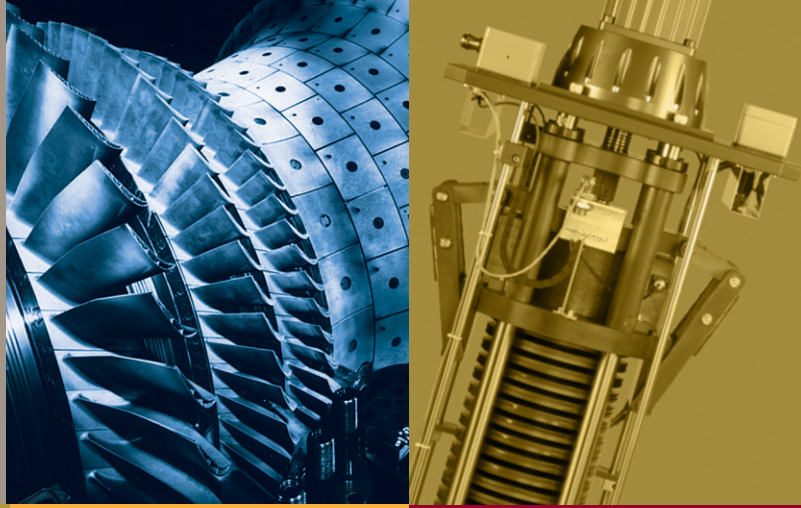


FAILSAFE ELECTRO-MECHANICAL ACTUATOR

High performance electric technology for failsafe operation in gas and steam turbines



Hydraulic systems dominate various control applications in the power generation industry due to their capability to reliably shut down in failure situations. When a shutdown is required, hydraulic systems provide the ability to close valves against gas pressure. However, these same hydraulic systems pose cost, complexity and physical space challenges due to the implied need for hydraulic infrastructure.

Moog has introduced an electric solution that eliminates the hydraulic infrastructure and provides safer, more compact and more cost-effective performance—plus the necessary failsafe protection in the event of an emergency shut-down. Moog's integrated solution includes a Failsafe Electro-mechanical Actuator, Moog Motion Controller and Servo Drive as well as application software.

Working in close collaboration with our customers, Moog engineers developed a patented, state-of-the-art solution: the first electro-mechanical failsafe mechanism to meet performance and safety requirements. In fact, Moog's electric solutions are approved to FM, CSA, and ATEX standards for use in hazardous areas. The solution reduces installation and maintenance effort bringing the advantages of electric control to the power generation market.



ADVANTAGES

- Ensures highest safety level via decoupled control and fast closing spring mechanism.
- Eliminates potential fire hazards from high-pressure oil leaks.
- Moog Motion Controller frees the processing power for other functions and increases flexibility.
- Delivers clean energy and low maintenance costs of electric technology.
- Eliminates hydraulic and pneumatic auxiliary systems.
- Helps to reduce the life cycle costs of the equipment: Lower cost of purchase, installation and commissioning, operation and maintenance.
- Enables preventative maintenance and monitoring for reduced operational costs.

APPLICATIONS

- Gas turbine applications
- Steam turbine applications
- Installation in harsh environments
- Retrofit and replacement of hydraulic actuators

FAILSAFE ELECTRO-MECHANICAL ACTUATOR

Comparison of Moog Failsafe Electro-mechanical Actuator to conventional hydraulic systems

FEATURES	ADVANTAGES
Extremely reliable failsafe function	Linear actuation and failsafe mechanism are decoupled
Innovative toggle lever	Reduced locking forces
No spring friction during ordinary turbine control	Compact dimensions of the system
Simplified, modular structure	High level of customer flexibility
Same mechanical interfaces as hydraulic system	Simple retrofit that doesn't require tubing and a hydraulic power unit
Decoupled linear actuation and failsafe mechanism	Extremely reliable performance
Simple, low-maintenance fail-safe mechanism	Protection of valuable gas turbine equipment
Condition monitoring of wear parts	Excellent preventative maintenance potential

FAILSAFE ELECTRO-MECHANICAL ACTUATOR

Lifetime and maintenance

- Operating lifetime until the first major overhaul equivalent to 40,000 h (EOH, equivalent operating hours, 8,000 h/a) or 1,500 turbine starts
- Spring designed for 500,000 load cycles
- TÜV type approval test according to EN 161
- Lifelong lubrication of moving parts

KEY DATA

ENVIRONMENTAL DATA	
Protection degree	IP54
Ambient temperature	-20 to +60 °C (-4 to +140 °F)
Hazardous location standards	ATEX II 3G -> Zone 2
PERFORMANCE DATA	
Failsafe valve close time	200 to 300 ms from trigger for 100 % stroke
Time lag until failsafe motion starts	< 50 ms
Rearming the failsafe functionality	3 s (uninterrupted logic supply)
Position accuracy (turbine control)	< ±0.25 mm (0.01 in)
Repeat accuracy	< ±0.1 mm (0.04 in)
Maximum motion time for full stroke	700 ms

ACTUATOR SIZES	S	M
Stroke	50 mm (1.97 in)	100 mm (3.94 in)
Spring force (minimum)	15 kN	30 kN
Force controlled (cont.)	5, 10, 15 kN	10, 20, 30 kN

Note: The Moog Failsafe Electro-mechanical Actuator can be tailored to meet your specific needs in terms of environmental and performance requirements (e.g. higher temperatures and forces, strokes, etc.)

