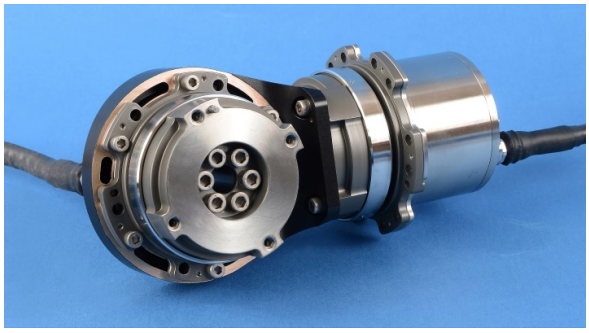
C14 Bi-Axis Gimbal

Design Description



C14 Bi-Axis Gimbal

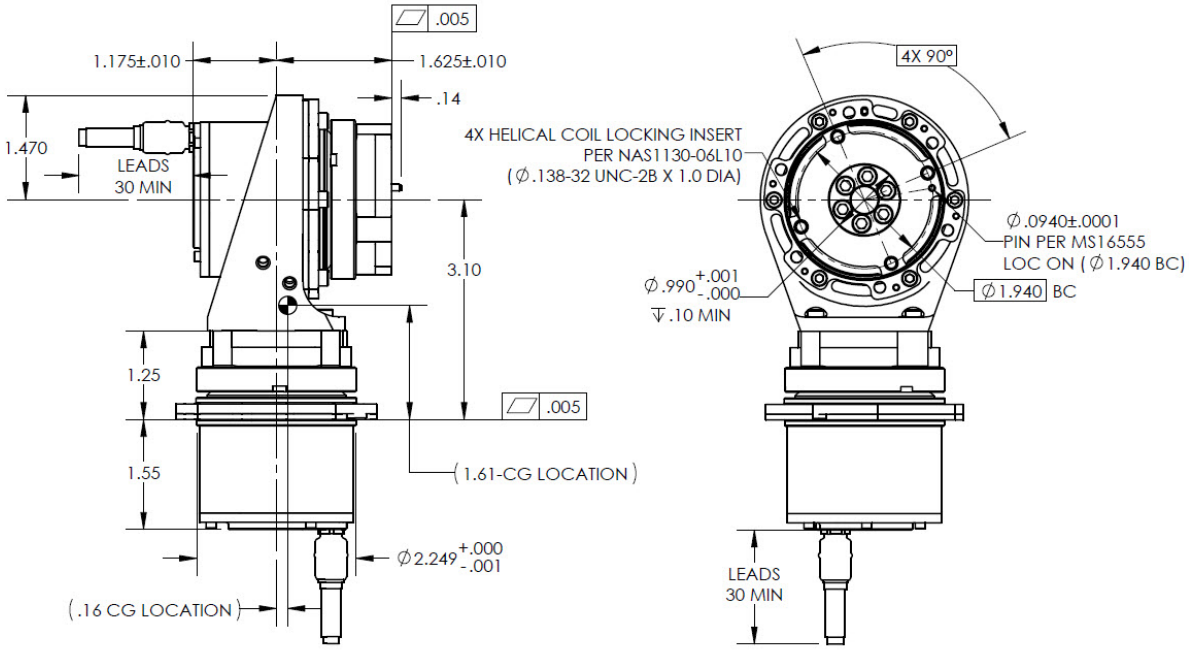
Sierra Nevada Corporation's (SNC) Space Systems offers a lightweight, bi-axial gimbal, featuring the C14 incremental rotary actuator developed specifically for critical spacecraft pointing applications. Originally developed for antenna pointing mechanisms on communications satellites, the device has also been adapted for solar array drives and is suitable for thruster or instrument pointing.

The actuator uses a 2-phase permanent magnet stepper motor to drive a zero backlash harmonic drive. An optional 3-phase motor is also available. Magnetic modeling and optimization ensure the permanent magnet stepper motor takes full advantage of the available volume for maximum performance per unit weight. Redundant versions are fully isolated with Nomex-Kapton insulators to prevent failure propagation. High capacity 440C stainless steel ball bearings support the output shaft for maximum stiffness and life. The actuator's titanium construction ensures high strength and consistent performance over a broad temperature range.

A high-stiffness, stainless steel harmonic drive with modified tooth profile and circular spline provides outstanding stiffness and torque capability with extremely low weight. A custom Oldham coupling between the motor assembly and transmission allows for a large through hole that can be used for wire routing, RF rotary joints, or waveguides. The motor and transmission are designed as freestanding units that allow for modular combinations of motors and transmissions to easily adapt the assembly to a variety of applications.

The gimbal features an aluminum biaxial bracket that has been optimized for low mass and high stiffness. A black anodized, high-emissivity surface finish promotes thermal management, while the low-resistance conversion coating at the mating surfaces ensures electrical bonding throughout the gimbal.

Dimensions



Note: *All dimensions above are in inches.*

Features	
• Compact design and mass efficient configuration	• Potentiometer for position telemetry
• 2-phase, 3-phase or 4-phase motor windings	• High stiffness and load capacity in a small package
• Electrical redundancy available	• Internal heaters and thermistor
• Bray or Pennzane lubrication	• Multiple harmonic drive ratios and optional hard stops
Note: Optional: Launch locks, RF coaxial cables, RF joints, and integrated antennas available upon request	

Applications	
• Critical spacecraft pointing applications	• Solar array drive, antenna, thruster, or instrument pointing

Heritage Programs	
• Eagle	• Tenacious 1, 2, 3, and 4
• OrbView -3 & -4	• Samaritan

Product Specifications	U.S.	SI
Mechanical		
Mass	2.7 lbm, excluding cables ~3.25 lb including 33 inches of cabling	1.23 kg, excluding cables ~1.5 kg including 85 cm of cabling
Step size	0.0625°	
Slew rate	>9°/s at no load	
Max. output acceleration	6°/s^2	
Output torque @ 4°/s	125 in-lb typical at 77 °F	14 Nm
Maximum inertial load	> 9 lb-in-s^2	>1 kg-m^2
Unpowered holding torque	8 in-lb	0.9 Nm
Actuator Torsional stiffness	30,000 in-lb/rad	3,390 Nm/rad
Actuator Independent Load Ratings (consult SNC engineering for combined loads)		
Axial load capacity (maximum)	1,425 lb	6,338 N
Radial load capacity (maximum)	275 lb	1,223 N
Moment load capacity (maximum)	800 in-lb	90 Nm
Electrical		
Winding resistance	57 Ω (nominal, 2-phase)	
Winding inductance	30 mH typical	
Torque constant	0.636 Nm/A	
Heater power	10 W (nominal, each)	
Potentiometer linearity	0.25% over 350° (357° total electrical range)	
Qualified Thermal Environment		
Operating temperatures	-94 °F to 158 °F	-70 °C to 70 °C
Nonoperating temperatures	-139 °F to 185 °F	-95 °C to 85 °C
Note: This data is for information only and subject to change. Contact SNC's Space Systems, Space Technologies for design data.		

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