



Achieving Precision and Higher Payloads with Compact Robotic Actuators

Designing modular robotic platforms is a balancing act. A single actuator needs to perform across multiple configurations including robotic arms, legs and mobile bases. However, each configuration has different torque, speed and environmental requirements which can often lead to compromises that limit performance at the joint system level.

HEBI Robotics is on a mission to make robots more accessible by simplifying how they are designed and assembled with standardized building blocks. For over a decade, their modular approach has been applied across a wide range of challenging applications—from snake robots and hexapod walkers to robotic arms and mobile bases for pipeline inspection, Non-Destructive Testing (NDT), maintenance and more.

As HEBI expands further into industrial settings, a new customer project reinforced the opportunity to expand their actuator lineup to better meet challenging or hazardous workspace needs without any performance tradeoffs.

Challenge

HEBI's customer project required a robotic system capable of traversing complex, confined spaces and positioning inspection probes and other heavy tooling with a high degree of accuracy and repeatability. The environment was highly variable and closer to real-world industrial conditions like those found in Oil & Gas, infrastructure or other rugged settings.

Rather than relying on HEBI's established series of high-ratio elastic actuators that use spur-gear reductions, the project required high torque density actuators and more accurate motion across multiple degrees of freedom—without increasing size or sacrificing architectural flexibility.

This meant rethinking how the motor itself was integrated into the actuator.

“TBM2G’s compact size and high torque allow us to develop smoother, faster, and more precise next-generation robotic joints. We love this motor.”

—Dave Rollinson
Chief Technology Officer
HEBI Robotics

Solution

To achieve the required shift in performance, HEBI focused on integrating the motor directly into the compact actuator design. This approach led to the selection of Kollmorgen's TBM™2G frameless motors as the foundation for the new H-Series Actuator®.

The frameless motor architecture allowed HEBI to optimize torque density, thermal performance and modularity at the joint level. By integrating the stator and rotor directly into the high torque density actuator, the H-Series delivers smoother motion and faster dynamic movement with higher accuracy—and without adding to the actuator's overall size.

The teams from Kollmorgen and HEBI collaborated throughout motor selection and integration to optimize motor configuration for the application. This collaboration helped streamline development and ensure the compact actuator design met performance targets for both the H-Series line and the customer project at hand.



10x

**more torque without
increasing the size
of existing actuators**

Results

The H-Series actuator delivered the performance gains and precision required for the confined-space inspection project. The system was able to position heavy tooling accurately while operating in tight mechanical constraints, exceeding specifications and motion expectations under real operating conditions.

By pairing the TBM2G frameless motor with strain wave gearing, the H-Series achieved zero backlash motion and up to 10 times more torque than their existing actuator line. This increase in torque density enabled HEBI to expand the capabilities of the entire joint system without increasing actuator size. The actuator's compact, sealed design—rated IP65—supports operation in challenging, rugged environments.

Beyond just raw performance, the H-Series Actuator simplifies manufacturing and assembly. Moving from a more complex actuator design to a streamlined, frameless motor-based approach improves ease of manufacturability and creates a clearer path to scaling production. The high torque-to-size ratio of the motor also created space within the actuator for embedded electronics, enabling smarter joints without increasing size.

Kollmorgen's responsiveness and engineer-to-engineer collaboration played a key role throughout the selection, design and integration process. Close technical support and U.S.-based manufacturing helped HEBI move efficiently through development to deployment.

All in all, the results position the H-Series Actuator as a powerful expansion in HEBI's revolutionary modular robotic platform with Kollmorgen's frameless motor at the core. Together, the combination is helping build the next phase of how HEBI shapes the way our world works.

About Kollmorgen

Kollmorgen, a Regal Rexnord Brand, has more than 100 years of motion experience, proven in the industry's highest-performing, most reliable motors, drives, AGV control solutions and automation platforms. We deliver breakthrough solutions that are unmatched in performance, reliability and ease of use, giving machine builders an irrefutable marketplace advantage.