

# INTEGRATED SMART ACTUATOR

High dynamic performance and compact design for mobile robotic hydraulic applications



The Moog family of lightweight hydraulic actuators with integrated servo valves, control electronics, sensors, and bus communications (EtherCAT and CANbus) is designed specifically for mobile robotic applications. Ideal for applications which require an extreme high power density, these products (stall force up to 10,300 N) offer precise force and position control, all in the smallest, integrated micro-hydraulic package we have ever built.

This product family offers high dynamic performance, making it attractive for challenging robotic control applications which require greater performance than the capabilities of electro-mechanical solutions. Employing an additive manufacturing process allows us to optimize size and weight and customize these actuators to your exact specifications. By supplying one integrated package instead of the traditional approach of using several individual hydraulic components, Moog solutions are more easily integrated into robotic designs.

## ADVANTAGES

- Highest performance & highest force-to-weight ratio, and ideal for mobile robotic operations
- Integrated servo valve, controls, sensors and software for an optimized lightweight, compact package
- Plug-and-play system for easy incorporation into your latest designs
- High dynamics, precise force control and better overall system control for enhanced responsiveness and a higher level of safety
- Robust, proven hardware for reliable operation even in extreme environments

## APPLICATIONS

- Robotics for Unstructured Environments
- Human-Scale Robotics
- Medical, including Rehabilitation, Orthotics and Prosthetics
- Mobile Robotics including Construction
- Collaborative Robotics
- Quadrupeds
- Humanoid
- Biomimetic
- Exo-Skeletons
- Tele-operation
- Haptics
- Virtual Reality, Simulation and Training
- Autonomous Vehicles



Integrated Smart Actuator for micro-hydraulic robotic applications

# SYSTEM OVERVIEW

## SMART CONTROL FOR ROBOTICS SYSTEMS

Moog integrated smart actuators are some of the most innovative actuators on the market today, featuring an integrated controller and software as well as a highly advanced control structure. Our customers also benefit from a real-time high-speed digital interface and Information-rich systems offering built-in error detection and diagnostics. Other sophisticated features include:

- Integral position, pressure and force control
- Safety Integrity Level (SIL) 2 (IEC Standards)- Capable
- Configurable and easy-to-adjust parameters

Our actuators also have an optional pre-configured control setting for specific applications which makes for easier prototyping, installation and operation, even without hydraulics expertise on-staff.

## INTEGRATED SMART ACTUATOR

KEY FEATURES	USER BENEFITS
High power-to-weight ratio and efficiency	Longer mission duration for battery-powered mobile robotic application
High dynamics and precise force control	Better overall system control, enabling improved responsiveness for challenging robotic applications
Fully integrated plug-and-play actuator, servo valve and controller	<ul style="list-style-type: none"><li>• Greatly simplified hydraulic system design and mechanical packaging</li><li>• Reduced need for hydraulic design on-staff</li></ul>
Higher dynamics and more robust than available electromechanical solutions	Improved performance and reliability for robotics used in an unstructured environment even with high impacts
Digital interface with on-board servo loop closure with CAN or EtherCAT communications	<ul style="list-style-type: none"><li>• Distributed control simplifies overall system layout</li><li>• Compatible with a variety of other system devices</li><li>• Bus communication allows enhanced diagnostics and greater flexibility to configure controls</li></ul>
Advanced low-power ARM processor with user-customizable control	<ul style="list-style-type: none"><li>• Optimized control for challenging robotics applications</li><li>• Reduced number of cables</li></ul>
Customizable designs through additive manufacturing	<ul style="list-style-type: none"><li>• Better fit with available envelope</li><li>• Deliver quickly with minimal impact to development schedules</li></ul>
Proven highly reliable in extreme operating conditions	Lower weight option for easy commercialization of new design even in challenging environments
Integrated onboard sensors for force and position control	Enables more dynamic system control
Onboard Inertial Measurement Unit (IMU)	Internet-of-Things (IoT)

