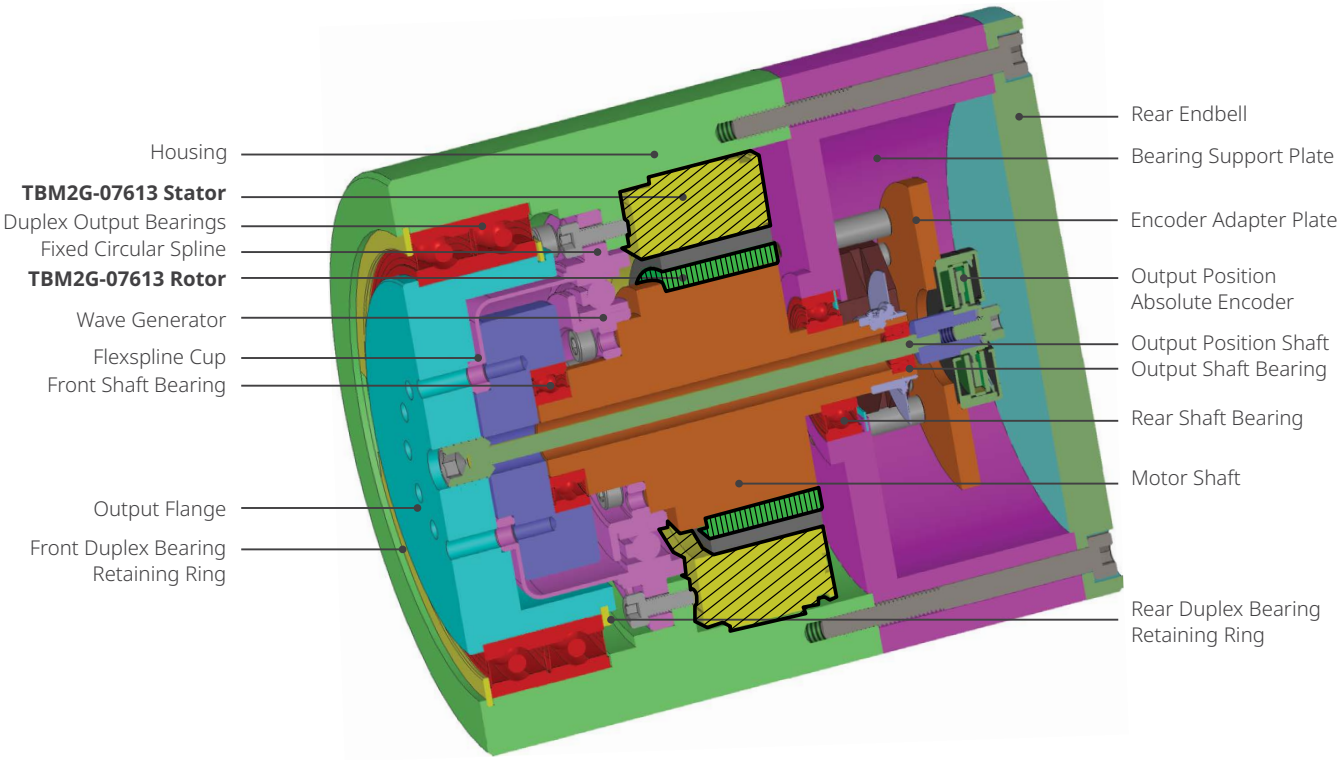
KOLLMORGEN
A REGAL REXNORD BRAND

TECH SHEET

Embedding TBM2G Frameless Motors into Gimbal and Precision Actuator Systems

A gimbal is a pivoting support that permits rotation of an object around an axis. Additional degrees of freedom can be obtained by combining or nesting two or more gimbals, with their axes of rotation at 90° apart.

Gimbals are often used to stabilize and control the position of equipment such as cameras, electro-optical and infrared sensors (EO/IR), thermal imagers, ground station antennas, and other sensing and communications equipment. In these applications, servo motors control the movement of each gimbal axis. Precision actuators are typical components in high-end General Automation applications such as robotic work station fixturing, machine tool equipment, anywhere 20-bit or greater resolution might be required for highly repeatable positioning.



Gimbal / Precision Actuator assembly incorporating TBM2G frameless servo motor from Kollmorgen

Why frameless?

Lightweight, torque-dense frameless servo motors can be specified with a short axial length and a range of diameters to fit gimbals of practically any form factor, taking advantage of the D^2L rule to deliver optimum torque.

When directly driving the load or when used with zero-backlash gearing, frameless motors offer ultimate responsiveness and precision — especially important for holding a target while counteracting unpredictable motions such as the buffeting of a missile in flight or when a manufacturing process needs a configurable and extremely repeatable fixture for high speed automation equipment.

