previous actuators we've produced. However, in this case, our focus was on affordability, reflected in the actuator's simple machined aluminium housing. In all other respects, the actuator is similar to the thrust vector actuator described in the next page, featuring a 28VDC motor, a high-integrity ball-screw mechanism and a dual-element LVDT for accurate position feedback.





IGV Actuator

VALVE CONTROL ACTUATOR (VCU)

This is a fuel and air control system for a missile. The Valve Control Unit (VCU) regulates the air and solid propellant mix during flight. The system consists of a brushless DC motor, ball-screw, motor drive and an electronic control interface that provides data transfer with the missile system and controls motor commutation. Key design features enable this control unit to provide short term high performance and operate at very high temperatures, while retaining a long shelf life.



Main design factors:

- Long storage period without maintenance (high reliability)
- High external loads, up to 30 G
- Temperatures up to 250°C/482°F
- High reaction speed >0.03 seconds/cycle



VCU Actuator

MISSILE FIN AND EJECTOR SEAT “RAISE” ACTUATOR

This simple, unhoused brushless motor format is used for several applications. The motor is hand wound using the basket winding technique, which ensures optimal performance in a small package. The rotor uses samarium cobalt rare earth magnets which do not degrade over long periods of time. The copper windings are impregnated with special formulation epoxy coating using vacuum pressure techniques, so they are impervious to their environment.

These are all important considerations for a rotary actuator design, which must be 100% reliable after long periods of storage and zero maintenance.



THRUST VECTORING ACTUATOR (TVA)

Pictured here is an example of one of our Thrust Vector Actuators. Working in pairs, their function is to direct a rocket nozzle's thrust to manoeuvre the rocket on its ascent.
Our original designs were used primarily for missiles, and in recent years we've re-purposed our range to provide thrust vector actuators for commercial space launchers.



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TVA



LIGHTWEIGHT CONTROL SURFACE ACTUATOR

This lightweight linear actuator was developed specifically for a UAV application where high performance and reliability needed to be combined with minimum weight and power consumption.

To provide efficient control of the primary flight surfaces, a stepping motor linked to a ball-screw forms the basis for the drive. With its integrated electronics, combined with a linear variable differential transformer (LVDT), the actuator consums less than 100 mW in its quiescent state, and no more than 1.5 W when resisting or moving axial loads of up to 30 N.

The actuator has been tested at temperatures as low as -70˚C, confirming its suitability for the cold environments encountered at high altitudes.

Alternative configurations can be supplied, customized to specific applications, where differing parameters need to be prioritized.



FLIGHT CONTROL SURFACES, FLAP & HORIZONTAL STABILISER “PITCH-TRIM” ACTUATORS

These linear actuators are used to move an aircrafts primary flight control surface. Two actuators are used, one to position the flaps and the other to set the elevator trim position. As this is operating a primary flight control on an amphibious aircraft the design features multiple levels of redundancy including duel leadscrews, separate load paths and position sensors together with non-jamming end stops. The actuators are also well sealed for protection against the seawater environment.



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Main design factors:

- Primary flight control actuator
- Multiple levels of redundancy
- Dual leadscrews, load paths, position sensors, segregated motor windings
- High force (17kn/3,822 lbf) non-back-drivable.
- Non-jamming mechanical end stops
- Seawater environment/sealing



Flap & Horizontal Trim Actuators

ELECTRIC LANDING GEAR ACTUATION SYSTEM

This actuation system uses two types of EMA (Linear and Rotary) to raise, lower and lock a helicopter landing gear. It is a fully electric system that replaces traditional hydraulic actuators and represents a major technological milestone in the journey towards the “more electric” aircraft. AMETEK Airtechnology Group was awarded this project in 2012 and the system was certified by EASA in 2015. It is widely understood to be the world’s first electric landing gear system to be certified for a helicopter. This flight-critical system not only meets the safety requirements, it also delivers several other benefits including: low weight, low maintenance, reduced turnaround times, easy plug-andplay installation and can be retrofitted as a post-delivery option.
In completing this project our actuation team have gained first hand experience and invaluable knowledge in the field of flight critical electric actuation. This has been invaluable for subsequent projects and we would be delighted to help you with yours.





Lock Actuator



Retract Actuator

Contact Us

Aerospace & Defence Applications

AMETEK Airtechnology Group

111 Windmill Road, Sunbury on Thames, TW16 7EF
United Kingdom

ametek-airtechnology.com