MOOG SYSTEM FOR GAS AND STEAM TURBINES

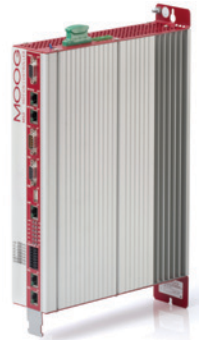
The Moog failsafe solution for power generation systems includes several Moog-designed and -built building block products, including the failsafe electro-mechanical actuator, a decentralized motion control system (using Moog Motion Controllers and Servo Drives) and application software for homing, diagnostics and safety functions.

FAILSAFE ELECTRO-MECHANICAL ACTUATOR

Our patented Failsafe Electro-mechanical Actuator, suitable for hazardous areas, controls the flow characteristics of the process valve defined by the position commands of the turbine controller. Moog engineers use a spring-controlled system to close/open the valve to a safe position in the event of an emergency condition. The actuator employs flexible interfaces for command and feedback between the turbine controller and the Motion Controller, including CANopen, Profibus-DP and 4 to 20 mA.



The PLC and Motion Controller utilize TÜV-certified application software. This software controls motion sequence, homing, plausibility tests, interpolated position, drive safety monitoring and application limits.



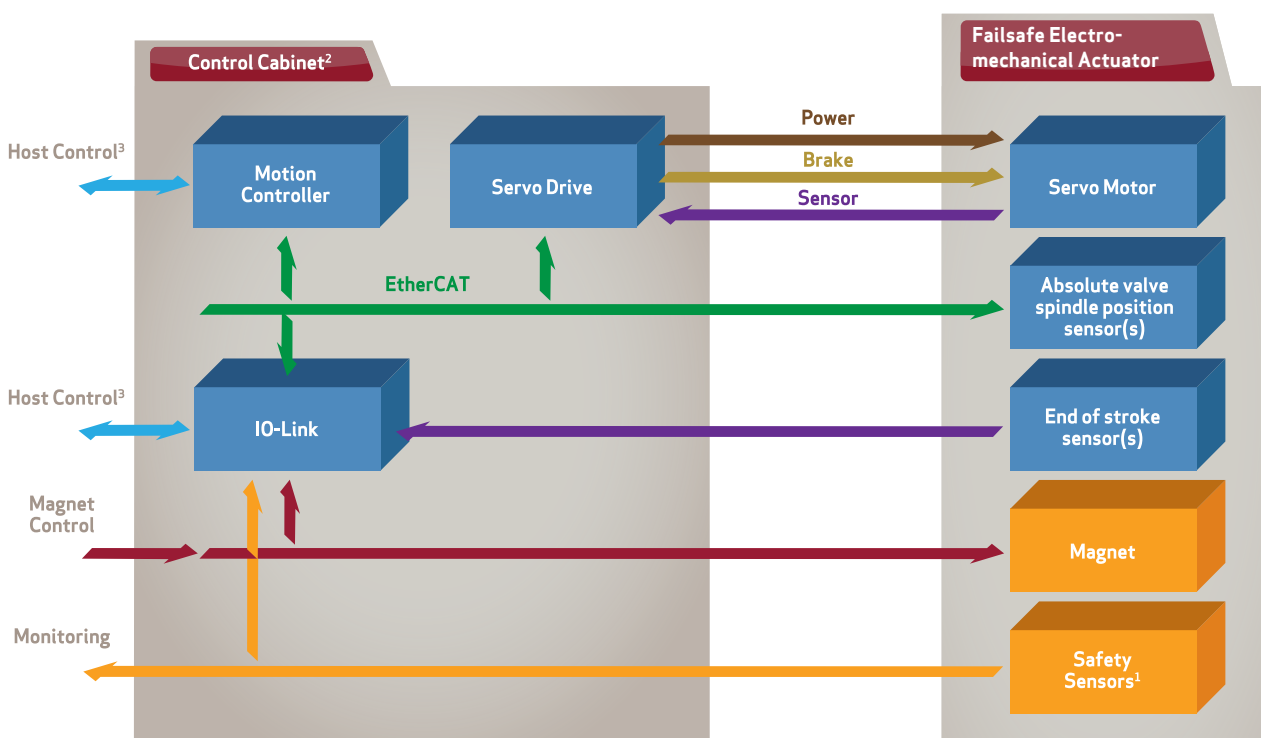
MODULAR MULTI-AXIS PROGRAMMABLE MOTION CONTROL SERVO DRIVE (MSD)

The MSD provides the highest levels of dynamic response, smooth performance and application versatility. It includes modular servo drives powered by a shared power supply and a motion controller to coordinate motion across multiple axes and single-axis modules with an integrated power supply. The MSD offers built-in closed-loop positioning capability, feedback sensors and an optional fieldbus interface. In addition, Moog certifies its use with cable lengths up to 500 m (1,640 ft), allowing placement of the servo drive and motion controller well outside the hazardous area of operation.