Integrating frameless motors with other motion components

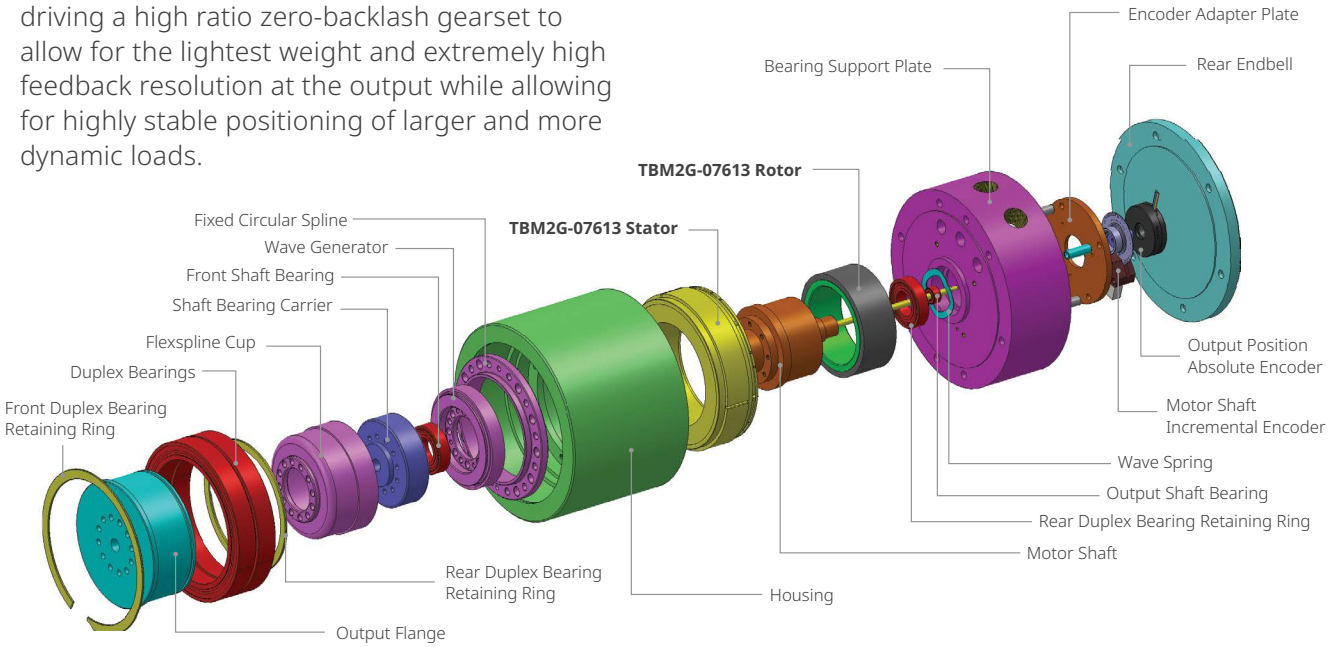
A complete motion system based on frameless servo motor technology incorporates additional components, depending on the application's functional requirements and design constraints.

- **Feedback device (required).** An encoder (absolute or incremental, often 20 bits of resolution or higher, depending on the application) or a resolver reports rotor position to the servo drive to enable closed-loop velocity and position control. Hall tracks on an encoder or optional Hall effect sensors built into the TBM2G motor provide the information necessary for the servo drive to properly commutate the current delivered to the motor.
- **Thermal sensor.** TBM2G servo motors are available with multiple standard sensor options to monitor winding temperature if necessary.
- **Gearing.** Frameless motors may be used with compact, zero-backlash harmonic (strain wave) gearing as well as with cycloidal, spur and planetary gears.
- **Brakes.** Electromagnetic or mechanical brakes may be required to provide holding torque and protect gimbal components while in an unpowered state. TBM2G performance is unaffected in close proximity to brake elements.
- **The gimbal's own shaft and bearings.** TBM2G frameless motor sets include a stator and a rotor configured within the actuator design, often driving a high ratio zero-backlash gearset to allow for the lightest weight and extremely high feedback resolution at the output while allowing for highly stable positioning of larger and more dynamic loads.

Additional precision actuator design considerations

Kollmorgen can help you navigate several design choices to maximize gimbal performance — for example:

- **Housing design.** Since the frameless stator is embedded directly into the gimbal design, make sure the supporting material can adequately dissipate heat. Steel is a good thermal conductor; aluminum is better, and a minimum wall thickness of 4–6 mm is typically required.
- **Thermal sensing.** During prototyping, you may want to use a thermal sensor to gauge how hot the motor runs while the axis is performing at its peak torque and speed.
- **Design for manufacturability.** A thorough understanding of the application's assembly process helps ensure that we can manufacture motors in the correct order while meeting your timeline and cost goals.
- **Outside resources.** If you need additional expertise or support to design and assemble your gimbal or precision actuator with confidence, we can help connect you with the right resources.



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