# SPECIFICATIONS

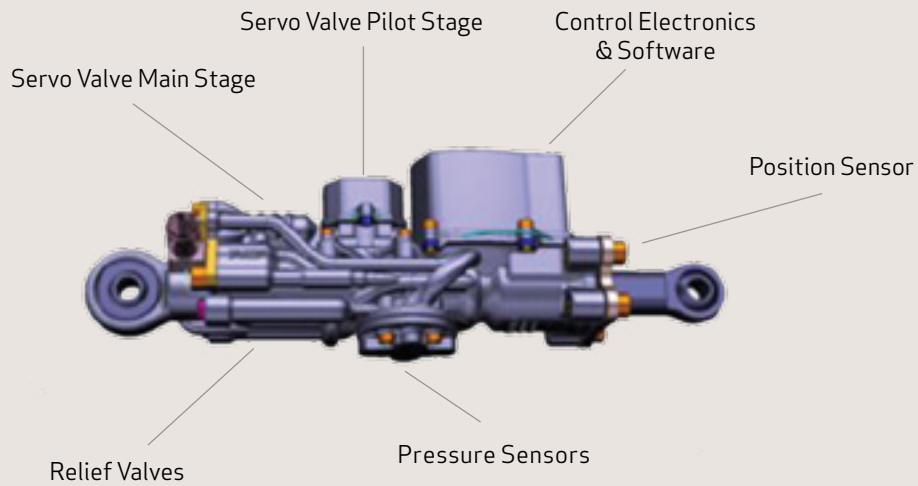
## A FAMILY OF MICRO-HYDRAULICS FOR ROBOTIC SYSTEMS

Moog offers a range of micro-hydraulic products for robotic systems offering high power density in a small package. Using our additive manufacturing capability we are able to create optimized and integrated hardware not otherwise possible with traditional design and manufacturing. Our micro-controllers, sensors and software are integrated to provide advanced control that can be configured to meet your needs.

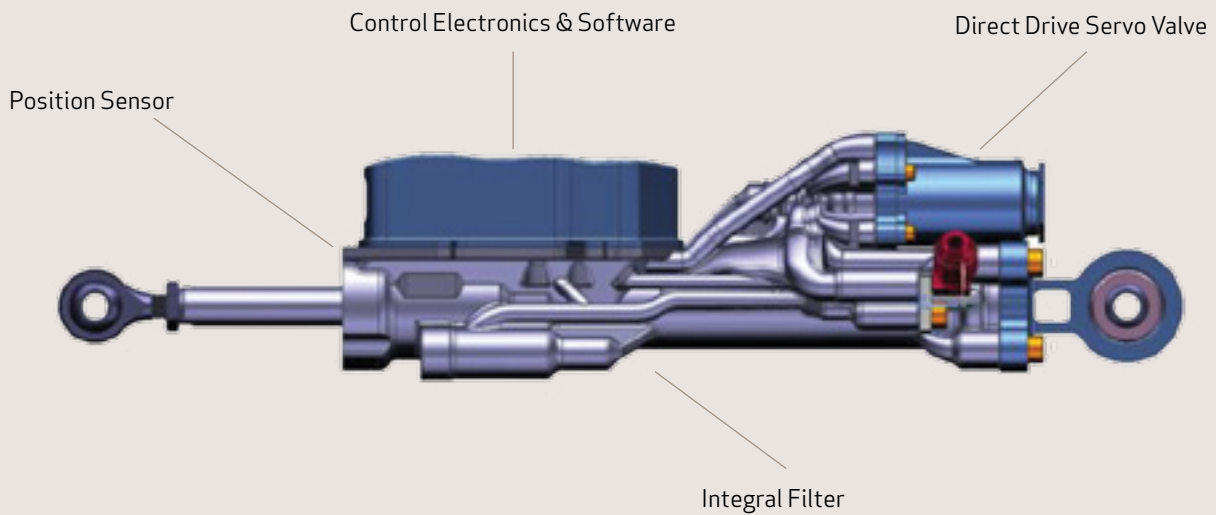
## SPECIFICATIONS

	FUTURE	CURRENT	MODEL E081-115	FUTURE
Piston Diameter (mm)	10	16	21.5	25
Rod Diameter (mm)	7	12	12	14
Actuator Stroke	80	100	100	200
Extend Stall Force @ 210bar N	1,600	4,200	7,500	10,300
Piston Slew Rate @ 66% Stall Load (mm/sec)	1,060	413	264	170
Closed Pin to Pin Length (mm)	180	220	295	410

## INTEGRATED SMART ACTUATOR - 2-STAGE SERVO VALVE VERSION



## INTEGRATED SMART ACTUATOR - DIRECT DRIVE SERVO VALVE VERSION\*



\*Future

**Contact us to order your Integrated Smart Actuator or learn more about our family of Micro-Hydraulics for Robotic Industry**

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**[www.moog.com/robotics](http://www.moog.com/robotics)**

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