MOTION CONTROLLERS

The Moog Ruggedized Motion Controller is easy to program and designed for harsh environments. Suitable for both electric and hydraulic systems, this product offers high-speed control even in the most demanding environments.



1 Option: sensors for safe monitoring of failsafe module functionality

2 Integrated into customers cabinet or separate

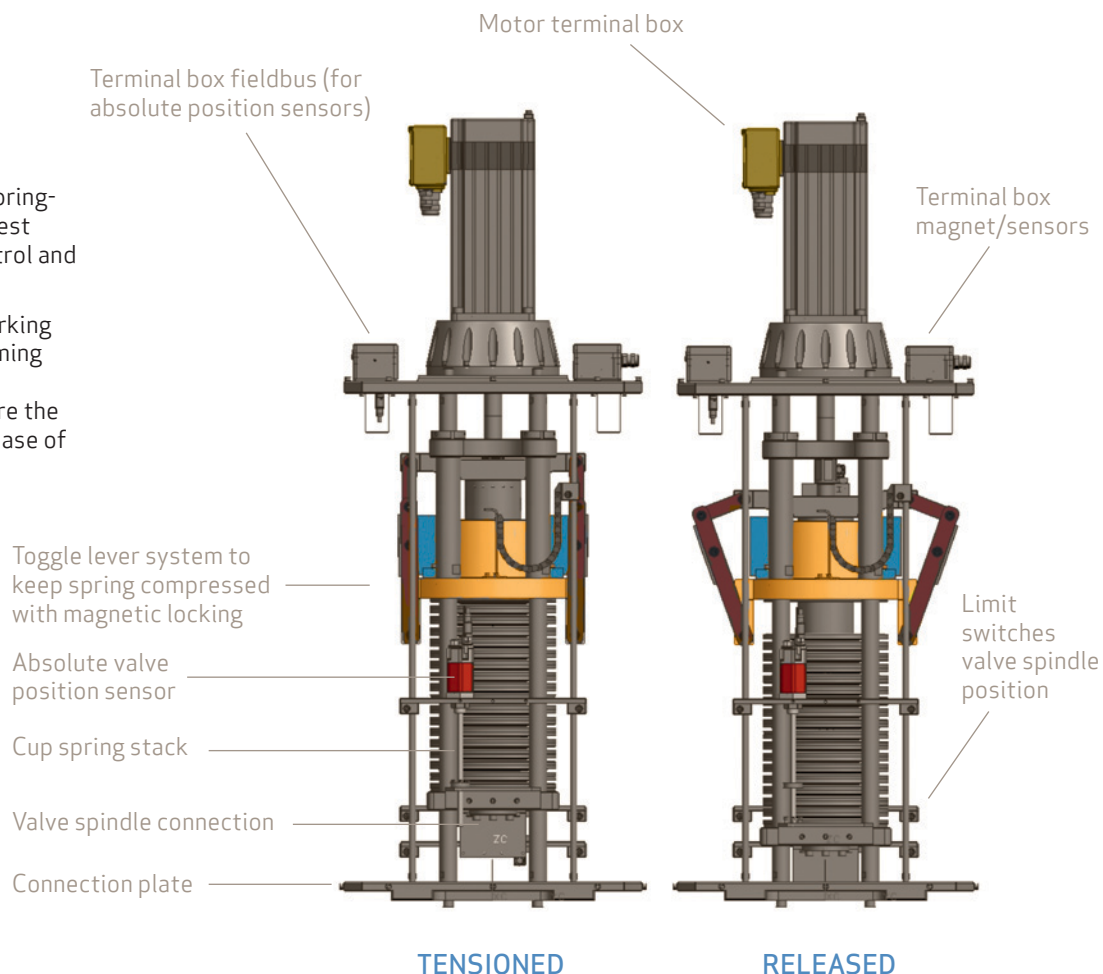
3 Via fieldbus and/or discrete signals

FAILSAFE MODES

FAILSAFE MODES

The system features a lockable, spring-controlled assembly with the highest safety level due to decoupled control and fast-closing spring mechanism.

In addition to the conventional working principle (spring assembly performing a push), Moog offers the option of having a reverse mechanism, where the spring assembly is pulled back in case of shutdown.



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Wherever you are in the world, you can rest assured that Moog's team of experienced, trained technicians are there for you with the service, training and parts you need to keep your equipment performing at peak condition. Moog Global Support® is your direct link to optimal gas turbine reliability and performance.



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Failsafe Electro-mechanical Actuator
Moog BB/Rev. B, October 2012, Id CDL31174-en

This technical data is based on current available information and is subject to change at any time by Moog. Specifications for specific systems or applications may vary.

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